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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**PROCUREMENT AND ACCEPTANCE TESTING PROCEDURES FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4005**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor format and equipment changes.	February 1996	
1.0	Add SVHS video system references.	February 1999	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes the steps for procurement and acceptance testing of photographic and video equipment. This equipment is purchased for new installations or as replacement equipment at scene monitoring sites. Acceptance testing is performed to ensure that all systems are fully functional and operating within acceptable limits when shipped to designated sites.

Purchasing, fabrication, and acceptance testing of a full system or individual components of a system are addressed in:

- TI 4005-1000 *Procurement and Acceptance Testing Procedures for 35 mm Automatic Camera Systems*
- TI 4005-1001 *Procurement and Acceptance Testing Procedures for 8 mm Automatic Camera Systems*
- TI 4005-1050 *Procurement and Acceptance Testing of SVHS Time-Lapse Video Camera Systems for the Healy Clean Coal Project*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Quote camera specifications, prices, and delivery times to purchasing agents.
- Obtain information regarding specific equipment needed.
- Obtain site information, contact person's name, telephone number, shipping address, and any other special instructions needed to ship equipment to a site.
- Coordinate purchasing with the data coordinator.
- Coordinate acceptance testing with the data coordinator and field specialist.

2.2 DATA COORDINATOR

The data coordinator shall:

- Prepare equipment purchase orders as directed by the project manager and send the orders to appropriate vendors.
- Receive, label, log, and inventory all equipment.
- Maintain inventory information in the equipment database.
- Assemble photographic equipment and perform initial quality assurance checks.
- Ship camera and lenses to a local factory-authorized repair facility for a full system check.

- Load the photographic system with film (or SVHS videotape) and take test photographs (or film footage).

- Assemble the photographic system (camera, cables, timer, and batteries) and perform acceptance testing procedures.

- Assemble the 35mm or 8 mm camera enclosures (including fabricating and installing camera tripods and security plates).

- Verify tripod placement and security of windows and doors in the 35 mm or 8 mm camera enclosure.

- Assemble a site operator's manual and all necessary 35 mm or 8 mm photographic monitoring supplies.

- Package and ship the photographic systems according to specifications.

2.3 FIELD SPECIALIST

The field specialist shall:

- Assemble the video equipment (including camera, cables, monitor, and SVHS recorder) and perform acceptance testing procedures.

- Assemble the video enclosures (including heaters, fans, power systems, and any required power systems, camera mounts, and security plates) and perform acceptance testing procedures.

- Assemble a site operator's manual and all necessary time-lapse video monitoring supplies.

- Package and ship the video systems according to specifications.

2.4 COMMUNICATIONS TECHNICIAN

A trained and certified communications technician shall acceptance test any communications system used in connection with a photographic or video monitoring system. These communications systems may include a microwave transmitter/receiver system or other specialized communications system.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 REQUIRED EQUIPMENT AND MATERIALS FOR 35 MM OR 8 MM SYSTEMS

Equipment and materials required to test a 35 mm or 8 mm photographic system include:

- A camera.

- A lens (for 35 mm camera only).

- A winding system (for 35 mm camera only).

- A camera databack (for 35 mm camera only).
- A UV filter (for 35 mm camera only).
- Programmable timer and cables.
- Batteries.
- Film.
- A documentation chart.
- A *Visibility Network Photo Log* (35 mm camera only).
- A *Camera Test Form* (8 mm camera only).
- A tripod mount and mounting hardware.
- An environmentally-sealed and lockable enclosure.

Equipment and materials required to test a camera system at a local factory-authorized dealer also include a multi-plex camera tester.

3.2 REQUIRED EQUIPMENT AND MATERIALS FOR SVHS VIDEO SYSTEMS

Equipment and materials required to test an SVHS time-lapse video system include:

- A high-resolution color video camera with lens.
- A programmable SVHS video recorder.
- A color video monitor.
- Power and signal cables.
- A cross-polarizing lens filter.
- A camera enclosure.
- SVHS videotapes.
- A voltmeter.
- An *SVHS Time-Lapse Video System Test Log*.

4.0 METHODS

This section includes the following four (4) subsections:

4.1 Procurement
4.2 Acceptance Testing
4.3 Inventory
4.4 Shipping

4.1 PROCUREMENT

Purchase Orders (POs) for system components or fully integrated systems are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are sent to the appropriate equipment vendors. Upon arrival at ARS, the equipment is cross-checked against the PO and readied for acceptance testing. Complete descriptions of procurement procedures are detailed in TI 4005-1000, *Procurement and Acceptance Testing Procedures for 35 mm Automatic Camera Systems*, TI 4005-1001, *Procurement and Acceptance Testing Procedures for 8 mm Automatic Camera Systems*, and TI 4005-1050, *Procurement and Acceptance Testing of SVHS Time-Lapse Video Camera Systems for the Healy Clean Coal Project*.

All photographic and video system components purchased from ARS Technologies, Inc. or other suppliers have undergone thorough manufacturer testing. All components are guaranteed.

4.2 ACCEPTANCE TESTING

Photographic or video equipment purchased from a manufacturer is subject to thorough inspection and acceptance testing upon receipt at ARS. These inspections include individual component and full system checks to verify that the equipment is operating within manufacturer's specifications.

ARS has a long, established relationship with local factory-authorized repair facilities. These facilities provide prompt, thorough photographic testing and preventive maintenance and repair services. Cameras that pass all tests are then tested as part of the integrated monitoring system.

Complete descriptions for ARS testing and factory-authorized dealer testing are detailed in TI 4005-1000, *Procurement and Acceptance Testing Procedures for 35 mm Automatic Camera Systems*, TI 4005-1001, *Procurement and Acceptance Testing Procedures for 8 mm Automatic Camera Systems*, and TI 4005-1050, *Procurement and Acceptance Testing of SVHS Time-Lapse Video Camera Systems for the Healy Clean Coal Project*.

4.3 INVENTORY

An up-to-date accounting of purchase and warranty information, location, and status of all purchased equipment is maintained. Primary accounting is performed on an equipment database developed by ARS. The database can be searched and sorted by fields to yield reports such as equipment listings by site, equipment type, manufacturer, model number, serial number, property number, purchase order number, date purchased, or a variety of additional search fields.

4.4 SHIPPING

Integrated photographic systems or individual components are packed for shipping following successful testing. All shipments will be made by the most expedient, cost-effective method. Packing slips containing item description, serial number, quantity, weight, and insurance value for all shipments accompany each shipping container. A record of the shipment including a copy of the packing slip is kept on file by the data coordinator.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**PROCUREMENT AND ACCEPTANCE TESTING PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEMS**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4005-1000**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
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PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the steps for procurement and acceptance testing of 35 mm photographic equipment. The primary purpose of acceptance testing is to ensure that all systems are fully functional and operating within acceptable limits when shipped to designated sites.

For the purpose of this TI, a full automatic 35 mm camera system consists of the following components:

- 35 mm camera with winder and databack
- Lens with UV filter
- Programmable timer and cabling
- Environmental enclosure with sunshield and internal locks
- Quick-release camera mount
- Documentation chart
- Instruction manuals and example forms
- Lens cleaning supplies
- Batteries
- Mounting post

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Quote camera specifications, prices, and delivery times to purchasing agents.
- Obtain information regarding specific equipment needed.
- Obtain site information, contact person's name, telephone number, shipping address, and any other special instructions needed to ship equipment to a site.
- Receive customer purchase orders, direct the data coordinator to fill the order, and further coordinate all information with the data coordinator.

2.2 DATA COORDINATOR

The data coordinator shall:

- Prepare equipment purchase orders and send to appropriate vendors.

- Receive, label, log, and inventory all equipment.
- Enter inventory information in the equipment database.
- Assemble camera equipment and perform initial quality assurance checks.
- Ship camera and lenses to a local factory-authorized repair facility for a full system check.
- Load the camera with film (when returned from the repair facility) and take test photographs.
- Assemble the photographic system (camera, cables, timer, and batteries) and perform acceptance testing procedures.
- Assemble the camera enclosures, including documentation charts, camera tripods, security plates, standard setting and troubleshooting labels.
- Verify tripod placement and security of windows and doors in the camera enclosure.
- Assemble a site operator's manual and all necessary photographic monitoring supplies.
- Package and ship the photographic systems according to specifications.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 CAMERA SYSTEM TESTING

Equipment and materials required to test a camera system include:

- Camera
- Programmable timer
- Lens
- Winding system
- Camera databack
- UV filter
- Power and camera cables
- Batteries
- Kodachrome 64 color slide film
- Photographic log
- Battery jumper bar

- Documentation chart
- Environmentally-sealed and lockable enclosure
- Tripod mount
- Multi-plex camera tester (used at the factory-authorized repair facility)

3.2 INVENTORY

An up-to-date accounting of purchase and warranty information, location, and status of all field and laboratory equipment will be maintained. Primary accounting will be performed on an equipment database developed by ARS. The database can be searched and sorted by fields to yield reports such as equipment listings by site, equipment type, manufacturer, model number, serial number, property number, purchase order number, date purchased, or a variety of additional search fields.

Monthly updates of the equipment database will be routinely performed by the data coordinator. Purchase orders, repair records, and all other available sources of equipment status will serve as documentation of equipment database entries.

All equipment not being used at a monitoring site will be stored in a secure location at ARS. A detailed inventory of all items awaiting maintenance, testing, or future deployment will be maintained at all times. Items uneconomical for repair will be salvaged for parts.

4.0 METHODS

This section includes the following three (3) subsections:

4.1 Procurement
4.2 Acceptance Testing
4.3 Shipping

4.1 PROCUREMENT

4.1.1 Individual Components

Purchase orders (POs) are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are sent to the appropriate equipment vendors. Equipment is inventoried and readied for testing after receipt at ARS.

After receiving the individual components, fabrication of a complete system may be required. Fabrication includes:

- Assembly of camera enclosure
- Assembly of integrated camera system for testing
- Assembly of site operator's manuals and operating supplies

4.1.2 Complete System

Purchase orders (POs) are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are given to the instrument technician at ARS Technologies, Inc. The equipment is inventoried when received by the data coordinator. All 35 mm automatic camera systems purchased from ARS Technologies, Inc. have undergone thorough acceptance testing. All components are guaranteed.

4.2 ACCEPTANCE TESTING

Camera equipment purchased from a manufacturer will be subject to thorough inspection and acceptance testing upon receipt at ARS. These inspections will include full system checks and verifications to ensure that the equipment is operating properly.

4.2.1 Testing Cameras and Lenses

Upon receiving a camera and lens from a vendor, the following are performed:

- The lens is attached to the camera.
- Camera batteries are installed.
- The camera is configured for remote operation (e.g., on a Canon EOS 630, the standard grip would be removed and a remote jack grip installed).
- Basic camera and lens functions are verified.
- Warranty cards are completed.
- Serial numbers are entered into the equipment database.
- The camera and lens are both sent to a factory-authorized repair facility.

ARS has a long, established relationship with local factory-authorized repair facilities. These facilities provide prompt, thorough photographic testing and preventive maintenance and repair services, including ambient and cold testing of:

- Current draw
- Shutter speed and curtain travel time
- Automatic exposure accuracy
- Film transport
- Diaphragm operation
- Lens focus and disable soft focus mechanism

When the camera, lens, and testing documentation are returned from the repair facility, the camera is loaded with a 36-exposure roll of Kodachrome 64 color slide film and is taken to an outdoor location. The following sequence of test photographs are taken:

- Three photographs of the documentation chart, at apertures of 5.6, 8.0, and 11.0.
- Three photographs of a vista, at ground to sky ratios of 70:30, 50:50, and 30:70. Each set is taken at an aperture setting ranging from 4.0 to 11.0.
- The lens is set to "auto" focus and the above procedures are repeated.
- The last few frames on the roll are taken in several different directions at a ground to sky ratio of 50:50.

The composition of each test photograph, test photograph settings, and the camera and lens serial numbers are documented on a photographic log. An example of a completed photographic log for a camera test session is provided as Figure 4-1. Film is then sent in for processing. When test photographs are returned from processing, they are thoroughly reviewed for exposure consistency, databack imprinting clarity, and focus. If problems are noted they are returned to the repair facility for further evaluation or on the advice of the repair facility, returned to the manufacturer. Cameras that pass all tests are then tested as part of the integrated monitoring system.

4.2.2 Testing of Integrated Monitoring System Including Camera, Timers, Cables, and Batteries

Timers and cables are tested by assembling the entire camera system, including timer, cables, batteries, and camera. The timer is set to the current time, date, and alarm times. The cables and camera are attached and the system is observed for two days to ensure all components are functioning properly.

4.2.3 Testing Enclosures

The placement of the tripod mount is verified and adjusted if necessary. The window, door lock, and latches are checked to ensure the enclosure is secure and completely weatherproof.

4.3 SHIPPING

Integrated camera systems or individual components are packed for shipping following successful testing. All shipments will be made by the most expedient, cost-effective method, usually by UPS Ground service. Packing slips containing item description, serial number, quantity, weight, and insurance value for all shipments accompany each shipping container. A record of the shipment including a copy of the packing slip is kept on file by the data coordinator.

VISIBILITY NETWORK PHOTO LOG

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Camera:_____
Lens:_____
TEST ROLL

EXP. #		DATE	TIME	APERTURE	NOTES
1	Doc Chart			5.6	
2				8.0	
3				11.0	
4	Manual			4.0	Ratios 70/30 50/50 30/70
5					
6					
7				5.6	
8					
9					
10				8.0	
11					
12					
13				11.0	
14					
15					
16	Auto			4.0	
17					
18					
19				5.6	
20					
21					
22				8.0	
23					
24					
25				11.0	
26					
27					
28	Manual			8.0	50/50 ratio in 9 different directions
29					
30					
31					
32					
33					
34					
35					
36					

Figure 4-1. Example Photographic Log for Camera Test Session.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**PROCUREMENT AND ACCEPTANCE TESTING PROCEDURES FOR 8 MM AUTOMATIC CAMERA SYSTEMS**
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NUMBER	**4005-1001**
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AUTHORIZATIONS		
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REVISION HISTORY			
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LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the steps for procurement and acceptance testing of 8 mm photographic equipment. The primary purpose of acceptance testing is to ensure that all systems are fully functional and operating within acceptable limits when shipped to designated sites.

For the purpose of this TI, a full automatic 8 mm camera system consists of the following components:

- 8 mm movie camera with intervalometer
- Programmable timer and cabling
- Environmental enclosure with sunshield and internal locks
- Quick-release camera mount
- Documentation chart
- Instruction manuals and example forms
- Lens cleaning supplies
- Batteries
- Mounting post

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Quote camera specifications, prices, and delivery times to purchasing agents.
- Obtain information regarding specific equipment needed.
- Obtain site information, contact person's name, telephone number, shipping address, and any other special instructions needed to ship equipment to a site.
- Receive customer purchase orders, direct the data coordinator to fill the order, and further coordinate all information with the data coordinator.

2.2 DATA COORDINATOR

The data coordinator shall:

- Prepare equipment purchase orders and send to appropriate vendors.
- Receive, label, log, and inventory all equipment.

- Enter inventory information in the equipment database.
- Assemble camera equipment and perform initial quality assurance checks.
- Ship camera and lenses to a local factory-authorized repair facility for a full system check.
- Assemble the photographic system (when returned from repair facility) including camera, cables, timer, and batteries, and perform acceptance testing procedures.
- Assemble the camera enclosures, including documentation charts, camera tripods, security plates, standard setting and troubleshooting labels.
- Verify tripod placement and security of windows and doors in the camera enclosure.
- Assemble a site operator's manual and all necessary photographic monitoring supplies.
- Package and ship the photographic systems according to specifications.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 CAMERA SYSTEM TESTING

Equipment and materials required to test a camera system include:

- Camera
- Programmable timer
- Power and camera cables (power cable internally wired into the camera)
- Batteries
- Kodachrome 40 super 8 movie film
- Photographic log
- Battery jumper bar
- Documentation chart
- Environmentally-sealed and lockable enclosure
- Tripod mount
- Camera text box

3.2 INVENTORY

An up-to-date accounting of purchase and warranty information, location, and status of all field and laboratory equipment will be maintained. Primary accounting will be performed on an equipment database developed by ARS. The database can be searched and sorted by fields to yield reports such as equipment listings by site, equipment type, manufacturer, model number, serial number, property number, purchase order number, date purchased, or a variety of additional search fields.

Monthly updates of the equipment database will be routinely performed by the data coordinator. Purchase orders, repair records, and all other available sources of equipment status will serve as documentation of equipment database entries.

All equipment not being used at a monitoring site will be stored in a secure location at ARS. A detailed inventory of all items awaiting maintenance, testing, or future deployment will be maintained at all times. Items uneconomical for repair will be salvaged for parts.

4.0 METHODS

This section includes the following three (3) subsections:

4.1 Procurement
4.2 Acceptance Testing
4.3 Shipping

4.1 PROCUREMENT

4.1.1 Individual Components

Purchase orders (POs) are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are sent to the appropriate equipment vendors. Equipment is inventoried and readied for testing after receipt at ARS.

All procurement, acceptance testing, and delivery will be performed within six (6) weeks of the written request. Timely completion of all requests is subject to the availability of the requested monitoring equipment.

After receiving the individual components, fabrication of a complete system may be required. Fabrication includes:

- Assembly of camera enclosure
- Assembly of integrated camera system for testing
- Assembly of site operator's manuals and operating supplies

4.1.2 Complete System

Purchase orders (POs) are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are given to the instrument technician at ARS Technologies, Inc. When the equipment is received by the data coordinator it is inventoried. All 8 mm automatic camera systems purchased from ARS Technologies, Inc. have undergone thorough acceptance testing. All components are guaranteed.

4.2 ACCEPTANCE TESTING

Camera equipment purchased from a manufacturer will be subject to thorough inspection and acceptance testing upon receipt at ARS. These inspections will include full system checks and verifications to ensure that the equipment is operating properly.

4.2.1 Testing Cameras, Timers, and Cables

Upon receiving a camera from a vendor, the following are performed:

- Temporary camera batteries are installed.
- Basic camera functions are verified.
- Warranty cards are completed.
- Serial numbers are entered into the equipment database.
- Camera is sent to a factory-authorized repair facility.

ARS has a long, established relationship with local factory-authorized repair facilities. These facilities provide prompt, thorough photographic testing and preventive maintenance and repair services, including testing of:

- Current draw
- Shutter speed
- Automatic exposure accuracy
- Film transport
- Lens focus

When the camera, lens, and testing documentation are returned from the repair facility, the following procedures are performed:

- The camera is configured for remote operation (e.g., on a Minolta XL-401/601, the internal batteries are removed and replaced with internal wiring).
- The camera is loaded with Kodachrome 40 super 8 movie film.
- The fully integrated system (camera, timer, and cables) is assembled in a test box.
- The camera is set to standard settings.
- The intervalometer is set at a 60-second interval.
- The timer is set to operate the camera for 8 hours a day.

- The camera is mounted in the test box to film an outdoor vista with a ground to sky ratio of 50/50.

- The timer and cables are observed for proper function.

- The camera is removed when the film cartridge is fully exposed (approximately 7 days).

Test photograph settings and the camera serial number are documented on an 8 mm photographic test log. An example of a completed 8 mm photographic log for a camera test session is provided as Figure 4-1. Film is then sent in for processing. When test film is returned from processing, it is thoroughly reviewed for exposure consistency and focus. If problems are noted the camera is returned to the repair facility for further evaluation, or on the advice of the repair facility, returned to the manufacturer.

4.2.2 Testing Enclosures

The placement of the tripod mount is verified and adjusted if necessary. The window, door lock, and latches are checked to ensure the enclosure is secure and completely weatherproof.

4.3 SHIPPING

Integrated camera systems or individual components are packed for shipping following successful testing. All shipments will be made by the most expedient, cost-effective method, usually by UPS Ground service. Packing slips containing item description, serial number, quantity, weight, and insurance value for all shipments accompany each shipping container. A record of the shipment including a copy of the packing slip is kept on file by the data coordinator.

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CAMERA TEST FORM - 8 MM

STARTING DATE _____ TIME _____

TYPE OF 8 MM CAMERA _____

SERIAL NUMBER _____

TYPE OF TIMER _____

SERIAL NUMBER _____

SETTINGS (if other than standard) _____

_____

ENDING DATE _____ TIME _____

PROBLEMS/COMMENTS _____

_____

_____

_____

_____

_____

_____

Figure 4-1. Example Photographic Log for Camera Test Session.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**PROCUREMENT AND ACCEPTANCE TESTING OF SVHS TIME-LAPSE VIDEO CAMERA SYSTEMS FOR THE HEALY CLEAN COAL PROJECT**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4005-1050**
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AUTHORIZATIONS		
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the steps for procurement and acceptance testing of SVHS time-lapse video monitoring equipment for the Healy Clean Coal Project Visibility Monitoring Program. The primary purpose of acceptance testing is to ensure that all systems are fully functional and operating within acceptable limits when shipped to designated sites.

For the purpose of this TI, a full SVHS time-lapse video camera system consists of:

- A high-resolution color video camera with lens.
- A programmable SVHS recorder, video monitor, and cabling.
- An environmental enclosure for the video camera with sunshield and security lock.
- A camera mount.
- Instruction manuals and example forms.
- Lens cleaning supplies.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Develop camera system specifications, price ranges, and delivery times.
- Obtain information regarding specific equipment needed.
- Obtain site information, contact person's name, telephone number, shipping address, and any other special instructions needed to ship equipment to a site.
- Coordinate purchasing with the data coordinator.
- Coordinate acceptance testing with the field specialist.

2.2 DATA COORDINATOR

The data coordinator shall:

- Prepare equipment purchase orders as directed by the project manager and send the orders to appropriate vendors.
- Receive, label, log, and inventory all equipment.
- Maintain inventory information in the equipment database.

2.3 FIELD SPECIALIST

The field specialist shall:

- Assemble the SVHS time-lapse video system, including camera, cables, monitor, and SVHS recorder, and perform acceptance testing procedures.
- Assemble the camera enclosures, including heaters, camera mounts, and security plates, and perform acceptance testing procedures.
- Assemble a site operator's manual and all necessary SVHS time-lapse video monitoring supplies.
- Package and ship the SVHS time-lapse video systems according to specifications.

2.4 HSE COMMUNICATIONS TECHNICIAN

The microwave technician from HSE Communications shall acceptance test the microwave system.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials required to test an SVHS time-lapse video system include:

- A high-resolution color video camera with lens.
- A programmable SVHS video recorder.
- A color video monitor.
- Power and signal cables.
- A cross-polarizing lens filter.
- A camera enclosure.
- SVHS videocassettes.
- A voltmeter.
- An SVHS Time-Lapse Video System Test Log.

4.0 METHODS

This section includes the following four (4) subsections:

4.1 Procurement
4.2 Acceptance Testing
4.3 Inventory
4.4 Shipping

4.1 PROCUREMENT

Purchase orders (POs) for system components or fully integrated systems are generated by the data coordinator and sent to the project manager for approval. Upon approval, the POs are sent to the appropriate equipment vendors. Upon arrival, equipment is cross-checked against the PO and readied for acceptance testing.

All procurement, acceptance testing, and delivery will be performed within six (6) weeks of the written request. Timely completion of all requests is subject to the availability of the requested monitoring equipment.

After receiving the system components, fabrication of a complete system by an ARS field specialist may be required. Fabrication includes:

- Assembly of the integrated SVHS video system for testing.
- Assembly of the camera enclosure.
- Assembly of site operator's manuals and operating supplies.

4.2 ACCEPTANCE TESTING

SVHS video equipment purchased from a manufacturer will be subject to thorough inspection and acceptance testing upon receipt at ARS. These inspections will include individual component and full system checks to verify that the equipment is operating within manufacturer's specifications. The results of video system tests are documented on an SVHS Time-Lapse Video System Test Log (see Figure 4-1). Test procedures for system components are discussed in the following subsections.

4.2.1 Component Tests

The following component tests are performed:

Camera and lens:
- Basic camera functions
- Lens focus
- Automatic exposure accuracy
- Remote control functionality
- Cable/connector integrity

SVHS recorder:
- Basic recorder functions
- Tape speed and mechanical integrity and cleanliness of the tape drive
- VCR programming and operation
- Date and time displays
- Cable/connector integrity

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SVHS TIME-LAPSE VIDEO SYSTEM TEST LOG

STARTING DATE: _____ TIME: _____

SYSTEM COMPONENTS (list camera, recorder, enclosure, mount, and other components):

Component	Model No.	Serial No.	Component Test Comments

SETTINGS (if other than standard):

_____
_____
_____
_____
_____

TEST COMMENTS/PROBLEMS:

_____
_____
_____
_____
_____
_____

ENDING DATE: _____

Figure 4-1. SVHS Time-Lapse Video System Test Log.

Monitor:
- Basic monitor functions
- Color and contrast
- Resolution display options
- Cable/connector integrity

Enclosures:
- Latches and seals to ensure that the system is weatherproof
- Climate control functions of:
  - Thermostat
  - Heaters
  - Vent fans
- Cable/connector integrity

Camera mount:
- Basic mount functions
- Remote control functionality
- Camera mount heater
- Cable/connector integrity

All component test information is logged on the SVHS Time-Lapse Video System Test Log. If problems are noted, the malfunctioning unit is repaired by ARS, returned to the supplier for repair, or at the advice of the supplier, returned to the manufacturer. All components passing the acceptance tests are integrated into a SVHS monitoring system and further tested as described below.

4.2.2 System Tests

Components are fully integrated into a field ready system and further tested as follows:

- The camera is mounted in the camera enclosure and placed outdoors to film an outdoor vista.

- The camera is configured for remote operation as it will be applied in the field monitoring program.

- The lens is focused on the selected vista using the monitor to verify the focus.

- The recorder is loaded with an SVHS videocassette and programmed as it will be applied in the field monitoring program.

- A 1-hour test is initially performed to ensure that the integrated system is working properly. Any noted inconsistencies are resolved.

- A 48-hour operational test is then performed during which the operation of all components are observed.

- Following the 48-hour test, the videotape is thoroughly reviewed for timing, exposure consistency, and focus.

If problems are noted, the system and its individual components are reevaluated. Problems are resolved by repair or replacement of malfunctioning or incompatible components.

4.2.3 Supporting Hardware

All supporting hardware (e.g., nuts, bolts, connectors, etc.) is checked, inventoried, and packaged to assure that all required hardware is available for installation. If special brackets, posts, or other support systems are required, or if modifications to standard components are necessary, they are fabricated and tested by ARS.

4.3 INVENTORY

An up-to-date accounting of purchase and warranty information, location, and status of all purchased equipment will be maintained. Primary accounting will be performed in The ARS Purchase Order/Inventory Database. The database can be searched and sorted by fields to yield reports such as equipment listings by site, equipment type, manufacturer, model number, serial number, property number, purchase order number, date purchased, or a variety of additional search fields.

Monthly updates of the equipment database will be routinely performed by the data coordinator. Purchase orders, repair records, and all other available sources of equipment status will serve as documentation of equipment database entries.

All equipment not being used at a monitoring site will be stored in a secure location at ARS. A detailed inventory of all items awaiting maintenance, testing, or future deployment will be maintained at all times. Items uneconomical for repair will be salvaged for parts.

4.4 SHIPPING

Integrated SVHS time-lapse video camera systems or individual components are packed for shipping following successful testing. All shipments will be made by the most expedient, cost-effective method. Packing slips containing item description, serial number, quantity, weight, and insurance value for all shipments accompany each shipping container. A record of the shipment including a copy of the packing slip is kept on file by the data coordinator.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SITE SELECTION FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4055**
DATE	**DECEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor text modifications.	April 1996	
1.0	Add digital camera/video system references	April 1999	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines site selection criteria for automatic camera monitoring systems.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visibility relationships to decision-makers and to the public. Self-contained, automatic camera monitoring systems or time-lapse video monitoring systems are easily installed and operated. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

An automatic camera visibility monitoring station takes 35 mm slides or high-resolution digital images of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera or an SVHS time-lapse recorder to record the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides, digital images, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for the computer image modeling of potential impairment.
- Support color and human perception research.

Slides, digital images, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

In addition to visibility monitoring, time-lapse video systems can be used for a variety of purposes, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.

- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

This SOP serves as a guideline to facilitate:

- Locating potential sites.
- Evaluating potential sites.
- Selecting the most appropriate site from the potential sites.
- Finalizing the selected site.

2.0 RESPONSIBILITIES

2.1 PROGRAM MANAGER

The program manager shall:

- Inform the project manager of the location area and site-specific monitoring objectives for a proposed scene monitoring site.
- As required, review the selected site with the project manager and project-specific Contracting Officer's Technical Representative (COTR).

2.2 PROJECT MANAGER

The project manager shall:

- Prepare the project-specific siting and operational objectives, guidelines, and considerations.
- Review with the field specialist photographic documentation, maps, and other information to determine the suitability of a site.
- Select the site for the scene monitoring equipment based on the criteria outlined in this SOP.
- As required, review the selected site with the program manager.

2.3 FIELD SPECIALIST

The field specialist shall:

- Initiate the search for potential sites by sending the pertinent siting criteria and associated siting materials to the local contact.

- Obtain permission to perform any site preparation that may be required.
- Obtain permission from private or public landowners for permanent access to the monitoring location.
- Maintain communications with the local contact during the field survey of potential sites. Verify that all potential sites have been identified and thoroughly evaluated, and that all materials are returned for review in a timely fashion. The actual field survey of potential monitoring sites can be performed by the field specialist, by the local contact, or by both.
- Work with the local contact sponsoring agency to identify a site operator and local primary contact to service the equipment.
- Review with the project manager photographic documentation, maps, and other information to determine the suitability of a site.
- Enter all site selection information in the site-specific Quality Assurance Database.

2.4 LOCAL (ON-SITE) CONTACT

The local contact shall:

- Review the technical and monitoring requirements provided by the field specialist.
- Identify potential sites and scenic vistas.
- Maintain communications with the field specialist during the field survey of potential sites. The actual field survey can be performed by the local contact, field specialist, or both.
- Photograph and document potential sites and scenic vistas. Provide a set of processed 3 1/2" x 5" prints and all pertinent documentation to the field specialist for review. Retain a second set of prints for on-site review. If necessary, the exposed film can be mailed to the field specialist for processing.
- Document the selected site location(s) and scenic vista(s) on a topographic map.
- Identify and contact local landowners, primary contacts, and operators regarding site installation and routine maintenance requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials are generally required to complete the site selection process includes:

- Topographic maps of the area of interest.
- A camera and film to take photographs of the proposed site(s) and scenic vista(s).
- A list of monitoring objectives, requirements, and associated air quality monitoring equipment.

- A list of local sources affecting the air in the area of interest.
- Information about the availability of AC power and telephone service for time-lapse video monitoring, electronic transmission of digital images, and/or associated aerosol and/or optical monitoring equipment.

4.0 METHODS

This section describes site selection procedures and includes three (3) major subsections:

4.1 Locating Potential Sites
4.2 Reviewing and Selecting Potential Sites
4.3 Finalizing Site Selection

4.1 LOCATING POTENTIAL SITES

Site selection begins with the process of locating potential sites and scenic vistas in the monitoring area of interest. The following steps detail the approach:

OBTAIN SITING CRITERIA

The field specialist obtains specific siting criteria from the project manager. Siting criteria may include regional or site-specific program objectives, meteorological conditions of the monitoring area, and/or other considerations.

To assure consistent, quality data and minimize data loss, scene monitoring sites should be selected to have most or all of the following characteristics:

- Be located to photograph a highly-visited scenic vista or important scenic features of the visibility-sensitive area being monitored, viewing:
  - The longest viewing path possible.
  - North or away from direct sun angles, to minimize lens flare and overexposure.
- Include a vista encompassing the same air mass monitored by associated aerosol (particle monitors) and/or optical (nephelometer or transmissometer) instrumentation.
- Be removed from local pollution sources (e.g., vehicle exhaust, wood smoke, road dust, etc.).
- Be representative of regional (not local) visibility.
- Be secure from vandalism.
- Have available servicing personnel (operator).
- Be reasonably accessible during all months of the year.

LOCATE POTENTIAL SITES

Locate potential sites from maps and through consultation with local contacts familiar with the monitoring area of interest.

SEND SITING PACKAGE TO LOCAL CONTACT

Send the scene monitoring siting package to a local contact familiar with the proposed monitoring area. The siting package includes the following:

- A cover letter that includes a brief description of the monitoring area and associated program objectives (Figure 4-1)
- Technical Notes summarizing scenic monitoring, monitoring services provided, (Figures 4-2 and 4-3 respectively), and the camera system type to be used (i.e., automatic 35 mm camera system, digital camera system, 8 mm camera system, or SVHS time-lapse video system)
- A list of siting criteria for the camera system to be used
- A disposable 35 mm camera or a camera and roll of print film
- A Photographic Log (Figure 4-4) for summarizing selected monitoring locations and monitoring vistas

FIELD SURVEY AND SITE SELECTION DOCUMENTATION

The local contact should review the technical and monitoring requirements and identify potential sites and scenic vistas in relation to the protocols provided. Actual field surveys can be performed by the local contact, an ARS field specialist, or both.

The results of the field survey should include a series of overlapping photographs taken of each proposed vista (preferably with a 50-135 mm zoom lens). Supplemental photographs of each site location should also be provided. The location, azimuth, predominant scenic feature, and lens focal length used for each photograph should be documented on the provided Photographic Log (Figure 4-4).

Identify and record the selected site location(s) and scenic vista(s) on a topographic map of the area.

Record any pertinent information regarding accessibility, security, vista preference, available AC power or telephone service, special requirements, etc.

Return the film, Photographic Log, site location maps, and any other selection materials to ARS for final review.

CHECK RETURNED SITING PACKAGE

Check the returned scene monitoring documentation and Photographic Log for completeness. Obtain any missing information from the local contact or from initial site selection materials. Process any undeveloped film. Evaluate the photographs of each potential site. If additional photographs are required, send another camera or additional film to the local contact with instructions detailing the photographs required.

June 11, 1993

Christi Gordon
Pike/San Isabel National Forest
1920 Valley Drive
Pueblo, Colorado 81008

Dear Christi:

Under the direction of Rich Fisher, COTR, and Tamra Blett (Region 2), the **Pike/San Isabel National Forest** has appropriated funds to establish a scene (camera-only) visibility monitoring site to represent the Colorado Front Range.

Air Resource Specialists Inc. (ARS) has been contracted to provide site selection and initialization consultation during FY-93. It is my understanding that the photographic monitoring equipment for the site selected will be provided by Region 2, and that monitoring will not begin until FY-94. Let me know if this is incorrect. Once the site is operational ARS will provide all necessary operational supplies, and report all collected data. In consultation with ARS, you and your staff will be responsible for initial site selection, equipment installation, and day-to-day monitoring operations.

Attached are ARS Technical Notes 92-201 and 92-202, that describe visibility monitoring approaches and the optical, scene, and aerosol monitoring instrumentation supported by Air Resource Specialists, Inc. I have also attached a list of siting protocols for 35mm camera-based visibility monitoring for your consideration prior to Forest's initial siting trip(s). Please review and keep this information for future reference.

When considering scene monitoring, your first task is to consider all possible site installation points and scenic views that best represent the visual air quality in the vicinity of the Class I area, or area of concern. To expedite the site installation process, a panorama of photographs from each potential site should be taken. One or two photographs of the site location would also be helpful for installation configuration. Two rolls of 35mm print film are enclosed for your use. If possible, panoramas should be taken with a 35mm camera with a 135mm lens. Carefully document the type of camera and lens focal length used for each set of photos.

When all siting trips have been completed, make double prints of the film, label and identify prominent landmarks directly on the prints. Mail one set of panoramas to me for review along with a corresponding topographic map (or Xerox of a map). Retain the other set for your reference during phone conversations. Forest maps of the area(s) selected would also be appreciated.

Thank you for your interest in air quality monitoring. Please call if you have any questions or require additional information pertaining to the USFS Air Quality Monitoring Program. I look forward to working with you and your Air Resource staff in the future.

Sincerely,

Kristi Savig
Project Manager

KS:ks
cc: T. Blett (Region 2 Air Resource Manager)
cc: R. Fisher (Contracting Officer- Tech. Rep.)

Figure 4-1. Example Siting Package Cover Letter.

Air Resource Specialists, Inc.

Automatic Camera Visibility Monitoring System

Technical Note 92-202

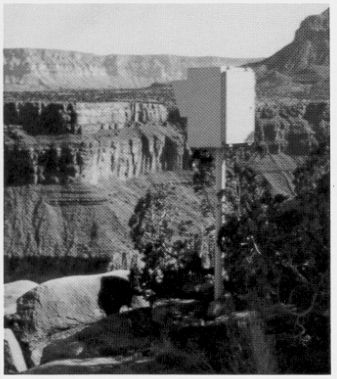

Figure 1. Automatic Camera System in a Remote Location

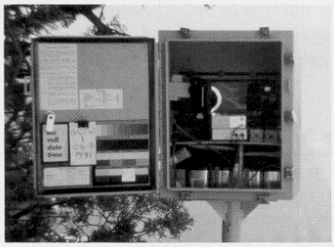

Figure 2. Station Components

Introduction

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility sensitive areas. Photography is an efficient way to document these events and trends on a media that is a valuable analytical tool and is also easily interpreted by decision makers and the public. Self-contained, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location. Camera-based visibility monitoring is an effective, economical component of a visibility monitoring program.

Value of Photographic Visibility Monitoring

The automatic camera visibility monitoring station takes 35mm slides of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8mm time-lapse camera to record the dynamics of visibility events. The station is self-contained and battery-powered and is easily installed, operated, and maintained.

The day-to-day variations in visual air quality captured on 35mm color slides or 8mm color movie film can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events)
- Provide a quality assurance reference for collocated measurements
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality
- Identify areas of potential impairment
- Estimate the optical properties of the atmosphere under certain conditions
- Provide quality media for visually presenting program goals, objectives, and results to decision makers and the public
- Support computer image modeling of potential impairment
- Support color and human perception research

Instrumentation

Figure 1 is a photograph of the automatic camera station in a remote mountain location. Figure 2 shows the components of a station, including a weatherproof shelter and mounting post, cameras, automatic timers, and batteries. The station can be outfitted with a variety of camera configurations, including one or two 35mm cameras or 8mm time-lapse cameras. The station is fabricated by ARS Technologies, Inc.

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Figure 4-2. Example Technical Note Summarizing ARS Scenic Monitoring.

Air Resource Specialists, Inc.

Visibility Monitoring Approaches

Technical Note 92-201

Introduction

Protection of the visibility resource in Class I wilderness areas, rural areas and urban areas is an important issue. A variety of monitoring techniques exist to document visibility conditions and to make quantitative measurements of the atmospheric properties that affect visibility. The IMPROVE Program (Interagency Monitoring of Protected Visual Environments) has partitioned visibility-related characteristics and measurements into three groups:

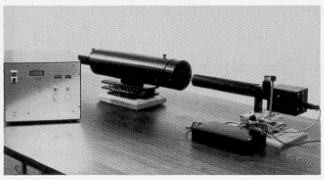
Optical: the ability of the atmosphere to scatter or absorb light passing through it. The physical properties of the atmosphere are described by extinction, scattering and absorption coefficients, plus an angular dependence of the scattering, known as the scattering phase function. Optical characteristics integrate the effects of atmospheric aerosols and gasses. Commonly applied optical monitoring instruments include transmissometers and nephelometers.

Scene: the appearance of a scene viewed through the atmosphere. Scene characteristics include observer visual range, scene contrast , color, texture, clarity and other descriptive terms. Scene characteristics change with illumination and atmospheric composition. Photographs are an effective way to document scene characteristics.

Aerosol: the physical properties of the ambient atmospheric aerosols (chemical composition, size, shape, concentration, temporal and spatial distribution and other physical properties) through which a scene is viewed. Fine particle measurements are commonly made to quantify aerosol characteristics.

The techniques most appropriately applied in a monitoring program depend on monitoring objectives and budget considerations. Air Resource Specialists, Inc. (ARS) can help you plan and develop your visibility monitoring and data analysis program. An overview of the variety of visibility-related air quality monitoring and analysis techniques supported by ARS is presented in this technical note.

Optical Monitoring



Transmissometer

ARS has been intimately involved with the development, implementation and operation of high-resolution, long-range transmissometers for visibility measurements. The Optec LPV-2 transmissometer, the only existing, operational long-range system, directly measures the ability of the atmosphere to transmit light. These measurements have an exact relationship to the total atmospheric extinction coefficient. ARS has developed the installation and operational protocols for the system and has installed and operated over 25 systems in class I areas and urban environments. ARS has also developed transmissometer analysis protocols and programs and provides a full range of system calibration and maintenance services. ARS is the recognized leader in transmissometer applications for visibility. A more complete description of transmissometer systems is provided in ARS Technical Note 92-204.

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Figure 4-3. Example Technical Note Summarizing ARS Air Quality Monitoring Services.

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Site Ventana Wilderness

Roll # 1

PHOTOGRAPHIC LOG

EXPOSURE NUMBER	DATE	TIME	DESCRIPTION/COMMENTS
			All photographs were shot with a 50 mm lens on a 35 mm camera.
From Figueroa Lookout:			
1	8/9/93	9:30 am	Guy Mountain (approx. 20 km, 21°)
2	8/9/93	9:30 am	Peak Mountain (approx. 20 km, 33°)
3	8/9/93	9:30 am	Hill 3690 (approx. 10 km, 70°)
4	8/9/93	9:30 am	Samon (approx. 31 km, 93°)
From Anderson Peak:			
1	8/12/93	1:50 pm	Ventana Cone (4727', 344°)
2	8/12/93	1:50 pm	Ventana Vista (333° - 3°)
3	8/12/93	1:50 pm	Ventana Vista
4	8/12/93	1:50 pm	Ventana Vista
5	8/12/93	1:50 pm	Anderson River Drainage (60°)

(2.13 3/93)

Figure 4-4. Example Photographic Log.

4.2 REVIEWING AND SELECTING POTENTIAL SITES

The siting package for potential sites must be reviewed to determine if any of the potential scenic vistas and their associated monitoring sites are acceptable. The following criteria should be used to evaluate the suitability of a potential site:

EVALUATE SITE SUITABILITY

- Overall monitoring criteria defined by the program manager
- Vista contains important scenic features of the area to be monitored
- Vista contains the same air mass monitored by associated aerosol and/or optical instrumentation (where applicable)
- Year-round site operator accessibility
- Availability of AC power for time-lapse video systems.
- Availability of telephone service for digital camera electronic transmission of captured images.
- Availability of a reliable site operator
- Environmental considerations (e.g., snow depth, temperature extremes, precipitation type and amount, relative humidity, etc.) that could affect camera operations or site accessibility
- Security from potential vandalism
- Locations of obstructions or interferences
- Influence of local pollution sources
- Viewing angle(s) in relation to the sun
- Type and location of any collocated instrumentation
- Local land manager or land owner cooperation
- Ease of installation, including distance to nearest town

SELECT BEST SITE

In consultation with the local contact, select the best site based on the results of the evaluation and pertinent on-site comments. Compromises may be required.

- Provide selected site description, map, and vista photograph to the project manager for final review and approval.

4.3 FINALIZING SITE SELECTION

After evaluating potential sites and selecting the most appropriate site, the following actions are required to finalize the site selection:

- Obtain approval of the selected site from the project manager.

- As required, the final site selection and related information are presented to the program manager and/or the project-specific COTR for final review and approval.

- Provide a detailed description of the selected site, scenic vista, lens focal length, method of installation, and proposed installation schedule to the property manager and selected site operator.

- Obtain permission to use the site and to arrange for any site preparation from the property manager, land manager (public lands), or land owner (private lands).

- Initiate installation protocols as described in SOP 4075, *Installation and Site Documentation for Scene Monitoring Equipment*.

- Enter all site location, scenic vista, and site operator contact information in the site-specific Quality Assurance Database.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**INSTALLATION AND SITE DOCUMENTATION FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4075**
DATE	**DECEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Update format.	May 1996	

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LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes installation and site documentation requirements for automatic visibility monitoring camera systems operated according to IMPROVE Protocol.

Camera-based visibility monitoring, referred to as scene monitoring by the IMPROVE Program, is an efficient way to document events and trends and is an effective way to communicate visibility relationships to decision-makers and to the public. Slides and movie film do not, however, provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

The automatic camera visibility monitoring station takes 35 mm slides of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera to record the dynamics of visibility events. Self-contained, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location.

The purpose of this standard operating procedure is to assure consistent, quality data and minimize data loss by:

- Installing procured automatic visibility monitoring camera systems according to manufacturers' specifications.

- Ensuring that visibility monitoring systems are installed in locations that view important scenic features, monitors the same air mass of associated aerosol and/or optical instrumentation, and are secure from potential vandalism (see SOP 4055, *Site Selection For Scene Monitoring Equipment*).

- Training site operators on camera system requirements and routine maintenance procedures (see SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*, and its associated technical instructions).

- Performing thorough on-site specification measurements.

- Documenting collected site specification measurements on the Visibility Monitoring Photographic Site and Target Specifications Form.

This SOP serves as a guideline to facilitate the following:

- Installing automatic visibility monitoring camera systems

- Completing the Visibility Monitoring Photographic Site and Target Specifications Form

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide the field specialist final site configuration materials including photographic documentation, maps, and approved installation location, vista, and configuration specifications.

- As required, review the determined site preparation and installation requirements and installation schedule with the project-specific Contracting Officer's Technical Representative (COTR).

2.2 FIELD SPECIALIST

The field specialist shall:

- Schedule the system installation.

- As required, review the determined site preparation and installation requirements with the local contact.

- Maintain communications with the local contact during site preparation. Verify that all required site preparation is completed prior to the installation.

- Obtain permission from private or public landowners to access the scene monitoring location for installation and training.

- Schedule an operator training session for all identified operator(s) and the primary local contact.

- Install all automatic camera system equipment according to installation and configuration requirements provided by the project manager.

- Complete the Visibility Monitoring Photographic Site and Target Specifications Form.

- Enter all site specification information in the Quality Assurance Database.

2.3 LOCAL (ON-SITE) CONTACT

The local contact shall:

- Review the determined site preparation and installation requirements with the field specialist.

- Identify and contact local landowners, primary contacts, and site operators regarding site installation and routine maintenance requirements.

- Perform any necessary site preparation required prior to the installation (e.g., tree removal, clear site access).

- Maintain communications with the field specialist and local landowners to confirm scheduled installation requirements.

- Schedule the operator training session with pertinent routine servicing personnel and the field specialist.

- Provide on-site equipment and tools required for the determined mounting configuration.

- Provide site access and installation assistance as needed.

- Verify site location and geographic reference specifications documented by the field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE INSTALLATION EQUIPMENT AND MATERIALS

Materials required to install an automatic camera system depend on the type of installation and surface material to which the enclosure is mounted. Standard equipment and materials required for any camera system installation include:

- Weatherproof automatic camera system enclosure provided with:

  - Four 1" carriage bolts (3/8" diameter)

  - Four 3/8" nuts and lock washers

  - Clear silicone seal

- Double-plated mounting post

- Camera system components and tripod mount

- Standard tool kit with adjustable crescent wrench, channel-lock pliers, standard combination wrench set, screwdrivers (flat-head and Phillips-head), wire snips, needle-nose pliers, regular pliers, wire ties, and electrical tape

- Brunton compass

- Level

- Site location maps

- Documentation camera(s) and 35 mm print film

The following site installation equipment and materials requirements have been categorized by mounting configuration.

3.1.1 Pre-Existing Concrete or Rock Installation

Standard equipment and tools required to install an automatic camera system in pre-existing concrete or rock include:

- Hammer drill (AC or battery, depending on line power availability)
- 5/8" hammer bit and 5/8" star drill
- Two pound (2 lb.) hand sledge hammer
- Hack saw
- Threaded rod and rock/concrete epoxy mounting method hardware:
  - Four 6" lengths of 1/2" threaded rod
  - Four to six 1/2" rock/concrete inserts (5/8" outside diameter)
  - Four to six 1/2" rock/concrete epoxy capsules
- Rock/concrete inserts and bolts mounting method hardware:
  - Eight or more 1/2" nuts and twelve or more washers
  - Four lock washers
  - Four 1/2" bolts (1-1/2" or 2" in length)

3.1.2 Soil Installation

Standard equipment and tools required to install an automatic camera system in soil include:

- Shovel
- Wheelbarrow
- 7-10 gallons of water (two 5-gallon water containers for transport, if necessary)
- Four 1/2" foundation J-bolts (8" to 12" in length)
- Eight 1/2" nuts and washers
- Four lock washers
- Thin plywood template of post mounting plate hole pattern (with pre-drilled mounting holes)
- Two to four bags of concrete mix

3.1.3 Wood Platform Installation

Standard equipment and tools required to install an automatic camera system in a wood surface or platform include:

- Drill (AC or battery, depending on line power availability)
- Drill bit set (up to 3/8" in diameter)
- Four 3/8" lag screws (1-1/2 to 3" in length, depending on wood thickness). Four washers and four lock washers

  or

- Four 1/2" carriage bolts (length depending on wood thickness). Eight nuts, eight washers and four lock washers

If there is adequate access to the underside of the wood surface, it is preferable to use carriage bolts instead of lag screws.

3.1.4 Concrete Pad Installation

Standard equipment and tools required to install an automatic camera system in a concrete pad include:

- Drill (AC or battery, depending on line power availability)
- 1/2" drill bit
- Wood saw
- 30" x 30" piece of 1/2" thick plywood
- Two 30" lengths of 2" x 4" lumber
- Two 27" lengths of 2" x 4" lumber
- Twenty-four or more 1" or 1-1/2" wood screws
- Twelve or more 2-1/2" or 3" wood screws
- Two to four bags of concrete mix (enough for 1.5 cubic feet of concrete)
- Four 1/2" x 6" carriage bolts (entire length must be threaded)
- Eight 1/2" nuts, 12 washers, and 4 lock washers
- Thin plywood template of post mounting plate hole pattern (with pre-drilled mounting holes)

3.2 SITE DOCUMENTATION MATERIALS

The following materials are generally required to complete the site documentation process:

- Photographs of the site, final equipment configuration, and scenic vista(s)
- On-site documentation acquired by the field specialist during installation, required to complete the Visibility Monitoring Photographic Site and Target Specifications Form (see Section 4.5) (e.g., site location, site operator contact information, etc.)
- Topographic maps of the area
- Ruler, protractor, and calculator

4.0 METHODS

This section describes site installation and documentation procedures and includes five (5) major subsections:

4.1 Site Preparation and Communication
4.2 Vista Alignment
4.3 Installation of Automatic Camera Equipment
4.4 Operator Training
4.5 Site Documentation

4.1 SITE PREPARATION AND COMMUNICATION

Prior to any installation site visit:

- Review the determined site preparation and installation requirements with the site-specific local contact.
- Schedule all site preparation activities.
- Maintain communications with the local contact during site preparation. Verify that all required site preparation is completed prior to the installation.
- Document the primary site operator(s) and back-up operator(s).
- Obtain permission from private or public landowners to access the monitoring location for installation and training.
- Schedule the site installation visit and operator training session.
- Arrange for any necessary installation assistance, as well as tools and equipment (e.g., wheelbarrow, water containers).

Once on site:

- Ensure that the selected visibility monitoring location views important scenic features, monitors the same air mass of associated aerosol and/or optical instrumentation, and is secure from potential vandalism.

- Verify the proposed installation configuration and time scheduled for the final training session.

4.2 VISTA ALIGNMENT

Before the automatic camera system can be installed, the mounting post must be appropriately aligned on the selected monitoring vista (target).

- Stand the mounting post on the installation spot.

- Determine the post orientation by aligning either short edge of the top mounting plate on the center of the expected vista (target).

- Minor camera alignment adjustments are made with the camera tripod mount after installation of the post and enclosure is complete.

4.3 INSTALLATION OF AUTOMATIC CAMERA EQUIPMENT

The automatic camera system mounting post, enclosure, and monitoring equipment will be installed in best accordance with the approved siting configuration specifications. Mounting post and enclosure installation procedures are described in the following subsections.

4.3.1 Mounting Post Installation

Mounting post installation procedures depend on the type of installation and surface material to which the post is mounted. The mounting posts may be attached to pre-existing concrete or rock, in soil, in a wood platform, or to a new concrete pad.

ATTACHMENT TO PRE-EXISTING CONCRETE OR ROCK

If vandalism is a concern or if the mounting surface is uneven, use threaded rods and rock/concrete epoxy capsules for mounting; otherwise, use rock/concrete inserts and bolts. A diagram depicting both techniques for pre-existing concrete or rock surface mounting is provided as Figure 4-1.

Threaded Rod and Rock/Concrete Epoxy:

- Using the post bottom mounting plate as a template, drill holes for the 1/2" diameter threaded rod segments. Refer to the instructions on the rock/concrete epoxy capsule box for hole diameter, depth, hole preparation, threaded rod preparation, and use of the epoxy capsules. Normally a 5/8" diameter hammer drill bit is used to drill a hole 4" deep.

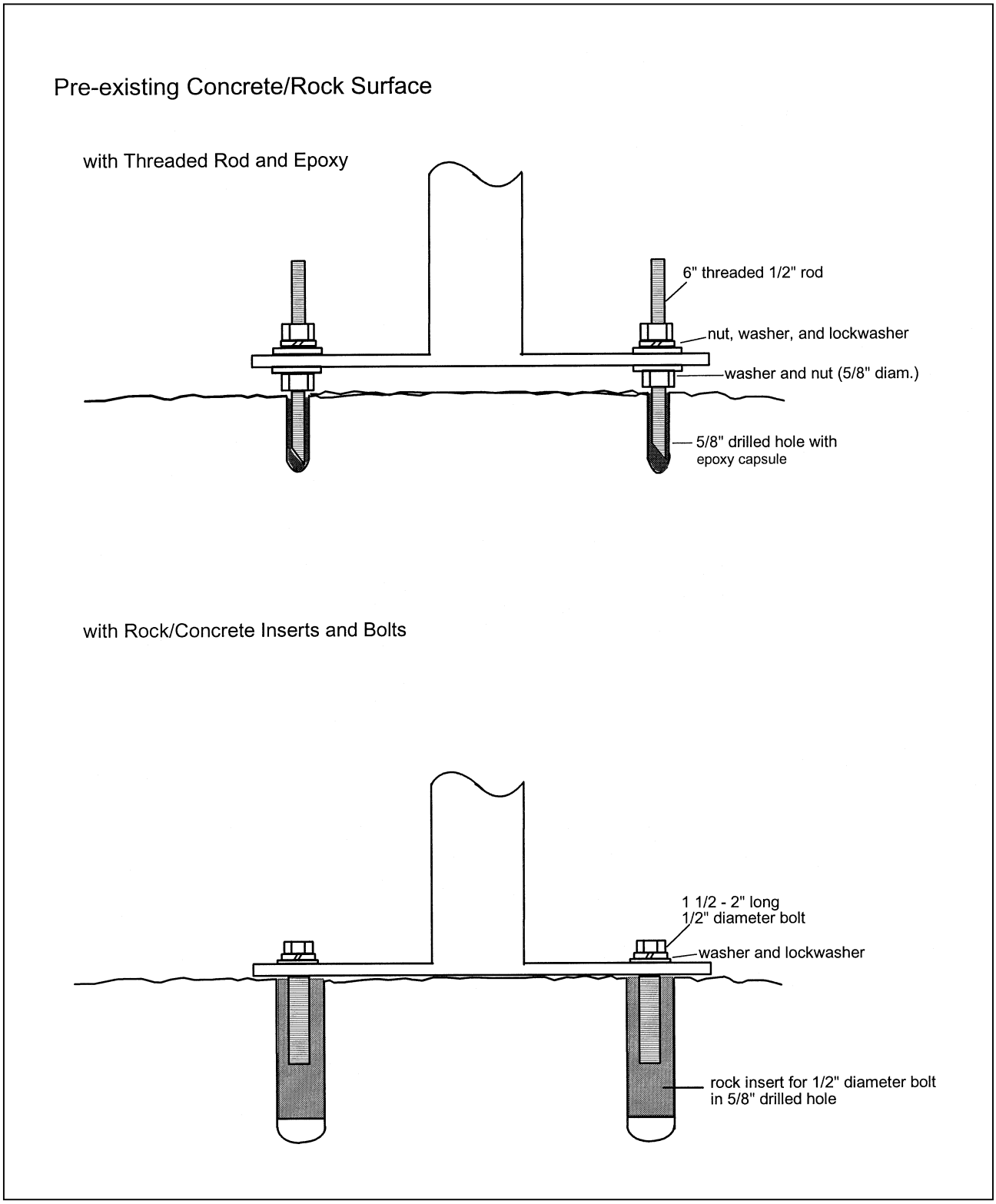

Figure 4-1. Mounting Post Configuration in Pre-Existing Concrete/Rock Surface.

- After the epoxy has set, screw a nut, with washer, on each rod section. Place the mounting post over the rods.

- Level the mounting post by adjusting the nuts. Verify that the mounting plate rests evenly on all four nuts.

- Using washers, lock-washers, and nuts, secure the mounting plate.

- To prevent vandalism or theft, bend over the tops of the threaded rods or damage the rod threads so that the nuts cannot be removed.

Rock/Concrete Inserts and Bolts:

- Using the post bottom mounting plate as a template, drill holes (typically 5/8" in diameter for 1/2" diameter bolts with inserts) slightly deeper than the length of the insert. Since the mounting plate hole insert alignment is critical, it is advisable to prepare one hole at a time and secure the mounting plate before proceeding with the next hole.

- Tap the insert into the hole and secure the post mounting plate with a bolt, washer, and lock washer. Proceed one hole at a time as noted above.

- Minor leveling adjustments can be made by placing additional washers between the mounting plate and the mounting surface.

- This type of post attachment is more vulnerable to theft or vandalism. Other deterrents such as lock and chaining the post should be considered.

ATTACHMENT TO CONCRETE PIER IN SOIL

The hole size, amount of concrete, type of hardware used, and other installation related hardware may vary depending on the observed mounting soil conditions and determined configuration requirements. A diagram depicting a concrete pier installation in soil is provided as Figure 4-2.

- Assemble wood template and J-bolts with nuts so that at least 1-1/2" of thread protrudes above the template.

- Dig a hole 1-1/2 feet in diameter and 1-1/2 to 2 feet deep. Fill the hole to ground level with concrete.

Note: The concrete/water mix should be fluid enough that it will mold around the J-bolts.

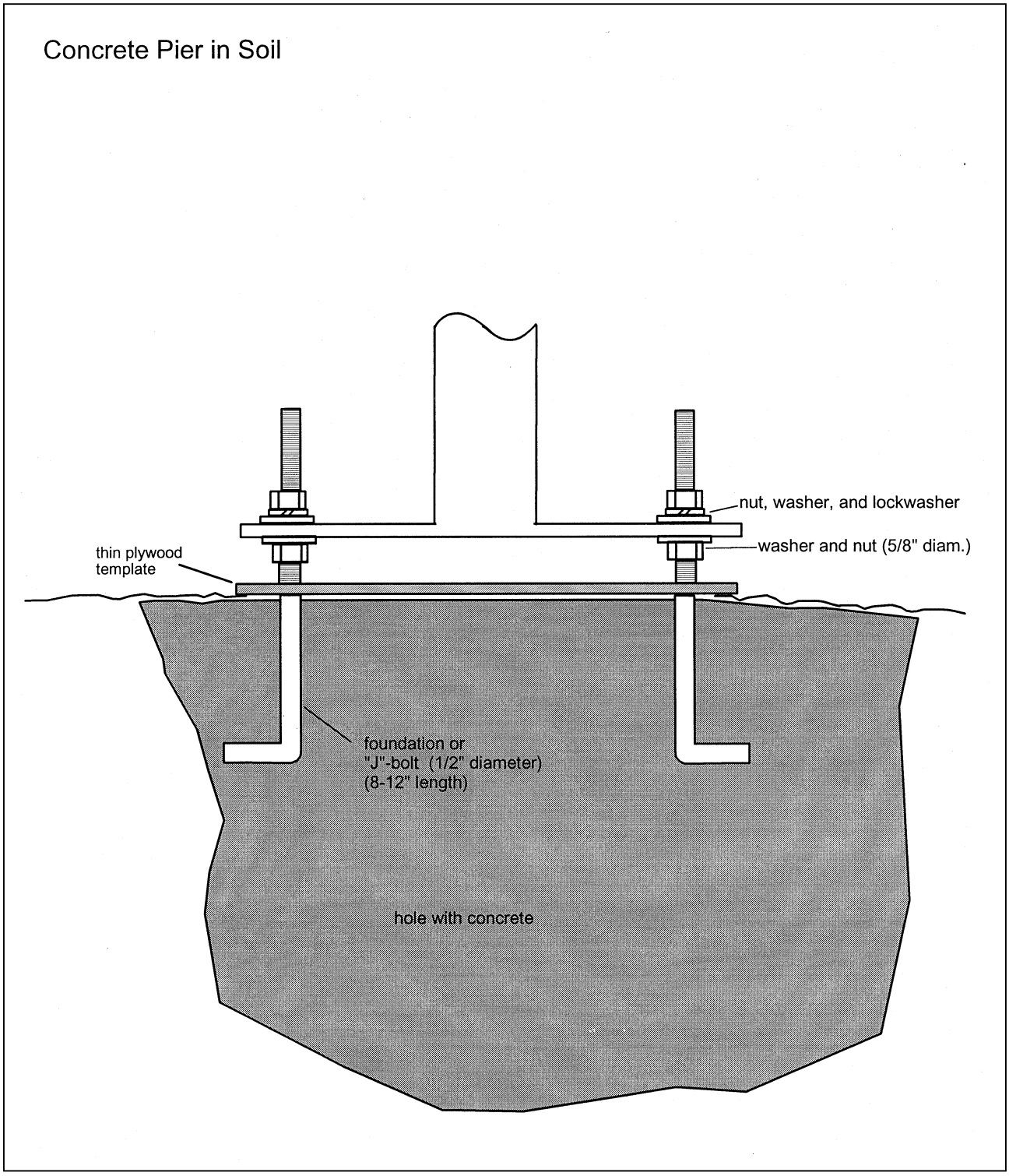

Figure 4-2. Mounting Post Configuration in Concrete Pier in Soil Surface.

- Place the template assembly on the wet concrete and work the J-bolts into the concrete as shown in Figure 4-2. Be careful to verify that the template is aligned on the selected vista (Section 4.2).

- Allow the concrete to set for least 10 hours. Drying time depends on soil temperature. If cold weather or heavy rain is expected, protect the concrete with insulating or waterproof cover.

- Place nuts and washers on the J-bolts and place the mounting post over the bolts.

- Level the post by adjusting the nuts. Verify that the mounting plate rests evenly on all four nuts.

- Using washers, lock-washers, and nuts, secure the mounting plate.

- To prevent vandalism or theft, bend over the tops of the threaded rods or damage the rod threads so that the nuts cannot be removed.

ATTACHMENT TO WOOD

Depending on the thickness of the wood platform and underside access, mounting can be accomplished with lag screws or carriage bolts. If there is adequate access to the underside of the wood surface, carriage bolts are more stable and often more of a vandalism deterrent than lag screws. The installation procedures, whether using carriage bolts or lag screws, are similar. A diagram depicting both methods for wood surface mounting is provided as Figure 4-3.

- Using the bottom post mounting plate as a template, drill holes for the screws or bolts in the wood.

- Secure the post mounting plate to the wood surface with the bolts or screws, using washers and lock washers.

- Minor leveling adjustments of the post can be done by placing additional washers between the wood surface and the mounting plate.

This type of installation is relatively vulnerable to theft or vandalism. Other deterrents such as lock and chaining the post should be considered.

ATTACHMENT TO CONCRETE PAD

Concrete pad installations are normally preferred on roof surfaces or in locations where the site cannot be permanently altered. Due to weight (approximately 200 pounds), it is advisable to pour a concrete pad after the form has been placed at the installation site. If a concrete form and pad will be exposed to weather for an extended period, the wood should be sealed and/or painted.

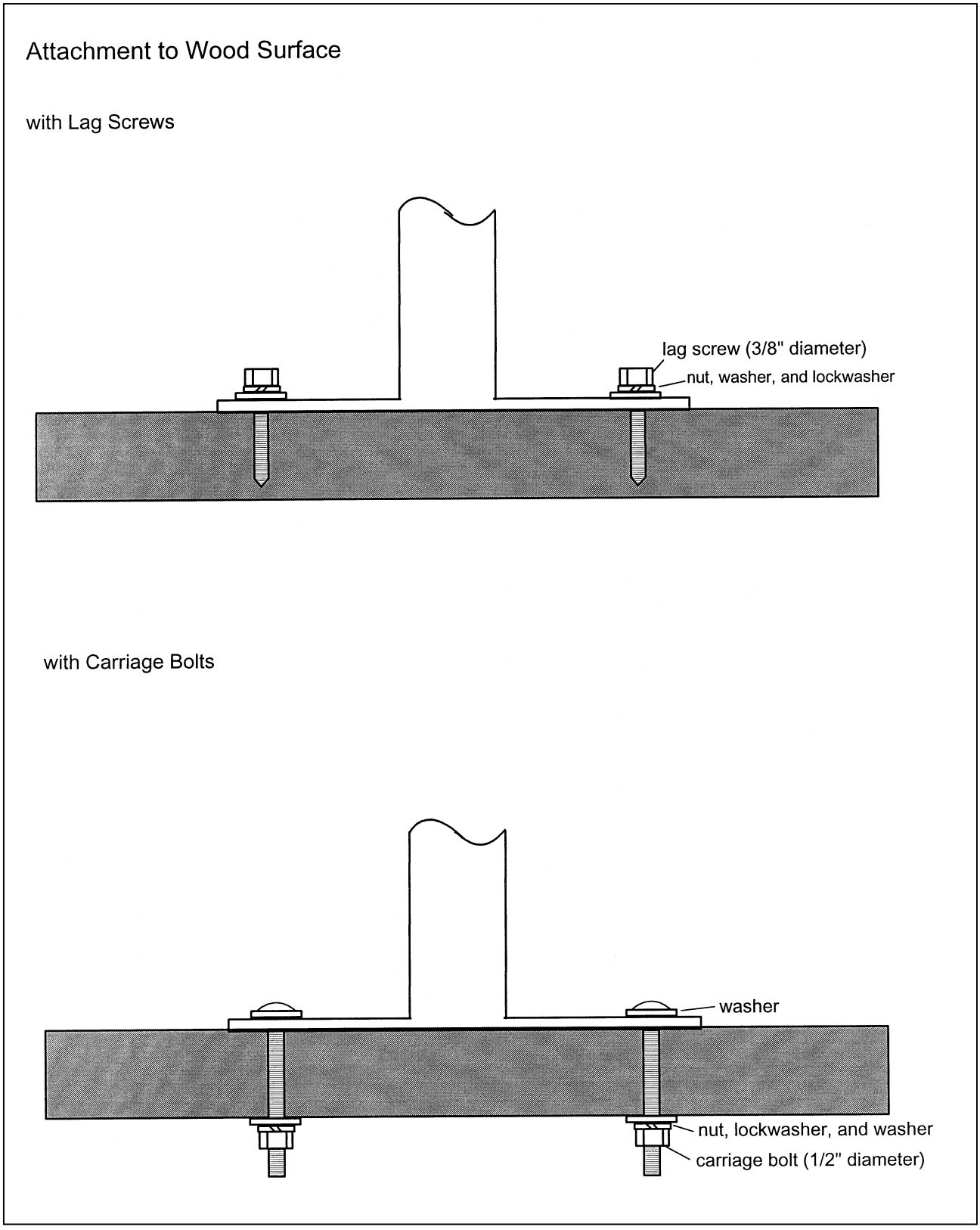

Figure 4-3. Mounting Post Configuration in Wood Surface.

A diagram depicting the pad form and hardware attachment is provided as Figure 4-4.

- Attach the 2" x 4" lumber to the large 1/2" plywood square.
  - The shorter (1-1/2") wood screws are used to secure the plywood to the 2" x 4"s.
  - The longer (2-1/2" to 3") screws are used at the corners to attach the 2" x 4"s to each other.
- Using the bottom post mounting plate as a template, drill four holes, 1/2" in diameter, in the plywood.
- Attach each of the four carriage bolts to the form using two washers, a lock washer, and a nut.
- Set the pad form on the installation site and fill to the top edge with concrete. Place the thin plywood template of the bottom post mounting plate over the tops of carriage bolts to ensure correct alignment.

Note: The concrete/water mix should be fluid enough that it will mold around the J-bolts.

- Allow the concrete to set for at least 10 hours. Drying time depends on air temperature. If cold weather or precipitation is expected, protect the concrete with an insulating and/or waterproof cover.
- After the concrete has set, remove the thin plywood template and attach the mounting post to the concrete pad with washers, lock washers, and nuts.
- Minor leveling adjustments of the post can be done by placing additional washers between the concrete surface and the mounting plate.
- To prevent vandalism or theft, bend over the tops of the carriage bolts or damage the threads so that the nuts cannot be removed.

4.3.2 Enclosure Installation

Enclosure installation involved three processes: mounting the sunshield, the enclosure, and the camera equipment.

MOUNT SUNSHIELD

As depicted in Figure 4-5, prior to attaching the enclosure to the installed mounting post, mount the sunshield hood to the enclosure using the three screws and nuts provided with the shield. Run a bead of clear silicone sealant around the outside edge of the hood where it contacts the enclosure.

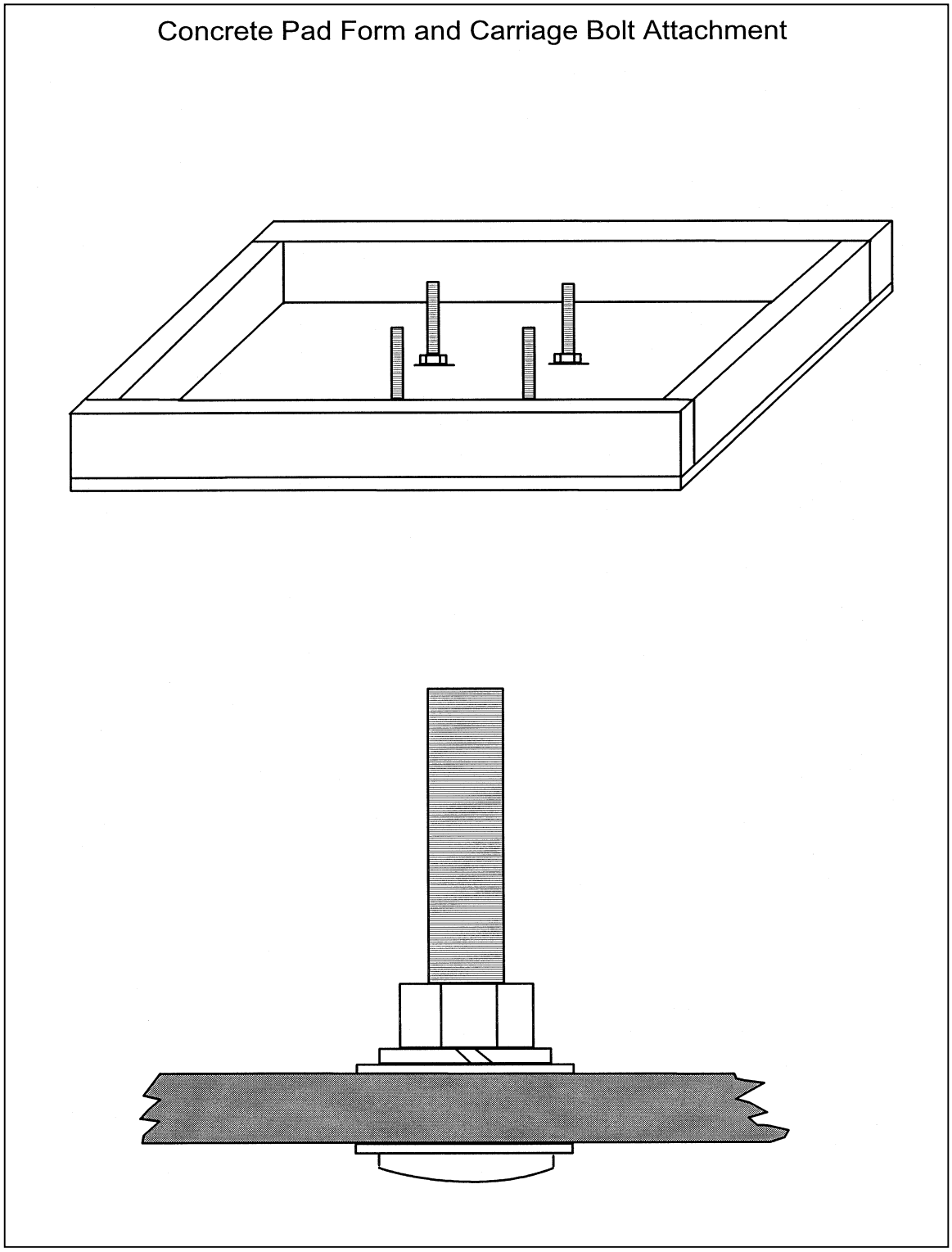

Figure 4-4. Mounting Post Configuration on Concrete Pad.

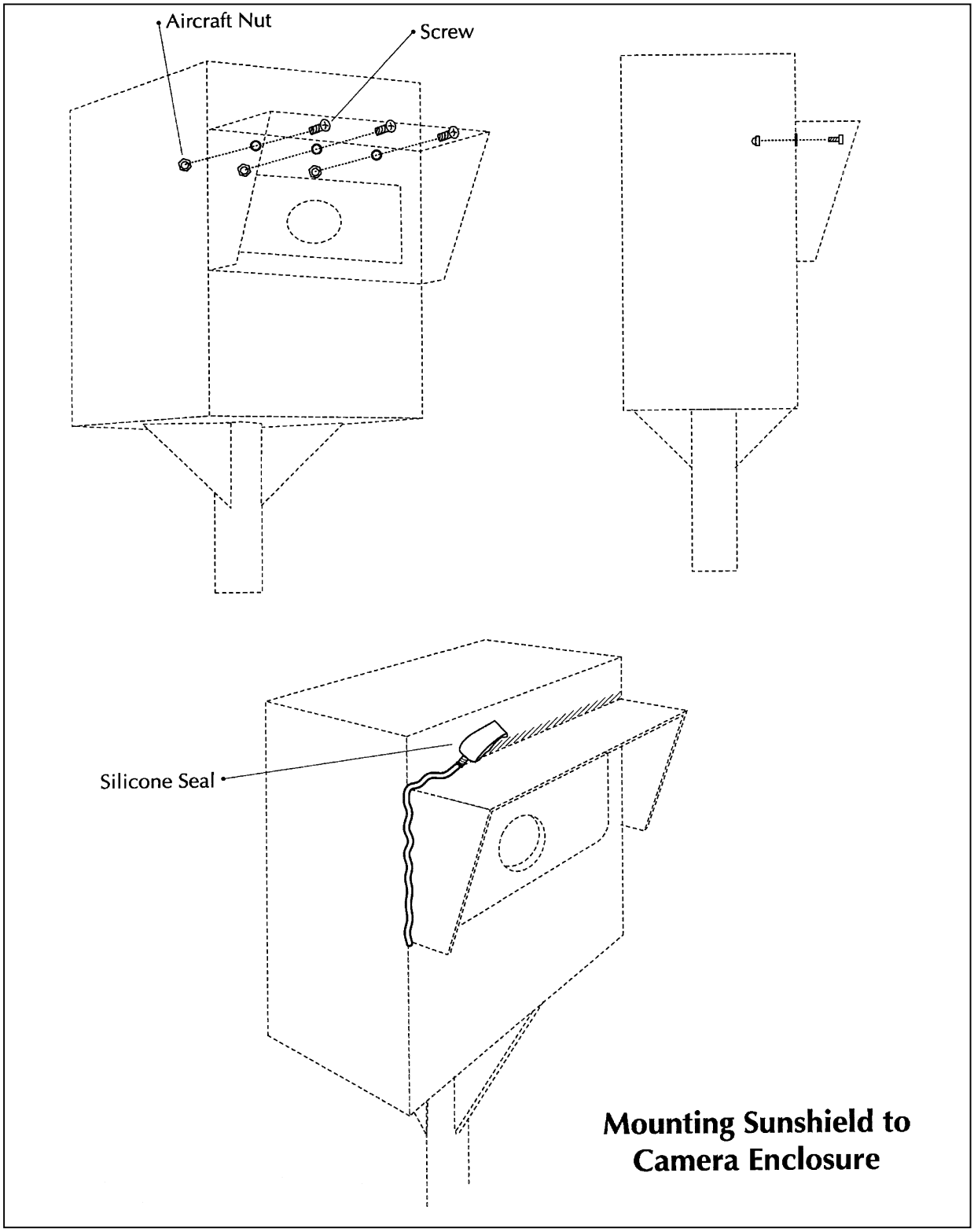

Figure 4-5. Enclosure Sunshield Mounting Configuration.

MOUNT ENCLOSURE	Mount the enclosure to the mounting plate with the four (4) short carriage bolts, lock washers, and nuts provided with the enclosure, as depicted in Figure 4-6. The rounded carriage bolt heads should be on the underside of the mounting plate.
MOUNT CAMERA EQUIPMENT	Mount the automatic camera equipment inside the enclosure on the tripod mounting plate provided. Detailed camera mounting diagrams are provided in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.

4.4 OPERATOR TRAINING

Operator training is provided by the field specialist following the completion of the camera system installation and configuration. Site operators are trained on camera system requirements and routine maintenance procedures. A Site Operator's Manual for Automatic Visibility Monitoring Camera Systems is also provided. This manual contains standard operating procedures and technical instructions applicable to the specific camera monitoring equipment located at the site. Additional manufacturer's instruction booklets and pertinent maintenance documentation forms are also provided.

4.5 SITE DOCUMENTATION

Site documentation for the automatic camera system visibility monitoring station includes completion of the Visibility Monitoring Photographic Site and Target Specifications Form (Figure 4-7) as is detailed in the following subsections. Site documentation procedures must be completed upon any of the following:

- Installation or removal of an automatic camera system
- Change in location or vista of an automatic camera system
- Significant changes of specification information included on the Visibility Monitoring Photographic Site and Target Specifications Form.

4.5.1 Camera Location and Geographic Reference

SITE NAME	Record the full site name including the type of site (e.g., National Park, etc.).
STATION TYPE/ FOCAL LENGTH	Record the automatic camera configuration (35 mm and/or 8 mm system and lens focal length (e.g., 50 mm, 135 mm, etc.)).
OBSERVATIONS /DAY	Record the periods in which photograph(s) are taken (e.g., 0900, 1200, and 1500; or 7:00 a.m. through 5:00 p.m. at 1-minute intervals).

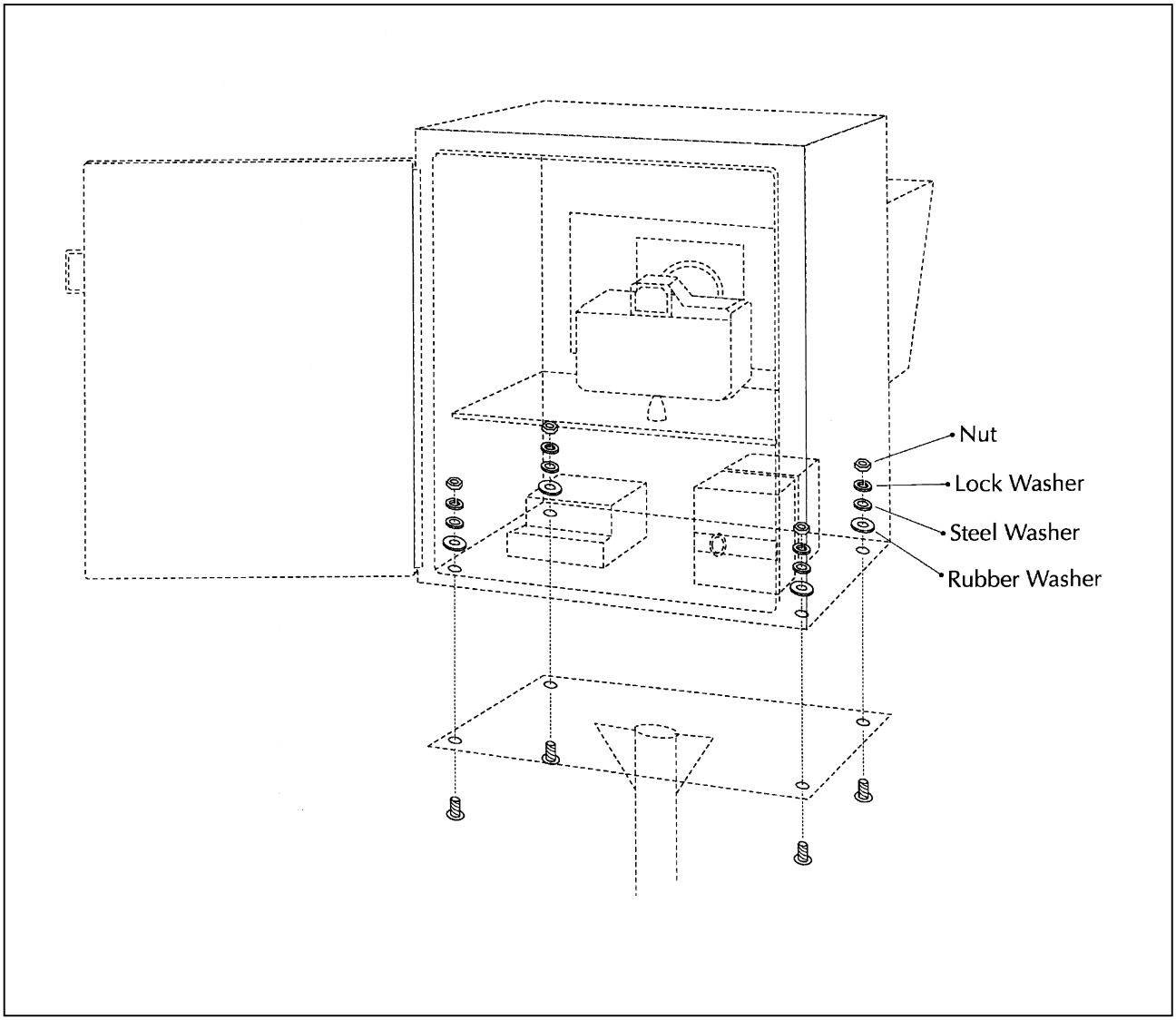

Figure 4-6. Enclosure Mounting Configuration.

VISIBILITY MONITORING
PHOTOGRAPHIC SITE AND TARGET SPECIFICATIONS

Site Name:

Station Type/Focal Length:

Observations/Day:

Elevation (M):

Longitude:
Latitude:
Map Reference:

Network:

Site Abbreviation: _____
Installation Date: _____
Installation By: _____

Site Specs By: _____
Date: _____
Previous Update: _____

Contacts:

Address:

Phone #, Fax #:

VISTA IDENTIFICATION		VISTA SPECIFICATIONS					
No.	Name	Dist. (km)	Elev. (m)	Bearing (°)	Elev. Angle	Site Path Elev. (m)	Rayleigh Coef.

NO.	VISTA COVER TYPE	PHOTOGRAPHIC REFERENCE

COMMENTS:

Figure 4-7. Visibility Monitoring Photographic Site and Target Specifications Form.

ELEVATION, LONGITUDE AND LATITUDE	Record the elevation (in meters) of the camera location. Record the longitude and latitude of the station in degrees, minutes, and seconds.
MAP REFERENCE	Record references for any maps available and/or used to complete this form. Note the map name, scale and source of the map.
NETWORK	Record the network name (e.g., IMPROVE) in this field.

4.5.2 Installation and Site Contact Documentation

SITE ABBREV-IATION	Record the four (4) character site abbreviation code.
INSTALLATION DATE	Record the date and time the camera system was installed.
INSTALLATION BY	Record the name of the person(s) who installed the system.
SITE SPECIFICATIONS VERIFICATION AND DATE COMPLETED	Record the name of the person(s) who completed and verified the site specifications, the date they were completed, and the date of the previous specification update.
SITE CONTACTS	Record the name, telephone, and fax numbers for any site operator(s), primary contact(s), and supervisor(s).
SITE MAILING ADDRESS AND SHIPPING ADDRESS	Record the site mailing address, the address to which correspondence is sent via US Mail, and the shipping address, the address to which UPS can deliver parcels. The shipping address cannot be a post office box.

4.5.3 Vista Identification and Specifications

VISTA NAME	Record the name of the monitored vista or the most dominant scenic feature(s)/target(s) in the vista.
DISTANCE	Record the distance in kilometers from the camera location to the dominant scenic feature. If only the vista name in known, document the approximate distance (in kilometers) to the most distant land feature.
ELEVATION	Record the ground level elevation in meters of the most dominant scenic feature, using the best available source (map, altimeter, etc.).
BEARING	Record the bearing from true north (in degrees) of the most dominant scenic feature from the camera location.

ELEVATION ANGLE

Calculate the elevation angle between the camera location and the most dominant scenic feature:

$$Elevation\ Angle = \left(\frac{Feature\ Elevation(m) - Site\ Elevation(m)}{dis\tan ce(km)\ x100}\right)\ \tan^{-1}$$

SITE PATH ELEVATION

Calculate the mean site path elevation between the camera location and the mean site path elevation:

$$Mean\ Site\ Path\ Elevation = \frac{Feature\ Elevation(m) + Site\ Elevation(m)}{2}$$

4.5.4 Photographic Reference and Comments

VISTA COVER TYPE

Record the dominant characteristics of the terrain in the vista and vegetative cover-type.

PHOTOGRAPHIC REFERENCE

Attach separate photographs (3" x 5" color prints preferred) of the:

- Selected site vista(s) with identified dominant scenic features.
- Cardinal direction views from the camera location (N,E,S,W).
- Camera system configuration.

COMMENTS

Document any dominant stationary or mobile pollutant influence on the site, listing the source and pollutant. Document any pertinent information regarding the lens configuration or installation configuration (e.g., enclosure mounted on lookout tower railing). Document any other information that is special to the site, such as site access, etc.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SITE CONFIGURATION FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4080**
DATE	**APRIL 1999**

AUTHORIZATIONS		
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

TABLE OF CONTENTS

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes site configuration requirements for photographic monitoring systems. These requirements may differ from system to system depending upon specific project goals and siting specifications. The purpose of this SOP is to assure constant, quality data and minimize data loss by:

- Ensuring that the monitoring systems are configured at locations that view important features, that meet monitoring or surveillance objectives, and are secure from potential vandalism.

- Training site operators on photographic or video monitoring system configuration requirements and operation.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visual relationships to decision-makers and to the public. Self-contained, automatic camera monitoring systems or time-lapse video monitoring systems are easily installed and operated. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

An automatic camera visibility monitoring station takes 35 mm slides or high-resolution digital images of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera or an SVHS time-lapse recorder to document the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides, digital images, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.

- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).

- Provide a quality assurance reference for collocated measurements.

- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.

- Identify areas of potential impairment.

- Estimate the optical properties of the atmosphere under certain conditions.

- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.

- Provide support data for the computer image modeling of potential impairment.

- Support color and human perception research.

Slides, digital images, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

In addition to visibility monitoring, time-lapse video systems can be used for a variety of other purposes, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.
- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

Specific information regarding site selection criteria is provided in SOP 4055, *Site Selection for Scene Monitoring Equipment.* The following technical instruction (TI) provides detailed information regarding specific site configuration procedures:

- TI 4080-3100 *Site Configuration for SVHS Time-Lapse Video Monitoring Equipment for the Healy Clean Coal Project*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide the field specialist with site configuration materials including photographic documentation, maps, and approved installation location, vista, and configuration specifications.
- As required, review the determined site configuration requirements with the project engineers.
- Schedule an operator training session with pertinent routine servicing personnel and the field specialist.

2.2 FIELD SPECIALIST

The field specialist shall:

- Review the determined site configuration requirements with the local contact and project manager.
- Ensure that the equipment is installed and configured according to project guidelines.
- Schedule an operator training session with pertinent routine servicing personnel and the project manager.

2.3 LOCAL (ON-SITE) CONTACT

The local contact shall:

- Review the determined site configuration requirements with the field specialist.
- Schedule an operator training session with the field specialist and the project manager.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE CONFIGURATION EQUIPMENT FOR 35 MM AUTOMATIC CAMERA SYSTEMS

A 35 mm automatic camera monitoring system consists of a camera and other components in an enclosure. A 35 mm camera may be configured with an 8 mm camera within the same enclosure. Components for a 35 mm camera configuration include:

- A 35 mm automatic camera
- A camera lens, generally 50 mm to 135 mm
- A programmable timer to trigger the camera
- A databack to imprint date and time on the film
- Batteries to operate all components
- A camera mount
- An environmental enclosure (with heater if required)
- A mounting post

3.2 SITE CONFIGURATION EQUIPMENT FOR 8 MM TIME-LAPSE CAMERA SYSTEMS

An 8 mm time-lapse camera monitoring system consists of a camera and other components in an enclosure. . An 8 mm camera may be configured with a 35 mm camera within the same enclosure. Components for an 8 mm camera configuration include:

- An 8 mm time-lapse movie camera with internal intervalometer
- A camera lens, generally 50 mm to 135 mm
- A programmable timer to trigger the camera on and off
- Batteries to operate all components
- A camera mount

- An environmental enclosure (with heater if required)

- A mounting post

3.3 SITE CONFIGURATION EQUIPMENT FOR DIGITAL CAMERA SYSTEMS

A high-resolution digital camera system consists of a camera, image capture computer, and image capture software in an enclosure. Specific components include:

- A digital camera that provides:
  - High-resolution JPEG images – 1280 x 960, 24-bit true color
  - Optical zoom of 38 to 114 mm (35 mm SLR equivalent)
  - RS-232 serial interface (high-resolution images can be taken at up to 3-minute intervals)

- An image capture computer with:
  - A Pentium processor
  - Windows 95/98/NT
  - A 1.2 gigabyte hard disk
  - (2) Type 2 PCMCIA slots
  - A PC-card 56K telephone modem or PC-card cellular telephone/modem

- Image capture software for:
  - Windows 95/98/NT
  - A 32-bit Windows program
  - Image acquisition via telephone, cellular telephone, or on-site image collection
  - User selectable JPEG image resolutions

- An environmental enclosure (with heater if required)

- A camera mount

- Electrical power (AC power or DC solar power)

3.4 SITE CONFIGURATION EQUIPMENT FOR SVHS TIME-LAPSE VIDEO SYSTEMS

An SVHS time-lapse video monitoring system consists of a camera assembly and a video recording assembly. Components included in each assembly are:

- Camera assembly:
  - A color video camera
  - A zoom camera lens, generally 8 mm to 48 mm
  - A pan/tilt camera mount
  - A mounting post with mounting plate
  - A camera enclosure
  - An uninterruptible power supply

- Video recording assembly:

  - A shelter (6’ x 6’ with heater)
  - An SVHS VCR for time-lapse recording
  - A color review monitor
  - An uninterruptible power supply

Other components may be required such as microwave transmission/receiver assemblies, or various remote control assemblies, depending upon siting requirements and situations, and project objectives.

4.0 METHODS

Scene monitoring station configurations are based on:

- Monitoring location and monitored scenic vista or view of interest.
- Frequency that various visual air quality conditions or monitoring interests occur.
- Complexity of diurnal variations and observed visibility events.
- Collocated air quality monitoring instrumentation.
- Site-specific monitoring objectives.
- Proximity to AC power if an AC SVHS time-lapse system is used.

For further information on site selection requirements, see SOP 4055, *Site Selection for Scene Monitoring Equipment.*

An automatic 35 mm camera system documents observed visual air quality at user selected times throughout the day. Photographic slides often provide a quality assurance reference for collocated visibility measurements. Slides are also a quality media that can be easily replicated or digitized to support computer image modeling and perception research. A high-resolution digital camera system can internally store up to 1,400 high-resolution images on its hard disk, which can be downloaded on demand by telephone or be directed to an independent on-site computer or other mass storage media. Automatic 8 mm time-lapse camera systems or SVHS time-lapse recorders document the dynamics of ongoing air quality and meteorological related events or other events.

This section describes site configuration procedures in four (4) major subsections:

4.1 Configuration of 35 mm and 8 mm Automatic Camera Monitoring Equipment
4.2 Configuration of Digital Camera Monitoring Equipment
4.3 Configuration of SVHS Time-Lapse Video Monitoring Equipment
4.4 Operator Training

4.1 CONFIGURATION OF 35 MM AND 8 MM AUTOMATIC CAMERA MONITORING EQUIPMENT

The 35 mm and 8 mm automatic camera monitoring sites have few options in equipment configuration. Standard configuration for these systems includes a camera assembly located inside an environmental enclosure. The enclosure rests on a mounting post viewing the scene of interest. These monitoring systems are battery-powered and require periodic servicing. Configuration options include camera type (35 mm and/or 8 mm), lens size, exposure frequency, an enclosure heater option, and a single-port (one camera system) or double-port (two camera systems) enclosure.

4.2 CONFIGURATION OF DIGITAL CAMERA MONITORING EQUIPMENT

The digital camera system includes a high-resolution digital camera with computer located inside an environmental enclosure. The enclosure rests on a mounting post viewing the scene of interest. These monitoring systems require AC or DC solar power and may be serviced through remote telephone connections. Configuration options include a regular telephone or cellular telephone connection, or an independent on-site computer or other mass storage media to store the acquired images. Image resolution and frequency of image capture are other options.

4.3 CONFIGURATION OF SVHS TIME-LAPSE VIDEO MONITORING EQUIPMENT

SVHS video monitoring sites may be installed using a wide variety of equipment configurations. Configurations are determined by specific project goals and objectives, monitoring interests, availability of power, and environmental conditions.

Generally, video monitoring sites are configured in two parts, a camera assembly and a video recording assembly. The camera assembly consists of an SVHS color video camera located inside a heated enclosure. The enclosure rests on a mounting post viewing the scene of interest. The video recording assembly is situated in a nearby shelter and includes a color monitor and a VCR to record the monitoring. Additional equipment may include a modem to transfer recorded camera images, additional monitors and VCRs (for real-time event programming), or a remote control unit for the camera function. The VCRs may be programmed as required for the specific needs of the monitoring project.

4.4 OPERATOR TRAINING

Operator training is provided by the field specialist following the completion of the photographic or video system configuration and equipment installation. Supplemental and refresher training is provided during scheduled site visits by the field specialist, and ARS telephone support is always available. Site operators are trained on photographic or video system requirements and routine maintenance procedures, including:

- An overview of project and system components
- Power supply, distribution, and cabling
- Signal connectors and cabling

- Heater systems
- Component replacement
- Camera and component function and operation
- On-site video monitor operation
- Recorded videotape review
- Film or videotape replacement
- Log sheet completion
- Troubleshooting
- ARS contact personnel

A site operator's manual is also provided to site operators. This manual contains technical instructions applicable to the specific camera or video monitoring equipment located at the site. Additional manufacturer's instruction booklets and pertinent maintenance documentation forms are also included in the manual.

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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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LIST OF TABLES

1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes site configuration requirements for SVHS time-lapse video monitoring camera systems for the Healy Clean Coal Project (HCCP). The purpose of this TI is to assure consistent, quality data and minimize data loss by:

- Ensuring that the monitoring systems are configured at locations that view important features, that meet surveillance objectives, and are secure from potential vandalism.
- Training site operators on video monitoring system configuration requirements and operation.

Three video monitoring sites have been installed for the Healy Clean Coal Project (see Figure 1-1):

- Denali National Park and Preserve (DNPP) (video camera and VCR)
- Garner Hill (video camera and microwave transmitter)
- Healy Clean Coal Project (HCCP) (time-lapse VCR, real-time VCR, and microwave receiver)

Images captured at Garner Hill are transmitted by microwave and received at HCCP.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide the field specialist site configuration materials including photographic documentation, maps, and approved installation location, vista, and configuration specifications.
- As required, review the determined site configuration requirements with the project engineers.
- Schedule an operator training session with pertinent routine servicing personnel and the field specialist.

2.2 FIELD SPECIALIST

The field specialist shall:

- Review the determined site configuration requirements with the local contact and project manager.
- Schedule an operator training session with pertinent routine servicing personnel and the project manager.

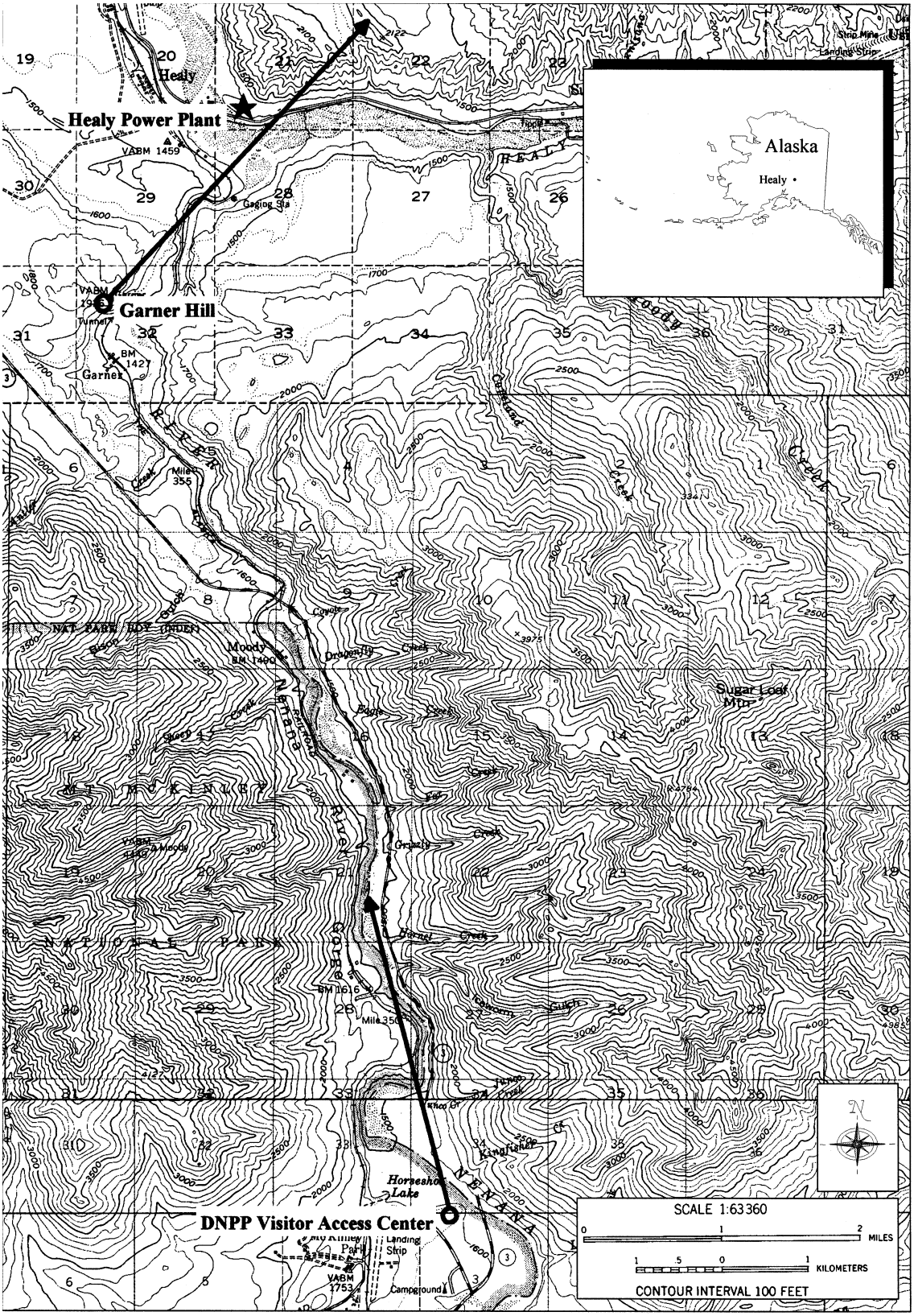

Figure 1-1. Map Showing the Monitoring Sites for the HCCP Monitoring Program.

2.3 LOCAL (ON-SITE) CONTACT

The local contact shall:

- Review the determined site configuration requirements with the field specialist.
- Schedule an operator training session with the field specialist and the project manager.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE CONFIGURATION EQUIPMENT FOR DNPP

The time-lapse video monitoring system at DNPP consists of a camera assembly and a video recording assembly. The components included in each assembly are:

Camera assembly components:

- Pelco NEMA 3R series camera enclosure with heated window and sun shroud
- Sony SSC-S20 CCD color video camera
- Cosmicar/Pentax zoom lens (8mm–48mm)
- Manual pan/tilt camera mount
- Mounting post with mounting plate
- Concrete pad
- Power distribution box with interconnect cabling

Video recording assembly components:

- Shelter (custom wood-frame 6'x6' building with 1500 watt baseboard heater)
- Panasonic AG-6740 SVHS VCR for time-lapse recording
- Panasonic CT1384Y color monitor
- Motorola cellular telephone
- Exterior telephone antenna
- Uninterruptible power supply (UPS)

3.2 SITE CONFIGURATION EQUIPMENT FOR GARNER HILL

The time-lapse video monitoring system at Garner Hill consists of a camera assembly and a microwave transmission assembly. The components included in each assembly are:

Camera assembly components:

- Pelco NEMA 3R series camera enclosure with heated window and sun shroud
- Sony SSC-S20 CCD color video camera
- Cosmicar/Pentax zoom lens (8mm-48mm)
- Pan/tilt camera mount and remote control pan/tilt unit
- Rohn 45 tower with lightning protection

Microwave transmission assembly components:

- Ekto Manufacturing 6'x6' metal shelter secured with ground anchors
- Panasonic CT1384Y color monitor
- Radio Waves, Inc. 23 62 microwave transmitter/receiver electronics and antenna
- Uninterruptible power supply (UPS)

Images captured at Garner Hill are transmitted by microwave to HCCP.

3.3 SITE CONFIGURATION EQUIPMENT FOR HCCP

The time-lapse video monitoring system at HCCP consists of a video recording assembly and a microwave receiver assembly. The components included in each assembly are:

Video recording assembly components:

- Sony Trinitron PUM-14N2A color review monitor
- Panasonic AG-6740 SVHS VCR for time-lapse recording
- Panasonic AG-6740 SVHS VCR for real-time recording of declared events
- Panasonic AG-1980P SVHS VCR review unit
- Uninterruptible power supply (UPS)
- Sigma Electronics VOA-21 video distribution amplifier

Microwave receiver assembly components:

- Radio Waves, Inc. 23 62 microwave transmitter/receiver electronics and antenna
- Pelco 9500 Series joystick transmitter/controller
- Multitech 4-wire modem

4.0 METHODS

This section describes site configuration procedures in four (4) major subsections:

4.1 Configuration of Video Monitoring Equipment at DNPP
4.2 Configuration of Video Monitoring Equipment at Garner Hill
4.3 Configuration of Video Monitoring Equipment at HCCP
4.4 Operator Training

4.1 CONFIGURATION OF VIDEO MONITORING EQUIPMENT AT DNPP

The DNPP site is configured in two parts, a camera assembly and a video recording assembly. A functional diagram of the DNPP configuration is provided as Figure 4-1. The standard view captured by the camera is presented as Figure 4-2.

The Sony SSC-S20 camera requires 24 VAC power. It is provided via a 120 VAC uninterruptible power supply (UPS) in the recording assembly shelter routed through conduit to a power strip located on the camera assembly post. A 24 VAC fused, transformer is plugged into the power strip and is routed directly to the camera via a clamped access hole in the Pelco enclosure.

The Pelco enclosure heater and ventilation fan require 120 VAC. It is provided via a surge protected power strip in the recording assembly shelter routed through conduit to a power strip located on the camera assembly post. A 120 VAC line is plugged into this power strip and routed directly to the Pelco heater via the clamped access hole. Note that this power line does not connect to the UPS.

The S-video signal cable is routed directly from the “S-video out” on the back of the Sony SSC-S20 camera to the “S-video in” connector on the back of the time-lapse VCR via the clamped access hole in the Pelco enclosure and metal conduit to the recording assembly shelter.

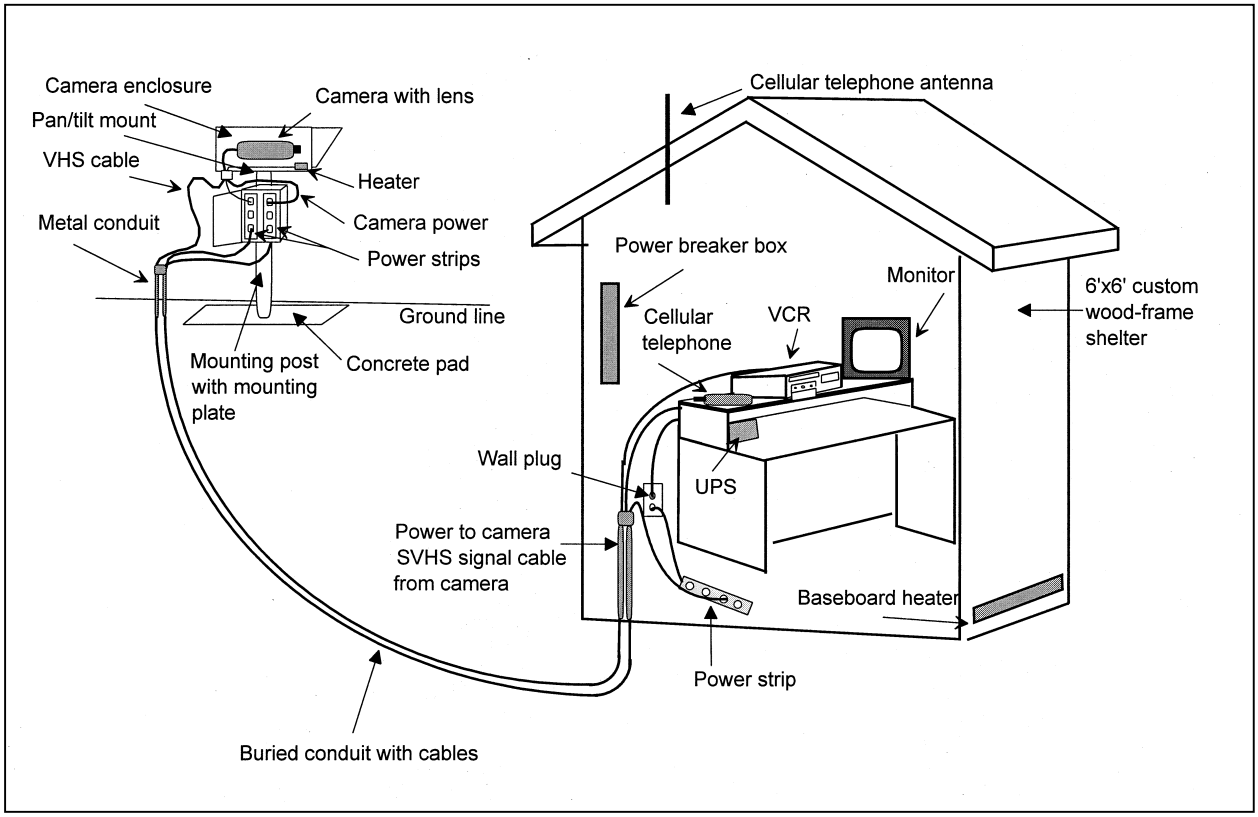

Figure 4-1. Configuration Diagram of Video Monitoring Components at DNPP.

Figure 4-2. View Taken With Video Camera at DNPP.

4.1.1 Camera Assembly at DNPP

The camera assembly consists of an SVHS color video camera located inside a heated enclosure (see Figure 4-3). The enclosure sits atop a mounting post on a concrete pad viewing northward, toward Moody Gap (see Figure 1-1). The camera has one standard setting; the "MODE" selection switch is set to **AUTO**.

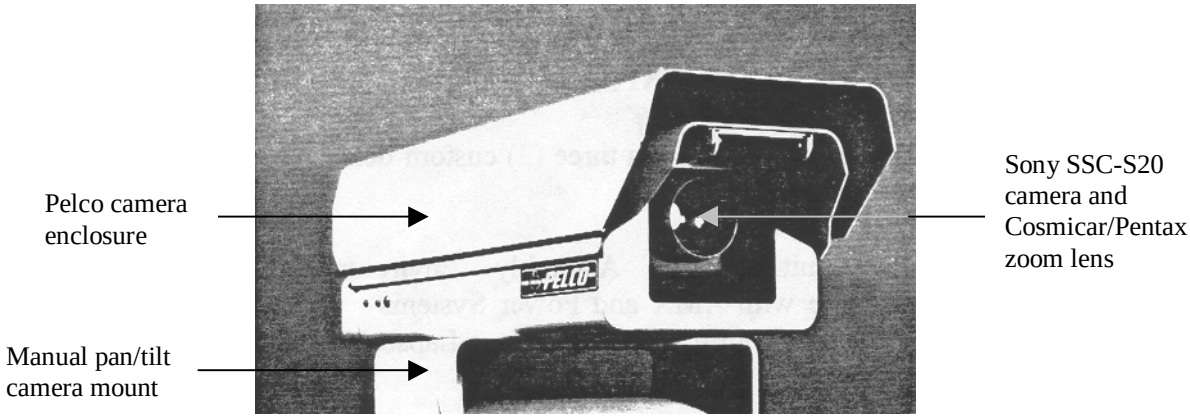

Figure 4-3. Photograph of the Camera Assembly at DNPP.

4.1.2 Video Recording Assembly at DNPP

The video recording assembly is 55 feet away from the camera assembly in a wooden, heated shelter (see Figure 4-4). Monitoring components in the shelter include a VCR, video monitor, UPS, and cellular telephone (see Figure 4-5).

The video monitor has one standard setting; the VIDEO SELECT switch is set to "VIDEO INPUT 1". The VCR standard settings are listed in Table 4-1.

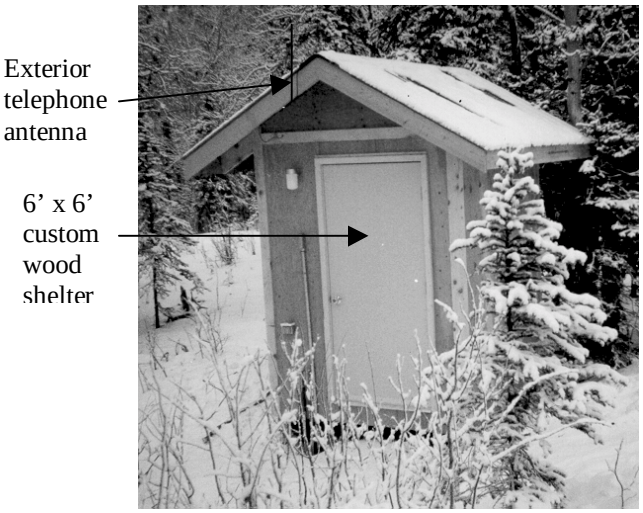

Figure 4-4. Video Recording Assembly Shelter at DNPP.

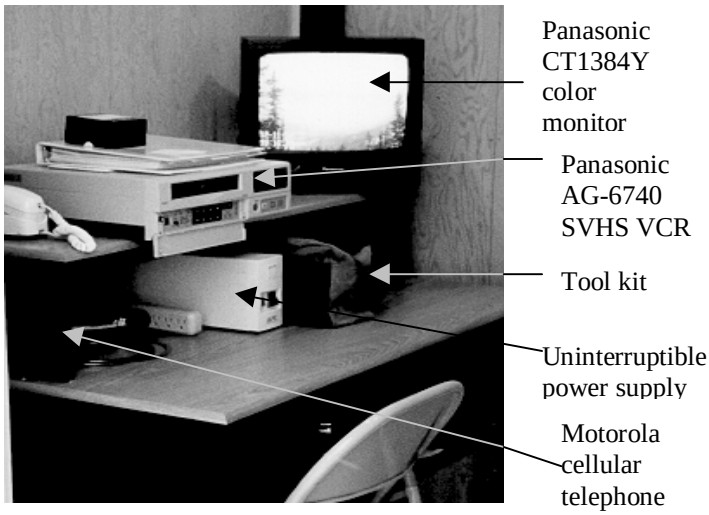

Figure 4-5. VCR and Video Monitor Installed in DNPP Shelter.

Table 4-1
Time-Lapse Monitoring System VCR Settings
for the DNPP Monitoring Site

Menu Screen	Switch/Option	Correct Setting		
1	(Display)			
	Mode	T/D		
	Character	WHITE		
	Position	L-BOTTOM		
	Time Select	24HOUR		
	Data	ON		
	Time Select	ON		
	T-Mode	ON		
	(Rec Indicated)			
	Not Rec	CAMERA		
2	(VTR Mode Select 1)			
	(High Density Rec)			
	Mode	ON		
	(Rec T-Mode)	OFF		
	(Tape in)	STOP		
	(Tape end)	STOP		
	Alarm in	STOP		
	(Eject Operation)			
	Mode	EJECT		
3	(VTR Mode Select 2)			
	Power Loss Memory			
	** ** ** ** **:**			
	(Video)			
	Mode	AUTO		
	In	S-VIDEO		
	S-VHS REC	ON		
	(Time Adjusting)			
	Set Time	5:00		
	Operation	MASTER		
4	(Alarm/Sensor Rec)			
	Mode	OFF		
	Duration	0.5MIN		
	Buzzer	OFF		
	Repeat in	OFF		
	(Reset Pulse)			
	Input Level	HIGH		
	(Camera SW)			
	Timing	1FIELD		
	Mode	TM2		
5	(1-Shot REC)			
	Field	1		
	Interval	3MIN		
	(Tape Remain)			
	Buzzer	OFF		
	(Rec Review)			
	Auto	OFF		
	Err Buzzer	OFF		
	(Err Warn Buzzer)	OFF		
6	(Internal Timer Rec)	Start	End	T-M
	Sun	OFF		
	Mon	OFF		
	Tue	OFF		
	Wed	OFF		
	Thu	OFF		
	Fri	OFF		
	Sat	OFF		
	DLY	(See Table 4-2)		480H
Other	Program Switch	OFF		
	Rec Lock	OFF		
	Time Mode	2H or 6H		
	Time/Counter	COUNT		
	Rec Mode	INT		

The only parameter that will vary from the table is the Internal Timer Record settings for automatic recording times. These values are set seasonally to accommodate day-length. The Internal Timer Record start and stop times and T-M are set by the site operator according to the times specified for the monitoring program. (see Table 4-2).

Refer to TI 4120-3650, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor,* for complete system operational procedures.

Table 4-2

VCR Monthly Recording Start/Stop Timer Settings
Healy Clean Coal Project, Post-Construction Visibility Monitoring Program

Healy, Yukon-Koyukuk County, Alaska (longitude W149.0° latitude N63.9°)												
Adjustment Date	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	1-Dec
Video Start*	08:30	07:00	05:30	03:30	00:00	00:00	00:00	02:30	04:30	06:00	07:30	09:30
Video Stop*	18:00	19:00	20:30	22:30	00:00	00:00	00:00	00:00	21:00	19:00	17:30	16:00

* All times are in Standard Time. Do not set the VCR time to Daylight Saving Time.

Sunrise/Sunset Reference Table

Date	31-Jan	28-Feb	31-Mar	30-Apr	31-May	22-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	22-Dec
Standard/daylight	AST	AST	AST	ADT	ADT	ADT	ADT	ADT	ADT	ADT	AST	AST
Begin civil twilight	08:40	07:18	05:29	04:27				03:39	05:47	07:18	07:45	09:29
Sunrise	09:37	08:06	06:18	05:33	03:58	03:31	03:40	05:06	06:39	08:05	08:38	10:46
Sun transit	13:09	13:08	13:00	13:53	13:54	13:58	14:00	14:02	13:56	13:45	12:39	12:55
Sunset	16:43	18:12	19:44	22:15	23:51	00:25	00:18	22:56	21:10	19:25	16:40	15:03
End civil twilight	17:40	19:00	20:34	23:23				00:20	22:02	20:12	17:33	16:20

Source:
U.S. Naval Observatory, Astronomical Applications Department
http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html

4.2 CONFIGURATION OF VIDEO MONITORING EQUIPMENT AT GARNER HILL

The Garner Hill site (see Figure 1-1) is configured in two parts, a camera assembly and a microwave transmission assembly. The microwave receiver assembly and video recording assembly associated with this camera are located at HCCP. Figure 4-6 is a photograph of the Garner Hill configuration. The standard view captured by the camera is presented as Figure 4-7. This view can be changed by the HCCP operator to document a visibility event.

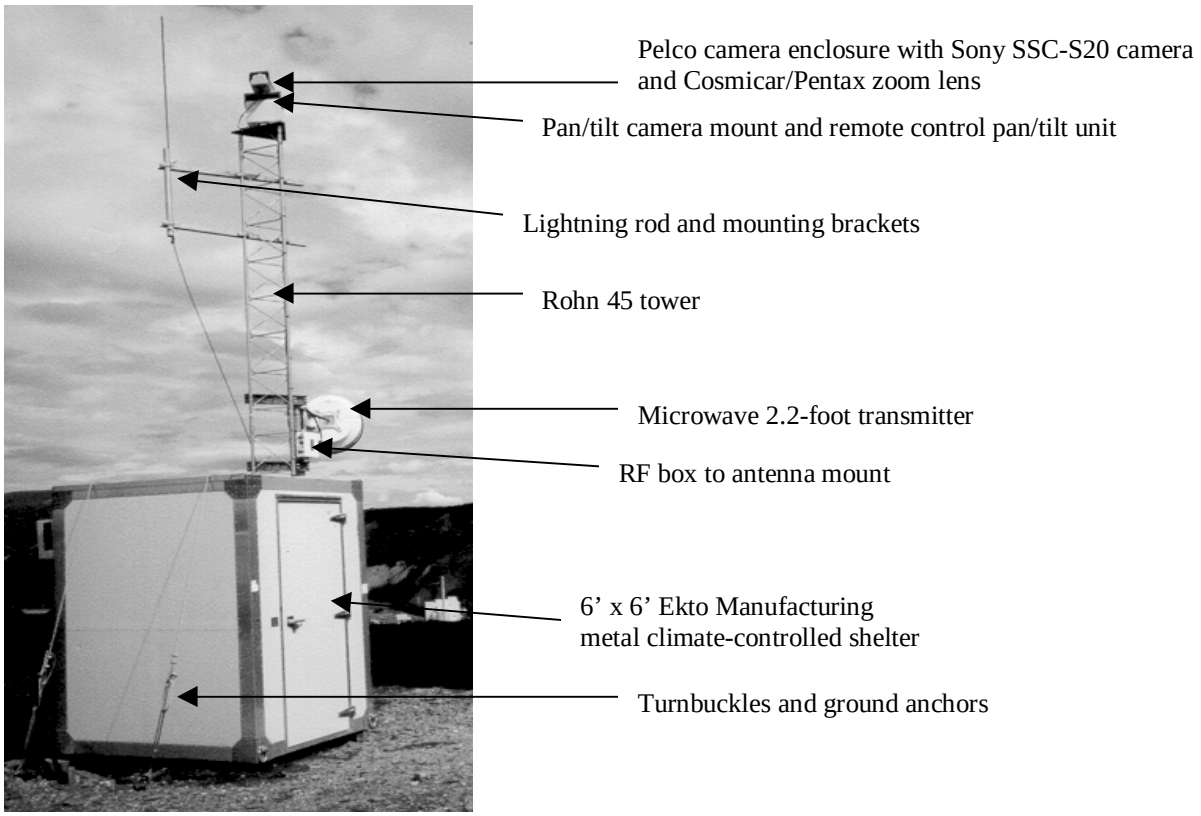

Figure 4-6. Configuration Photograph of Monitoring Components at Garner Hill.

Figure 4-7. View Taken With Video Camera at Garner Hill.

4.2.1 Camera Assembly at Garner Hill

The camera assembly consists of a color video camera located inside a heated enclosure with a remote control pan/tilt unit (see Figure 4-8). The enclosure sits atop a tower viewing HCCP. The camera has one standard setting; the "MODE" selection switch is set to **AUTO**.

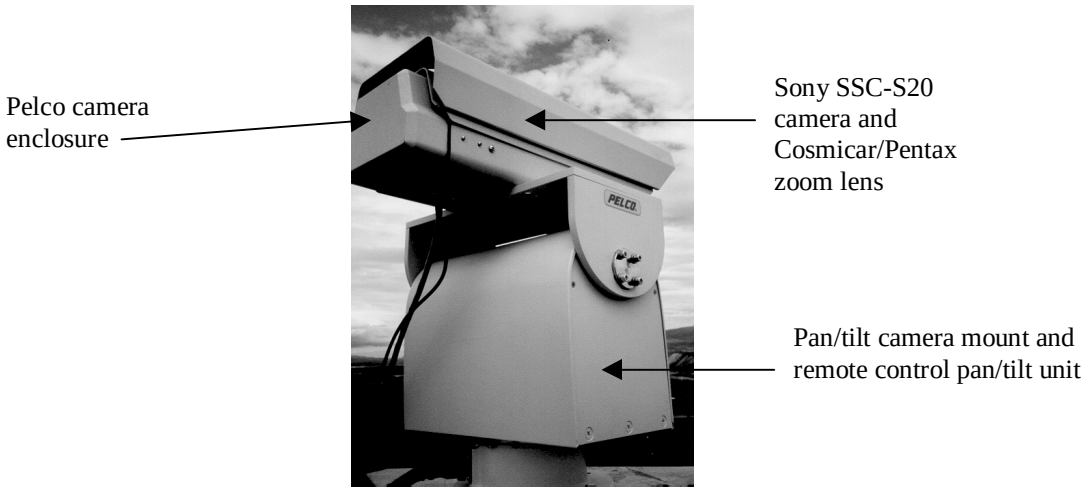

Figure 4-8. Photograph of the Camera Assembly at Garner Hill.

The video monitor has one standard setting; the "VIDEO SELECT" switch is set to **VIDEO INPUT 1.**

4.2.2 Microwave Transmission Assembly at Garner Hill

The microwave transmission assembly is situated on the same tower as the camera (see Figure 4-6). The tower is attached to a heated shelter, which houses a video monitor used to verify proper camera alignment, and the microwave transmitter electronics. The video monitor has one standard setting; the "VIDEO SELECT" switch is set to **VIDEO INPUT 1**. The video monitor is used by the operator to ensure camera operation and to assist in focusing and system troubleshooting.

A technician from HSE Communications installed and configured the microwave components (FCC license #739592). The real-time analog signal from the camera is translated by the microwave receiver/transmitter and forwarded to the microwave antenna. The 2½-foot antenna is securely mounted 12 feet above ground level to ensure a direct, unobstructed line of site from Garner Hill to the plant. The microwave operates at 23GHz and does not interfere with other communications bands that exist on Garner Hill or at the plant. The microwave receiver/transmitter also can receive positioning signals from the HCCP joystick controller and direct the signals to the automatic pan/tilt head.

Refer to TI 4120-3655, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at Garner Hill - Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*, for complete system verification procedures.

4.3 CONFIGURATION OF VIDEO MONITORING EQUIPMENT AT HCCP

The HCCP site (see Figure 1-1) is configured in two parts, a video recording assembly and a microwave receiver assembly. The microwave transmitter assembly and camera associated with this equipment are located at Garner Hill.

4.3.1 Video Recording Assembly at HCCP

The video recording assembly is situated in the control room at HCCP. Monitoring components are located in an instrument rack (see Figure 4-9) and include (from top to bottom on the right side of the rack): two color monitors, a joystick transmitter/controller to operate the camera at Garner Hill, an event VCR to record real-time events, a time-lapse VCR to record standard monitoring programming, a modem, and a microwave converter. Computer components are used by RTP, Inc. to collect data from Bison Gulch and are not part of the video assembly.

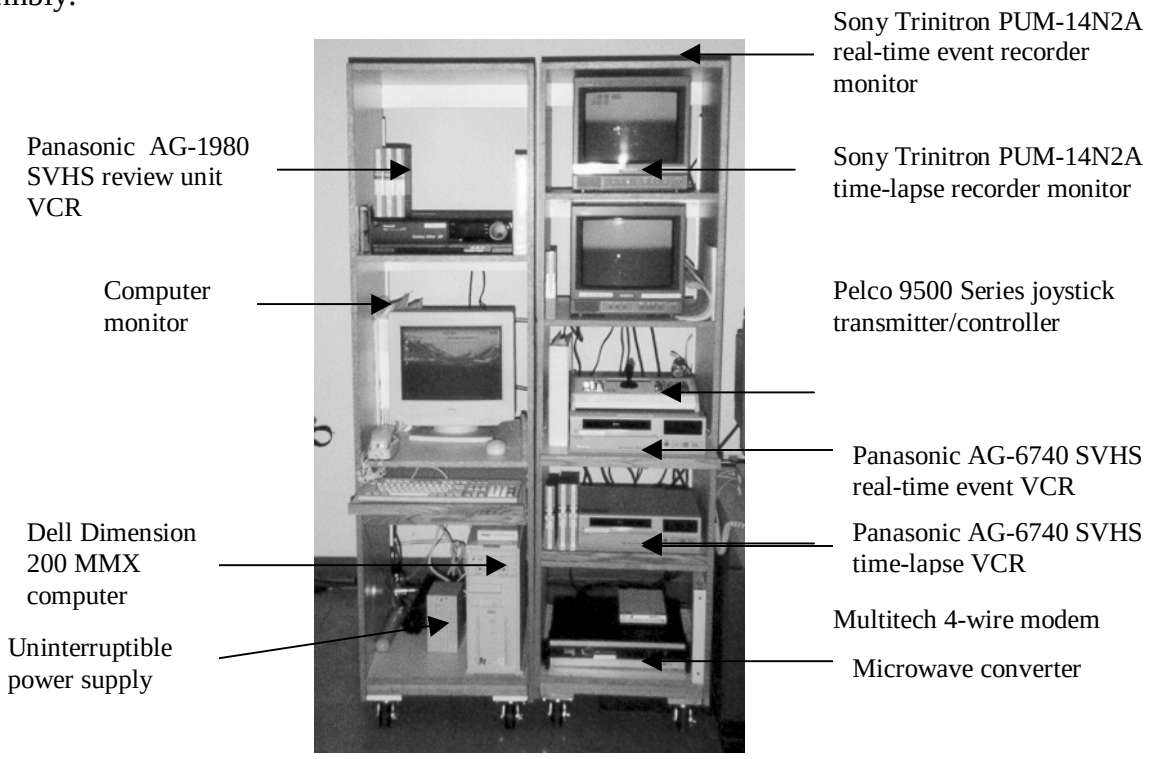

Figure 4-9. Photograph of the Video Recording Assembly at HCCP.

The video monitors have one standard setting; the "LINE A" button is the selected input. All other switches are set to the factory default settings. Both time-lapse VCRs have standard settings as listed in Table 4-3. Check each menu screen against the values in the table. The only parameter that can vary from the table is the Internal Timer Record settings for automatic recording times. These values are set seasonally to accommodate day-length. The Internal Timer Record start and stop times and T-M are set by the site operator according to the times specified in Table 4-2.

Refer to TI 4120-3660, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*, for complete system verification procedures.

Table 4-3
Time-Lapse Monitoring System VCR Settings
for the HCCP Monitoring Site

Menu Screen	Switch/Option	Correct Setting		
1	(Display)			
	Mode	T/D		
	Character	WHITE		
	Position	L-BOTTOM		
	Time Select	24HOUR		
	Data	ON		
	Time Select	ON		
	T-Mode	ON		
	(Rec Indicated)			
	Not Rec	CAMERA		
2	(VTR Mode Select 1)			
	(High Density Rec)			
	Mode	ON		
	(Rec T-Mode)	OFF		
	(Tape in)	STOP		
	(Tape end)	STOP		
	Alarm in	STOP		
	(Eject Operation)			
	Mode	EJECT		
3	(VTR Mode Select 2)			
	Power Loss Memory			
	** ** ** ** **:**			
	(Video)			
	Mode	AUTO		
	In	LINE		
	S-VHS REC	ON		
	(Time Adjusting)			
	Set Time	5:00		
	Operation	MASTER		
4	(Alarm/Sensor Rec)			
	Mode	OFF		
	Duration	0.5MIN		
	Buzzer	OFF		
	Repeat in	OFF		
	(Reset Pulse)			
	Input Level	HIGH		
	(Camera SW)			
	Timing	1FIELD		
	Mode	TM2		
5	(1-Shot REC)			
	Field	1		
	Interval	3MIN		
	(Tape Remain)			
	Buzzer	OFF		
	(Rec Review)			
	Auto	OFF		
	Err Buzzer	OFF		
	(Err Warn Buzzer)	OFF		
6	(Internal Timer Rec)	Start	End	T-M
	Sun	OFF		
	Mon	OFF		
	Tue	OFF		
	Wed	OFF		
	Thu	OFF		
	Fri	OFF		
	Sat	OFF		
	DLY	(See Table 4-2)		480H
Other	Program Switch	OFF		
	Rec Lock	OFF		
	Time Mode	2H OR 6H		
	Time/Counter	COUNT		

4.3.2 Microwave Receiver Assembly at HCCP

The microwave receiver assembly is situated on the north side of the control room at HCCP (see Figure 4-10).

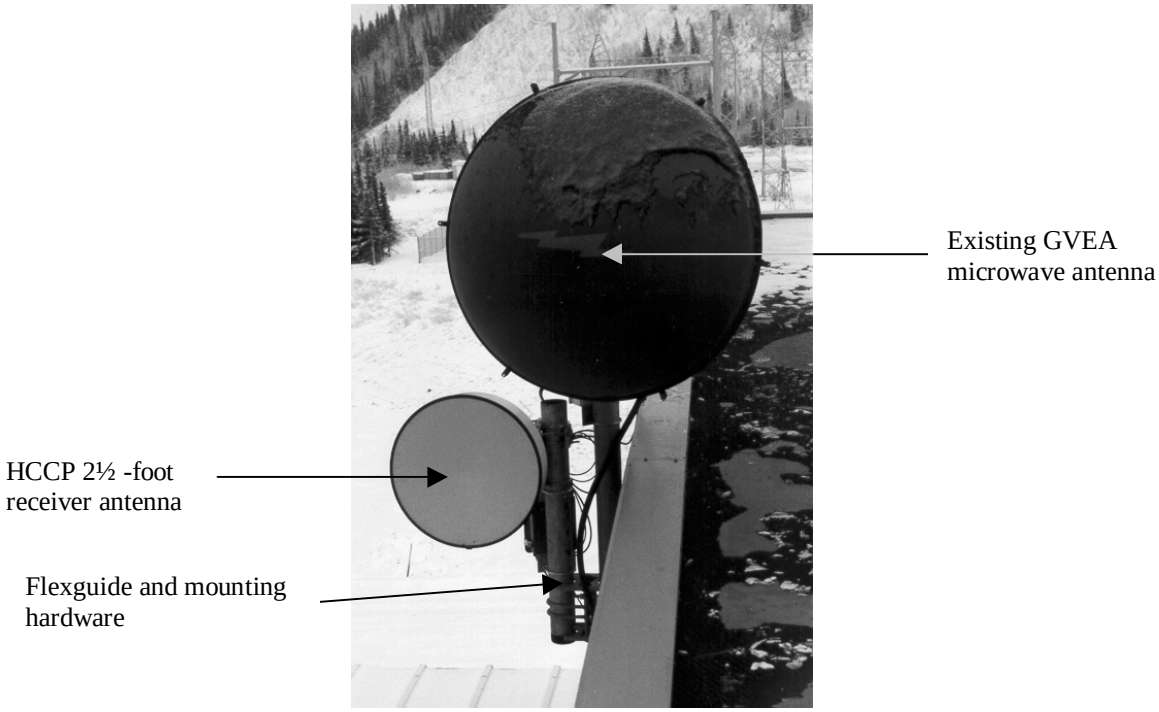

Figure 4-10. Configuration Photograph of Microwave Receiver Assembly at HCCP.

A technician from HSE Communications installed and configured the microwave components (FCC license #739591). The real-time analog signal from the camera is translated by the microwave receiver/transmitter and forwarded to the microwave antenna. The 2½-foot antenna is securely mounted 35 feet above ground level to ensure a direct, unobstructed line of site from Garner Hill to the plant. The microwave operates at 23GHz and does not interfere with other communications bands that exist on Garner Hill or at the plant. The microwave receiver/transmitter also can receive positioning signals from the HCCP joystick controller and direct the signals to the automatic pan/tilt head.

4.4 OPERATOR TRAINING

Operator training is provided by the field specialist following the completion of the video system configuration. Supplemental and refresher training is provided during scheduled site visits by the field specialist. ARS telephone support is always available. Site operators are trained on video system requirements and routine maintenance procedures, including:

- An overview of project and system components
- Power supply, distribution, and cabling
- Signal connectors and cabling

- Heater systems
- Component replacement
- Time-lapse recorder functions and operation
- On-site monitor operation
- Recorded videotape review
- Changing videotapes
- Completing log sheets
- Troubleshooting
- ARS contacts

A Time-Lapse Video Monitoring Field Procedures Notebook is also provided to site operators. This notebook contains technical instructions applicable to the specific camera monitoring equipment located at the site. Additional manufacturer's instruction booklets and pertinent maintenance documentation forms are also provided.

5.0 REFERENCES

Federal Communications Commission, April 1998, File Number 739592. (Figure 5-1).

Federal Communications Commission, April 1998, File Number 739591. (Figure 5-2).

FEDERAL COMMUNICATIONS COMMISSION

PRIVATE OPERATIONAL FIXED MICROWAVE RADIO STATION LICENSE

LICENSEE	ASSOCIATED BROADCAST STATION	FILE NUMBER	CALL SIGN
AIR RESOURCES SPECIALISTS INC 1901 SHARP POINT DR STE E FORT COLLINS CO 80525		739592	WPNM499
	RADIO SERVICE MW INDUSTRIAL/BUSINESS		STATION CLASS FIXED
	EFFECTIVE DATE 04/16/1998	CONSTRUCTION DATE 10/16/1999	EXPIRATION DATE 04/16/2008

SPECIAL CONDITIONS OF GRANT:
NONE

SITES

TRANSMITTER STREET ADDRESS	COUNTY	CITY	ST
GARNER HILL LOCATED ON TOWERS SPUR	YUKON KOYUKUK	HEALY	AK

SITE NO	LATITUDE	LONGITUDE	DATUM	ELEVATION (FT)	TIP HEIGHT (FT)	ANTENNA PAINTING & LIGHTING CODES FCC FORM 715/715A
001	63-50-14.0 N	148-58-38.0 W	N83	1936	22	
002	63-51-21.0 N	148-56-58.0 W	N27	RECEIVER SITE		

FREQUENCY PATHS

FREQUENCY AND POWER INFORMATION			PATH		SEGMENT INFORMATION							
FREQUENCY (MHZ) OR CHANNEL	TOLERANCE (%)	EMISSION DESIGNATOR	EIRP (DBM)	SEG NO	EMIT SITE NO	ANT HGT (FT)	BEAM-WIDTH (DEG)	HTxWD (FT)	POL	AZIM (DEG)	RECEIVER SITE NO	RECEIVER CALL SIGN
023175.000000	0.03000	25M0F8W	57.0	0001	1 001	15	1.6		V	33.4	002	WPNM498

FCC 469
SEPTEMBER 1994

Figure 5-1. FCC File Number 739592.

FEDERAL COMMUNICATIONS COMMISSION

PRIVATE OPERATIONAL FIXED MICROWAVE RADIO STATION LICENSE

LICENSEE	ASSOCIATED BROADCAST STATION	FILE NUMBER	CALL SIGN
AIR RESOURCES SPECIALISTS INC 1901 SHARP POINT DR STE E FORT COLLINS CO 80525		739591	WPNM498
	RADIO SERVICE: MW INDUSTRIAL/BUSINESS		STATION CLASS: FIXED
	EFFECTIVE DATE: 04/16/1998	CONSTRUCTION DATE: 10/16/1999	EXPIRATION DATE: 04/16/2008

SPECIAL CONDITIONS OF GRANT:
NONE

SITES

TRANSMITTER STREET ADDRESS	COUNTY	CITY	ST
HEALY CLEAN COAL PROJECT POWER PLANT 4.2 MI ON HEALY SPUR RD	YUKON KOYUKUK	HEALY	AK

SITE NO	LATITUDE	LONGITUDE	DATUM	ELEVATION (FT)	TIP HEIGHT (FT)	ANTENNA PAINTING & LIGHTING CODES FCC FORM 715/715A
001	63-51-21.0 N	148-56-58.0 W	N83	1304	94	
002	63-50-14.0 N	148-58-38.0 W	N27	RECEIVER SITE		

FREQUENCY PATHS

FREQUENCY AND POWER INFORMATION			PATH	SEGMENT INFORMATION								
FREQUENCY (MHZ) OR CHANNEL	TOLERANCE (%)	EMISSION DESIGNATOR	EIRP (DBM)	SEG NO	EMIT SITE NO	ANT HGT (FT)	BEAM-WIDTH (DEG)	HTxWD (FT)	POL	AZIM (DEG)	RECEIVER SITE NO	CALL SIGN
021975.000000	0.03000	25M0F8W	57.0	0001 1	001	30	1.6		V	213.4	002	WPNM499

Page: 1 OF 1

FCC 469
SEPTEMBER 1994

Figure 5-2. FCC File Number 739591.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**AUTOMATIC CAMERA SYSTEM MAINTENANCE**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4120**
DATE	**MARCH 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Changes to responsibilities and equipment.	April 1996	
2.0	Add digital camera/video system references.	April 1999	

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LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines the quality assurance and quality control actions associated with the operation and maintenance of automatic visibility monitoring camera systems.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visual relationships to decision-makers and to the public. Self-contained, automatic camera monitoring systems or time-lapse video monitoring systems are easily installed and operated. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

An automatic camera visibility monitoring station takes 35 mm slides or high-resolution digital images of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera or an SVHS time-lapse recorder to record the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides, digital images, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for the computer image modeling of potential impairment.
- Support color and human perception research.

Slides, digital images, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

In addition to visibility monitoring, time-lapse video systems can be used for a variety of other purposes, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.
- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

The automatic camera system maintenance quality assurance program consists of three (3) major categories:

- Routine Site Operator Maintenance Procedures
  Routine servicing and scheduled maintenance is carried out by site operators on a routine basis.
- Troubleshooting and Emergency Maintenance Procedures
  Identifying and troubleshooting system malfunctions is carried out by site operators, a field specialist, and/or data coordinator, as required.
- Biannual Laboratory Maintenance Procedures
  Intercomparison studies of film exposure, data collection, and equipment operations is carried out on an ongoing basis. Functional instrument checks, exposure calibrations, system lubrication, and preventative maintenance are carried out on a biannual basis.

A variety of camera monitoring configurations exist. Manufacturers change their model lines frequently as outdated models are discontinued and new models are introduced. Over the years, a variety of different camera and time-lapse systems have been applied to monitor visibility. Many of these systems still actively take visibility photographs in operational monitoring networks. This SOP is, therefore, supported by a series of monitoring configuration-specific technical instructions (TIs), as described in Section 4.0.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance or specific troubleshooting needs.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and data coordinator concerning the video monitoring schedule and requirements for routine maintenance or specific troubleshooting needs.

- Train the site operator in all phases of camera or video system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits for video monitoring systems.
- Resolve problems reported by the site operator regarding video monitoring systems.
- Document all technical support provided to the site operator regarding video monitoring systems.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and field specialist concerning the schedule and requirements for routine maintenance or specific troubleshooting needs.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Identify possible camera or video system malfunctions and contact the site operator to schedule system troubleshooting visits.
- Review all site documentation completed by the site operator for accuracy and completeness, and file all documentation and correspondence.
- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all system components and support hardware.
- Coordinate all aspects of biannual camera and video system maintenance.
- Document all capital instrumentation changes and maintain inventory records in the Air Resource Specialists, Inc. (ARS) Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and field specialist concerning the schedule and requirements for routine maintenance or specific troubleshooting needs.

- Schedule regular site maintenance visits and perform all procedures described in the instrument-specific TIs associated with this SOP.

- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet or Time-Lapse Video Monitoring Status/Assessment Sheet and mail the white copy of the sheet to the data coordinator.

- Report any noted inconsistencies immediately to the data coordinator or field specialist.

- Schedule biannual maintenance with the data coordinator.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Site operators will maintain all necessary equipment and spare parts to accommodate routine, field, and emergency maintenance of the automatic camera and video systems. If required, factory-authorized maintenance and repair of monitoring equipment will be coordinated by ARS. Equipment and spare parts generally required to support routine servicing and on-site troubleshooting and emergency maintenance include the following:

- Voltmeter
- Spare camera and timer batteries for 35 mm and 8 mm camera systems
- Various size and type screwdrivers
- Adjustable wrench
- Keys for enclosure and any padlocks
- Watch
- Optical cleaning supplies
- Site operator's manual
- Pen or pencil
- Grease pencil
- Film rolls or SVHS videotape cassettes
- Padded mailing envelopes

A variety of cameras and monitoring configurations exist. Specific backup equipment requirements for each site will vary with the system configuration. Configuration-specific TIs detail the required equipment and materials for each site type. ARS has established service agreements with local factory-authorized repair facilities for Canon, Contax, Olympus, Minolta, Yashica, Panasonic, and Sony manufactured products. These facilities are capable of providing prompt and thorough testing, preventive maintenance, and repair services, as described in Section 4.3.

3.2 INVENTORY

It is imperative that all capital instrumentation changes made as a result of routine and biannual maintenance be thoroughly documented and maintained in the ARS Purchase Order/Inventory Database. Any on-site equipment changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or on a Time-Lapse Video Monitoring Status/Assessment Sheet. Specific model and serial number items tracked are discussed further in the instrument-specific troubleshooting and emergency maintenance TIs (see Section 4.2).

4.0 METHODS

This section includes three (3) subsections:

4.1 Routine Site Operator Maintenance Procedures
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Biannual Laboratory Maintenance Procedures

Methods and procedures described in these subsections are summarized in Figure 4-1.

Site operators are trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. This manual contains standard operating procedures and technical instructions applicable to the specific camera or video monitoring equipment located at the site. Additional manufacturers' instructions booklets and pertinent maintenance documentation forms are also provided.

4.1 ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES

Routine servicing schedules are based on the number of photographs or images taken each day. A common 35 mm camera monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this monitoring schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera(s), clean the system components, and perform scheduled preventive maintenance. A common 8 mm or time-lapse video monitoring schedule includes monitoring continuously (e.g., 1 frame per minute) during the daylight hours of 0800 through 1800. Assuming this monitoring schedule, site operators service the camera approximately every 7 days (8 mm cameras) or 14 days (video systems), to change film, check the performance of the camera(s), clean the system components, and perform scheduled preventive maintenance.

Regular servicing and the identification and documentation of film rolls or videotapes are essential. During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and any equipment or monitoring inconsistencies on the Visibility Monitoring Status/Assessment Sheet or Time-Lapse Video Monitoring Status/Assessment Sheet. Completed sheets are mailed with each roll of film or videotape. If operator entries on the sheet indicate that further action is necessary, immediate corrective action will be taken by the data coordinator.

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film or videotape change:

- Inspect overall system and clean shelter window.
- Verify that film or videotape advanced and settings are correct.
- Rewind and remove film or videotape (complete film canister or videotape label).
- Load new film or videotape (complete film canister or videotape label).
- Inspect and clean camera lens.
- Check system batteries or time-lapse system power source.
- Check camera and databack settings.
- Check timer and time-lapse system alarm settings.
- Photograph film documentation board.
- Verify proper camera alignment.
- Verify system operation.
- Complete status/assessment sheet:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock enclosure.
- Mail film or videotape and the white copy of the completed status/assessment sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm and 8 mm timer batteries every 6 months.
- Return time-lapse recorder annually for factory-authorized servicing.

Unscheduled Maintenance performed as required:

- If the operator notes a problem, he/she calls or notifies the field specialist and/or data coordinator. If ARS notes a problem, the data coordinator calls the site operator.
- The site operator, in communication with ARS, applies troubleshooting and emergency maintenance procedures.
- If necessary, ARS express mails a replacement system to the site.
- The site operator replaces the system and returns the malfunctioning unit to ARS.

Figure 4-1. Automatic Camera System Field Quality Control Procedures.

Throughout the monitoring effort, ARS and site operators maintain close personal communication. Operators are encouraged to call or notify ARS if they have any questions or problems. A data coordinator and/or field specialist is available during normal business hours (0800-1700 MST) to provide telephone assistance to site operators. A telephone answering/message system operates during non-business hours. ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Instrument-specific routine site operator maintenance procedures are provided in detail in the following TIs:

- TI 4120-3100 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*
- TI 4120-3110 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*
- TI 4120-3120 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*
- TI 4120-3130 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*
- TI 4120-3140 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*
- TI 4120-3150 *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System – Pentax ZX-10*
- TI 4120-3200 *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*
- TI 4120-3210 *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*
- TI 4120-3650 *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP – Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*
- TI 4120-3655 *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
- TI 4120-3660 *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Maintaining a monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film or videotape.

- The site operator applies defined troubleshooting procedures to test the system and notifies the data coordinator of his/her findings. The data coordinator attempts to diagnose the problem and suggest specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When a camera-related or video recording problem cannot be identified or resolved by the site operator, or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup system to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair.

- The operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet or Time-Lapse Video Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction
  - Actual or estimated amount of data loss
  - Steps taken to test the system components
  - Corrective action taken
  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

Instrument-specific troubleshooting steps are provided in detail in the following TIs:

- TI 4120-3300 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*
- TI 4120-3310 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*

- TI 4120-3320 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*
- TI 4120-3330 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*
- TI 4120-3340 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*
- TI 4120-3350 *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System – Pentax ZX-10*
- TI 4120-3400 *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*
- TI 4120-3410 *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*
- TI 4120-3750 *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP – Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*
- TI 4120-3755 *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
- TI 4120-3760 *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*

4.3 BIANNUAL LABORATORY MAINTENANCE PROCEDURES

Internal quality assurance of automatic camera equipment is based primarily on visual review of developed film or videotape. Film/videotape handling and review procedures are fully discussed in SOP 4305, *Collection of Scene Monitoring Photographs, Film, and Videotape*. Alignment, exposure, and data collection efficiency can all be assessed from developed film or videotape. Any noted problems will initiate corrective action. Using quality site operators, verification of system performance and correction of identified problems can be successfully accomplished. On rare occasions when unresolvable problems persist, a field specialist will visit a site to repair, reconfigure, or reinstall a malfunctioning system, and will retrain the site operator.

Ongoing review of film, videotape, and site operator identified problems often initiates corrective actions. Servicing of all cameras and support systems is performed by mailing replacement parts and/or systems to the site operators and repairing those components returned by the site operators. Operational camera systems are biannually cycled out of the monitoring network. Shelters remain in place and the cameras and timers are cycled for laboratory maintenance.

Automatic camera and video system maintenance is normally provided by local factory-authorized repair facilities capable of performing the following:

- Cleaning, lubrication, and adjustment of all 35 mm or 8 mm camera components
- Automatic exposure calibration checks
- Ambient/cold testing of:
  - Current draw
  - Shutter speed and curtain travel time
  - Automatic exposure meter readout
  - Film transport
- Lens focus checks (and disabling of the soft focus mechanism in Canon 135 mm lenses)
- Battery and camera cabling integrity checks and necessary repair
- Timer circuitry checks
- Cleaning the VCR's head drum assembly, pinch roller, and capstan
- Checking the VCR's back tension and take-up torque
- Checking and adjusting videotape path
- Checking VCR play and rewind performance

Additional preventive maintenance performed on each serviced system includes:

- Camera system battery replacements
- Timer system battery replacements
- Lens cleaning
- Operational testing

Instrument-specific routine and annual laboratory maintenance procedures are provided in detail in the following TIs:

- TI 4120-3500 *Biannual Laboratory Maintenance Procedures for 35 mm Automatic Camera Systems*
- TI 41420-3510 *Biannual Laboratory Maintenance Procedures for 8 mm Automatic Time-Lapse Camera Systems*

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CANON EOS 630**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3100**
DATE	**MARCH 1993**

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OTHER		

REVISION HISTORY			
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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Canon EOS 630 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Canon EOS 630: - one 6 V lithium battery
  - Canon Quartz Date Back E: - one 3 V lithium battery
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*
  - TI 4120-3300, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3300, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Canon EOS 630 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Canon EOS 630 System, provided in the site operator's manual. Detailed schematic diagrams of the Canon EOS 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Canon EOS 630 Part I
- Canon EOS 630 Part II
- Canon Quartz Date Back E
- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3300.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

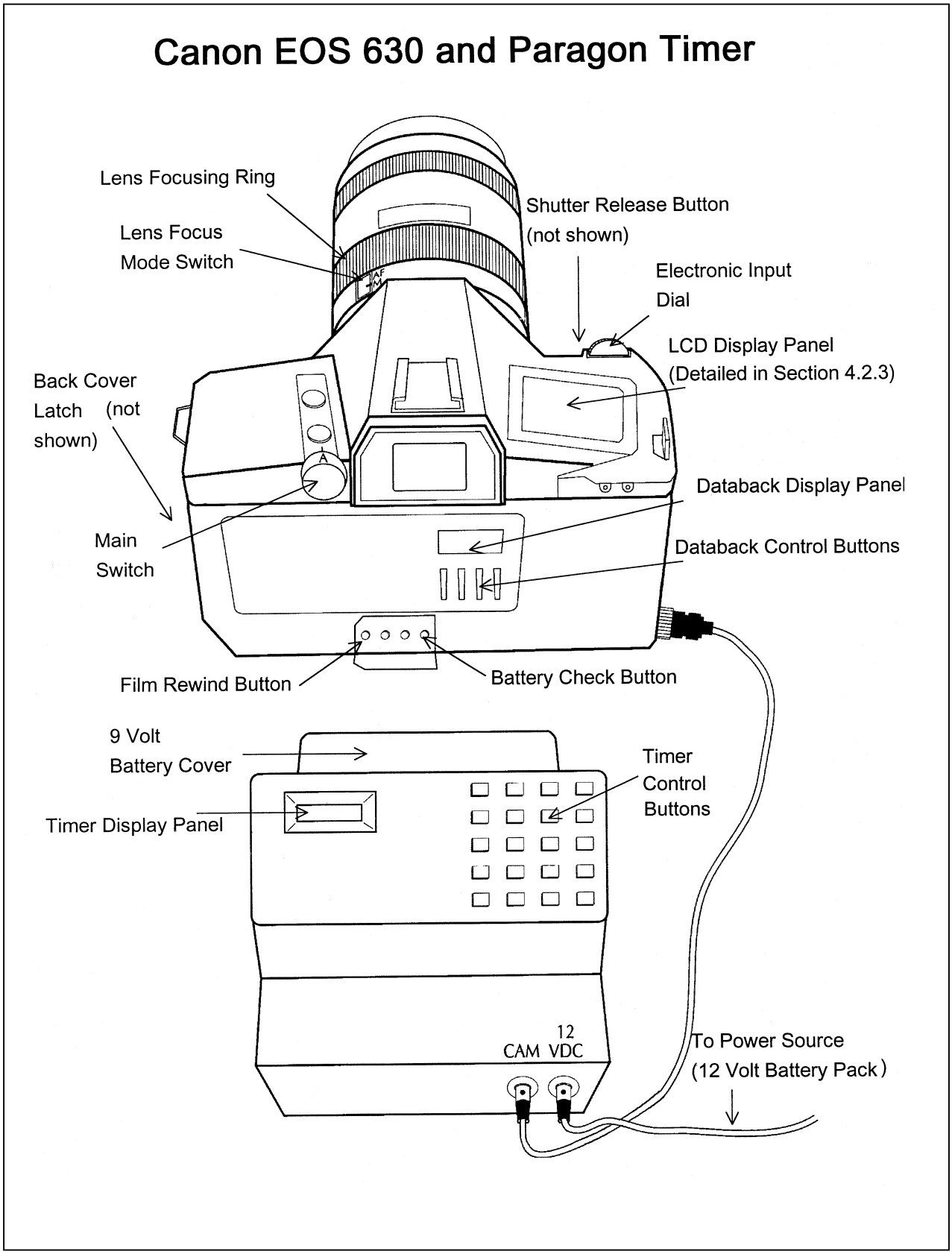

Figure 4-1. Canon EOS 630 System Components.

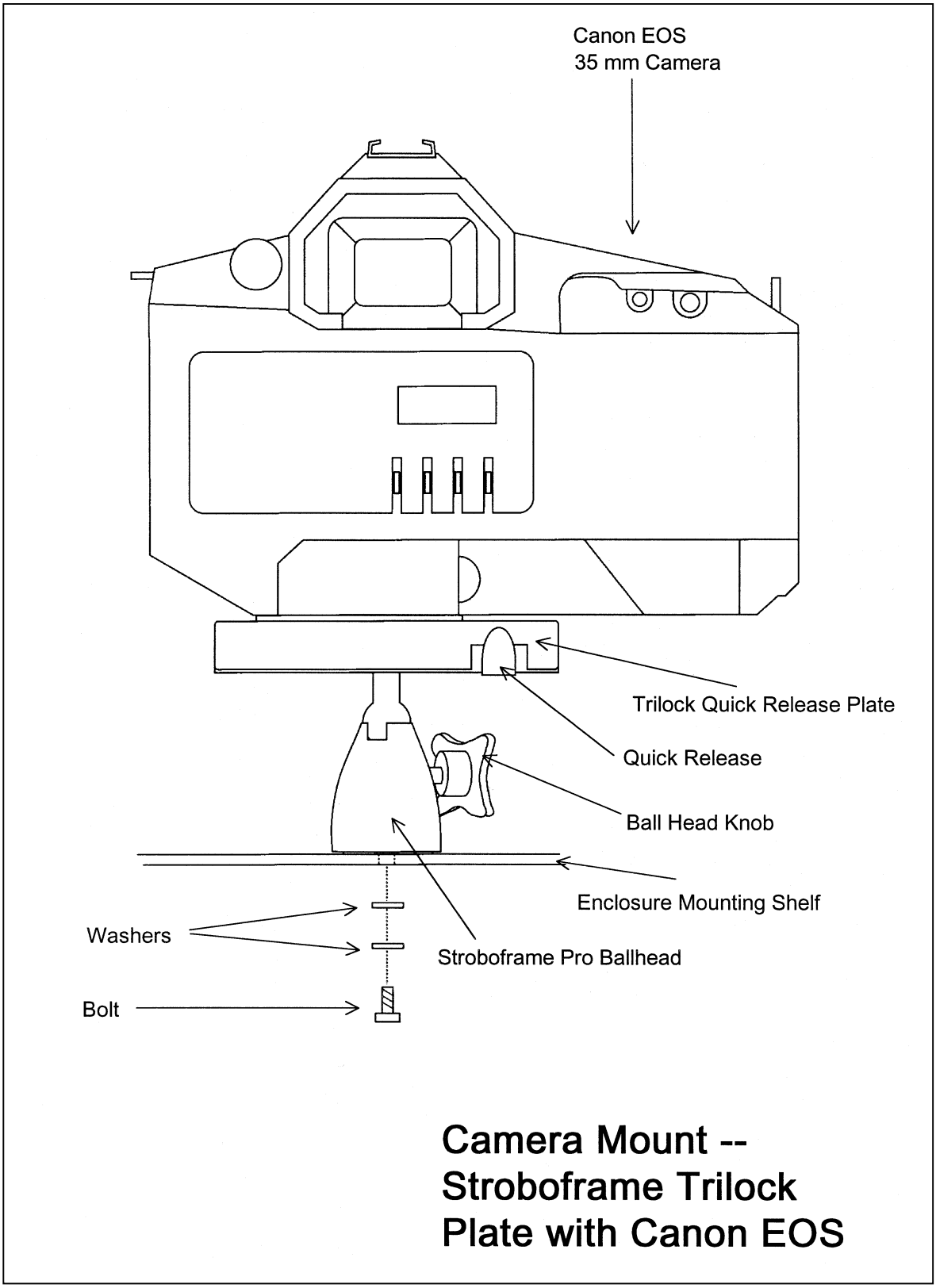

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

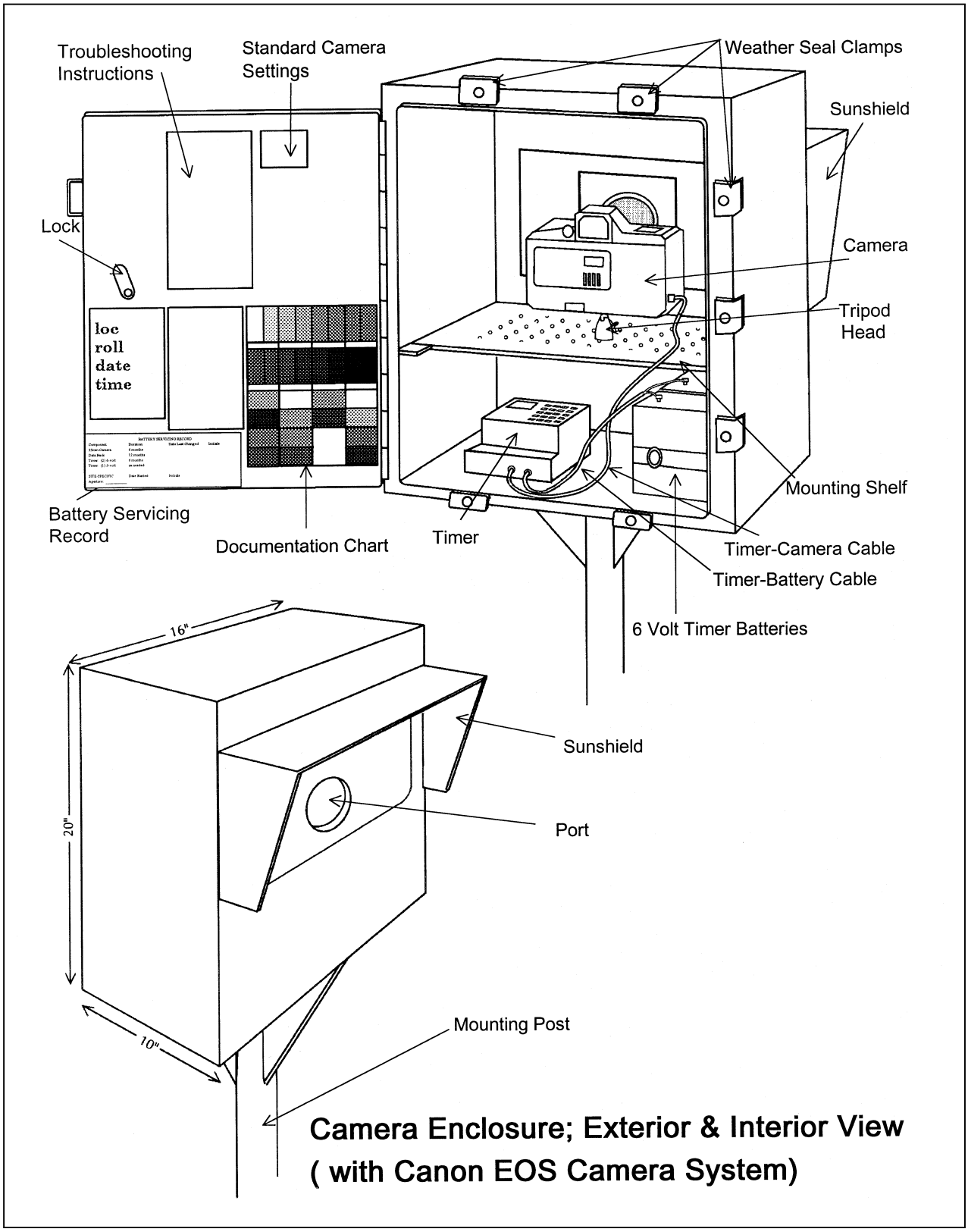

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

Current % Cloud Cover _____ Temperature _____ (Now) _____ (Max) _____ (Min)

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED _____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Canon EOS 630 Automatic Camera System.

Location DENA Roll No. 9
Operator Andrea Blakesley

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 5/27/94 Time 11:30

Yes	No	
☑	☐	Batteries tested
☑	☐	Monitoring target visible
☑	☐	Camera alignment correct
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Documentation photograph taken
☑	☐	Lens focus on infinity
☑	☐	Film advancing properly
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) ON(PZ-20)
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

FILM REMOVED

Today's Date 6/4/94 Time 15:20

Yes	No	
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 29
☑	☐	Timer found in proper condition
☑	☐	Camera/timer cable secure
☑	☐	Camera found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) ON(PZ-20)
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

DESCRIBE WEATHER CONDITIONS for the duration of this roll Mostly sunny and mild, cool and rainy for two days

% Cloud Cover 75% Temperature Now 63 Max 65 Min 38

COMMENTS/ACTION TAKEN Manual shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6 v. timer batteries

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525 303-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emmision source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Push the **QUICK RELEASE** lever on the tripod plate and lift the camera off the mount. Disconnect the camera/timer cable from the timer at the timer jack and remove the camera from the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken durng the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS. If the film is already rewound, the film-load check mark will be flashing ( ). Assume all 36 exposures were taken and document as such.

VERIFY SETTINGS

Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

Observe the film-load check mark ( ) on the display panel:

- If flashing, the film was automatically rewound after the last frame was exposed.
- If not flashing, open the switch cover (on the back of the camera below the databack) and press the **FILM REWIND** button (first button on the left).

During rewind the film transport bars move in sequence from right to left to indicate the function in progress. The film rewind stops automatically when the film has been completely rewound. Do not open the back until the film-load check mark flashes.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the DX film contacts or shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permenantly logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation

- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, push the **BACK COVER LATCH** down while pressing the **BACK COVER LOCK** button. The Canon EOS loads the film automatically if the following steps are carefully taken:

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber, upper flat end first. The film-load check mark appears in the display panel.
- Pull the film leader across the shutter curtain until its tip is aligned with the orange index.
- Make sure the film has no slack and that its perforations are properly engaged with the sprocket teeth.

  NOTE: If the film leader extends past the orange index, remove the film cartridge and manually rewind excess film back into cartridge.

- Close the camera back cover. The film will automatically advance and stop when "1" appears in the display panel. During film advance the film transport bars will appear at the bottom of the display panel, moving in sequence from left to right.

  NOTE: If the film is not loaded correctly, the bars will flash after the camera motor has stopped and the shutter will not release. Open the back cover and reload the film.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.

- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.

- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

- Write the following on the note pad provided:

  - Monitoring site name or abbreviation

  - Roll number

  - Date and time

- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.

- Press the **SHUTTER BUTTON**. Verify that the film counter has incremented one frame.

- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Open the switch cover (on the back of the camera below the databack) and press the **BATTERY CHECK** button (the button at the farthest right). While pressing the button, observe the display panel. A "bc" appears in the display and the level of battery power is indicated by:

- three bars - battery power sufficient

- two bars - low (have a new battery on hand)

- one flashing bar - very low (replace with a new battery)

- blank display - drained (replace with a new battery)

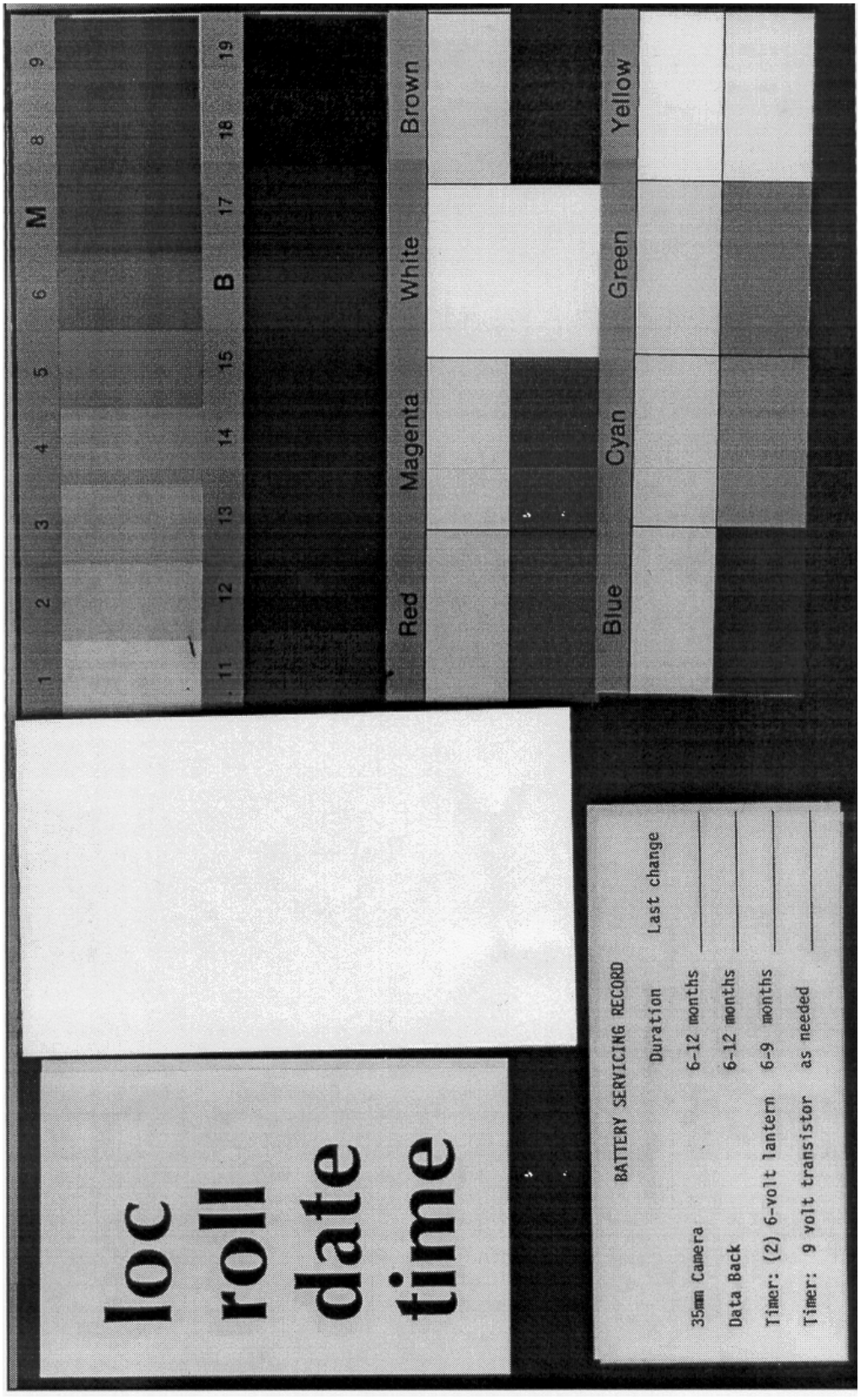

Figure 4-6. Photographic Documentation Board.

If required, change the camera 6 V lithium battery and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Canon EOS 630 are:

Main Switch	A
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0 (Zero)
Program Mode Selection	AV
Drive Mode Selector	S (single)
Lens Focus Mode	M (manual)

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

The databack should be in the "day-time" mode displaying the current day of the month and current time.

If the word "BATTERY" is displayed or if the display is blank, the databack battery is drained. Replace the battery only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current date and time.

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

<u>Review timer display:</u>

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review.
- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod plate.
- Securely reconnect the camera/timer cable to the timer at the timer jack.
- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Observe the camera display panel. The display should not illuminate for more than 6 seconds. If the display continues to illuminate beyond 6 seconds, an electrical short may exist in a portion of the cable jack.

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED	Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.
CLOSE AND SECURE ENCLOSURE	Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3300, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (annually)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Canon EOS 630 are provided in TI 4120-3300.

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE

The Canon EOS 630 camera runs on one 6 V lithium battery pack. This battery should be replaced every six months or as directed by the data coordinator.

- Remove the grip by loosening the screw on the right side of the camera with a coin or similar object.
- Push the orange lever in the battery compartment upward to release the used battery. Tilt the camera to allow the used battery to slide out of the compartment. Measure and record the voltage of the used battery.
- Remove the new battery from its packaging and test and record the voltage. The new battery should measure approximately 6 volts.
- Insert the new battery end first and lock it in place with the orange lever.
- Replace the grip securely and check the battery as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Canon Quartz Date Back E runs on one 3 V coin-shaped lithium battery. The databack battery should be replaced annually, or as required by the data coordinator. Be sure to replace the battery only when film is not loaded.

- Open the camera back. The battery compartment is located on the inside of the databack opposite the hinge. To open the compartment, turn the screw counterclockwise using a small Phillips-head screwdriver.
- Insert the screwdriver tip into the chamber and then gently push the used battery. It will pop up and can then be removed. Measure and record the voltage of the used battery.
- Remove the new battery from its packaging and test and record the voltage. The new battery should measure approximately 3 volts.

- Wait 15 seconds after removing the used battery and then load the new battery with the "+" side facing up.

- To load the new battery, first insert one side into the chamber and then press it to the left with your finger until it will go no further.

- Slide the battery slightly to the right, lock it into place and replace the cover; tighten the screw securely.

- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.

- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.

- Place the new batteries together at opposite polarity (in series).

- Connect the two batteries at one end.

- Connect the opposite terminals to the cable from the timer.

- Perform the above test to assure the connections are secure.

- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

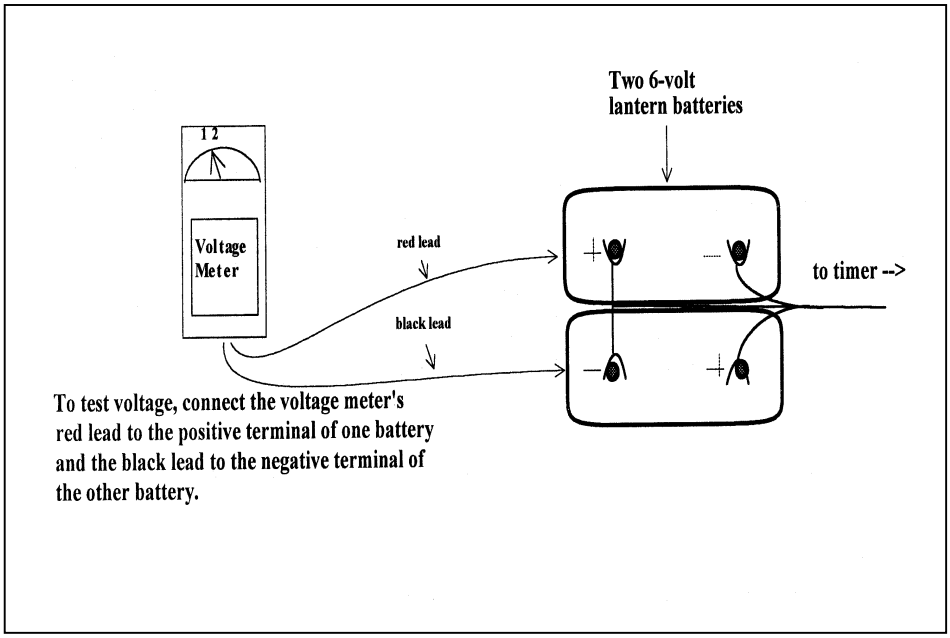

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

CANON EOS 630

The Canon EOS 630 is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The automatic (A) operation and aperture priority (AV) exposure mode provide properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Canon EOS 630 are:

Main Switch	A
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0 (Zero)
Program Mode Selection	AV
Drive Mode Selector	S (single)
Lens Focus Mode	M (manual)

REVIEW CAMERA SETTINGS

Press the **CAMERA SHUTTER** halfway or the display panel illumination button to view the camera display panel. If the display does not appear, confirm that the "main switch" is set to "A" and that the battery power level is sufficient. Verify all standard settings as they appear in Figure 4-8.

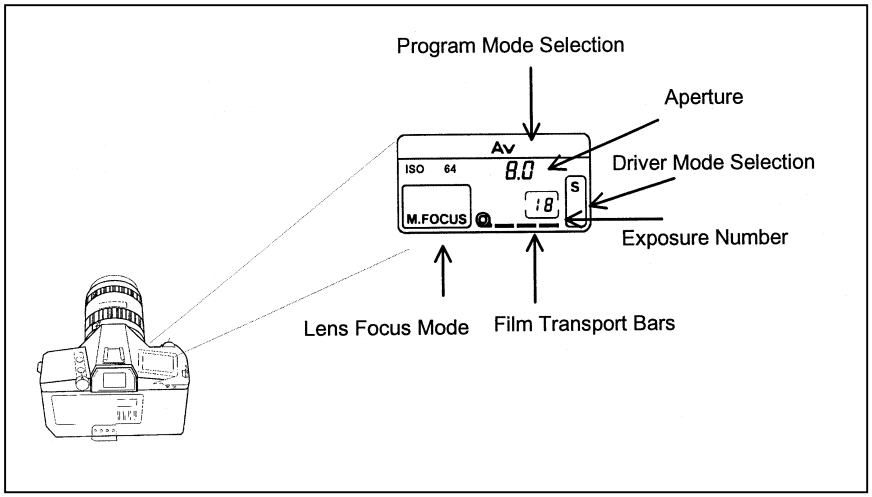

Figure 4-8. Canon EOS 630 Display Panel.

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Canon EOS 630 (Part I and Part II) manufacturers' instruction booklets for detailed camera setting procedures.

CANON QUARTZ DATE BACK E

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Canon Quartz Date Back E automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation the databack should display the local date and time. Verify that no colon or digits are flashing.

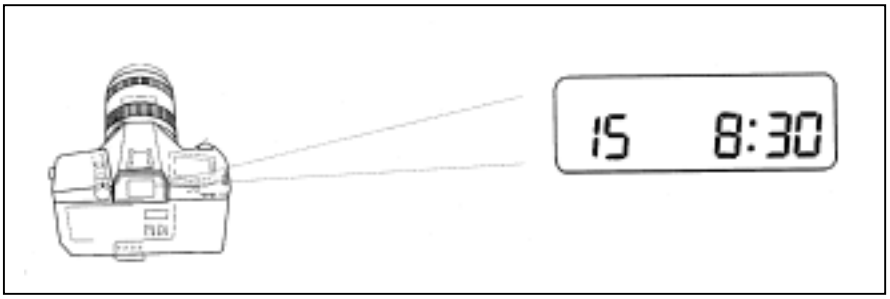

Figure 4-9. Canon Quartz Date Back E Display.

If the word "BATTERY" is displayed or if the display is blank, the databack battery is drained.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

To set the databack:

- Press the **MODE** button until the "DAY/HOUR/MINUTE" mode is displayed.
- Press the **SELECT** button twice -- the "MINUTES" display will flash.
- Press the **SET** button until the correct "MINUTES" are displayed. Constant pressure on the "SET" button will rapidly advance the numbers.
- Press the **SELECT** button -- the "HOUR" display will flash. Press the **SET** button until the correct "HOUR" is displayed.
- Press the **MODE** button four times until the "YEAR/MONTH/DAY" mode is displayed.
- Press the **SELECT** button -- the "YEAR" display will flash. Press the **SET** button until the correct "YEAR" is displayed.

- Press the **SELECT** button -- the "MONTH" display will flash. Press the **SET** button until the correct "MONTH" is displayed.

- Press the **SELECT** button -- the "DAY" display will flash. Press the **SET** button until the correct "DAY" is displayed.

- Press the **MODE** button once to return to the "day-time" mode. The databack should remain in this mode during regular operation.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule

- 2 photographs/day = 15-17 day servicing schedule

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

<u>To set the timer clock</u>:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the TIMER flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

<u>To program times for photographs to be taken</u>:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or

- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.

- The horizon is level.

- The vista is framed correctly.

- The sunshield and port are not visible in the viewfinder.

- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3300, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed or focused documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-10) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3300.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____

Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-10. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CONTAX 167MT**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3110**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Contax 167MT 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Contax 167MT: - four AAA alkaline batteries
  - Contax 167MT Data Back D-7: - two 3 V lithium batteries
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*
  - TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Contax 167MT 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Contax 167MT System, provided in the site operator's manual. Detailed schematic diagrams of the Contax 167MT 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Contax 167MT
- Contax Data Back D-7
- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3310.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

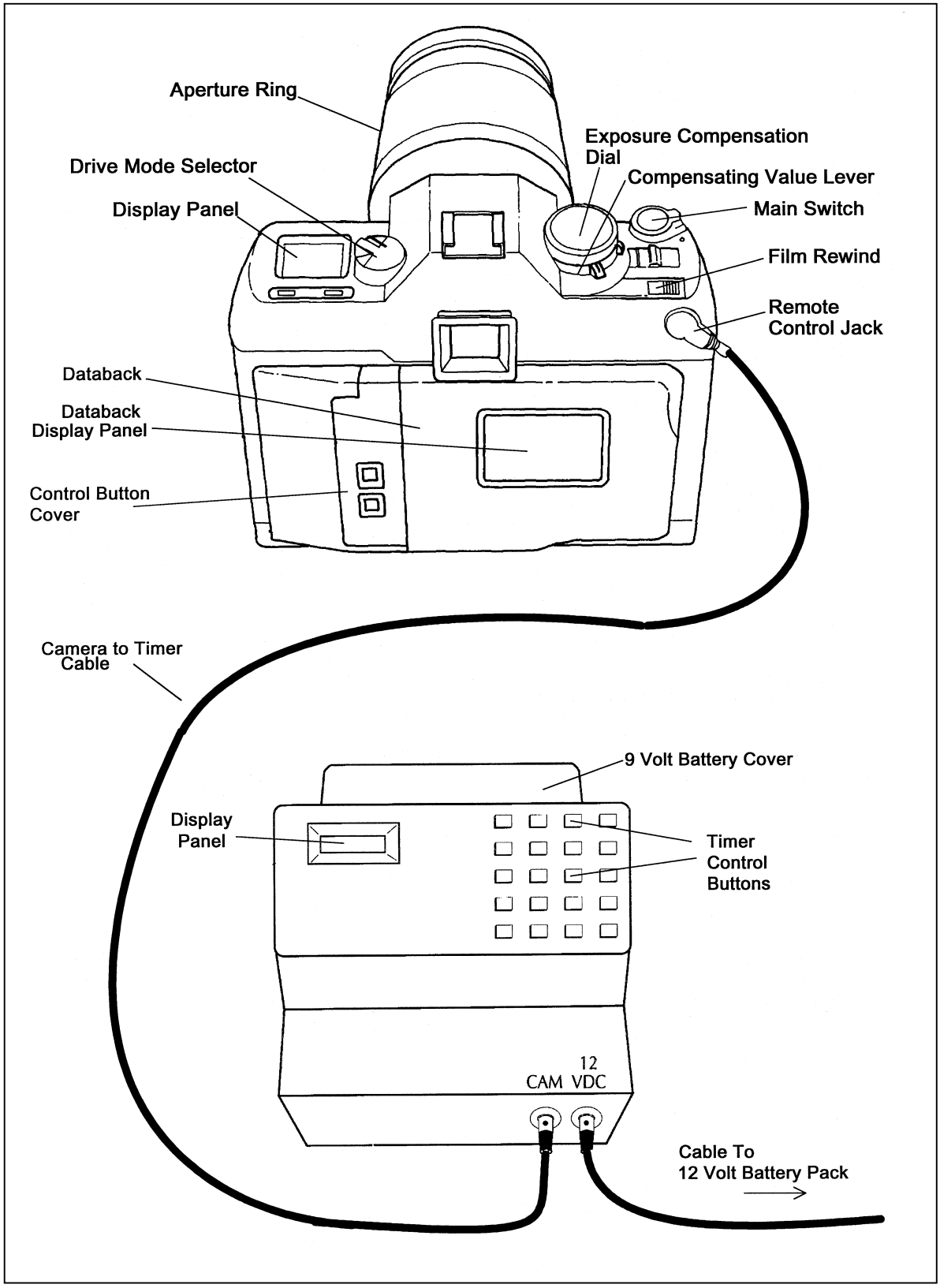

Figure 4-1. Contax 167MT System Components.

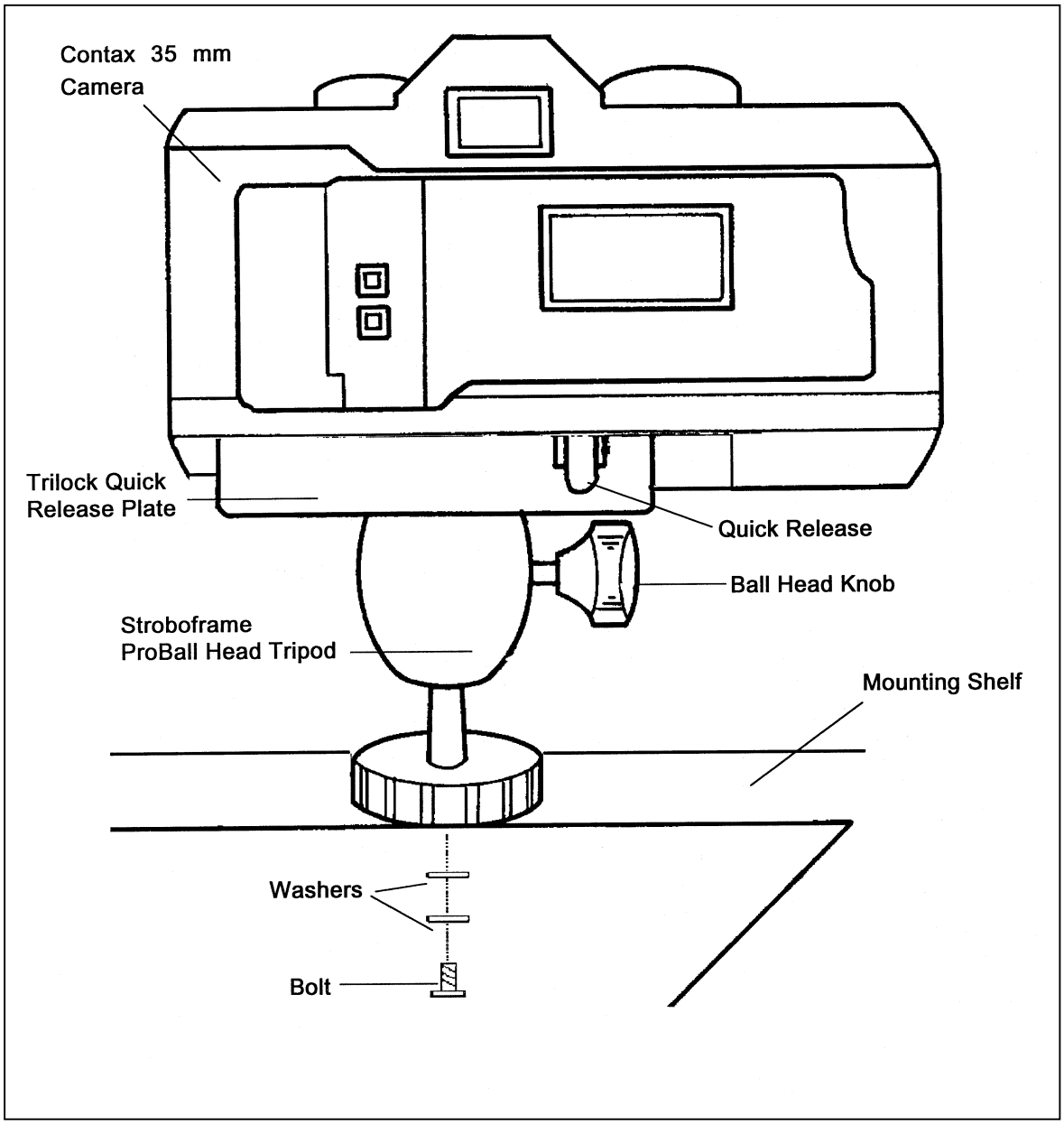

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

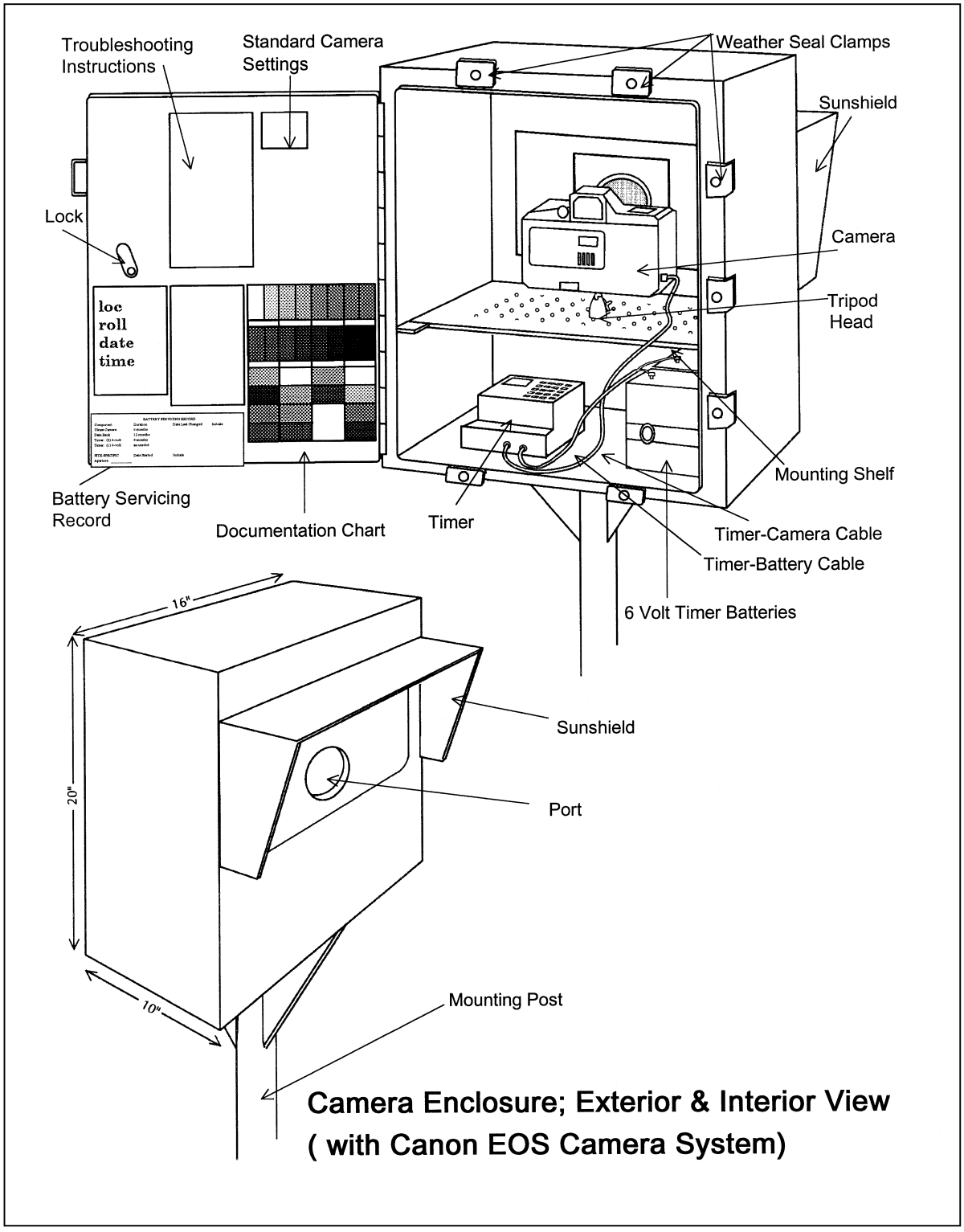

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

Current % Cloud Cover _____ Temperature _____ _____ _____
Now Max Min

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED _____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Contax 167MT Automatic Camera System.

Location DENA Roll No. 9
Operator Andrea Blakesley

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 5/27/94 Time 11:30

Yes	No	
☑	☐	Batteries tested
☑	☐	Monitoring target visible
☑	☐	Camera alignment correct
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Documentation photograph taken
☑	☐	Lens focus on infinity
☑	☐	Film advancing properly
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	IS0/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

FILM REMOVED

Today's Date 6/4/94 Time 15:20

Yes	No	
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 29
☑	☐	Timer found in proper condition
☑	☐	Camera/timer cable secure
☑	☐	Camera found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

DESCRIBE WEATHER CONDITIONS for the duration of this roll Mostly sunny and mild, cool and rainy for two days

% Cloud Cover 75% Temperature 63 (Now) 65 (Max) 38 (Min)

COMMENTS/ACTION TAKEN Manual shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6 v. timer batteries

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525 303-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emission source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Press and move the **QUICK RELEASE** lever to the "R" (release) position and lift the camera off the mount. Disconnect the camera/timer cable from the timer at the timer jack and remove the camera from the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken during the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS.
VERIFY SETTINGS	Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

While pressing the **RELEASE** button, slide the **REWIND** switch to the left. The camera will automatically start rewinding the film.

Make sure the wind motor has stopped and the exposure counter shows "00" before opening the camera back.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation
- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, press the camera back **LOCK RELEASE** button in the center and push down the camera **BACK OPENING** lever. The Contax 167MT loads the film automatically if the following steps are carefully taken:

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber.

- Pull the film leader across the shutter curtain until its tip is aligned with the orange index.

- With the camera back open, press the **SHUTTER RELEASE** button once or twice to advance the film. Verify that the film is properly engaged on the take-up spool.

- Firmly close the camera back; verify that the main switch is "ON." Press the **SHUTTER RELEASE**. The camera will automatically advance the film until the exposure counter shows "01."

  NOTE: The exposure counter may advance even though the film is not loaded correctly. You must verify that the film is properly engaged on the take-up spool to ensure proper loading.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.

- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.

- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

- Write the following on the note pad provided:

  - Monitoring site name or abbreviation

  - Roll number

  - Date and time

- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.

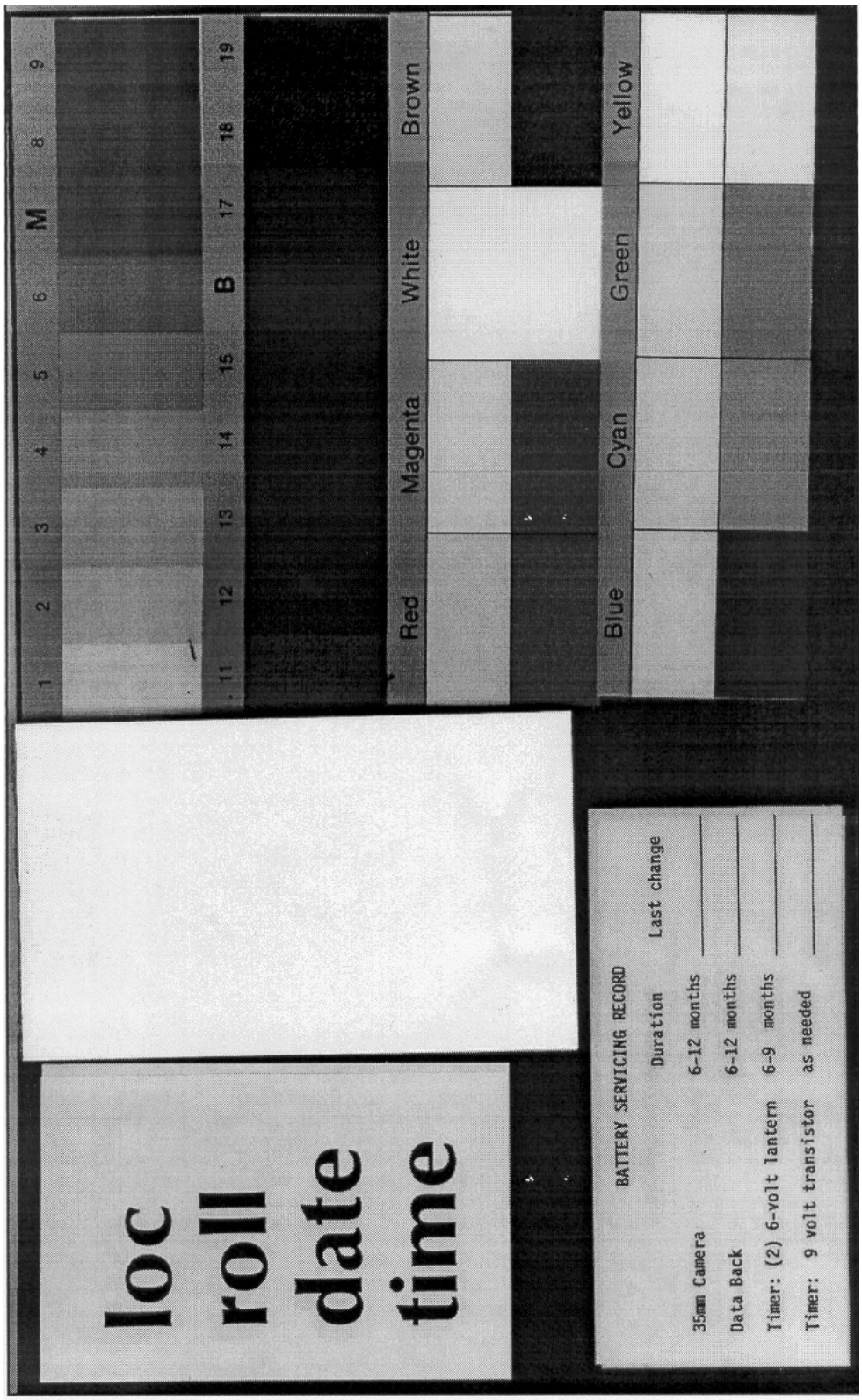

Figure 4-6. Photographic Documentation Board.

- Press the **SHUTTER BUTTON**. Verify that the film counter has incremented one frame.

- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Check the camera batteries by turning on the "main switch" and pressing the **MODE** and **ISO** buttons simultaneously.

- All display panel indicators on - battery power sufficient

- All display panel indicators flashing* - low (have new batteries on hand)

- No display panel indicators - drained or installed incorrectly (replace with new batteries or reinstall)

  * As batteries lose voltage, the display panel will flash faster.

If required, change the camera's four AAA alkaline batteries and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Contax 167MT are:

Main Switch	☐
Program Mode Selection	AV
ISO/ASA	64
Aperture	f8.0
Drive Mode Selector	S
Exposure Compensation	(zero) 0
Automatic Compensation Value Level	0&0

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

The databack should be in the "year-month-day-time" mode displaying the current year, month, day, and time.

If the display is flashing or blank, the databack batteries are drained. Replace the batteries only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current year, month, day, and time.

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

Review timer display:

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review.
- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod head.

- Press and move the **QUICK RELEASE** lever to the "L" (lock) position.

- Securely reconnect the camera/timer cable to the timer at the timer jack.

- Look through the viewfinder and align the camera on the vista to be photographed.

- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).

- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Observe the camera main lamp. The lamp should not illuminate for more than 20 seconds. If the lamp continues to illuminate beyond 20 seconds, an electrical short may exist in a portion of the cable jack.

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND A CTIONS PERFORMED	Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.
CLOSE AND SECURE ENCLOSURE	Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (annually)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Contax 167MT are provided in TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE	The Contax 167MT camera runs on four AAA alkaline batteries. The batteries should be replaced every six months or as directed by the data coordinator.

- Loosen the battery compartment cover screw on the bottom of the camera. Remove the battery compartment cover and used batteries. Measure and record the voltage of the used batteries.

- Remove the new batteries from their packaging and test and record the voltage. Each new battery should measure at least 1.5 volts.

- Insert four batteries with polarity as indicated by the (+) and (-) markings on the battery compartment. The camera will not operate if the (+) and (-) ends are reversed.

- Fit the mounting hole on the battery compartment cover onto the guide pin on the camera body, return the cover to its original position, and close it with the fixing screw.

- After changing batteries, check them as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Contax 167MT Data Back D-7 runs on two 3 V coin-shaped lithium batteries. The databack batteries should be replaced annually, or as required by the data coordinator. Be sure to replace the batteries only when film is not loaded.

- Open the camera back. The battery compartment is located on the inside of the databack opposite the hinge. To open the compartment, turn the screw counterclockwise using a small Phillips-head screwdriver.

- Insert the screwdriver tip into the chamber and then gently push the used batteries. They will pop up and can then be removed. Measure and record the voltage of the used batteries.

- Remove the new batteries from their packaging and test and record the voltage. The new batteries should measure approximately 3 volts.

- Wait 15 seconds after removing the used batteries and then load the new batteries with the "+" side facing up.

- Load the new batteries into each chamber and replace the cover; tighten the screw securely.

- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

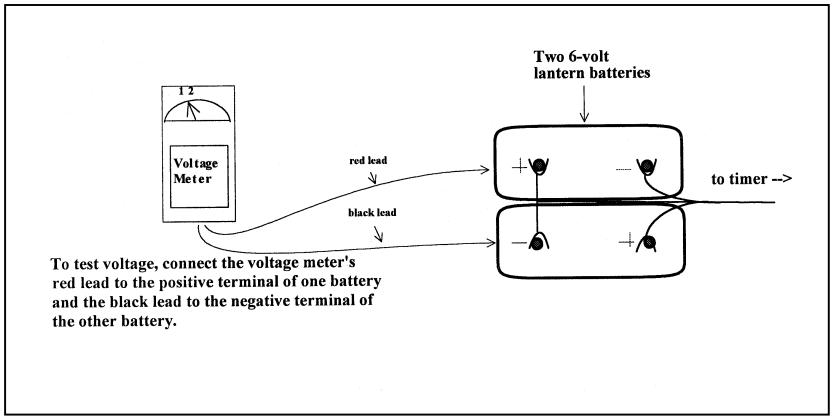

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

CONTAX 167MT

The Contax 167MT is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The aperture priority (AV) exposure mode provides properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Contax 167MT are:

Main Switch	□
Program Mode Selection	AV
ISO/ASA	64
Aperture	f8.0
Drive Mode Selector	S
Exposure Compensation	(zero) 0
Automatic Compensation Value Level	0&0

REVIEW CAMERA SETTINGS

Press the **CAMERA SHUTTER** halfway or the **MODE** button to illuminate the camera display panel for approximately 20 seconds. If the display does not appear, confirm that battery power level is sufficient. Verify all standard settings as they appear in Figure 4-8.

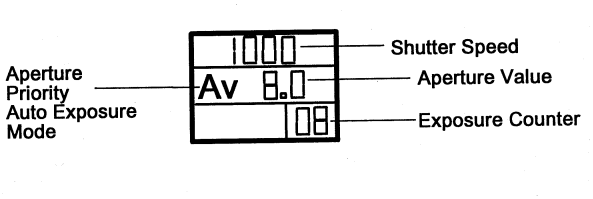

Figure 4-8. Contax 167MT Display.

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Contax 167MT manufacturers' instruction booklet for detailed camera setting procedures.

CONTAX DATABACK D-7

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Contax Data Back D-7 automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation the databack should display the local date and time with the colon flashing, as in Figure 4-9.

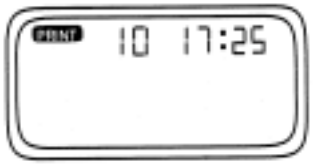

Figure 4-9. Contax Data Back D-7 Display.

If the display is flashing or is blank, the databack batteries are drained.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

To set the databack:

- Open the control button cover on the left side of the databack. A fingernail catch is located at the top of the cover.
- Press the **MODE** button until the "DATE AND TIME" mode is displayed.

- Press the **SET** button once--the "MINUTES" display will flash. Press the up (▲) or down (▼) button until the correct "MINUTES" is displayed.

- Press the **SELECT** button--the "HOUR" display will flash. Press the up (▲) or down (▼) button until the correct "HOUR" is displayed.

- Press the **SELECT** button--the "YEAR" display will flash. Press the up (▲) or down (▼) button until the correct "YEAR" is displayed.

- Press the **SELECT** button--the "MONTH" display will flash. Press the up (▲) or down (▼) button until the correct "MONTH" is displayed.

- Press the **SELECT** button--the "DAY" display will flash. Press the up (▲) or down (▼) button until the correct "DAY" is displayed.

- Press the **SET** button to return to the "DATE AND TIME" mode. The databack should remain in this mode during regular operation.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule.

- 2 photographs/day = 15-17 day servicing schedule.

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

<u>To set the timer clock</u>:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the TIMER flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

To program times for photographs to be taken:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or

- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.
- The horizon is level.
- The vista is framed correctly.
- The sunshield and port are not visible in the viewfinder.
- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment

- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-10) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____

Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-10. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CONTAX 137 MA**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3120**
DATE	**OCTOBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Karen K. Rosener	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Contax 137 MA 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Contax 137 MA: - four AA alkaline batteries
  - Contax 137 MA Data Back D-5: - two 1.5 V silver oxide batteries
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*
  - TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Contax 137 MA 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Contax 137 MA System, provided in the site operator's manual. Detailed schematic diagrams of the Contax 137 MA 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Contax 137 MA Quartz
- Contax 137 MA Data Back D-5 Quartz
- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3320.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

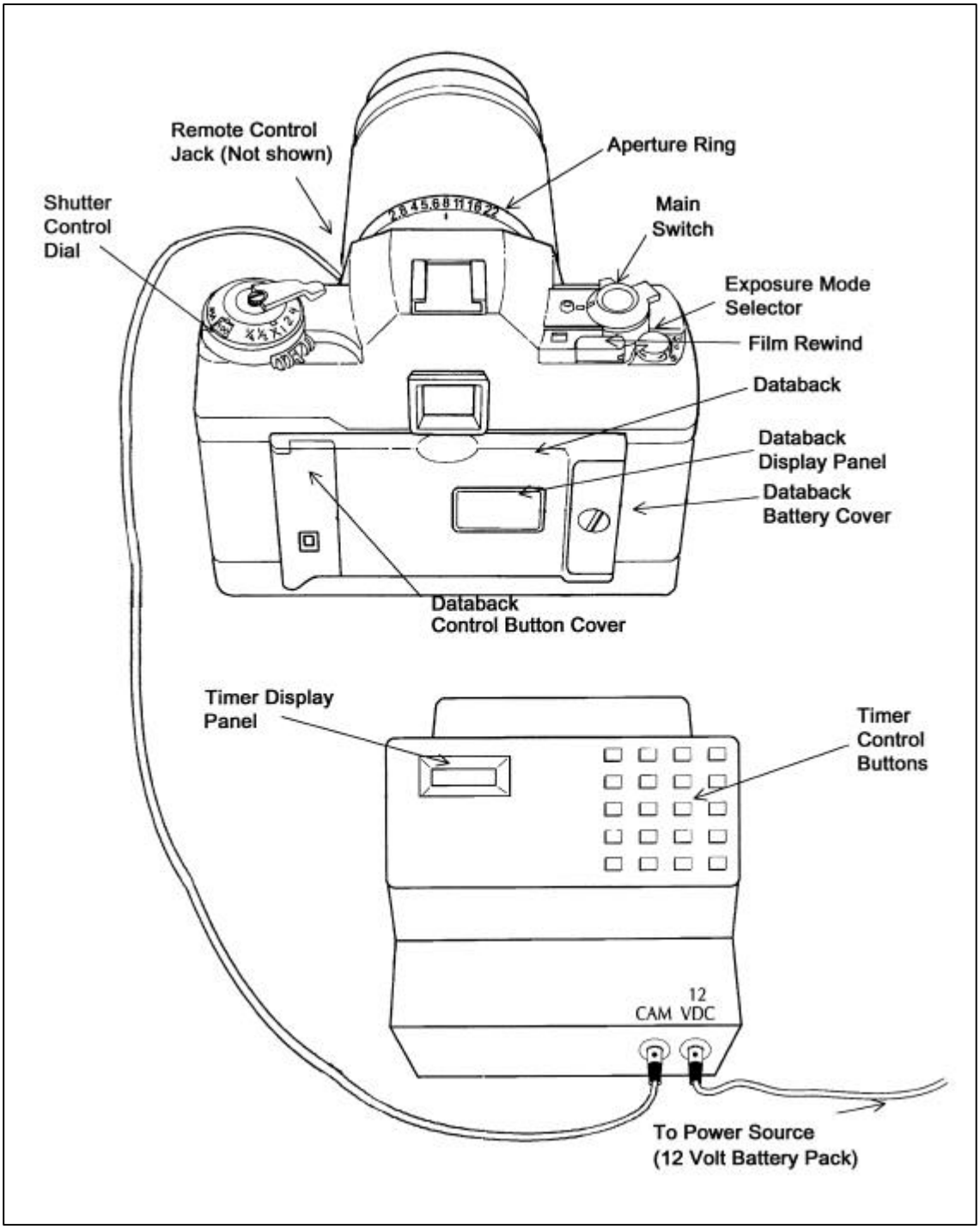

Figure 4-1. Contax 137 MA System Components.

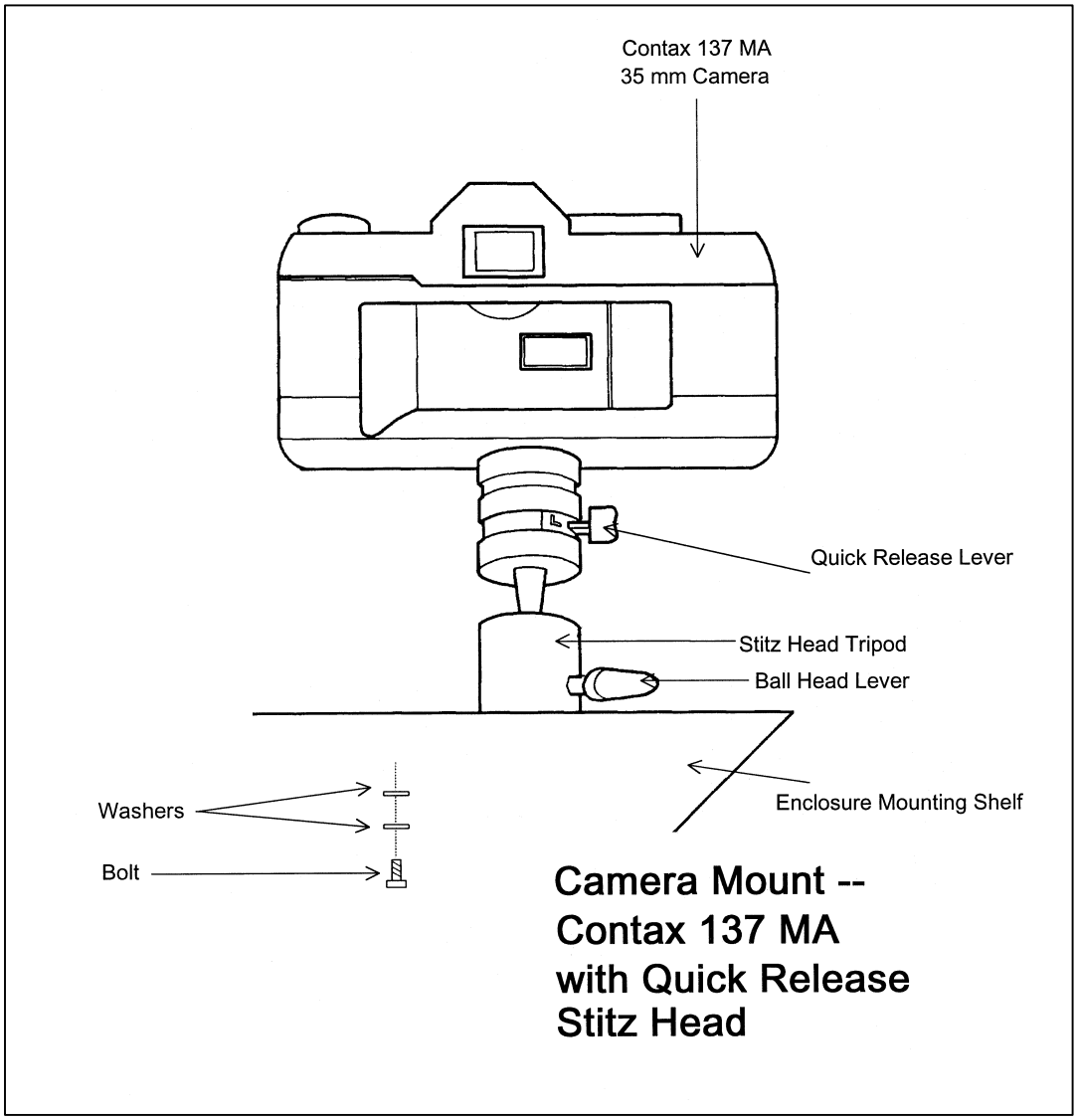

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

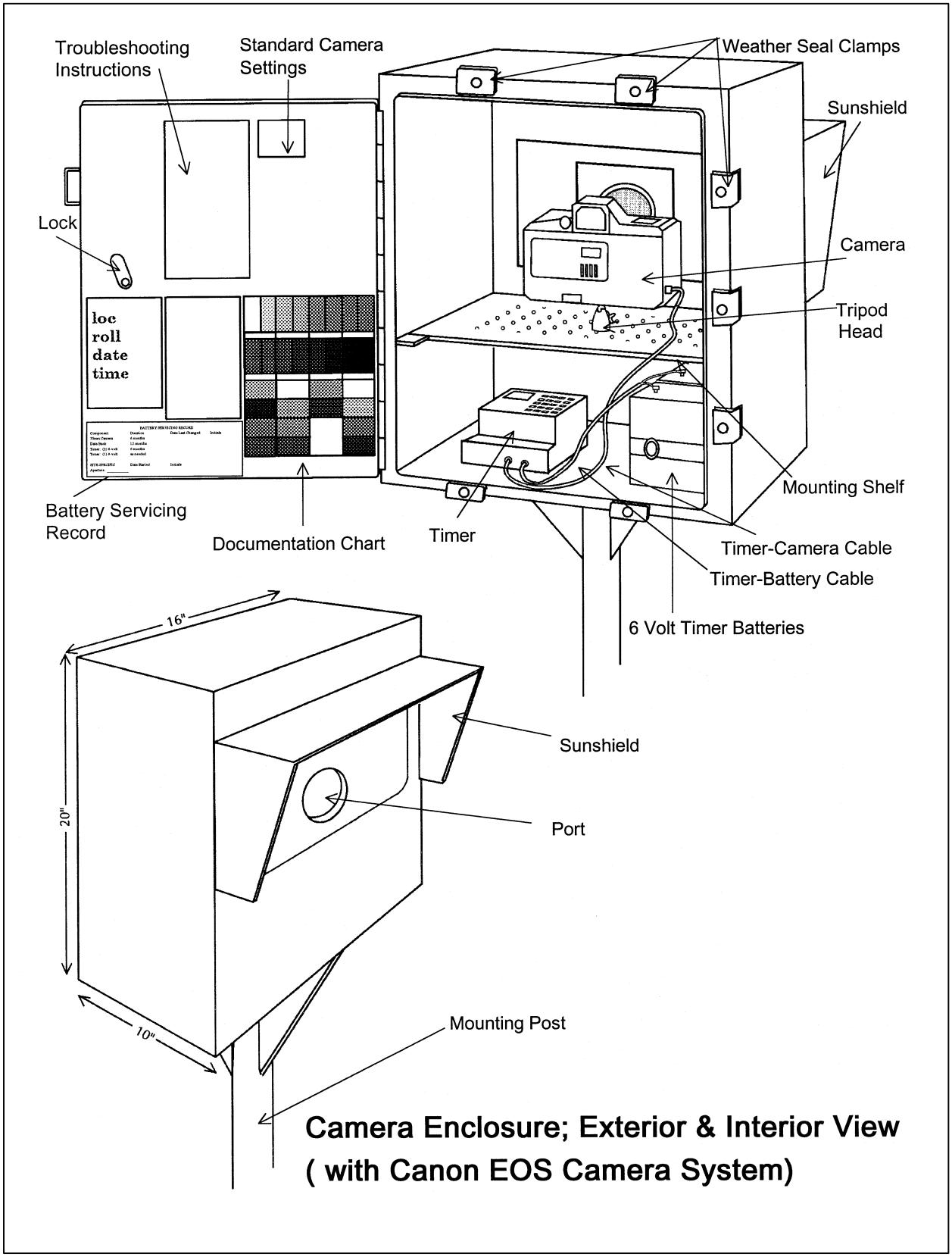

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

Current % Cloud Cover _____ Temperature _____ (Now) _____ (Max) _____ (Min)

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED _____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Contax 137MA Automatic Camera System.

Location DENA Roll No. 9
Operator Andrea Blakesley

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 5/27/94 Time 11:30

Yes	No	
☑	☐	Batteries tested
☑	☐	Monitoring target visible
☑	☐	Camera alignment correct
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Documentation photograph taken
☑	☐	Lens focus on infinity
☑	☐	Film advancing properly
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) ON(PZ-20)
☑	☐	Aperture F8.0
☑	☐	IS0/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

FILM REMOVED

Today's Date 6/4/94 Time 15:20

Yes	No	
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 29
☑	☐	Timer found in proper condition
☑	☐	Camera/timer cable secure
☑	☐	Camera found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) ON(PZ-20)
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

DESCRIBE WEATHER CONDITIONS for the duration of this roll Mostly sunny and mild, cool and rainy for two days

% Cloud Cover 75% Temperature 63 (Now) 65 (Max) 38 (Min)

COMMENTS/ACTION TAKEN Manual shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6v. timer batteries

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525
303-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emission source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Press and move the **QUICK RELEASE** lever to the "R" (release) position and lift the camera off the mount. Disconnect the camera/timer cable from the timer at the timer jack and remove the camera from the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken during the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS.
VERIFY SETTINGS	Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

Open the rewind button cover (located next to the main switch) and press the **REWIND** button. The button should stay down; there is no need to keep pressing it.

NOTE: The film will tear if this button is not pushed in before attempting to rewind the film.

Lift the **FILM REWIND CRANK-HANDLE** up and turn it in the direction of the arrow. While rewinding, you will feel a slight resistance. If the rewind crank is difficult to turn, check the "rewind release" button as described above.

When the crank turns freely with no resistance, the film has been completely rewound into the cartridge. Do not open the camera back until you are sure that the film has been completely rewound.

Open the camera back by pulling up on the rewind knob.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation
- Roll number
- Date and time loaded

- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, lift the **REWIND CRANK HANDLE** and pull it up firmly.

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber.
- Pull the film leader across the shutter curtain and insert it into the film take-up spool.
- With the camera back open, press the **SHUTTER RELEASE** button to wind the film. Make sure the film has no slack and that its perforations are properly engaged with the sprocket teeth.
- Press the **SHUTTER RELEASE** button again until you are confident that the film is firmly connected to the take-up spool.
- Firmly close the camera back cover. Take additional exposures until "1" appears in the exposure counter.

NOTE: The exposure counter may advance even though the film is not loaded correctly. You can assume that the film is loaded correctly ONLY if the rewind shaft rotates when the shutter release is pressed.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

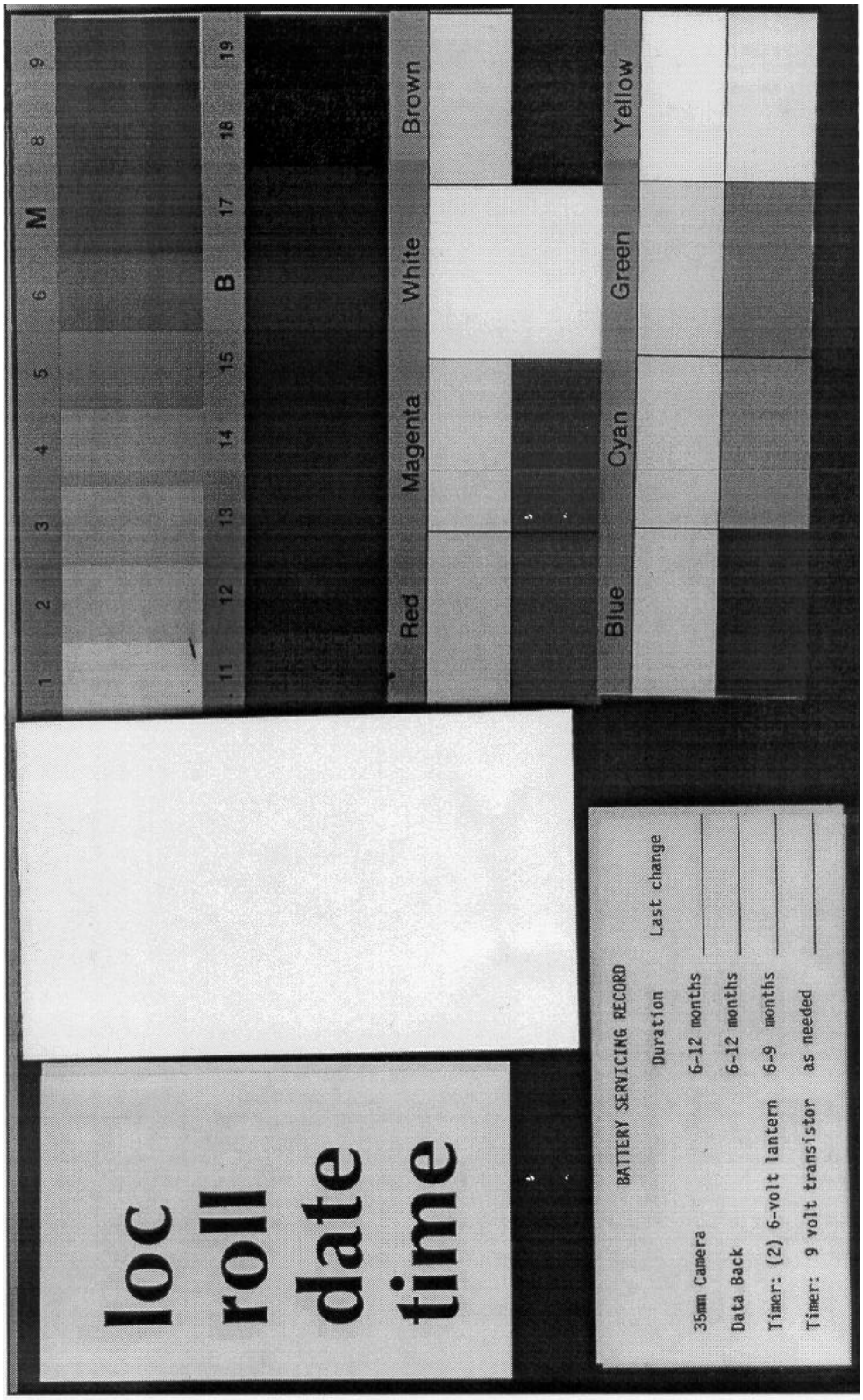

Figure 4-6. Photographic Documentation Board.

- Write the following on the note pad provided:
  - Monitoring site name or abbreviation
  - Roll number
  - Date and time
- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.
- Press the **SHUTTER BUTTON**. Verify that the film counter has incremented one frame.
- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Check the camera batteries by turning on the "main switch" and pressing the **MODE** and **ISO** buttons simultaneously.

- Bright Green Light - battery power sufficient
- Flashing or Dim Green Light - low (have new batteries on hand)
- No Light - drained or installed incorrectly (replace with new batteries or reinstall)

If required, change the camera's four AA alkaline batteries and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Contax 137 MA are:

Main Switch	ON
Exposure Mode Selector	S
Shutter Control Dial	A
Exposure Compensation	XI
Film Speed	ASA 100

Aperture Ring	F8
Focus	Infinity

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

The databack should be in the "day-time" mode displaying the current day of the month and current time with the colon flashing.

If the display is flashing or blank, the databack batteries are drained. Replace the batteries only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current date and time.

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

<u>Review timer display:</u>

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

<u>Review the programmed timer events:</u>

- Press **PRG** then **C1** to select Channel 1 for review.
- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod head.
- Press and move the **QUICK RELEASE** lever to the "L" (lock) position.
- Securely reconnect the camera/timer cable to the timer at the timer jack.
- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Observe the camera main lamp. The lamp should not illuminate for more than 15 seconds. If the lamp continues to illuminate beyond 15 seconds, an electrical short may exist in a portion of the cable jack.

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED

Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.

CLOSE AND SECURE ENCLOSURE

Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA.*

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (annually)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Contax 137 MA are provided in TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA.*

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE

The Contax 137 MA camera runs on four AA alkaline batteries. The batteries should be replaced every six months or as directed by the data coordinator.

- Lift up the fastening knob of the battery compartment cover located on the bottom of the camera. Turn it in the **OPEN** direction and remove the battery compartment cover.
- Remove the new batteries from their packaging and test and record the voltage. Each new battery should measure at least 1.5 volts.
- Insert four batteries with polarity as indicated by the (+) and (-) markings on the battery compartment. The camera will not operate if the (+) and (-) ends are reversed.
- After installing the batteries in the battery case, insert it into the battery compartment in the direction shown by the diagram in the battery compartment.
- Fit the mounting hole on the battery compartment cover onto the guide pin on the camera body, return the cover to its original position, and lock it in place by turning the fastening knob as far as it will go in the direction of the white dot.
- After changing batteries, check them as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Contax 137 MA Data Back D-5 runs on two 1.5 V coin-shaped silver oxide batteries. The databack batteries should be replaced every six months, or as required by the data coordinator. Be sure to replace the batteries only when film is not loaded.

- Insert a coin edge or other suitable object into the screwhead located in the center of the battery compartment cover on the outside of the databack.
- Turn the screw counterclockwise and open the cover. Remove the used batteries. Measure and record the voltage of the used batteries.
- Remove the new batteries from their packaging and test and record the voltage. The new batteries should measure approximately 1.5 volts.
- Install two 1.5 V silver oxide batteries with their plus (+) marks facing upward. Replace the cover.

- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

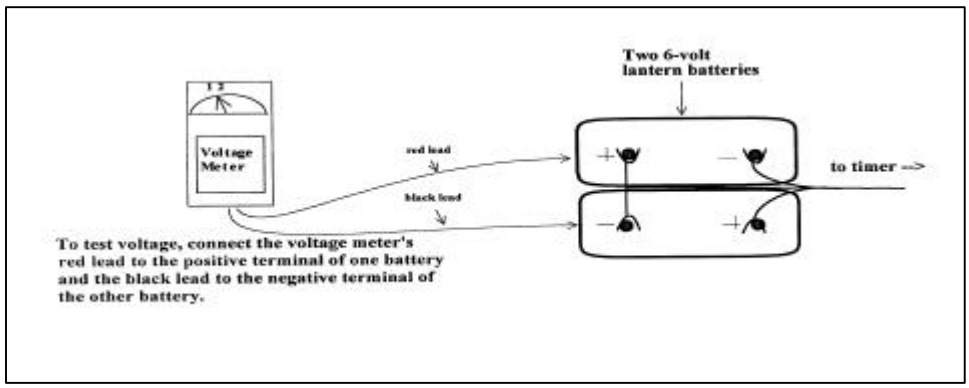

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

CONTAX 137 MA

The Contax 137 MA is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The automatic operation and aperture priority exposure mode provide properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Contax 137 MA (Figure 4-8) are:

Main Switch	ON
Exposure Mode Selector	S
Shutter Control Dial	A
Exposure Compensation	XI
Film Speed	ASA 100
Aperture Ring	F8

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Contax 137 MA manufacturers' instruction booklet for detailed camera setting procedures.

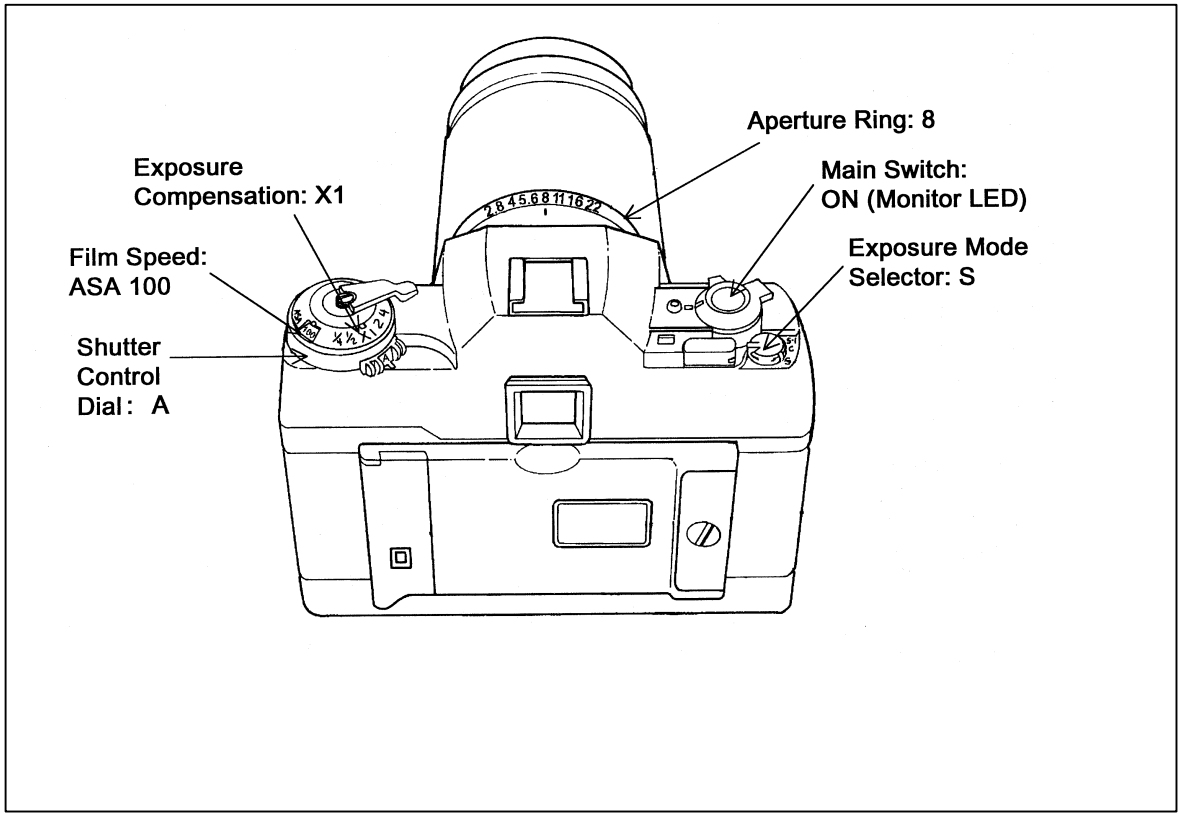

Figure 4-8. Contax 137 MA Standard Settings.

CONTAX DATABACK D-5

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Contax Data Back D-5 automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation the databack should display the local date and time with the colon flashing, as in Figure 4-9.

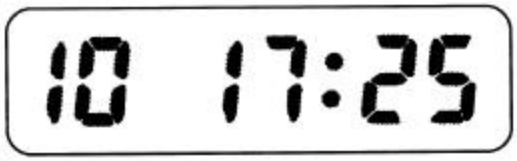

Figure 4-9. Contax Data Back D-5 Display.

If the display is flashing or is blank, the databack batteries are drained.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

To set the databack:

- Open the control button cover on the left side of the databack. A fingernail catch is located at the top of the cover.
- Press the **MODE** button until the "Y.M.D." (year-month-day) is displayed. In this mode the apostrophe (') in the upper left corner flashes.
- Press the **SELECT** button once and the "YEAR" display will flash. Press the **SET** button until the correct year is displayed.
- Press the **SELECT** button again and the "MONTH" display will flash. Press the **SET** button until the correct month is displayed.
- Press the **SELECT** button again and the "DAY" display will flash. Press the **SET** button until the correct day is displayed.
- Press the **MODE** button until the "D.T.M." (day-time) mode is displayed. The colon (:) between the hour and minute display will flash.
- Press the **SELECT** button and the "HOUR" display will flash. Press the **SET** button until the correct hour is displayed.

- Press the **SELECT** button again and the "MINUTE" display will flash. Press the **SET** button until the correct minute is displayed.

- Push the **SELECT** button one more time to return to the "D.T.M. OPERATING" mode. The databack should remain in this mode during regular operation.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule.

- 2 photographs/day = 15-17 day servicing schedule.

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

<u>To set the timer clock</u>:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the TIMER flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

<u>To program times for photographs to be taken</u>:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or

- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.

- The horizon is level.

- The vista is framed correctly.

- The sunshield and port are not visible in the viewfinder.

- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-10) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3320.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____

Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-10. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - OLYMPUS OM2N**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3130**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Olympus OM2N 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Olympus OM2N: - two 1.5 V silver oxide batteries
  - Olympus Recordata Back 3 or 4: - two 1.5 V silver oxide batteries
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*
  - TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N.*

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Olympus OM2N 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Olympus OM2N System, provided in the site operator's manual. Detailed schematic diagrams of the Olympus OM2N 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Olympus OM2N
- Olympus Recordata Back 3 or 4
- Olympus Winder 2
- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3330.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries every 6 months.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

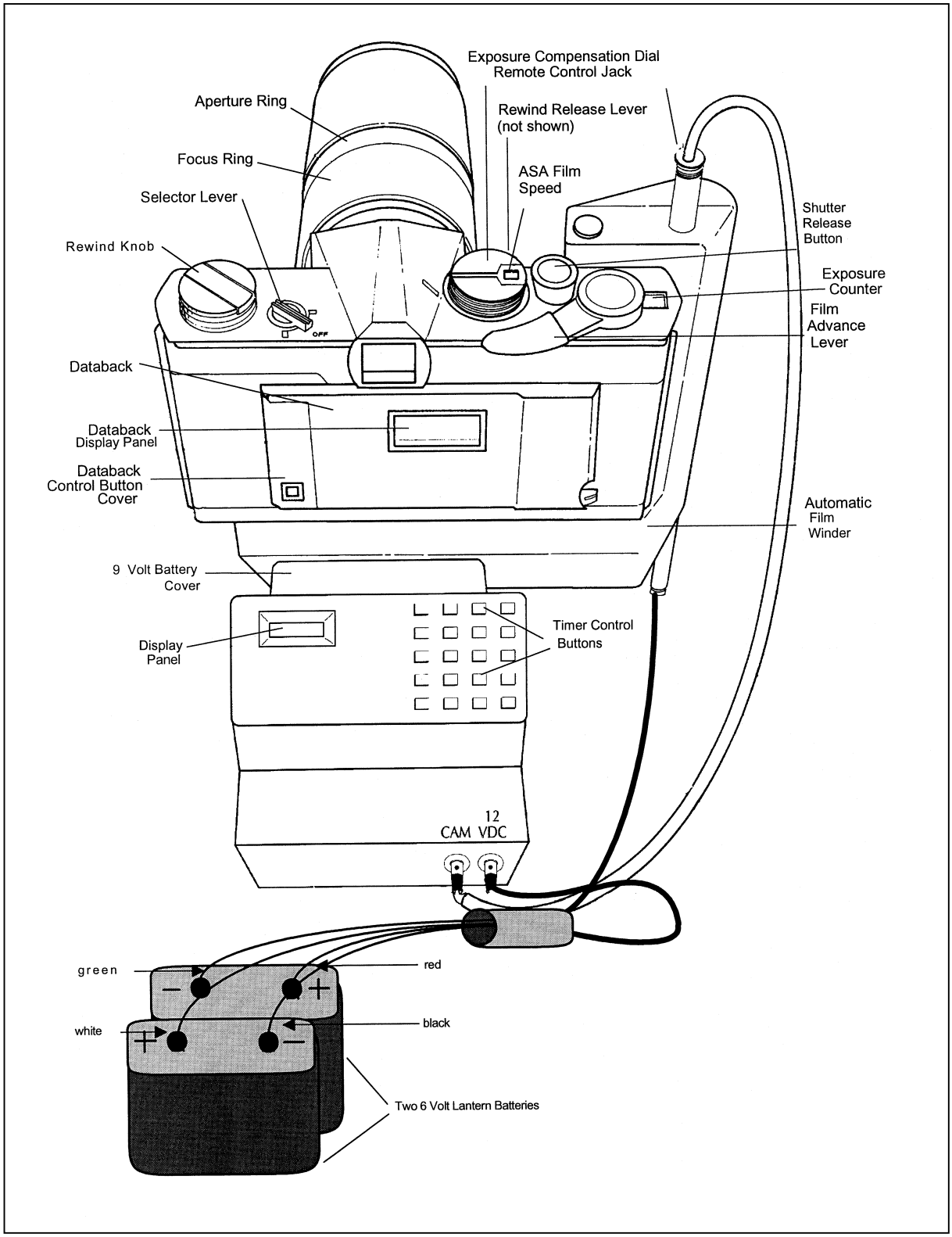

Figure 4-1. Olympus OM2N System Components.

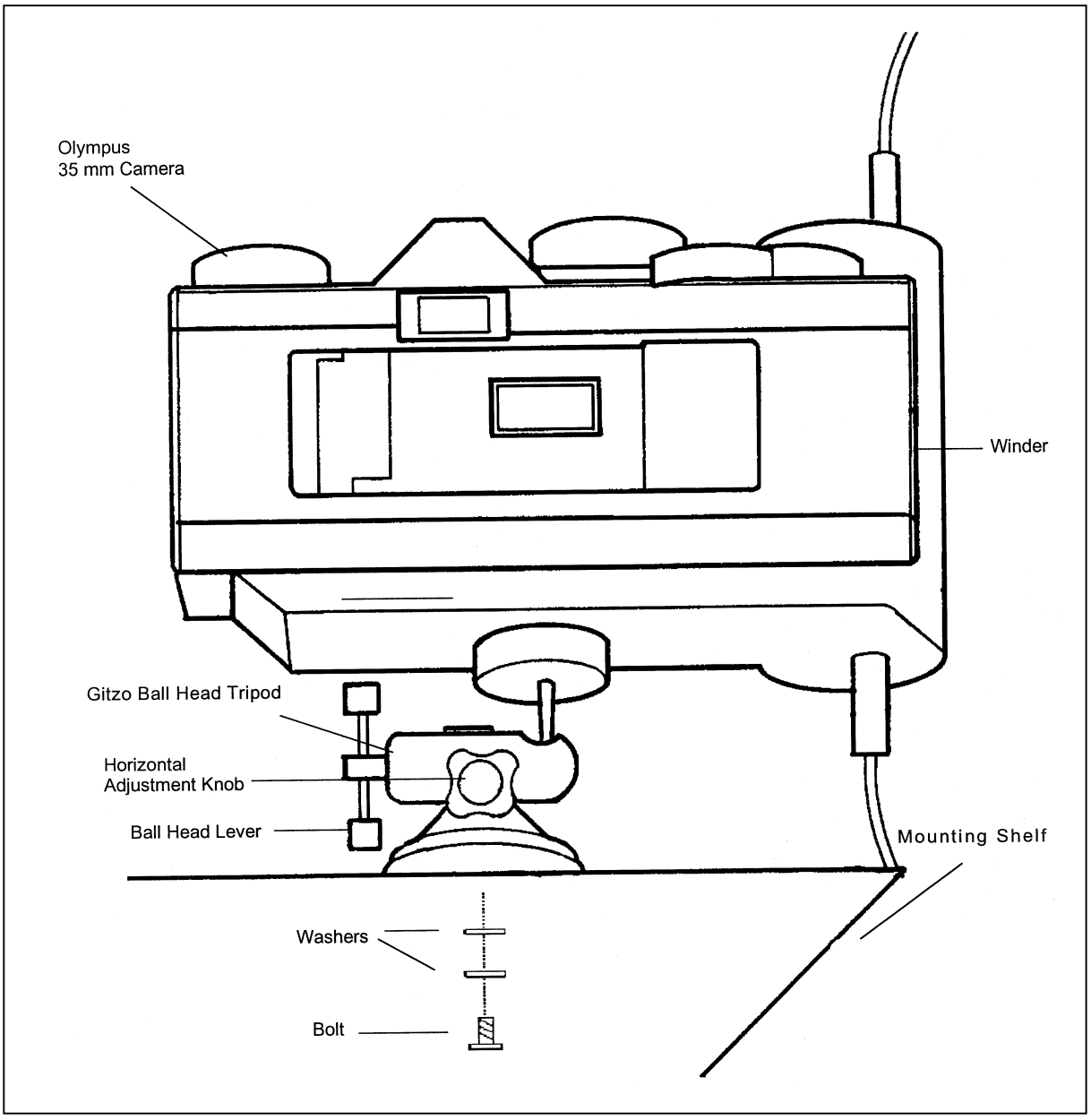

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

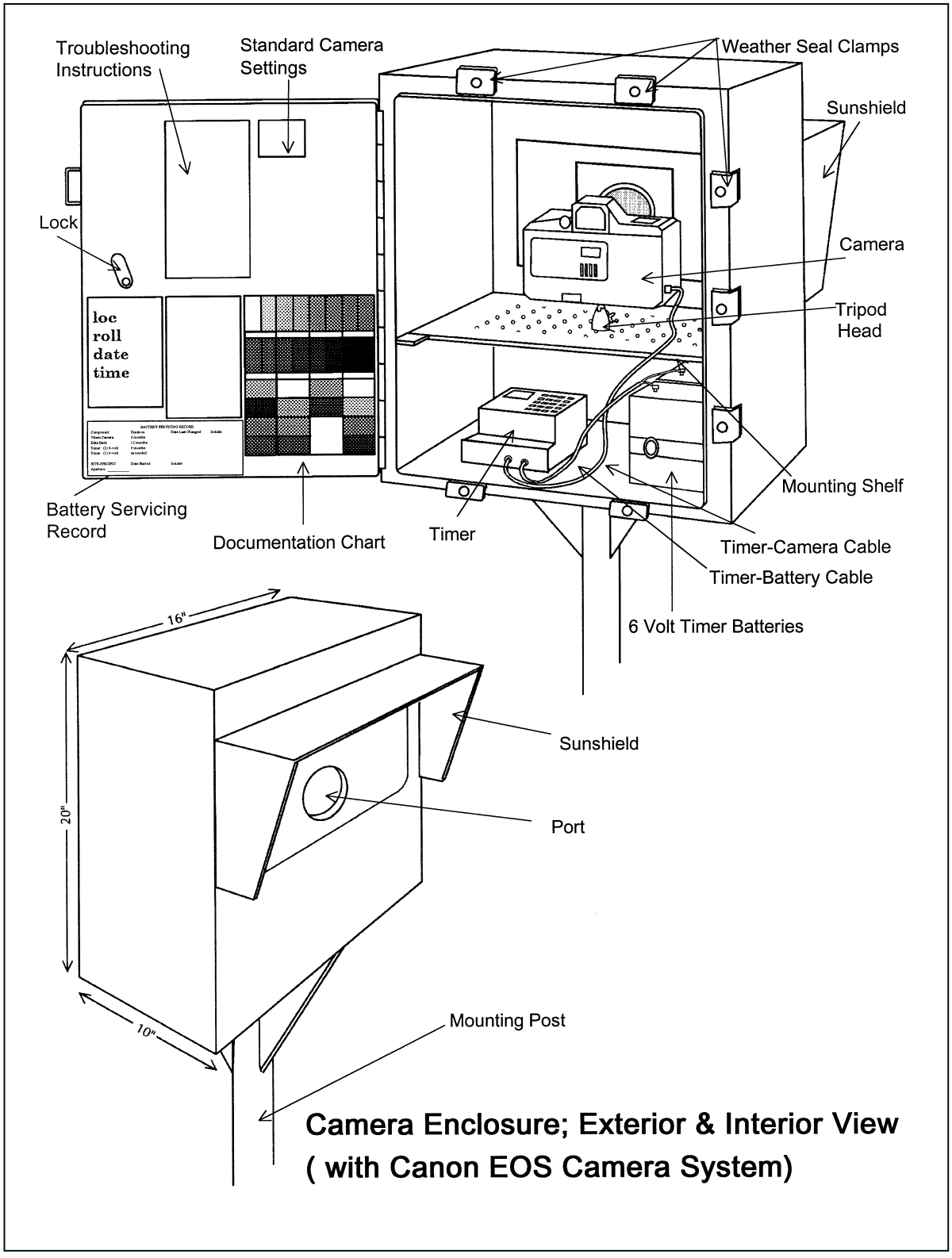

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

Current % Cloud Cover _____ Temperature _____ (Now) _____ (Max) _____ (Min)

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED _____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Olympus OM2N Automatic Camera System.

Location DENA Roll No. 9
Operator Andrea Blakesley

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 5/27/94 Time 11:30

Yes	No	
☑	☐	Batteries tested
☑	☐	Monitoring target visible
☑	☐	Camera alignment correct
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Documentation photograph taken
☑	☐	Lens focus on infinity
☑	☐	Film advancing properly
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

FILM REMOVED

Today's Date 6/4/94 Time 15:20

Yes	No	
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 29
☑	☐	Timer found in proper condition
☑	☐	Camera/timer cable secure
☑	☐	Camera found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

DESCRIBE WEATHER CONDITIONS for the duration of this roll Mostly sunny and mild, cool and rainy for two days

% Cloud Cover 75% Temperature 63 (Now) 65 (Max) 38 (Min)

COMMENTS/ACTION TAKEN Manual shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6 v. timer batteries

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525 303-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emission source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Loosen the camera winder fastening screw. Disconnect the camera body from the automatic winder. The tripod, winder, and winder cabling will remain intact inside the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken during the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS.
VERIFY SETTINGS	Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

Located on the front of the camera body to the right of the lens piece is the rewind release lever. Turn the lever counterclockwise to the "R" position. The film will tear if the rewind lever is not set before attempting to rewind the film.

Fold out the **REWIND CRANK** and wind it in the direction of the arrow. While rewinding, you will feel slight resistance on the crank. IF THE REWIND CRANK IS DIFFICULT TO TURN, check the rewind release lever as described above.

When the crank turns freely without resistance, the film has been completely rewound into the cartridge. Do not open the camera back until you are sure that the film has been completely rewound. You cannot damage the film by turning the rewind lever longer than necessary, but the film will be exposed to light and damaged if it is not completely rewound.

Open the camera back by pulling up on the rewind knob.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation
- Roll number

- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, pull the **REWIND KNOB** up.

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber, upper flat end first.
- Pull the film leader across the shutter curtain and insert it into the film take-up spool.
- With the camera back open, press the **SHUTTER RELEASE** button and turn the advance lever to make sure the film has no slack and that its perforations are properly engaged with the sprocket teeth.
- Press the **SHUTTER RELEASE** button again and turn the advance lever until you are confident that the film is firmly connected to the take-up spool.
- Firmly close the camera back cover.

NOTE: The exposure counter will increment even if the film is loaded correctly. You can assume that the film is loaded correctly ONLY if the rewind shaft rotates when the shutter release is pressed.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

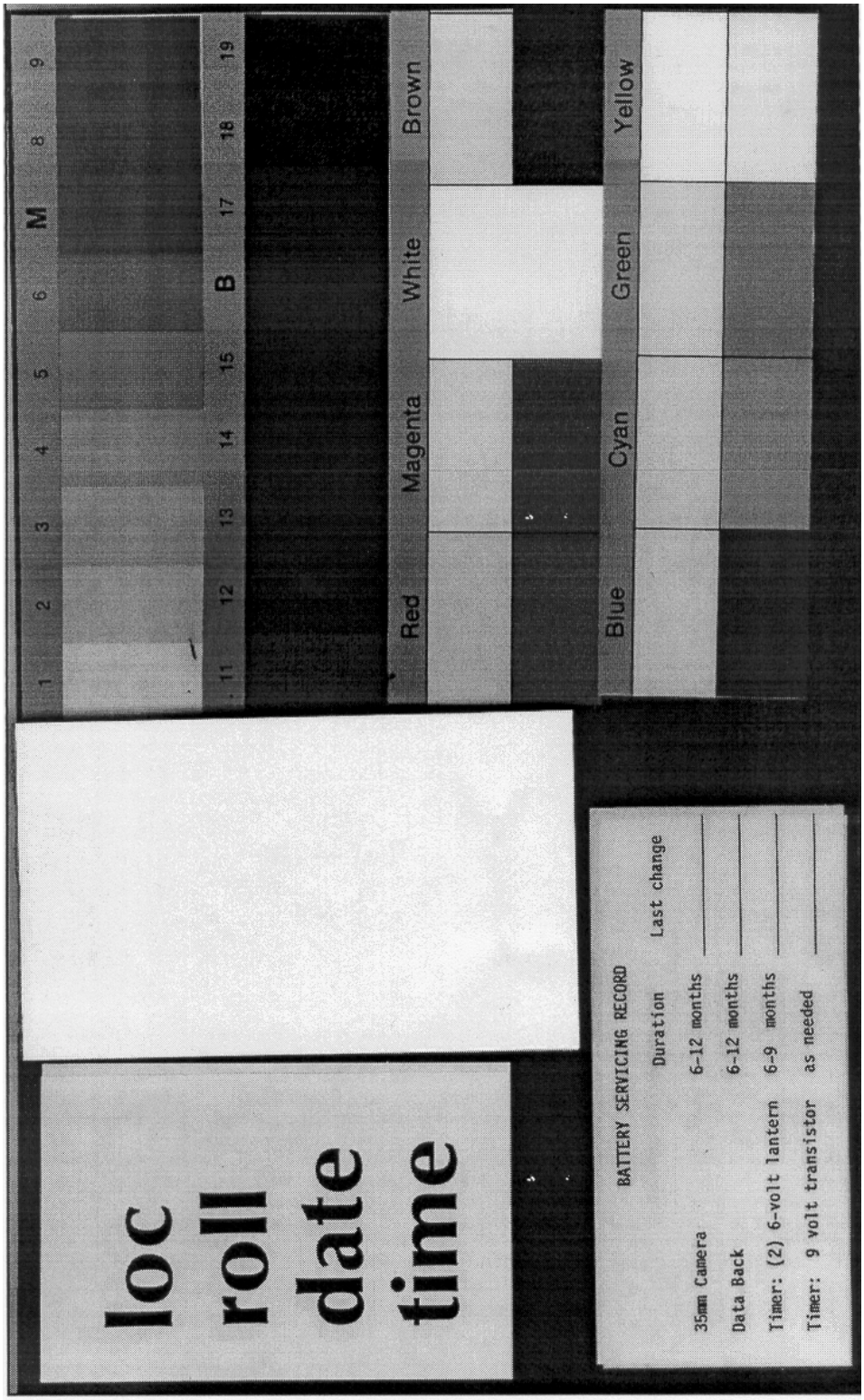

Figure 4-6. Photographic Documentation Board.

- Write the following on the note pad provided:
  - Monitoring site name or abbreviation
  - Roll number
  - Date and time
- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.
- Press the **SHUTTER BUTTON**. Manually turn the advance lever. Verify that the film counter has incremented one frame.
- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Move the selector lever to the battery check position. Note the condition of the red lamp:

- Continuous Red Light - battery power sufficient
- Flashing Light - low (have new batteries on hand)
- No Light - drained or installed incorrectly (replace with new batteries or reinstall)

If required, change the camera's two 1.5 V silver oxide batteries and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Olympus OM2N are:

OM2N Selector Lever	OFF
Winder	Single
Exposure Compensation	Zero
Film Speed	ASA 64
Aperture Ring	F8
Focus	Infinity

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

When using the Recordata Back 3, the databack should be in the "day-time" mode displaying the current day of the month and current time. If the Recordata Back 4 is used, the databack should be in the "year-month-day" mode displaying the current date.

Independent of the model used, if the display is flashing or blank, the databack batteries are drained. Replace the batteries only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current date and time (Recordata Back 3) or current date (Recordata Back 4).

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

Review timer display:

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review.
- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod head.
- Securely reconnect the camera/timer cable to the timer at the timer jack.
- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED	Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.
CLOSE AND SECURE ENCLOSURE	Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*.

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (every six months)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Olympus OM2N are provided in TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N.*

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE	The Olympus OM2N camera runs on two 1.5 V silver oxide batteries. The batteries should be replaced every six months or as directed by the data coordinator.

- The battery compartment is on the bottom of the camera. Unscrew the cap with a coin.
- Remove the new batteries from their packaging and test and record the voltage. Each new battery should measure at least 1.5 volts.
- Insert the two new 1.5 V silver oxide batteries with the (+) facing you.
- Always replace batteries as a pair.
- Replace the compartment cap and tighten.
- After changing batteries, check them as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Olympus OM2N Recordata Back 3 or 4 run on two 1.5 V silver oxide batteries. The databack batteries should be replaced every six months, or as required by the data coordinator. Be sure to replace the batteries only when film is not loaded.

- Open the camera back by pulling up on the rewind knob crank.
- Insert a coin edge or other suitable object into the screwhead located in the center of the battery compartment cover on the inside of the databack.
- Turn the screw counterclockwise and open the cover. Remove the used batteries. Measure and record the voltage of the used batteries.
- Remove the new batteries from their packaging and test and record the voltage. The new batteries should measure approximately 1.5 volts.
- Insert two 1.5 V silver oxide batteries with their plus (+) marks facing upward, otherwise the databack will not function.
- Replace the cover.
- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

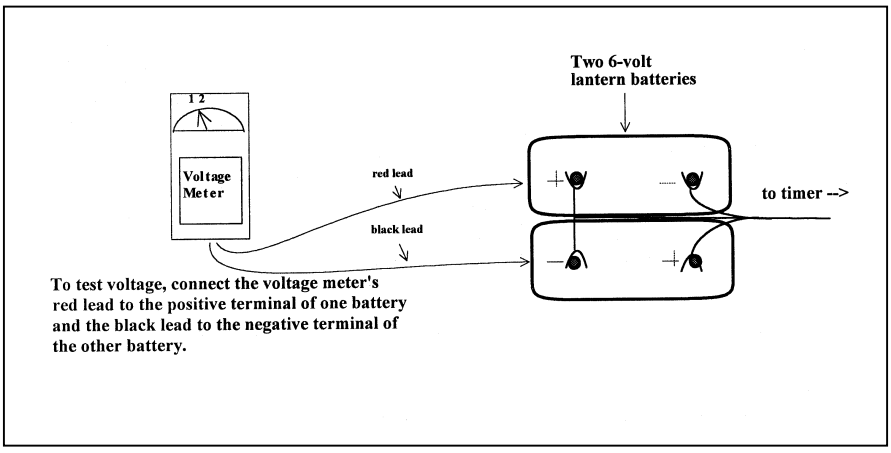

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

OLYMPUS OM2N

The Olympus OM2N is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The automatic operation and aperture priority exposure mode provide properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Olympus OM2N are:

OM2N Selector Lever	OFF
Winder	Single
Exposure Compensation	Zero
Film Speed	ASA 64
Aperture Ring	F8
Focus	Infinity

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Olympus OM2N manufacturers' instruction booklet for detailed camera setting procedures.

OLYMPUS RECORDATA BACK 3 OR 4

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Olympus Recordata Back 3 or 4 automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation, the Recordata Back 3 should display the local date and time. When using a Recordata Back 4, the databack should display the year, month, and day. Verify that no digits are flashing (see Figure 4-8).

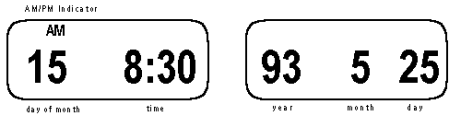

Figure 4-8. Olympus Recordata Back Displays.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

<u>To set the Recordata Back 3:</u>

- Open the control button cover on the left side of the databack. A fingernail catch is located at the bottom of the cover.
- Press the **TIME SET MODE** button (the second button from the top) until the flashing SET indicator in the top left corner is displayed.
- Press the **SELECT** button until the correct year-month-day format is displayed. The "DAY" will be flashing. Press the **SET** button until the correct day is displayed. Constant pressure on the set button will rapidly advance the numbers.
- Press the **SELECT** button again and the "MONTH" display will flash. Press the **SET** button until the correct month is displayed.
- Press the **SELECT** button again and the "YEAR" display will flash. Press the **SET** button until the correct year is displayed.
- Press the **SELECT** button again and the "TIME" format will be displayed. Again press the **SELECT** button and the "MINUTE" display will flash. Press the **SET** button until the correct minute is displayed.

- Press the **SELECT** button and the "HOUR" display will flash. Press the **SET** button until the correct hour is displayed.

  NOTE: The databack has an "AM" and "PM" setting. Be certain the correct indicator is displayed.

  Return to the correct operating mode by pressing the **TIME SET** mode button until ONLY the day, time, and AM or PM are displayed and the colon (:) between the hour and minutes is flashing.

To set the Recordata Back 4:

- Open the control button cover on the left side of the databack. A fingernail catch is located at the bottom of the cover.

- Press the **SELECT** button until the correct year-month-day format is displayed. The "DAY" will be flashing. Press the **SET** button until the correct day is displayed. Constant pressure on the set button will rapidly advance the numbers.

- Press the **SELECT** button again and the "MONTH" display will flash. Press the **SET** button until the correct month is displayed.

- Press the **SELECT** button again and the "YEAR" display will flash. Press the **SET** button until the correct year is displayed.

- Press the **SELECT** button twice and the time will be displayed with the seconds flashing. Press the **SELECT** button again and the minutes will flash. Press the **SET** button until the correct minute is displayed.

- Press the **SELECT** button and the "HOUR" display will flash. Press the **SET** button until the correct hour is displayed.

  NOTE: The databack has an "AM" and "PM" setting. Be certain the correct indicator is displayed.

  Return to the correct operating mode by pressing the top button until the year-month-day format is displayed.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule.

- 2 photographs/day = 15-17 day servicing schedule.

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

To set the timer clock:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the TIMER flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

To program times for photographs to be taken:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or
- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.
- The horizon is level.
- The vista is framed correctly.
- The sunshield and port are not visible in the viewfinder.
- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N.*

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-9) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3330.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____

Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-9. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - PENTAX PZ-20**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3140**
DATE	**JULY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Karen K. Rosener	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Pentax PZ-20 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Pentax PZ-20: - one 6 V lithium battery
  - Pentax Data Back FE: - one 3 V lithium battery
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*
  - TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20.*

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Pentax PZ-20 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Pentax PZ-20 System, provided in the site operator's manual. Detailed schematic diagrams of the Pentax PZ-20 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Pentax PZ-20
- Pentax Data Back FE
- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3340.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

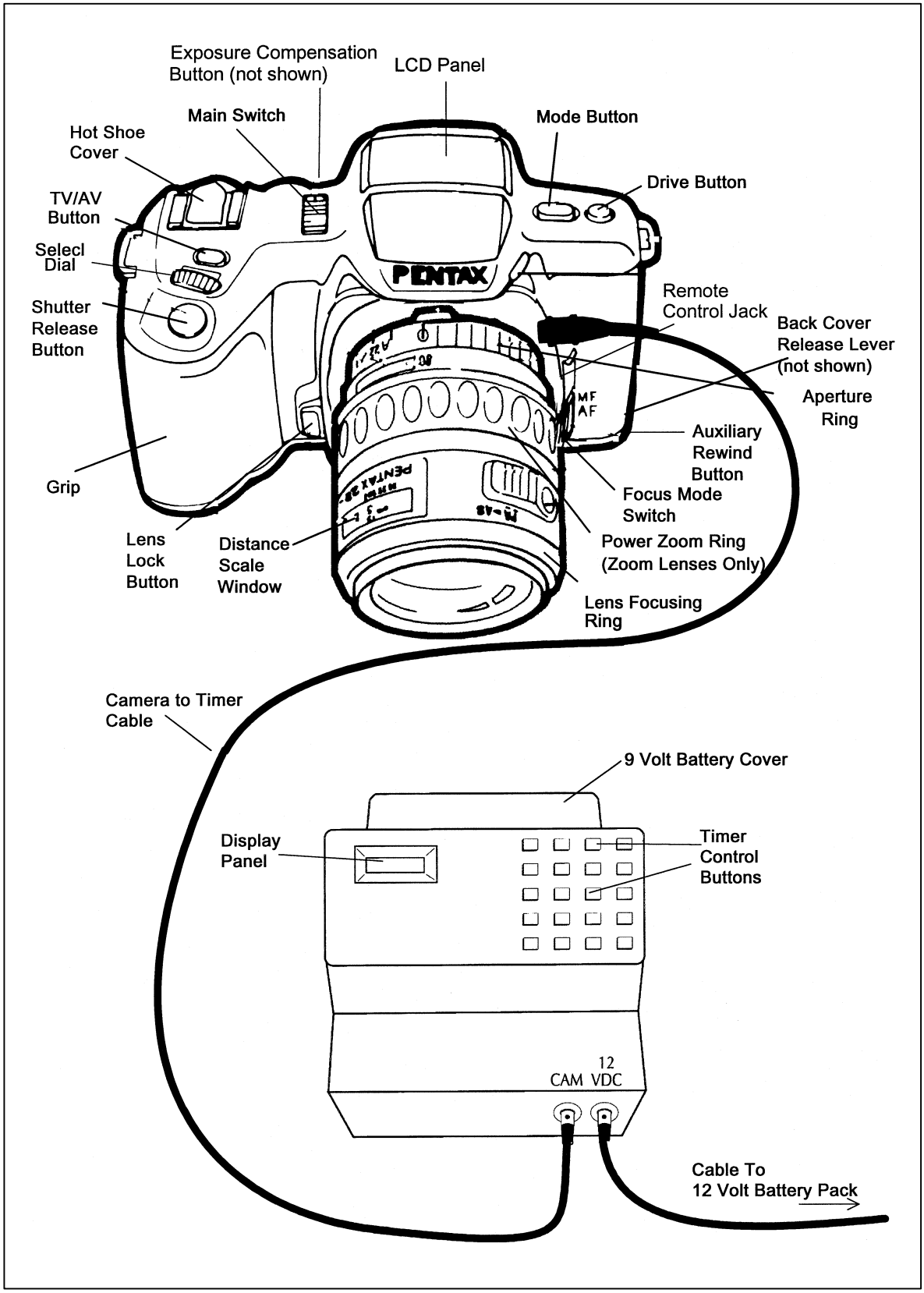

Figure 4-1. Pentax PZ-20 System Components.

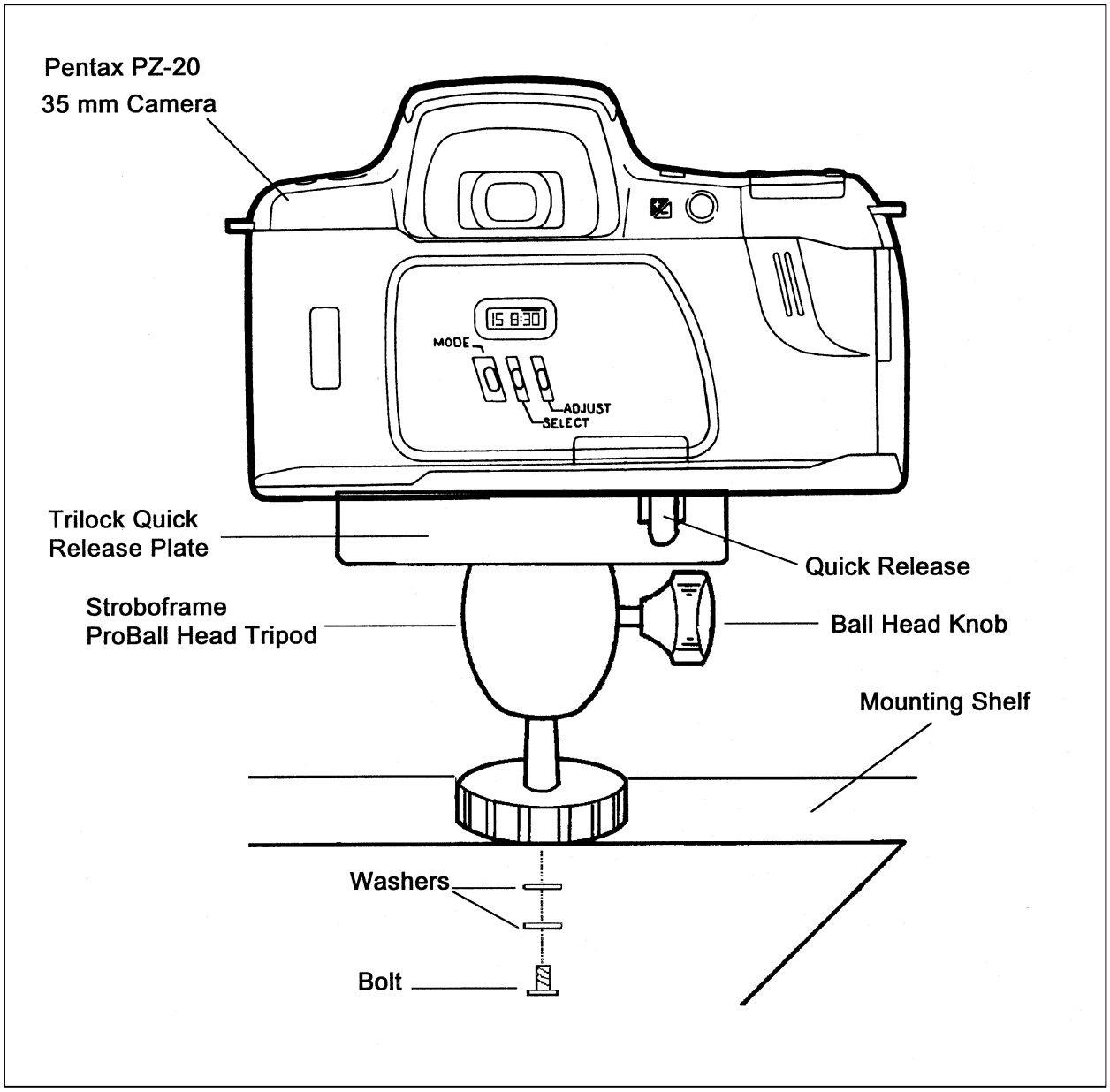

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

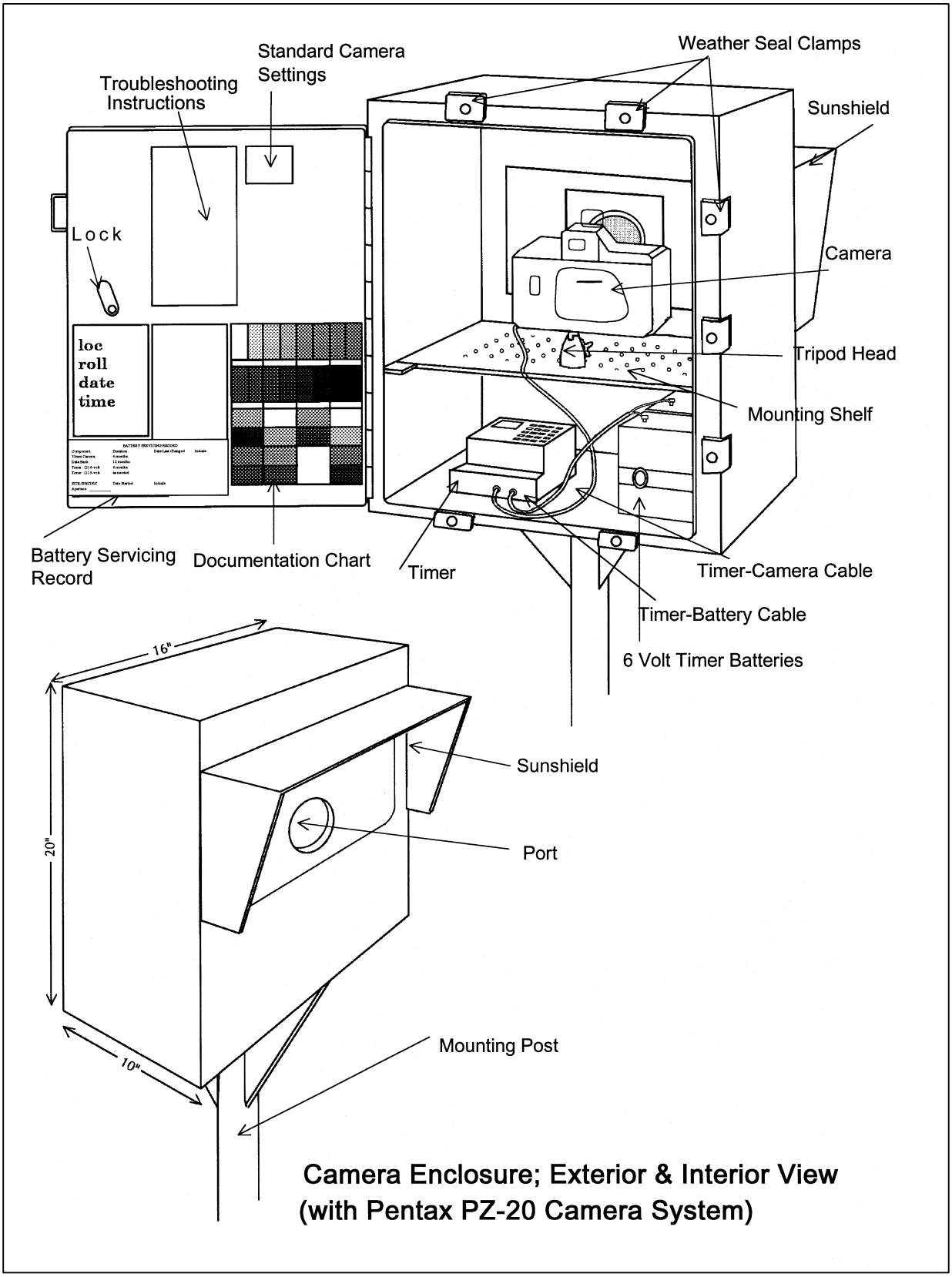

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

Current % Cloud Cover _____ Temperature _____ (Now) _____ (Max) _____ (Min)

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED _____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Pentax PZ-20 Automatic Camera System.

Location DENA Roll No. 9
Operator Andrea Blakesley

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 5/27/94 Time 11:30

Yes	No	
☑	☐	Batteries tested
☑	☐	Monitoring target visible
☑	☐	Camera alignment correct
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Documentation photograph taken
☑	☐	Lens focus on infinity
☑	☐	Film advancing properly
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

FILM REMOVED

Today's Date 6/4/94 Time 15:20

Yes	No	
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 29
☑	☐	Timer found in proper condition
☑	☐	Camera/timer cable secure
☑	☐	Camera found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled
☑	☐	Camera main switch (circle one) A(E0S) Auto(0M2s) Off(0M2n) On(137MA) ☐(167MT) (ON(PZ-20))
☑	☐	Aperture F8.0
☑	☐	ISO/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)

DESCRIBE WEATHER CONDITIONS for the duration of this roll Mostly sunny and mild, cool and rainy for two days

% Cloud Cover 75% Temperature 63 (Now) 65 (Max) 38 (Min)

COMMENTS/ACTION TAKEN Manual shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6v. timer batterics

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525
303-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emission source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Push the **QUICK RELEASE** lever on the tripod plate and lift the camera off the mount. Disconnect the camera/timer cable from the timer at the timer jack and remove the camera from the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken during the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS. If the film is already rewound, the film-load check mark will be flashing ( ). Assume all 36 exposures were taken and document as such.

VERIFY SETTINGS

Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

Observe the film-load check mark ( ) on the display panel:

- If flashing, the film was automatically rewound after the last frame was exposed.
- If the roll of film has not been completely exposed, pull the **HOT SHOE COVER** off the top of the camera. Depress the **AUXILIARY REWIND** button with the protruding section of the hot shoe cover. (The camera main switch must be in the "ON" position).

During rewind, the film-load check mark ( ) will flash and the exposure counter counts frame numbers in reverse. The film rewind stops automatically when the film has been completely rewound. Do not open the back until the film-load check mark flashes.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the DX film contacts or shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any quipment or monitoring idscrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation
- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, push the **BACK COVER LATCH** down. The Pentax PZ-20 loads the film automatically if the following steps are carefully taken:

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber, upper flat end first.
- Pull the film leader across the shutter curtain until its tip is aligned with the orange index bar marked "FILM."
- Make sure the film has no slack and that its perforations are properly engaged with the sprocket teeth.
- Firmly close the camera back cover. The film will automatically advance and stop when "1" appears in the display panel.

  NOTE: If the film is not loaded correctly, the film transport symbol (0_ F) will flash after the camera motor has stopped and the shutter will not release. Open the back cover and reload the film.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

- Write the following on the note pad provided:
  - Monitoring site name or abbreviation
  - Roll number
  - Date and time
- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.
- Press the **SHUTTER BUTTON**. Manually turn the advance lever. Verify that the film counter has incremented one frame.
- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Observe the display panel. If a battery symbol ( ) appears in the display directly above the film transport symbol ( ) the level of battery power is:

- ( ) - nearly exhausted, replace with new battery
- ( ) flashing - very low, shutter will not release, replace with new battery
- blank display - drained, replace with new battery

If required, change the camera's 6 V lithium battery and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

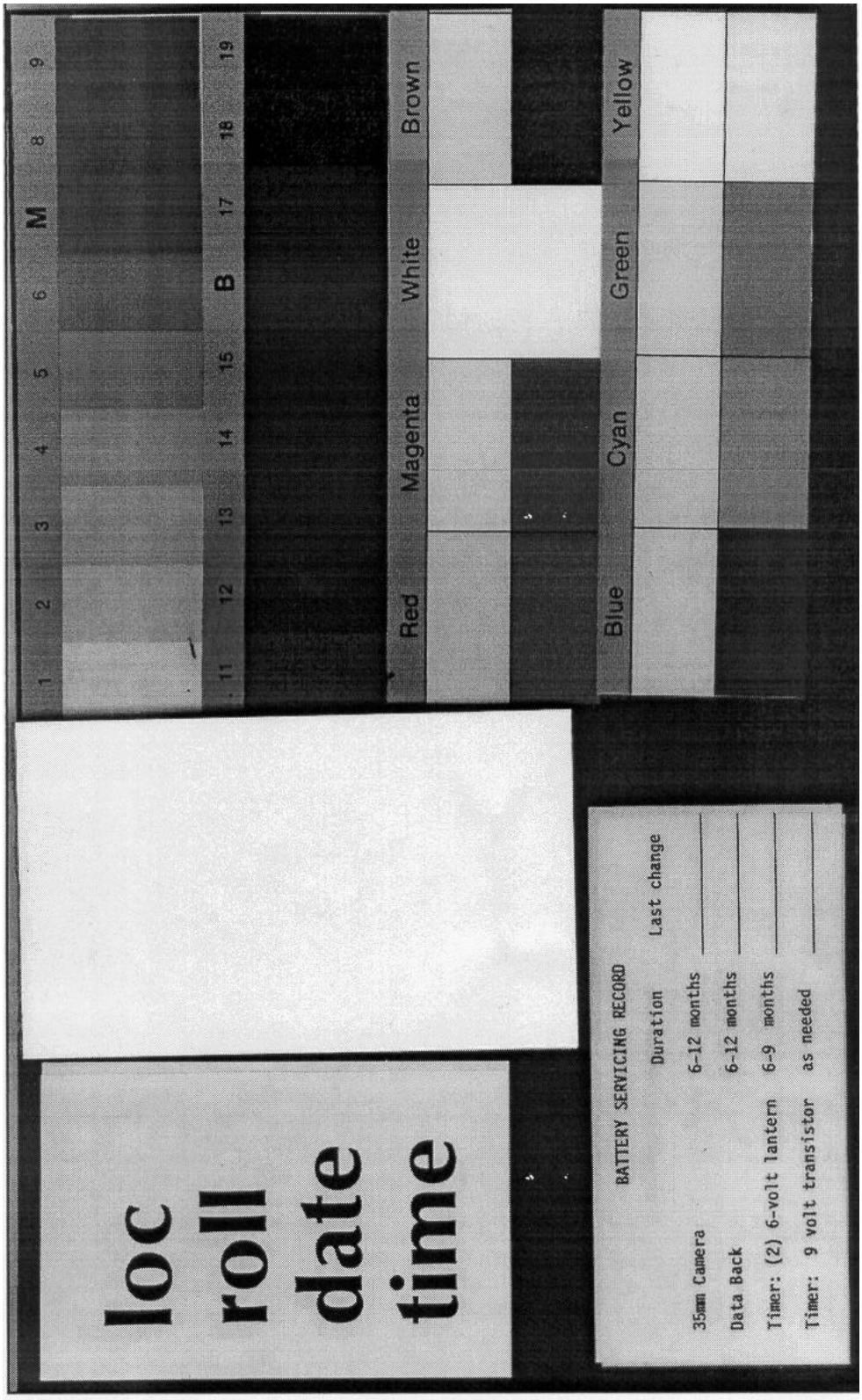

Figure 4-6. Photographic Documentation Board.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Pentax PZ-20 are:

Main Switch	ON
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0.0
Program Mode Selection	A
Drive Mode Selector	☐ (single)
Lens Focus Mode	MF (manual)

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

The databack should be in the "day-time" mode displaying the current day of the month and current time, with the bar mark (-) displayed directly above the minutes.

If the display is blank, the databack battery is drained. Replace the batteries only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current date and time.

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

<u>Review timer display:</u>

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

<u>Review the programmed timer events:</u>

- Press **PRG** then **C1** to select Channel 1 for review.

- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod head.
- Securely reconnect the camera/timer cable to the timer at the timer jack.
- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED	Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.
CLOSE AND SECURE ENCLOSURE	Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20.*

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (annually)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Pentax PZ-20 are provided in TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20.*

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE

The Pentax PZ-20 camera runs on one 6 V lithium battery pack. This battery should be replaced every six months or as directed by the data coordinator.

- Open the battery chamber cover by pulling the cover lock in the direction of the arrow.
- Turn the camera upright and allow the battery to slide out of the compartment. Measure and record the voltage of the used battery.
- Remove the new battery from its packaging and test and record the voltage. The new battery should measure at least 6 volts.
- Insert the new battery end first and lock it in place by closing the battery chamber cover.
- After changing the battery, check it as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Pentax Data Back FE runs on one 3 V coin-shaped lithium battery. The databack battery should be replaced annually, or as required by the data coordinator. Be sure to replace the battery only when film is not loaded.

- The battery compartment is located on the bottom of the camera back cover. To open the compartment, use a fingernail or small screwdriver and press down.
- The battery holder will pop out and can then be removed. Measure and record the voltage of the used battery.
- Remove the new battery from its packaging and test and record the voltage. The new battery should measure approximately 3 volts.
- Wait 15 seconds after removing the used battery and then load the new battery with the "+" side facing up.
- Slide the battery holder into the battery compartment until it locks in place.
- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

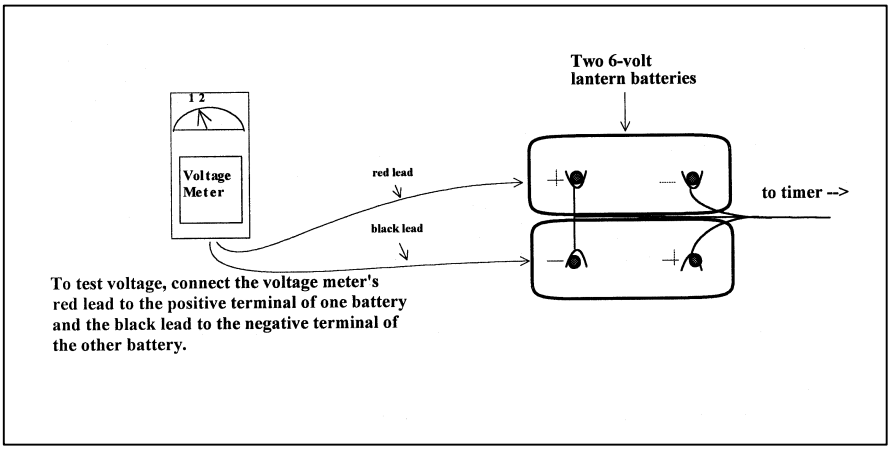

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

PENTAX PZ-20

The Pentax PZ-20 is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The automatic operation and aperture priority exposure mode provide properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Pentax PZ-20 are:

Main Switch	ON
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0.0
Program Mode Selection	A
Drive Mode Selector	☐ (single)
Lens Focus Mode	MF (manual)

REVIEW CAMERA SETTINGS

Press the **CAMERA SHUTTER** halfway to view the camera display panel. If the display does not appear, confirm that the main switch is set to "ON" and that the battery power level is sufficient. Verify all standard settings as they appear in Figure 4-8.

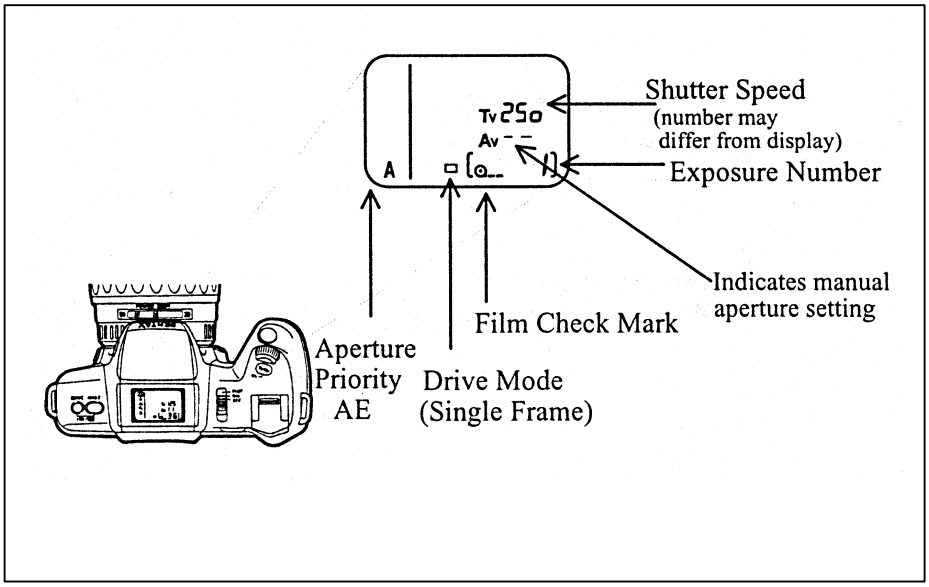

Figure 4-8. Pentax PZ-20 Display Panel.

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Pentax PZ-20 manufacturers' instruction booklet for detailed camera setting procedures.

PENTAX DATA BACK FE

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Pentax Data Back FE automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation, the Pentax Data Back FE should display the local date and time. Verify that the bar mark (-) appears above the minutes to ensure the databack is in the "IMPRINT" mode (Figure 4-9).

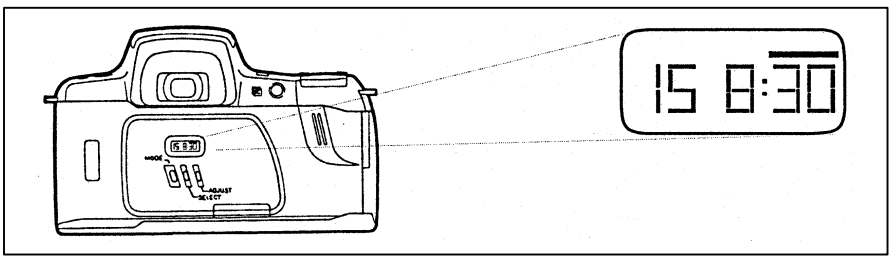

Figure 4-9. Pentax Data Back FE Displays.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

To set the Pentax Data Back FE:

- Press the **MODE** button until the "DAY/HOUR/MINUTE" mode is displayed.
- Press the **SELECT** button once -- the "HOUR display will flash.
- Press the **ADJUST** button until the correct hour is displayed. Constant pressure on the "ADJUST" button will rapidly advance the numbers.
- Press the **SELECT** button -- the "MINUTES" display will flash. Press the **ADJUST** button until the correct minutes are displayed.
- Press the **MODE** button four times until the "YEAR/MONTH/DAY" mode is displayed.
- Press the **SELECT** button -- the "YEAR" display will flash. Press the **ADJUST** button until the correct year is displayed.
- Press the **SELECT** button -- the "MONTH" display will flash. Press the **ADJUST** button until the correct month is displayed.
- Press the **SELECT** button -- the "DAY" display will flash. Press the **ADJUST** button until the correct day is displayed.
- Press the **MODE** button once to return to the "DAY AND TIME" mode. A bar mark (-) should appear in the upper right corner of the display. This indicates the databack is in the "IMPRINTING" mode. The databack should remain in this mode during regular operation.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule.
- 2 photographs/day = 15-17 day servicing schedule.

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

To set the timer clock:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the TIMER flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

To program times for photographs to be taken:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or
- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.
- The horizon is level.
- The vista is framed correctly.
- The sunshield and port are not visible in the viewfinder.
- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20.*

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-10) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3340.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____

Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-10. Photographic Monitoring Network Quality Assessment Log.

Air Resource
Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - PENTAX ZX-10**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3150**
DATE	**JANUARY 1999**

AUTHORIZATIONS		
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Pentax ZX-10 35 mm camera system.

Routine servicing schedules are based on the number of photographs taken each day. Assuming a three-photograph per day schedule, site operators service the camera approximately every 10 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, the site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, the project manager, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera, databack, and timer batteries:
  - Pentax ZX-10: - two 3 V lithium batteries
  - Pentax Data Back: - one 3 V lithium battery
  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*
  - TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Ballpoint pen
- Grease pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10.*

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Pentax ZX-10 35 mm camera and Paragon EC72D automatic timer. Routine servicing procedures are summarized in the Automatic 35 mm Camera System User's Manual for the Pentax ZX-10 System, provided in the site operator's manual. Detailed schematic diagrams of the Pentax ZX-10 35 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Pentax ZX-10

- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3350.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking three photographs a day at 0900, 1200, and 1500. Assuming this schedule, site operators service the camera approximately every 10 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheets:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

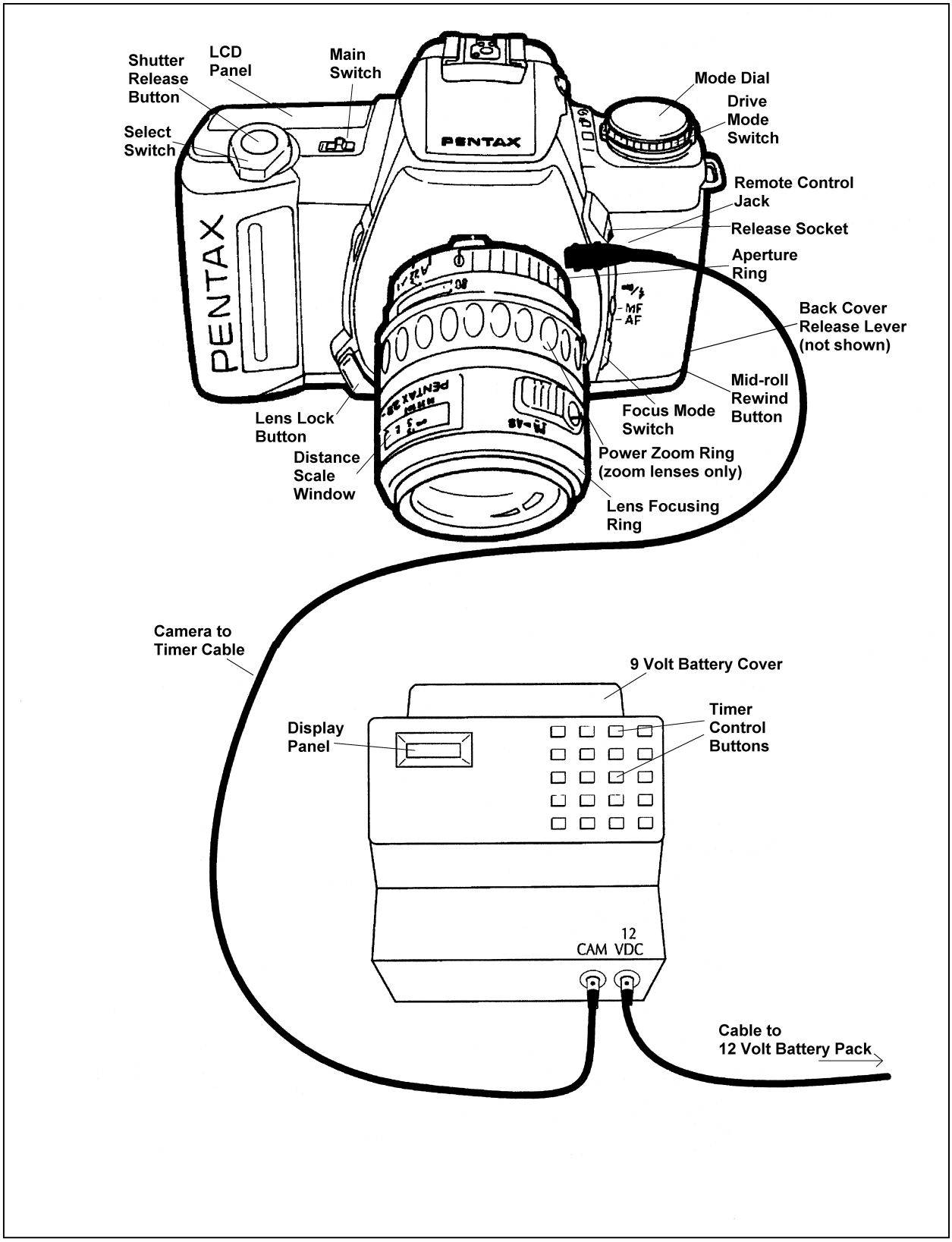

Figure 4-1. Pentax ZX-10 System Components.

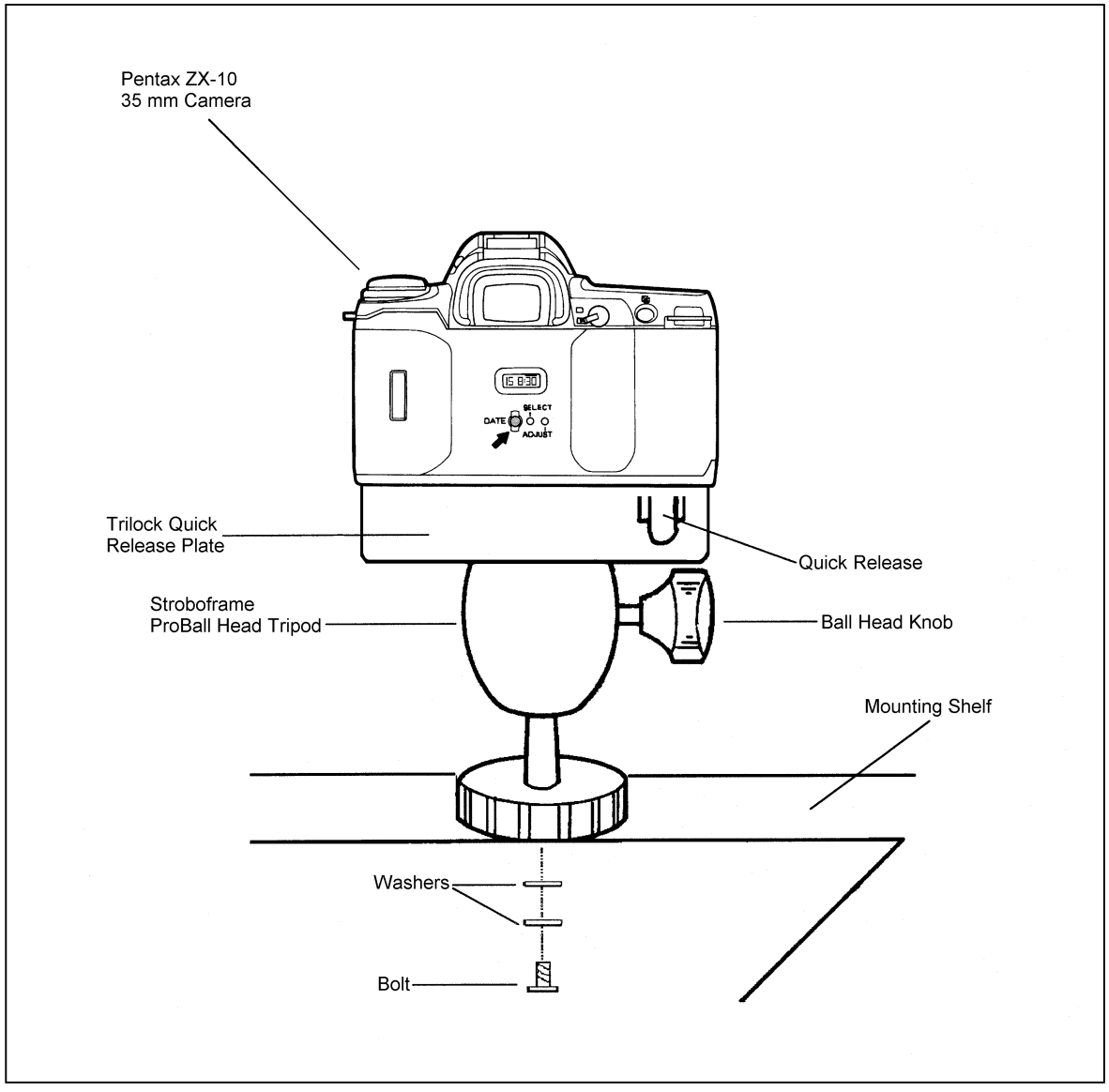

Figure 4-2. Automatic 35 mm Camera System Tripod Assembly.

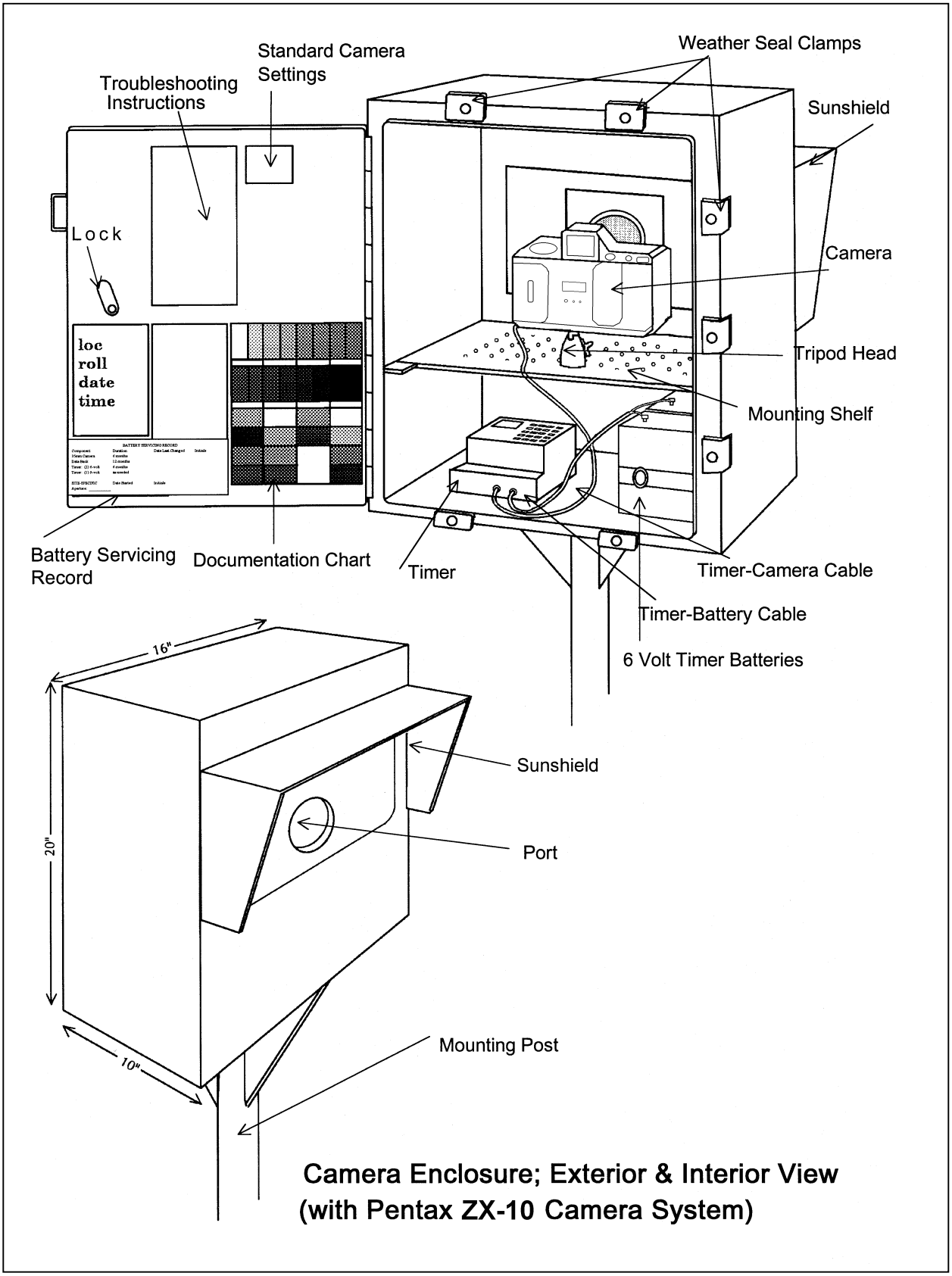

Figure 4-3. Automatic 35 mm Camera System Enclosure.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail the white original to the data coordinator with each roll of film. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
VISIBILITY CONDITIONS	Describe recent and current visibility conditions that may be useful in verifying qualitative photographic observations. Such conditions may include, but are not limited to: • Extremely clean • Regional haze • Layered haze

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date_____ Time_____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(E0S) Off(0M2n) On(137MA) On(PZ-20) On(ZX-10) ☐ (167MT)
☐	☐	Aperture F8.0
☐	☐	IS0/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Data back display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED

Today's Date_____ Time_____

Yes	No	
☐	☐	Camera found in proper condition
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(E0S) Off(0M2n) On(137MA) On(PZ-20) On(ZX-10) ☐ (167MT)
☐	☐	Aperture F8.0
☐	☐	IS0/ASA 64 (137 MA ASA 100)
☐	☐	All other camera settings correct (refer to 35mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____

_____

_____

_____

Current % Cloud Cover_____ Temperature _____ _____ _____
Max Min

COMMENTS/ACTION TAKEN _____

_____

_____

_____

SUPPLIES NEEDED _____ _____

_____

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525 **970-484-7941**

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet for the Pentax ZX-10 Automatic Camera System.

Location FTCC Roll No. 45
Operator K. Rosener

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date 12/2/98 Time 10:15

Yes	No	
☑	☐	Batteries tested
☑	☐	Documentation photograph taken
☑	☐	Camera main switch (circle one) A(E0S) Off(0M2n) On(137MA) On(PZ-20) On(ZX-10) ☐ (167MT)
☑	☐	Aperture F8.0
☑	☐	IS0/ASA 64 (137MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)
☑	☐	Lens focus on infinity
☑	☐	Data back display correct
☑	☐	Timer clocks and alarms verified
☑	☐	Camera/timer cable secure
☑	☐	Camera alignment correct
☑	☐	Film advancing properly
☑	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED

Today's Date 12/10/98 Time 9:30

Yes	No	
☑	☐	Camera found in proper condition
☑	☐	Camera alignment correct
☑	☐	Film advanced as expected exposure count on 30
☑	☐	Camera main switch (circle one) A(E0S) Off(0M2n) On(137MA) On(PZ-20) On(ZX-10) ☐ (167MT)
☑	☐	Aperture F8.0
☑	☐	IS0/ASA 64 (137 MA ASA 100)
☑	☐	All other camera settings correct (refer to 35mm camera checklist)
☑	☐	Camera/timer cable secure
☑	☐	Timer found in proper condition
☑	☐	Film rewound correctly
☑	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll Sunny and cold

Current % Cloud Cover 10 % Temperature 37 (Now) 45 (Max) 25 (Min)

COMMENTS/ACTION TAKEN Manual Shot taken after doc chart photo

SUPPLIES NEEDED Back-up 6 V. timer batteries

Mail white copy and 35mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525 970-484-7941

Figure 4-5. Completed Example of an Automatic Camera Visibility Monitoring Status/Assessment Sheet.

- Plumes
- Severity of haze
- Emission source activity (e.g., nearby forest fires, controlled burns, construction, dusty roads, residential wood burning, etc.)
- Any perceptible odors (e.g., wood smoke)

COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	List any servicing supplies or documentation materials required for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect the outside of the enclosure window for dirt and clean if necessary.
VERIFY CAMERA ALIGNMENT	The camera alignment must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA /TIMER CABLES	Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems, including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
REMOVE CAMERA	Push the **QUICK RELEASE** lever on the tripod plate and lift the camera off the mount. Disconnect the camera/timer cable from the timer at the timer jack and remove the camera from the enclosure.
DOCUMENT EXPOSURE NUMBER COUNT	The frame counter indicates if the film advanced properly and how many photographs were taken during the monitoring period. Document whether the film advanced correctly and the observed exposure count number. Report any discrepancies promptly to ARS. If the film is already rewound, the film-load check mark will be flashing (⊸). Assume all 36 exposures were taken and document as such.

VERIFY SETTINGS

Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality photographs). Correct any inconsistencies.

REWIND FILM

Observe the film-load check mark ( ) on the display panel:

- If flashing, the film was automatically rewound after the last frame was exposed.
- If the roll of film has not been completely exposed, depress the **AUXILIARY REWIND** button with the protruding section of the camera strap buckle or the tip of a ballpoint pen. (The camera main switch must be in the "ON" position).

During rewind, the film-load check mark ( ) will flash and the exposure counter counts frame numbers in reverse. The film rewind stops automatically when the film has been completely rewound. Do not open the back until the film-load check mark flashes.

REMOVE FILM AND COMPLETE CANISTER LABEL

Remove exposed film from the camera and place it in the most recently labeled plastic canister. Complete the film canister label by writing in the current date and time.

Inspect film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the DX film contacts or shutter curtain.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found.
- All servicing or maintenance actions performed.
- Current and recent weather conditions.
- Current and recent visibility conditions.

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CANISTER

The film canister label identifies the contents of each roll of film. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the plastic film canister. Fill out a film canister label with the following information and attach it to the outside of the plastic canister:

- Monitoring site abbreviation
- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To open the camera back, push the **BACK COVER LATCH** down. The Pentax ZX-10 loads the film automatically if the following steps are carefully taken:

- Remove the film cartridge from the plastic film canister, open the camera back, and insert the film cartridge into the film chamber, lower protruding end first.
- Pull the film leader across the shutter curtain until it is aligned with the orange film leader mark and the tip is positioned under the film retainer.
- Make sure the film has no slack and that its perforations are properly engaged with the sprocket teeth.
- Firmly close the camera back cover. The film will automatically advance and stop when (1) appears in the display panel.

  NOTE: If the film is not loaded correctly, the film transport symbol (E) will flash after the camera motor has stopped and the shutter will not release. Open the back cover and reload the film.

Store the empty, labeled plastic film canister inside the camera enclosure until the film is removed.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not remove the lens from the camera body or attempt to clean inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

PHOTOGRAPH DOCUMENTATION BOARD

The first exposure on every roll must be of the documentation board which contains the gray scale, color chart, battery servicing record, and pertinent data collection information (Figure 4-6).

- Write the following on the note pad provided:
  - Monitoring site name or abbreviation
  - Roll number
  - Date and time
- Adjust your position and turn the focus ring to achieve a close-up, sharply focused photograph.
- Press the **SHUTTER BUTTON.** Verify that the film counter has incremented one frame.
- Reset the focus ring to infinity.

The documentation chart should be evenly lit for the photograph. The board is mounted to the enclosed door with Velcro tabs and may be temporarily removed if proper lighting conditions are not possible in its normal position. You may have to shift your position slightly to find a spot where there is no glare from the sun on the board.

CHECK CAMERA BATTERY

Observe the display panel. If a battery symbol (▭) appears in the display directly above the aperture priority indicator (**Av**) the level of battery power is:

- (▭) - nearly exhausted, replace with new battery
- (▭) flashing - very low, shutter will not release, replace with new battery
- blank display - drained, replace with new battery

If required, change the camera's two 3 V lithium batteries and retest the system. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Report any problems promptly to ARS.

Camera battery change procedures are described further in Section 4.2.2.

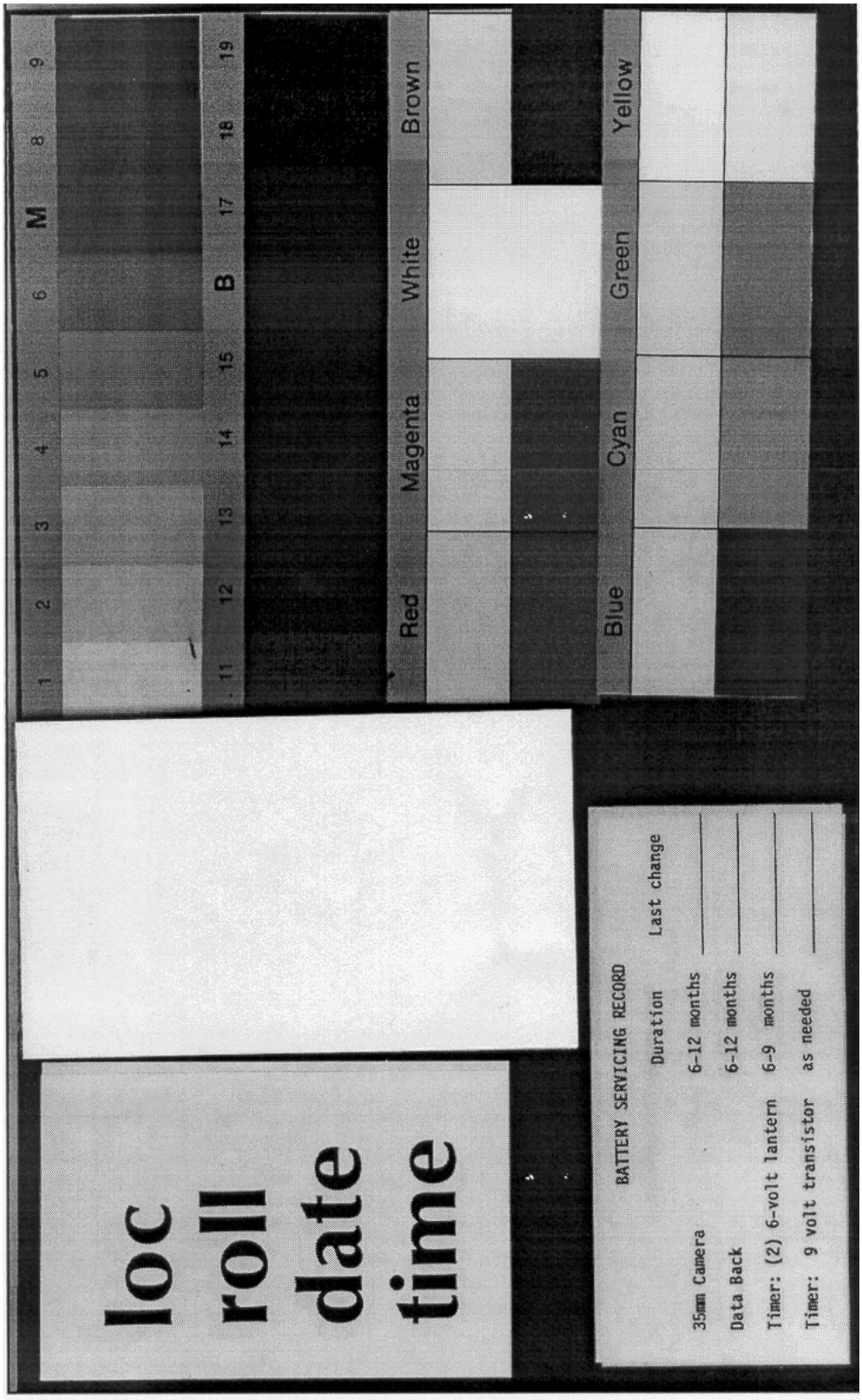

Figure 4-6. Photographic Documentation Board.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Pentax ZX-10 are:

Main Switch	ON
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0.0
Mode Dial	Pict
Drive Mode Selector	□ (single)
Lens Focus Mode	MF (manual)

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door and in the Automatic 35 mm Camera System User's Manual provided in the site operator's manual.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK DATABACK SETTING AND BATTERIES

The databack should be in the "day-time" mode displaying the current day of the month and current time, with the bar mark (¯) displayed directly above the minutes.

If the display is blank, the databack battery is drained. Replace the batteries only when the film is not loaded. Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and "battery servicing record" portion of the documentation chart. Reset the databack for the current date and time.

Databack setting and programming instructions, as well as battery change procedures are described further in Section 4.2.

CHECK TIMER SETTINGS

Review timer display:

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon should be flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review.

- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

REPLACE AND ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Mount the camera on the tripod head.
- Securely reconnect the camera/timer cable to the timer at the timer jack.
- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment photograph is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED	Document any servicing or maintenance actions performed during the film loading process. Place the completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.
CLOSE AND SECURE ENCLOSURE	Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the camera enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding roll of film in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10.*

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of:

- Camera battery changes (every six months)
- Databack battery changes (annually)
- Timer battery changes (every six months)

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Replacement databack batteries are provided annually. Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera, databack, and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Pentax ZX-10 are provided in TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10.*

4.2.1 Film and Film Storage

Only Kodachrome 64 slide film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each roll of film has an emulsion number and expiration date. This information must be documented on the canister label of each exposed film roll (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA BATTERY CHANGE

The Pentax ZX-10 camera runs on two 3 V lithium batteries. These batteries should be replaced every six months or as directed by the data coordinator.

- Open the battery chamber cover by turning the cover lock with a coin to the “open” position.
- Turn the camera upright and allow the batteries to slide out of the compartment. Measure and record the voltage of the used batteries.
- Remove the new batteries from their packaging and test and record the voltage. The new batteries should measure at least 3 volts each.
- Insert the new batteries and lock them in place by turning the battery chamber cover to the “close” position.
- After changing the batteries, check them as described in Section 4.1.3.

DATABACK BATTERY CHANGE

The Pentax Data Back runs on one 3 V coin-shaped lithium battery. The databack battery should be replaced annually, or as required by the data coordinator. Be sure to replace the battery only when film is not loaded.

- The battery compartment is located on the inside of the camera back cover. To open the compartment, use a small Phillips screwdriver and remove the screw on the battery chamber cover.
- Remove the battery. Measure and record the voltage of the used battery.
- Remove the new battery from its packaging and test and record the voltage. The new battery should measure approximately 3 volts.
- Wait 15 seconds after removing the used battery and then load the new battery with the "+" side facing up.
- Replace the battery chamber cover and tighten the fixing screw.
- Check the display and reset the databack for the current date and time as described in Section 4.1.3.

TIMER BATTERY VERIFICATION AND CHANGES

The Paragon EC72D timer runs on two 6 V lantern batteries. If this power source is low or removed, the output will de-energize, but the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire. The timer automatically returns to the "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-7):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-7. The measurement should be approximately 12 volts.

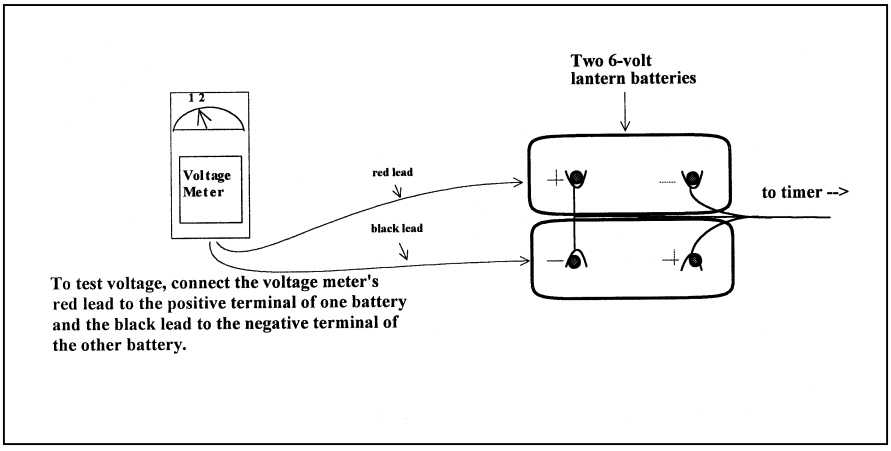

Figure 4-7. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If the clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet and battery servicing record portion of the documentation chart. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

PENTAX ZX-10

The Pentax ZX-10 is a rugged, reliable 35 mm camera equipped with an automatic film winder and remote control terminal. The automatic operation and aperture priority exposure mode provide properly exposed photographs under remote automatic monitoring conditions.

Standard settings for the Pentax ZX-10 are:

Main Switch	ON
Aperture	f8.0
ISO/ASA	64
Exposure Compensation	0.0
Mode Dial	Pict
Drive Mode Selector	☐ (single)
Lens Focus Mode	MF (manual)

REVIEW CAMERA SETTINGS

Press the **CAMERA SHUTTER** halfway to view the camera display panel. If the display does not appear, confirm that the main switch is set to "ON" and that the battery power level is sufficient. Verify all standard settings as they appear in Figure 4-8.

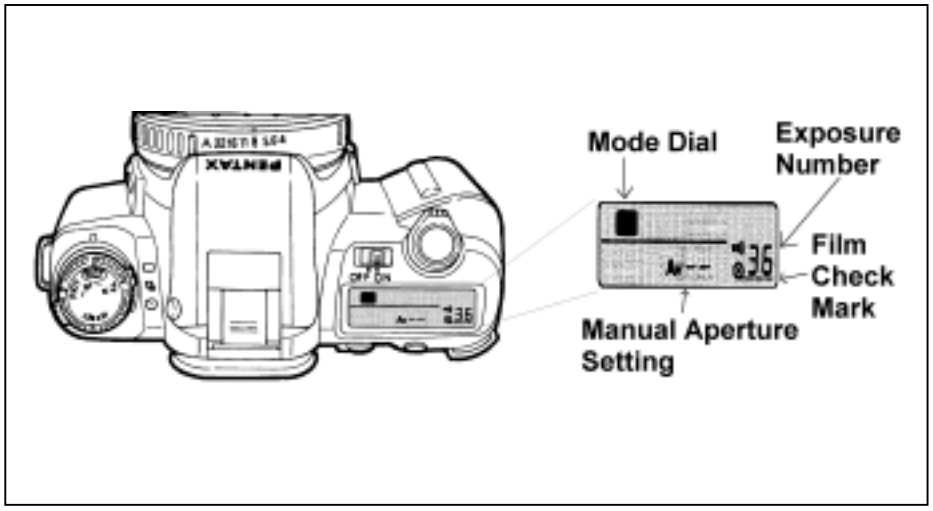

Figure 4-8. Pentax ZX-10 Display Panel.

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each roll of film that the setting is in effect.

Refer to the Pentax ZX-10 manufacturers' instruction booklet for detailed camera setting procedures.

PENTAX DATA BACK FE

The date and time that a visibility monitoring photograph was taken is vital information for analysis. The Pentax Data Back FE automatically imprints selected data on the film.

REVIEW DATABACK SETTINGS

During regular operation, the Pentax Data Back should display the local date and time. Verify that the bar mark (¯) appears above the minutes to ensure the databack is in the "IMPRINT" mode (Figure 4-9).

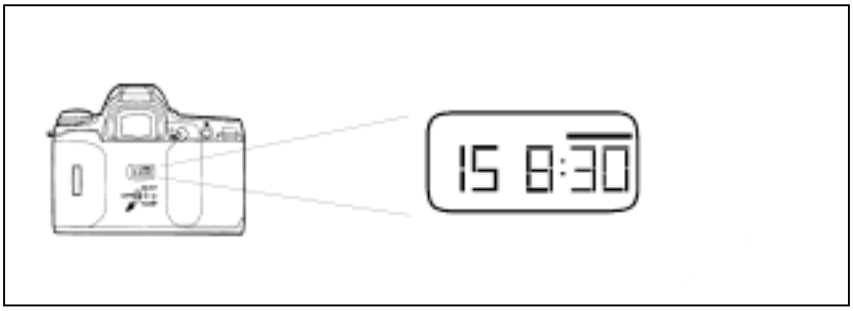

Figure 4-9. Pentax Data Back Displays.

NOTE: Standard/Daylight Savings Time Changes: Every spring and fall it will be necessary to change the databack clock to correspond with local standard or local daylight time. The data coordinator will provide a reminder postcard to document changes made.

To set the Pentax Data Back (use the protruding tip of the camera strap buckle):

- Press the **DATE** button until the "DAY/HOUR/MINUTE" mode is displayed.
- Press the **SELECT** button once -- the "HOUR display will flash.
- Press the **ADJUST** button until the correct hour is displayed. Constant pressure on the "ADJUST" button will rapidly advance the numbers.
- Press the **SELECT** button -- the "MINUTES" display will flash. Press the **ADJUST** button until the correct minutes are displayed.
- Press the **DATE** button four times until the "YEAR/MONTH/DAY" mode is displayed.
- Press the **SELECT** button -- the "YEAR" display will flash. Press the **ADJUST** button until the correct year is displayed.
- Press the **SELECT** button -- the "MONTH" display will flash. Press the **ADJUST** button until the correct month is displayed.
- Press the **SELECT** button -- the "DAY" display will flash. Press the **ADJUST** button until the correct day is displayed.
- Press the **DATE** button once to return to the "DAY AND TIME" mode. A bar mark (-) should appear in the upper right corner of the display. This indicates the databack is in the "IMPRINTING" mode. The databack should remain in this mode during regular operation.

PARAGON EC72D TIMER

The Paragon automatic timer is normally programmed for three photographs a day at 0900, 1200, and 1500. If necessary, alternate sampling schedules can be programmed for 1 to 32 user-selected photographs a day.

Routine servicing schedules are based on the number of photographs taken.

- 3 photographs/day = 10-11 day servicing schedule.

- 2 photographs/day = 15-17 day servicing schedule.

- 1 photograph/day = 30-33 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday = 1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D TIMER

To set the timer clock:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" is displayed, with a colon and "1" flashing. Press **CLK**; the flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., 1015 = 10:15 a.m.) Press one key for the current date of the week; (1 = Sunday . . . 7 = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1". Press two keys for the current month and two keys for the current date (e.g., 0615 = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984". Press two keys for the current year (e.g., 90). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day of week will be displayed with the colon flashing.

To program times for photographs to be taken:

- Press **PRG** to enter "program" mode.

- Press **C1** to select Channel 1 for programming; "E:01" (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., 0900 for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- The next event slot will be displayed (e.g., E:02). Repeat the step immediately above for each time of the day a photograph should be taken.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

NOTE: If more than 16 photographs per day are desired, Channel 2 may be used to program up to 16 additional events provided the Channel 2 output terminals have also been wired to the camera.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each photograph is compared to others of the same view during analysis. Therefore, alignment must remain constant from one roll of film to the next.

A 3" x 5" site alignment photograph is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or
- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.
- The horizon is level.
- The vista is framed correctly.
- The sunshield and port are not visible in the viewfinder.
- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10.*

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed with each roll of film. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Missing or improperly exposed documentation chart photographs
- Improper film loading or rewinding
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Weak or missing databack imprinting
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-10) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3350.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____
Operator: _____
From: _____

PROBLEM DESCRIPTION:

_____
_____
_____
_____

ACTION REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____

CORRECTIVE ACTION TAKEN (to be completed by site operator):

_____
_____
_____
_____
_____
_____

Date: _____ Operator: _____

Return Yellow Copy To:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Figure 4-10. Photographic Monitoring Network Quality Assessment Log.

Air Resource
Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC CAMERA SYSTEM - MINOLTA XL 401/601**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3200**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Karen K. Rosener	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Minolta XL 401/601 8 mm camera system.

Routine servicing schedules are based on the interval setting and number of hours photographed each day. Assuming an eight-hour per day schedule at 60-second intervals, site operators service the camera approximately every 6 to 7 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera and timer batteries:
  - Minolta XL 401/601 - two 6 V lantern batteries
  - Paragon EC72D - one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*
  - TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for Automatic Camera System - Minolta XL 401/601*
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film cartridge labels
- Pen or pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for Automatic Camera System - Minolta XL 401/601*.

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Minolta XL 401/601 8 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Minolta XL 401/601 8 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Minolta XL 401/601 Owners Manual

- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Camera System - Minolta XL 401/601*.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking photographs at 60-second intervals for 8 hours a day (e.g., 0800 - 1600). Assuming this schedule, site operators service the camera approximately every 6 to 7 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail it to the data coordinator with each film cartridge. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Verify that film advanced and settings are correct.
- Remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera settings.
- Check timer settings.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheet:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/ Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 8 mm camera and timer batteries every 6 months.

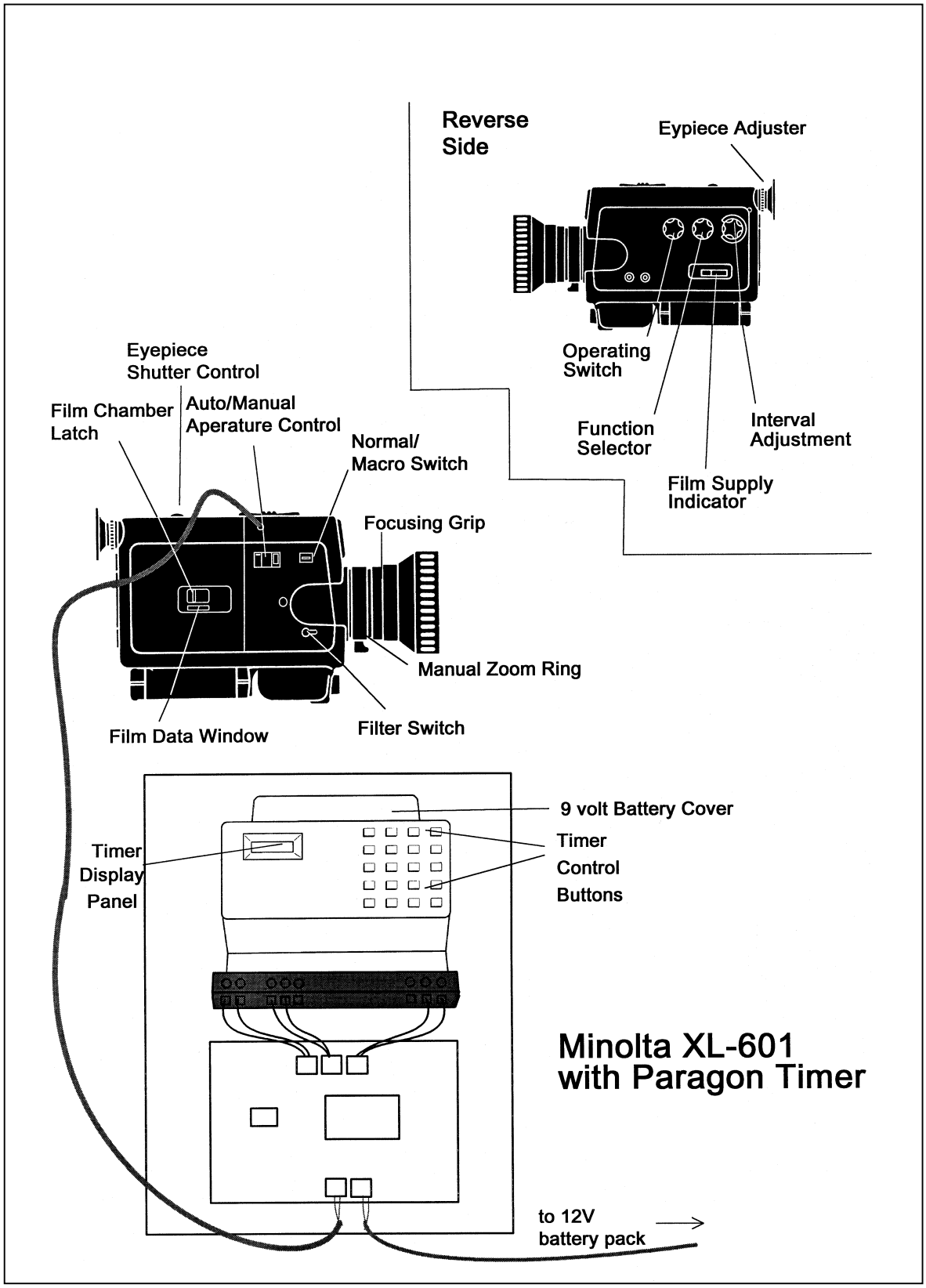

Figure 4-1. Minolta XL 401/601 System Components.

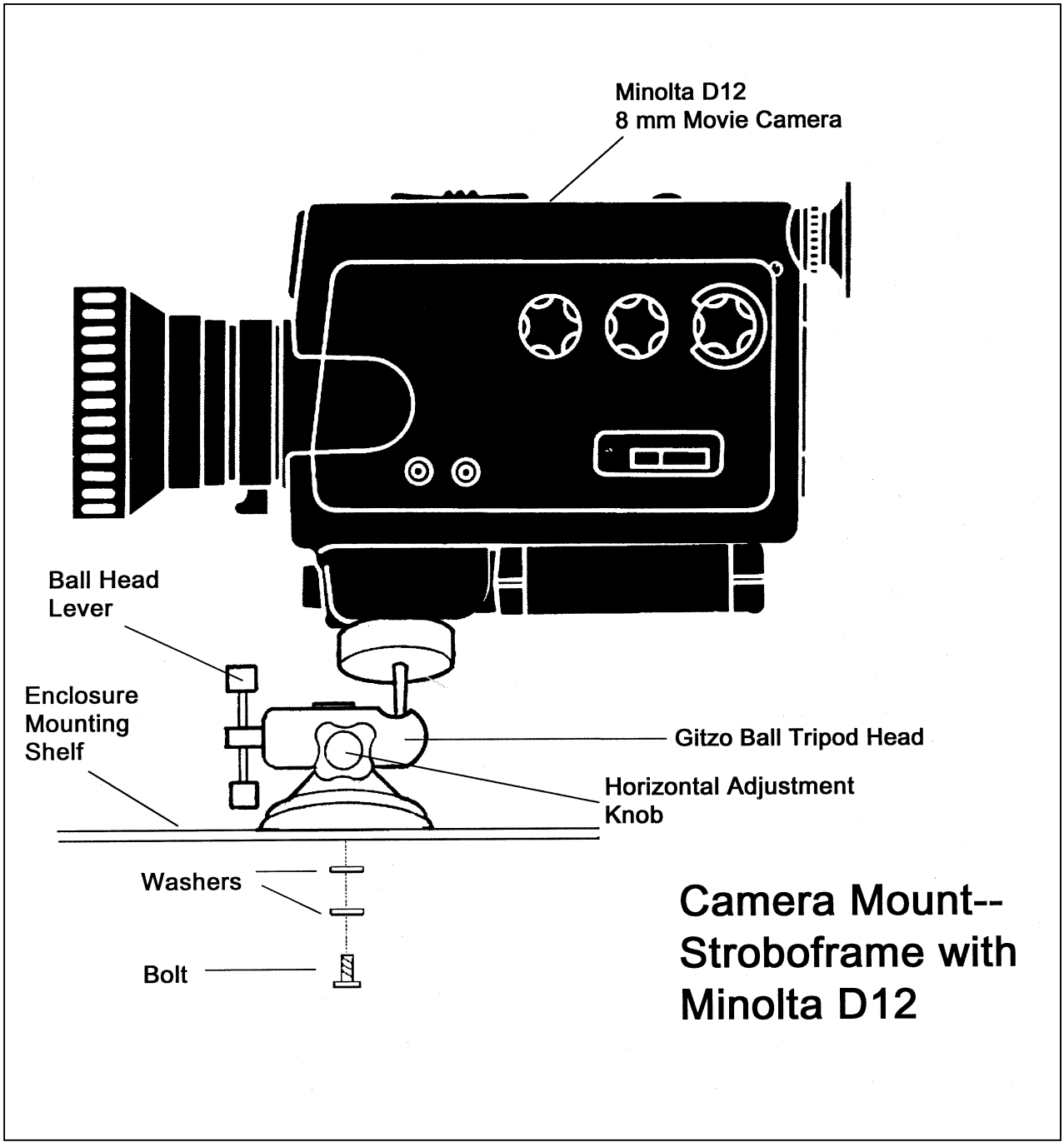

Figure 4-2. Automatic 8 mm Camera System Tripod Assembly.

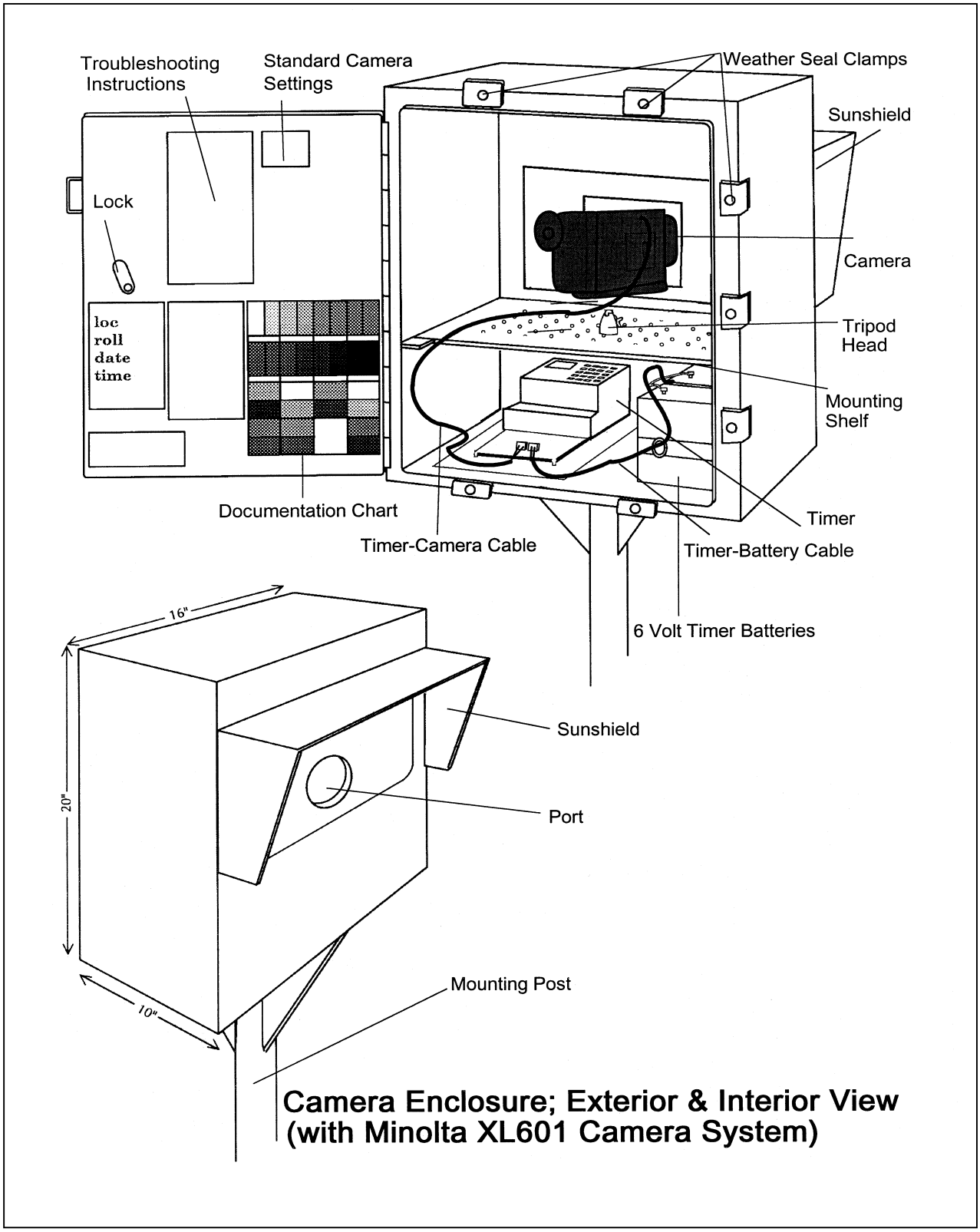

Figure 4-3. Automatic 8 mm Camera System Enclosure.

Location: _____ Roll No.: _____
Operator: _____

8 MM TIME-LAPSE CAMERA VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED **FILM REMOVED**

Today's Date: _____ Time: _____ Today's Date: _____ Time: _____

Yes	No		Yes	No	
___	___	Label Film Cartridge	___	___	Enclosure Found in Proper Condition (clean window if necessary)
___	___	Load Film:			
___	___	Lens Inspected	___	___	Camera Alignment Correct
___	___	Camera Settings Verified:	___	___	Camera and Timer Found in Proper Condition
		Normal/Macro Switch – NORMAL			
		Aperture Switch - AUTO	___	___	Exposure Count (record fraction):
		Filter Switch –DAYLIGHT			¼, ½, ¾, F) _____
		Function Switch - INTERVALOMETER	___	___	Camera Settings Verified:
		Interval Adjustment I			Normal Macro Switch - NORMAL
		- 60 second position (recommended)			Aperture Switch - AUTO
		Function Switch – INTERVALOMETER			Filter Switch - DAYLIGHT
		Zoom Magnification			Function Switch-INTERVALOMETER
		- At prescribed site-specific setting			Interval Adjustment
		Focus - ∞ (Infinity)			- 60 second position (recommended)
___	___	Verify Timer Settings			Zoom Magnification
___	___	Focus - ∞ (Infinity)			- at prescribed site-specific setting
___	___	Camera Aligned			Focus - ∞ (Infinity)
___	___	Verify Camera and Timer are Working Properly	___	___	Film cartridge label completed
___	___	Enclosure Secure			

DESCRIBE GENERAL WEATHER CONDITIONS _____
_____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

COMMENTS/ACTION TAKEN _____
_____

SUPPLIES NEEDED: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Visibility Monitoring Status/Assessment Sheet for Minolta XL 401/601 8 mm Camera System.

Location: VOYB Roll No.: 23
Operator: Steve Blair

8 MM TIME-LAPSE CAMERA VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date: 7/20/93 Time: 13:05

Yes	No	
x		Label Film Cartridge
x		Load Film:
x		Lens Inspected
x		Camera Settings Verified:
		Normal/Macro Switch - NORMAL
		Aperture Switch - AUTO
		Filter Switch –DAYLIGHT
		Function Switch - INTERVALOMETER
		Interval Adjustment
		- 60 second position (recommended)
		Function Switch – INTERVALOMETER
		Zoom Magnification
		- At prescribed site-specific setting
		Focus - ∞ (Infinity)
x		Verify Timer Settings
x		Focus - ∞ (Infinity)
x		Camera Aligned
x		Verify Camera and Timer are Working Properly
x		Enclosure Secure

FILM REMOVED

Today's Date: 7/26/93 Time: 10:40

Yes	No	
x		Enclosure Found in Proper Condition (clean window if necessary)
x		Camera Alignment Correct
x		Camera and Timer Found in Proper Condition
x		Exposure Count (record fraction): ¼, ½, ¾, F)
x		Camera Settings Verified:
		Normal Macro Switch - NORMAL
		Aperture Switch - AUTO
		Filter Switch - DAYLIGHT
		Function Switch - INTERVALOMETER
		Interval Adjustmentl
		- 60 second position (recommended)
		Zoom Magnification
		- at prescribed site-specific setting
		Focus - ∞ (Infinity)
x		Film cartridge label completed

DESCRIBE GENERAL WEATHER CONDITIONS Mostly cloudy, wind out of the south at 10 mph

Temperature (F) 76 Now 85 Max 56 Min % Cloud Cover 70

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED: 8mm film

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-5. Completed Example of a Visibility Monitoring Status/Assessment Sheet for Minolta 401/601 8 mm Camera System.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	Request any servicing supplies or documentation materials necessary for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

OPEN ENCLOSURE	Open the enclosure by loosening the weather-tight clamps and unlocking the latch.
INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect outside of enclosure window for dirt and clean if necessary. Document any abnormal accumulations.

VERIFY CAMERA ALIGNMENT

The camera alignment and zoom magnification must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.

VERIFY CAMERA/ TIMER CABLES

Listen for the shutter click and verify that the interval between clicks is correct. Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.

DOCUMENT CARTRIDGE EXPOSURE

The film supply indicator shows if the film advanced properly and how much of the film cartridge was exposed during the monitoring period. Document whether the film advanced correctly and the observed cartridge exposure. Report any discrepancies promptly to ARS.

VERIFY SETTINGS

Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality frame exposures). Correct any inconsistencies.

REMOVE FILM AND COMPLETE CARTRIDGE LABEL

Open the film chamber cover by pulling the **COVER LATCH** to the rear. Swing open the cover door and remove the exposed film cartridge from the camera. Complete the film cartridge label by writing in the current date and time.

Inspect the film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles.

COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET

Document:

- Any equipment or monitoring discrepancies found
- All servicing or maintenance actions performed
- Current and recent weather conditions

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CARTRIDGE

The film cartridge label identifies the contents of each film cartridge. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the packaging. Fill out a film cartridge label with the following information and attach it to the labeled side of the film cartridge:

- Monitoring site abbreviation
- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To load film:

- Open the film chamber cover.
- Insert the film cartridge into the film chamber with the labeled side out. Angle the cartridge into the camera from the rear and push down on the rear edge of the cartridge until it is seated flat in the compartment with a click.
- Close the cover and push until it clicks.
- Check the film view window for the film type display.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not attempt to clean the inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Minolta XL 401/601 are:

Normal/Macro Switch	NORMAL
Aperture Switch	AUTO
Filter Switch	DAYLIGHT (filter in position)
Function Switch	INTERVALOMETER
Interval Adjustment	60-second position (recommended)
Zoom Magnification	At prescribed site-specific setting
Focus	∞ (Infinity)

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK TIMER SETTINGS

Review timer display:

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review. In normal operation, Event 1 (E:01) is set at the desired starting time.
- Press **C2** to select Channel 2 for review. In normal operation, Event 1 (E:01) is set at the desired stopping time. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If the timer check occurs during operating hours, press **C1** to resume filming.

ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Look through the viewfinder and align the camera on the vista to be photographed.
- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment print is provided in the camera enclosure for reference).
- Firmly tighten all levers on the tripod head and recheck the alignment.
- Set the eyepiece shutter control to the "C" (closed) position.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- Press **C1**; the camera should fire at the set interval. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera. If the camera does not fire at the set interval, the cable might be malfunctioning.

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED

Document any servicing or maintenance actions performed during the film loading process. Place a completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems.

CLOSE AND SECURE ENCLOSURE

Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the site enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding film cartridge in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialist, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Camera System - Minolta XL 401/601*.

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of camera and timer battery changes (every six months).

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Minolta XL 401/601 are provided in TI 4120-3400.

4.2.1 Film and Film Storage

Only Kodachrome 40 color movie film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each film cartridge has an emulsion number and expiration date. This information must be documented on the cartridge label of each exposed film cartridge (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA/TIMER BATTERY VERIFICATION AND CHANGES

The Minolta XL 401/601 8 mm camera and Paragon EC72D timer board run on two 6 V lantern batteries. If this power source is low or removed, the output from the board to the camera and timer will de-energize. However, the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire at the set interval. The timer automatically returns to "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-6):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.

- Measure the voltage of the new batteries as shown in Figure 4-6. The measurement should be approximately 12 volts.

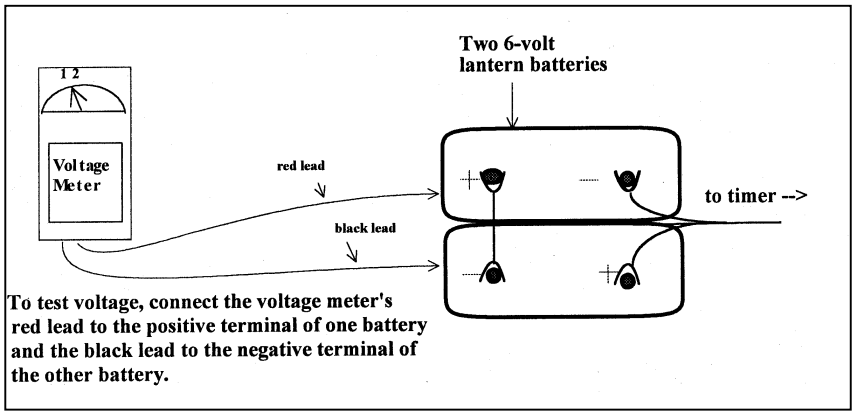

Figure 4-6. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

MINOLTA XL 401/601

The Minolta XL 401/601 is a rugged, reliable 8 mm camera equipped with an intervalometer for time-lapse filming. The internal camera batteries have been bypassed with internal wiring that can be directly connected to the timer board terminal block marked "camera." The wires must be inserted into the proper (positive (+) and negative (-)) position.

Standard settings for the Minolta XL 401/601 are:

Normal/Macro Switch	NORMAL
Aperture Switch	AUTO
Filter Switch	DAYLIGHT (filter in position)
Function Switch	INTERVALOMETER
Interval Adjustment	60-second position (recommended)
Zoom Magnification	At prescribed site-specific setting
Focus	∞ (Infinity)

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each film cartridge that the setting is in effect.

Zoom capabilities for the Minolta XL 401 or 601 can be changed between wide angle (8.5 or 7.5 mm respectively) to telephoto (34 or 45 mm respectively). A setting of 13 mm is approximately equivalent to a 50 mm lens field of view on a 35 mm camera.

The recommended time-lapse interval is 60 seconds. This allows for 60 hours of time on a 50-foot roll of film.

Refer to the Minolta XL 401/601 manufacturer's manual for detailed camera setting procedures.

Document any setting changes made that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

PARAGON EC72D TIMER

The Paragon automatic timer is often programmed for eight hours a day. Alternate sampling schedules can be programmed for any desired number of hours per day.

Routine servicing schedules are based on the number of hours photographs are taken. Assuming a 60-second time-lapse interval, the following servicing schedules are recommended:

- 8 hours daily monitoring = 6-7 day servicing schedule.
- 10 hours daily monitoring = 5-6 day servicing schedule.
- 12 hours daily monitoring = 4-5 day servicing schedule.
- 14 hours daily monitoring = 3-4 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday =1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

To set the timer clock:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" TIMERis displayed, with a colon and "1" flashing. Press **CLK**; the flashing stops.

- Using the 24-hour clock format, press four keys for the current time (e.g., **0915** = 09:15 a.m., **2330** = 11:30 p.m.). Press one key for the current date of the week; (**1** = Sunday . . . **7** = Saturday). Press **E** to enter.

- "101" is displayed, indicating "January 1." Press two keys for the current month and two keys for the current date (e.g., **0615** = June 15). Press **E** to enter.

- "84" is displayed, indicating "1984." Press two keys for the current year (e.g., **90**). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day-of-week will be displayed with the colon flashing.

To program times for photographs to be taken:

- Press **PRG** to enter "PROGRAM" mode.

- Press **C1** to select Channel 1 for programming. The starting time and E:01 (for the first event) is displayed.

- Press four keys for the time the first photograph should be taken (e.g., **0900** for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- Press **C2** to select Channel 2 for programming the ending time. "E:01" is displayed.

- Press four keys for the time the first photograph should be taken (e.g., **1700** for 5:00 p.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each film cartridge is compared to others of the same view during analysis. Therefore, alignment must remain constant from one film cartridge to the next.

A 3" x 5" site alignment print is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or
- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.
- The horizon is level.
- The vista is framed correctly (proper zoom factor).
- The sun shield and port are not visible in the viewfinder.
- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*.

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed to ARS with each film cartridge. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Improper film loading
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-7) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____
Operator: _____
From: _____

PROBLEM DESCRIPTION:

ACTION REQUEST:

CORRECTIVE ACTION TAKEN (to be completed by site operator):

Date: _____ Operator: _____

Return Yellow Copy To:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Figure 4-7. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC CAMERA SYSTEM - MINOLTA D12**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3210**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Karen K. Rosener	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	Revise illustrations and forms.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Minolta D12 8 mm camera system.

Routine servicing schedules are based on the interval setting and number of hours photographed each day. Assuming an eight-hour per day schedule at 60-second intervals, site operators service the camera approximately every 6 to 7 days to change film, check the performance of the camera system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Site Operator's Manual for Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, and a supply of Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine maintenance.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine maintenance.
- Train the site operator in all phases of camera system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the schedule and requirements for routine maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain an on-site file of the yellow copy.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver

- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera and timer batteries:
  - Minolta D12 - two 6 V lantern batteries
  - Paragon EC72D - one 9 V transistor battery
- Watch
- Lens cleaner and lens paper
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*
  - TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for Automatic Camera System - Minolta D12*
  - Manufacturers' instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film cartridge labels
- Pen or pencil
- Supplemental visibility monitoring film
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for Automatic Camera System - Minolta D12*.

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Maintenance

Detailed procedures described in these subsections are summarized in Table 4-1.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Minolta D12 8 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Minolta D12 8 mm camera system and associated components are provided in Figures 4-1 through 4-3.

The following manufacturers' instruction booklets are provided in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Minolta Autopak-8 D12

- Paragon EC72, EC72D, and EC72E

Resolution of problems noted during routine servicing or scheduled maintenance can be more fully investigated by following the troubleshooting and emergency maintenance procedures defined in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Camera System - Minolta D12*.

4.1 ROUTINE SERVICING

Routine servicing schedules are based on the number of photographs taken each day. A common monitoring schedule includes taking photographs at 60-second intervals for 8 hours a day (e.g., 0800 - 1600). Assuming this schedule, site operators service the camera approximately every 6 to 7 days. Alternate monitoring schedules are discussed in Section 4.2.3. Supplemental film and backup batteries should be on hand whenever the site is visited, this will minimize servicing time and data loss should a problem occur or be detected during servicing.

During each routine site visit, the operator will thoroughly document all pertinent data collection information, any maintenance performed, and note any equipment or monitoring discrepancies found on the Visibility Monitoring Status/Assessment Sheet (Figure 4-4). The site operator must complete all applicable portions of this sheet and mail it to the data coordinator with each film cartridge. A completed example status/assessment sheet is provided in Figure 4-5. Blank status/assessment sheets are provided in the site operator's manual. The following subsections detail how to complete the status/assessment sheet.

Table 4-1

Automatic Camera System
Field Quality Control Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Verify that film advanced and settings are correct.
- Remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera settings.
- Check timer settings.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheet:
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/ Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 8 mm camera and timer batteries every 6 months.

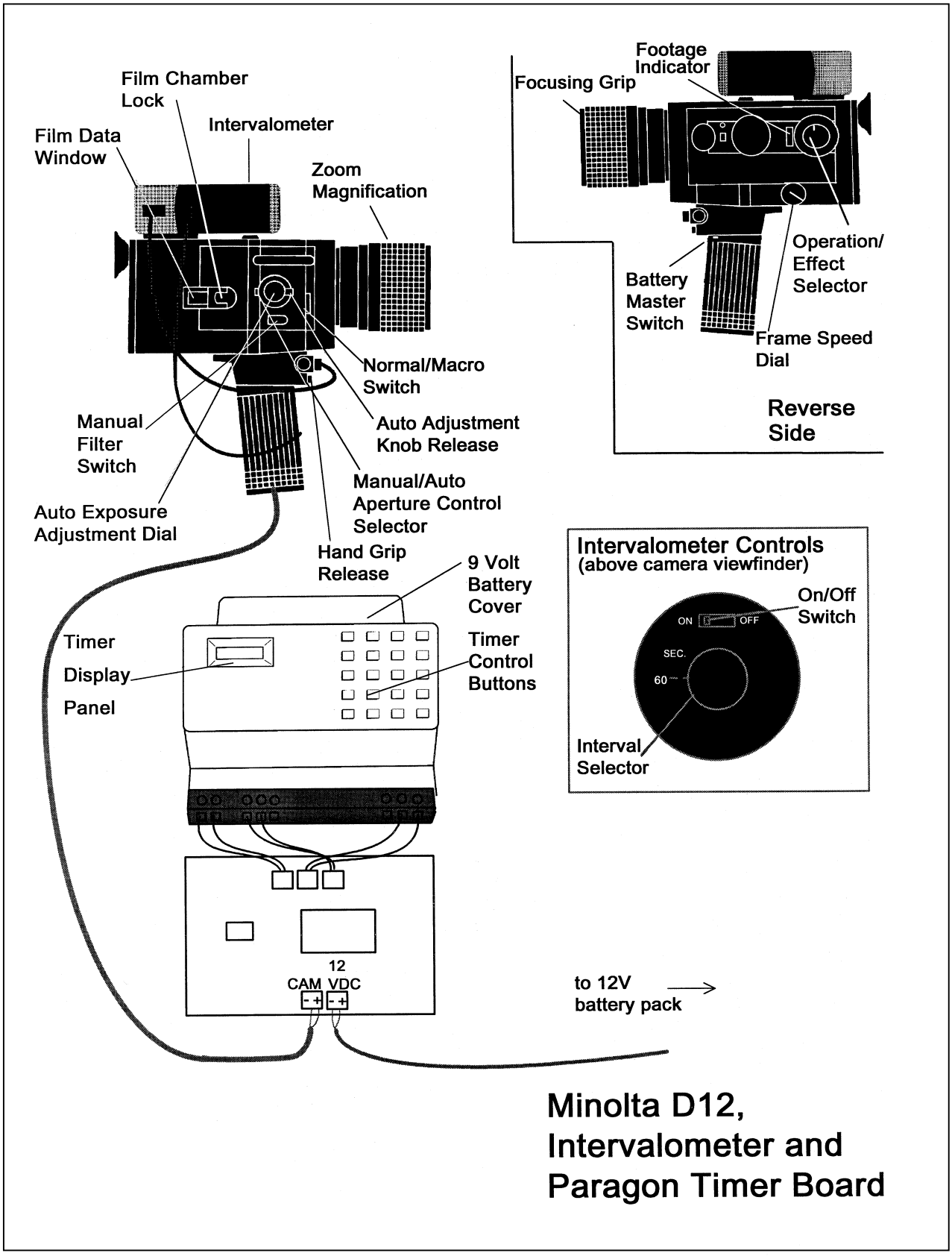

Figure 4-1. Minolta D12 System Components.

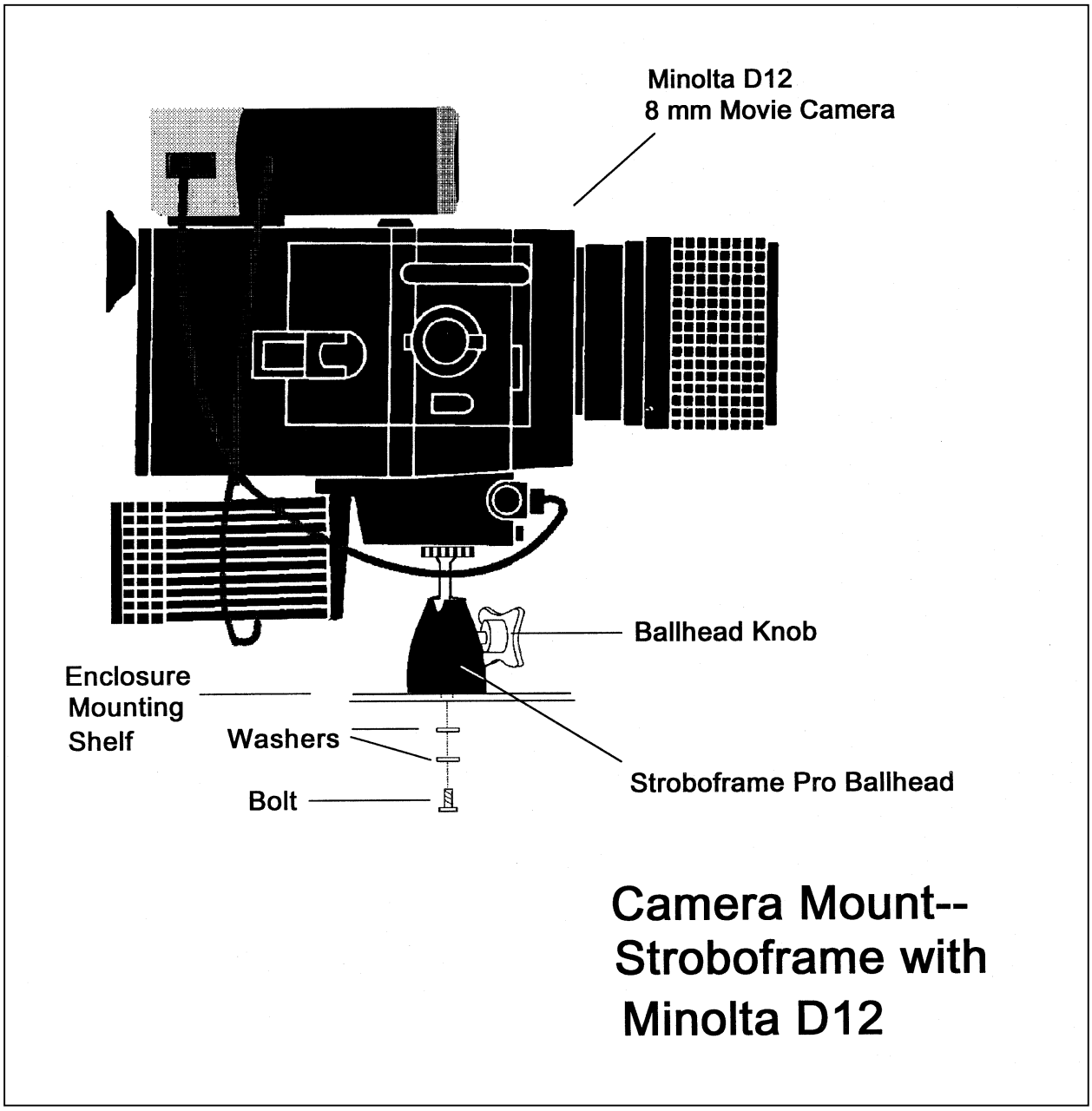

Figure 4-2. Automatic 8 mm Camera System Tripod Assembly.

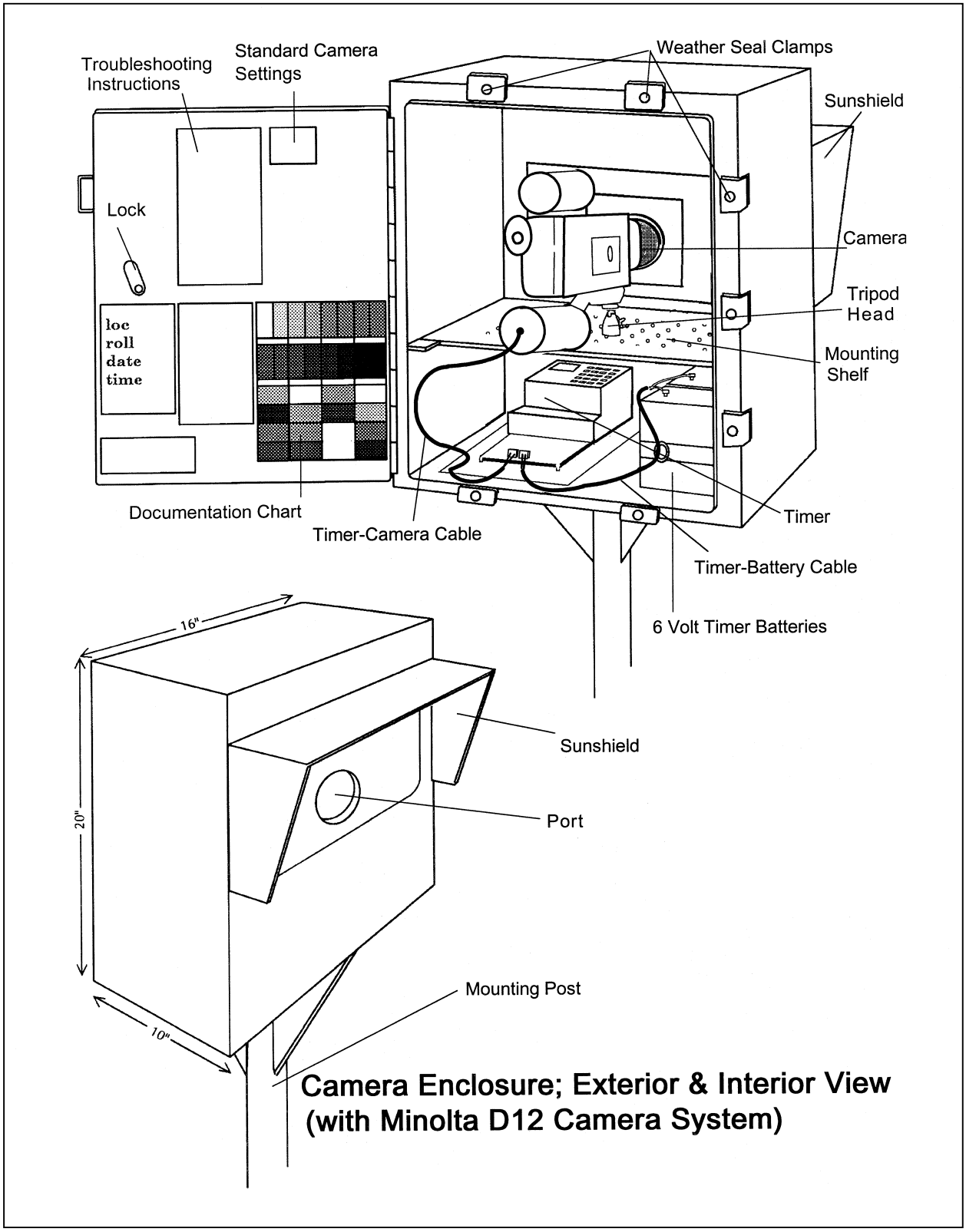

Figure 4-3. Automatic 8 mm Camera System Enclosure.

Location: _____ Roll No.: _____
Operator: _____

8 MM TIME-LAPSE CAMERA VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED **FILM REMOVED**

Today's Date: _____ Time: _____ Today's Date: _____ Time: _____

Yes	No		Yes	No	
___	___	Label Film Cartridge	___	___	Enclosure Found in Proper Condition (clean window if necessary)
___	___	Load Film:			
___	___	Lens Inspected	___	___	Camera Alignment Correct
___	___	Camera Settings Verified:	___	___	Camera and Timer Found in Proper Condition
		Normal/Macro Switch - N(normal)			
		Aperture Switch - A(auto)	___	___	Exposure Count (record footage): _____
		Manual Filter Switch -no lamp symbol (daylight position)	___	___	Camera Settings Verified:
		Auto Exposure Adjustment Dial - Red mark (no adjustment)			Normal Macro Switch - N(normal)
		INTERVALOMETER ON			Aperture Switch - A(auto)
		Interval Selector - 60 second position (recommended)			Manual Filter Switch - no lamp symbol (daylight position)
		Operation/Effect Selector - N(normal)			Auto Exposure Adjustment Dial - Red mark (no adjustment)
		Frame Speed Dial - S.F. (single frame)			INTERVALOMETER - ON
		Battery Master Switch - OFF			Interval Selector
		Zoom Magnification - At prescribed site-specific setting			- 60 second position (recommended)
		Focus - ∞ (Infinity)			Operation/Effect Selector - N(normal)
___	___	Verify Timer Settings			Frame Speed Dial - S.F. (single frame)
___	___	Camera Aligned			Battery Master Switch - OFF
___	___	Verify Camera and Timer are Working Properly			Zoom Magnification - at prescribed site-specific setting
					Focus - ∞ (Infinity)
___	___	Enclosure Secure	___	___	Film cartridge label completed

DESCRIBE GENERAL WEATHER CONDITIONS _____
_____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

COMMENTS/ACTION TAKEN _____
_____

SUPPLIES NEEDED: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Visibility Monitoring Status/Assessment Sheet for Minolta D12 8 mm Camera System.

Location: VOYB Roll No.: 32
Operator: Steve Blair

8 MM TIME-LAPSE CAMERA VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED

Today's Date: 7/20/93 Time: 13:05

Yes	No	
x		Label Film Cartridge
x		Load Film:
x		Lens Inspected
x		Camera Settings Verified:
		Normal/Macro Switch - N(normal)
		Aperture Switch - A(auto)
		Manual Filter Switch -no lamp symbol (daylight position)
		Auto Exposure Adjustment Dial - Red mark (no adjustment)
		INTERVALOMETER ON
		Interval Selector - 60 second position (recommended)
		Operation/Effect Selector - N(normal)
		Frame Speed Dial - S.F. (single frame)
		Battery Master Switch - OFF
		Zoom Magnification - At prescribed site-specific setting
		Focus - ∞ (Infinity)
x		Verify Timer Settings
x		Camera Aligned
x		Verify Camera and Timer are Working Properly
x		Enclosure Secure

FILM REMOVED

Today's Date: 7/26/93 Time: 10:40

Yes	No	
x		Enclosure Found in Proper Condition (clean window if necessary)
x		Camera Alignment Correct
x		Camera and Timer Found in Proper Condition
x		Exposure Count (record footage): _____
x		Camera Settings Verified:
		Normal Macro Switch - N(normal)
		Aperture Switch - A(auto)
		Manual Filter Switch - no lamp symbol (daylight position)
		Auto Exposure Adjustment Dial - Red mark (no adjustment)
		INTERVALOMETER - ON
		Interval Selector - 60 second position (recommended)
		Operation/Effect Selector - N(normal)
		Frame Speed Dial - S.F. (single frame)
		Battery Master Switch - OFF
		Zoom Magnification - at prescribed site-specific setting
		Focus - ∞ (Infinity)
x		Film cartridge label completed

DESCRIBE GENERAL WEATHER CONDITIONS Mostly cloudy, wind out of the south at 10 mph

Temperature (F) 76 Now 85 Max 56 Min % Cloud Cover 70

COMMENTS/ACTION TAKEN _____

SUPPLIES NEEDED: 8mm film

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-5. Completed Example of a Visibility Monitoring Status/Assessment Sheet for Minolta D12 8 mm Camera System.

4.1.1 Status/Assessment Sheet General Information

The following general information appears on the Visibility Monitoring Status/Assessment Sheet.

LOCATION	Either the full site location name or the four-letter site abbreviation.
ROLL NO.	The consecutive site roll number of the film used to document the monitoring period.
OPERATOR(S)	The full name of the site operator(s).
DATE AND TIME	The standard calendar date and local time when the film was loaded and when the film was removed.
WEATHER CONDITIONS	At the time of film removal, describe recent and current weather conditions that may be helpful in interpreting the photographic data. Such conditions may include, but are not limited to: • Temperature extremes • Percent cloud cover currently observed • Severe weather (lightning, hail, high winds, etc.) • Passing storm fronts • Precipitation • Stagnant air masses • Fog
COMMENTS	Describe any equipment or monitoring discrepancies found, troubleshooting or scheduled maintenance performed, and/or corrective actions taken.
SUPPLIES NEEDED	Request any servicing supplies or documentation materials necessary for ongoing monitoring.

4.1.2 Status/Assessment Sheet Film Removal Section

OPEN ENCLOSURE	Open the enclosure by loosening the weather-tight clamps and unlocking the latch.
INSPECT ENCLOSURE	Inspect the interior and exterior of the enclosure for damage or other problems (water leakage, etc.). Inspect outside of enclosure window for dirt and clean if necessary. Document any abnormal accumulations.

VERIFY CAMERA ALIGNMENT	The camera alignment and zoom magnification must remain constant from one roll to the next. Look through the camera viewfinder to verify that the alignment has remained correct during the monitoring period. If not, note the degree of misalignment and the probable cause.
VERIFY CAMERA/ TIMER CABLES	Listen for the shutter click and verify that the interval between clicks is correct. Check the camera/timer and power system (6 V lantern batteries) cable connections. Verify that all cables are secure. Check the integrity of the cables and component connectors. Document any problems including broken connectors, loose or bare wires, etc. Report any problems promptly to ARS.
DOCUMENT CARTRIDGE EXPOSURE	The film supply indicator shows if the film advanced properly and how much of the film cartridge was exposed during the monitoring period. Document whether the film advanced correctly and the observed cartridge exposure. Report any discrepancies promptly to ARS.
VERIFY SETTINGS	Verify all camera and timer settings. Document any settings that are different from those listed on the Visibility Monitoring Status/Assessment Sheet, whether they are site-specific settings or settings made in error. (Site-specific settings may be required at sites where non-standard exposure settings are necessary to ensure quality frame exposures). Correct any inconsistencies.
REMOVE FILM AND COMPLETE CARTRIDGE LABEL	Open the film chamber cover by lifting the **FILM CHAMBER KEY** and turning it in the direction of the arrow. Swing open the cover door and remove the exposed film cartridge from the camera. Complete the film cartridge label by writing in the current date and time. Inspect the film compartment for fragments of film. Blow lightly into the compartment to remove film fragments or other particles. DO NOT TOUCH the DX film contacts or shutter curtain.
COMPLETE VISIBILITY MONITORING STATUS/ ASSESSMENT SHEET	Document: • Any equipment or monitoring discrepancies found • All servicing or maintenance actions performed • Current and recent weather conditions

4.1.3 Status/Assessment Sheet Film Loading Section

LABEL FILM CARTRIDGE	The film cartridge label identifies the contents of each film cartridge. All of the information on the label is permanently logged at ARS when the film is received.

Open a box of new, unexposed film and remove the packaging. Fill out a film cartridge label with the following information and attach it to the labeled side of the film cartridge:

- Monitoring site abbreviation
- Roll number
- Date and time loaded
- Emulsion number and expiration date (information listed on Kodak film box)

LOAD FILM

To load film:

- Open the film chamber cover.
- Insert the film cartridge into the film chamber with the labeled side out. Angle the cartridge into the camera from the rear and push down on the rear edge of the cartridge until it is seated flat in the compartment with a click.
- Close the cover and turn the film chamber key to lock it in place. Replace the key flat against the side of the case.
- Check the film view window for the film type display.

INSPECT CAMERA LENS

Inspect the exterior of the UV filter mounted on the camera lens for any accumulation of dust, dirt, or fingerprints. If accumulation is noted:

- Clean the outside of the UV filter with the lens paper and fluid provided.
- If necessary, unscrew the UV filter and clean the lens and inside surface of the UV filter. Do not attempt to clean the inner surface of the lens.
- Use lens paper and fluid to clean the viewfinder eyepiece when necessary.

CHECK CAMERA SETTINGS

Verify and change, if necessary, all camera settings for correct automatic operation. Standard settings for the Minolta D12 are:

Normal/Macro Switch	N(Normal)
Aperture Control Selector	A(Auto)
Manual Filter Switch	No lamp symbol (Daylight Position)
Auto Exposure Adjustment Dial	Red mark (No adjustment)
Operation/Effect Selector	N(Normal)
Frame Speed Dial	S.F. (Single Frame)

Battery Master Switch	OFF
Lens Focus	∞ (Infinity)
Intervalometer	ON
Interval Selector	60-second position (recommended)
Zoom Magnification	At prescribed site-specific setting

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS are documented on the enclosure door.

Document any settings that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

CHECK TIMER SETTINGS

Review timer display:

- The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, and the colon flashing.
- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- If the timer display is blank, the timer battery wiring may be incorrect or the battery power may be insufficient.

Review the programmed timer events:

- Press **PRG** then **C1** to select Channel 1 for review. In normal operation, Event 1 (E:01) is set at the desired starting time.
- Press **C2** to select Channel 2 for review. In normal operation, Event 1 (E:01) is set at the desired stopping time. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Section 4.2.3. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

NOTE: If the timer check occurs during operating hours, press **C1** to resume filming.

ALIGN CAMERA

It is important for the alignment to be consistent from one roll to the next.

- Look through the viewfinder and align the camera on the vista to be photographed.

- Verify that the alignment matches the previous alignment, the horizon is level, the enclosure port does not appear in the frame, and the lens focus is on infinity. (A 3" x 5" site alignment print is provided in the camera enclosure for reference).

- Firmly tighten all levers on the tripod head and recheck the alignment.

- Set the eyepiece shutter control to the "C" (closed) position.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck the alignment.

VERIFY CAMERA/ TIMER CABLES AND FILM ADVANCE

Verify the camera/timer and power system (6 V lantern batteries) cable connections.

Test the timer and battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- Press **C1**; the camera should fire at the set interval. The timer automatically returns to the "RUN" mode.

If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient.

Test the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera. If the camera does not fire at the set interval, the cable might be malfunctioning.

Document any discrepancies and/or corrective actions taken. Report any problems promptly to ARS.

DOCUMENT FINDINGS AND ACTIONS PERFORMED

Document any servicing or maintenance actions performed during the film loading process. Place a completed Visibility Monitoring Status/Assessment Sheet (yellow copy) in the Site Operator’s Manual for Automatic Visibility Monitoring Camera Systems.

CLOSE AND SECURE ENCLOSURE

Place the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems inside the site enclosure for future reference. Close and lock the camera enclosure door. Tighten all door seal clamps and padlock the enclosure door hasp.

4.1.4 Mailing the Film and Completed Status/Assessment Sheet

Place the original (white) copy of the Visibility Monitoring Status/Assessment Sheet and corresponding film cartridge in a padded mailing envelope.

Mail both the film and the Visibility Monitoring Status/Assessment Sheet immediately to:

Air Resource Specialist, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Call ARS immediately if any inconsistencies were noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

Detailed troubleshooting procedures to assist with telephone-directed problem resolution are presented in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Camera System - Minolta D12*.

4.2 SCHEDULED MAINTENANCE

Proper film storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Scheduled maintenance normally consists of camera and timer battery changes (every six months).

Replacement camera and timer batteries are provided by ARS with each film shipment (every six months). Additional batteries will be provided as needed or as requested by the site operator. Test all batteries with a voltmeter before placing them in the system component. Verify all timer or camera battery malfunctions by testing removed component batteries with a voltmeter.

Additional servicing tasks identified by the data coordinator may include:

- Camera and timer configuration checks or changes
- Camera alignment changes
- Revision of data collection procedures

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

The following subsections further describe proper methods for film storage, scheduled maintenance procedures, and corresponding servicing documentation. Troubleshooting and emergency maintenance procedures for the Minolta D12 are provided in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Camera System - Minolta D12*.

4.2.1 Film and Film Storage

Only Kodachrome 40 color movie film provided by ARS should be loaded into the visibility monitoring camera unless otherwise directed. Each film cartridge has an emulsion number and expiration date. This information must be documented on the cartridge label of each exposed film cartridge (see Section 4.1.3).

Photographic film is sensitive to heat and moisture. These elements can affect the film, altering both the processed photographs and the data analysis. For example, film subjected to heat often has a pink or purple cast while film subjected to moisture does not process consistently. To ensure proper film storage, keep the film inside a Ziploc bag with desiccant and place the bag inside the clearly labeled film storage box. The box should be stored in a freezer, refrigerator, or cool (less than 70°F), dry location.

If stored in a freezer, allow film to thaw at room temperature for at least two hours before loading it in the camera.

4.2.2 Changing System Batteries

CAMERA/TIMER BATTERY VERIFICATION AND CHANGES

The Minolta D12 8 mm camera and Paragon EC72D timer board run on two 6 V lantern batteries. If this power source is low or removed, the output from the board to the camera and timer will de-energize. However, the time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Both 6 V lantern batteries should be replaced biannually or as directed by the data coordinator.

To test the main power source (two 6 volt batteries):

- The timer must be in "RUN" mode, with the time and day displayed and colon flashing.
- Press **C1**; the camera should fire at the set interval. The timer automatically returns to "RUN" mode.
- If the camera does not fire, the camera/timer wiring is incorrect or the battery power to the timer is insufficient. Test and record the voltage of the used batteries. Camera/timer wiring verification procedures are described in Section 4.1.3.

To change the 6 volt batteries (Figure 4-6):

- Disconnect all wires from the used batteries.
- Place the new batteries together at opposite polarity (in series).
- Connect the two batteries at one end.
- Connect the opposite terminals to the cable from the timer.
- Perform the above test to assure the connections are secure.
- Measure the voltage of the new batteries as shown in Figure 4-6. The measurement should be approximately 12 volts.

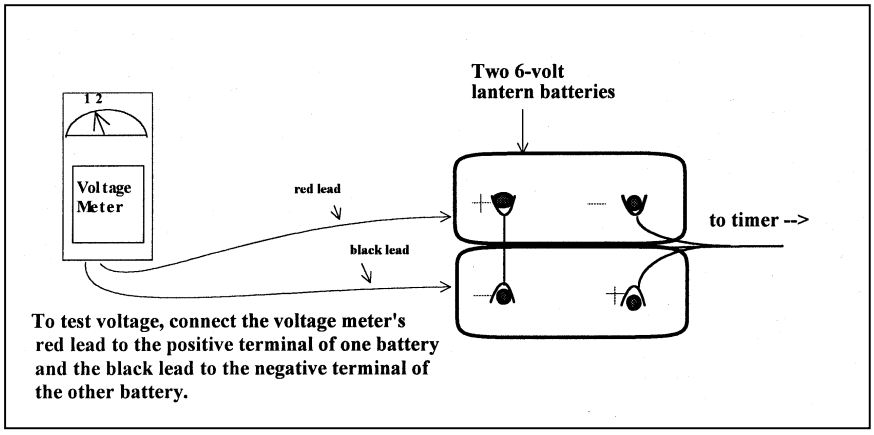

Figure 4-6. Paragon Timer Battery Configuration.

To test the 9 volt battery:

- Disconnect main power source.
- If clock display goes blank, no 9 V battery is connected or the battery needs to be replaced. The 9 V battery supplies only the current necessary to maintain the timer display and program memory when the main power source is disconnected. This battery should not need to be replaced more often than every two years unless the 6 volt batteries have failed and were not discovered for several days.

To change the 9 volt battery:

- Remove battery cover (located above timer control panel) by pressing sides together and pulling left or right.
- Snap the battery into the battery clip.
- Replace the battery cover.

Document all battery changes on the Visibility Monitoring Status/Assessment Sheet. Report any problems incurred promptly to ARS.

4.2.3 System Reconfiguration

MINOLTA D12

The Minolta D12 is a rugged, reliable 8 mm camera equipped with an intervalometer for time-lapse filming. The internal camera batteries have been bypassed with internal wiring that can be directly connected to the timer board terminal block marked "camera." The wires must be inserted into the proper (positive (+) and negative (-)) position.

Standard settings for the Minolta D12 are:

Normal/Macro Switch	N(Normal)
Aperture Control Selector	A(Auto)
Manual Filter Switch	No lamp symbol (Daylight Position)
Auto Exposure Adjustment Dial	Red mark (No adjustment)
Operation/Effect Selector	N(Normal)
Frame Speed Dial	S.F. (Single Frame)
Battery Master Switch	OFF
Lens Focus	∞ (Infinity)
Intervalometer	ON
Interval Selector	60-second position (recommended)
Zoom Magnification	At prescribed site-specific setting

CHANGE CAMERA SETTINGS

Lighting conditions of the target or vista may require site-specific exposure settings. Setting changes directed by ARS should be noted on the Visibility Monitoring Status/Assessment Sheet for each film cartridge that the setting is in effect.

Zoom capabilities for the Minolta D12 can be changed between wide angle (6.5 mm) to telephoto (78 mm). A setting of 13 mm is approximately equivalent to a 50 mm lens field of view on a 35 mm camera.

The recommended time-lapse interval is 60 seconds. This allows for 60 hours of time on a 50-foot roll of film.

Refer to the Minolta Autopak-8 D12 manufacturers' instruction booklet for detailed camera setting procedures.

Document any setting changes made that are different from those listed above on each Visibility Monitoring Status/Assessment Sheet.

PARAGON EC72D TIMER

The Paragon automatic timer is often programmed for eight hours a day. Alternate sampling schedules can be programmed for any desired number of hours per day.

Routine servicing schedules are based on the number of hours photographs are taken. Assuming a 60-second time-lapse interval, the following servicing schedules are recommended:

- 8 hours daily monitoring = 6-7 day servicing schedule.
- 10 hours daily monitoring = 5-6 day servicing schedule.
- 12 hours daily monitoring = 4-5 day servicing schedule.
- 14 hours daily monitoring = 3-4 day servicing schedule.

During regular operation the Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week (Sunday =1; Saturday = 7) with the colon flashing.

SETTING THE PARAGON EC72D

<u>To set the timer clock</u>:

- Wire power (two 6 V lantern batteries) to timer. A "0:00 1" TIMERis displayed, with a colon and "1" flashing. Press **CLK**; the flashing stops.
- Using the 24-hour clock format, press four keys for the current time (e.g., **0915** = 09:15 a.m., **2330** = 11:30 p.m.). Press one key for the current date of the week; (**1** = Sunday . . . **7** = Saturday). Press **E** to enter.
- "101" is displayed, indicating "January 1." Press two keys for the current month and two keys for the current date (e.g., **0615** = June 15). Press **E** to enter.
- "84" is displayed, indicating "1984." Press two keys for the current year (e.g., **90**). Press **E** to enter. Control will automatically switch to the "RUN" mode. The time and day-of-week will be displayed with the colon flashing.

<u>To program times for photographs to be taken</u>:

- Press **PRG** to enter "PROGRAM" mode.
- Press **C1** to select Channel 1 for programming. The starting time and E:01 (for the first event) is displayed.
- Press four keys for the time the first photograph should be taken (e.g., **0900** for 9:00 a.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.
- Press **C2** to select Channel 2 for programming the ending time. "E:01" is displayed.

- Press four keys for the time the first photograph should be taken (e.g., **1700** for 5:00 p.m.). Press **0** to program the event to occur daily. Press **E** to enter the event into memory.

- Press **RUN** to return to "RUN" mode after all selected photograph times are programmed.

Procedures to review programmed timer events are provided in Section 4.1.3.

SITE-SPECIFIC CAMERA ALIGNMENT

Correct alignment of the camera is extremely important. Each film cartridge is compared to others of the same view during analysis. Therefore, alignment must remain constant from one film cartridge to the next.

A 3" x 5" site alignment print is provided for your reference in the camera enclosure. Alignment changes or adjustments may be necessary when:

- Selected features are not properly framed in the view, and/or

- Exposure discrepancies result from intruding foreground or backlit features.

Any alignment change directed by ARS should be fully documented on the Visibility Monitoring Status/Assessment Sheet.

VERIFY CAMERA ALIGNMENT

Look through the viewfinder to verify the following:

- The alignment matches the referenced site-specific alignment photograph.

- The horizon is level.

- The vista is framed correctly (proper zoom factor).

- The sun shield and port are not visible in the viewfinder.

- The lens focus is on infinity.

Document any misalignment found and assess probable cause on the Visibility Monitoring Status/Assessment Sheet.

If weather conditions obscure the target area, use foreground features to judge alignment. Visit the site again when the weather clears to recheck alignment.

Procedures to ensure ongoing alignment are provided in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*.

4.2.4 On-Site Data Control

During each routine site visit, the operator documents maintenance performed and notes all discrepancies on the Visibility Monitoring Status/Assessment Sheet. The completed original (white copy) is mailed to ARS with each film cartridge. A copy (yellow) is kept in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems. If discrepancies or operator comments on the sheets indicate that further action is necessary, immediate corrective action is taken.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Operators are encouraged to call or notify ARS if they have questions or problems. Ongoing review of film and site operator documentation often initiates corrective actions.

Common data collection problems identified include:

- Roll number discrepancies
- Improper film loading
- Late film changes
- Improper camera alignment
- Incorrect camera settings
- Incorrect timer settings
- Incomplete Visibility Monitoring Status/Assessment Sheet documentation

All scheduled maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Visibility Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

If necessary, a Photographic Monitoring Network Quality Assessment Log (Figure 4-7) is mailed to the site to further document corrective actions taken. The site operator documents the date of correction and what was done, and returns a carbon copy of the log to ARS.

Problems and equipment malfunctions requiring extensive troubleshooting and/or maintenance are fully described in TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*.

PHOTOGRAPHIC MONITORING NETWORK
QUALITY ASSESSMENT LOG

Site: _____ Date: _____
_____
Operator: _____
From: _____

PROBLEM DESCRIPTION:

ACTION REQUEST:

CORRECTIVE ACTION TAKEN (to be completed by site operator):

Date: _____ Operator: _____

Return Yellow Copy To:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

White - Original, site copy
Yellow - return to ARS
Pink - ARS retain

Figure 4-7. Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CANON EOS 630**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3300**
DATE	**JUNE 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes, including responsibilities.	April 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Canon EOS 630 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Canon EOS 630 automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Canon EOS 630: - one 6 V lithium battery

  - Canon Quartz Date Back E: - one 3 V lithium battery

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*

- TI 4120-3300, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*
- Automatic 35 mm Camera System User's Manual
- Manufacturer's instruction booklets
- Visibility Monitoring Status/Assessment Sheets
- Film canister labels

• Pen or pencil

• Grease pencil

• Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

• A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.

• The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

• If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Canon EOS 630 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Canon EOS 35 mm automatic camera system and associated components are provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Canon EOS 630 Part I

- Canon EOS 630 Part II

- Canon Quartz Date Back E

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film
- Improperly secured battery or timer cable connections
- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.
2) Follow the component troubleshooting procedures described in the following subsections.
3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.
4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Canon EOS 35 mm Camera and Paragon Timer

Standard Settings Check List			
Canon EOS 630		**Canon Quartz Date Back E**	**Paragon Timer**
Main Switch	A	Day-of-Month/Time	Time/Day-of-Week
Aperture	f8.0		
ISO/ASA	64		
Exposure Compensation	0 (Zero)		
Program Mode Selection	AV		
Drive Mode Selector	S (Single)		
Lens Focus Mode	M (Manual)		

Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Open the switch cover (on the back of the camera below the databack) and press the battery check button. A "BC" and three bars (indicating sufficient battery power) should appear in the display panel.	• The battery pack was not installed properly. • The camera battery power level is insufficient or drained (a "BC" and two bars or less appears).
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button. The shutter should open and close, and the film and the film counter should advance one frame.	• The "main switch" is in the "L" (lock) position. • No film is in the camera. • Camera battery malfunction. • Camera needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3100). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3100). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3100). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3100). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart. Note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Canon EOS 630 camera runs on one 6 V lithium battery pack. Under normal operating conditions, this battery lasts up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the battery pack before replacing, especially if it was recently replaced.

- Verify the "main switch" and "program mode selector" camera settings. If these selections are inadvertently left in a wrong position (i.e., green square or «•»), the batteries may drain prematurely.

- The metering system on the camera may not be shutting off, even when the automatic camera settings are correct. Check the camera for excessive current draw.

To check if all systems are working properly, press the camera shutter halfway to observe the camera display panel. The shutter speed display (Figure 4-1, upper left) should not illuminate for more than six seconds. If the shutter speed display continues to illuminate beyond six seconds, an electrical short may exist in a portion of the cable jack or in the camera itself.

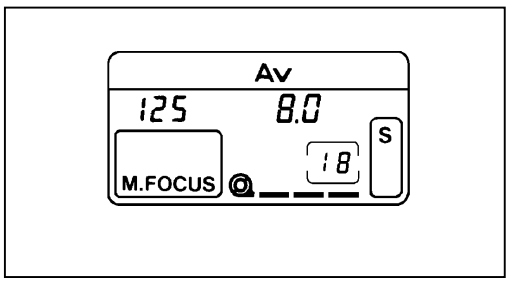

Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

DATABACK BATTERIES

The Canon Quartz Date Back E runs on one 3 V coin-shaped lithium battery. Under normal operating conditions, this battery will last a minimum of 12 months. Replace the battery only when the film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The word "BATTERY" will be displayed or the display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or battery before replacing, especially if it was recently replaced.

- Verify that the databack is in the day-time mode displaying the current day of the month and current time. No information will be imprinted on the film when the display is in the "OFF" position.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3100.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the frame counter on the camera display panel. Document how many photographs were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

If the film was not loaded correctly, the film transport bars will remain flashing and the shutter will not release. If so, open the back cover and reload the film. Review the film loading procedures described in TI 4120-3100, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Canon EOS 630*. Document your findings on a Visibility Monitoring Status Assessment Sheet and mail the sheet, without any film, to ARS.

VERIFY INTERNAL CAMERA WINDER

Check the camera battery as described in TI 4120-3100.

- Take a manual photograph. Press the **SHUTTER RELEASE** button; the shutter should open and close, and the film and film OPERATIONcounter should advance one frame. If the camera will not fire manually, verify that the "main switch" is in the "A" position and the battery check is good.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire. Observe the camera display panel; after firing, the shutter speed display should not illuminate for more than six seconds. If the shutter speed continues to illuminate beyond six seconds, an electrical short may exist in a portion of the cable jack.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3100.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

  - Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Canon EOS 630*. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3100.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3100, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Canon EOS 630*.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3100 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CONTAX 167MT**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3310**
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Contax 167MT 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Contax 167MT automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Contax 167MT: - four 1.5 V AAA alkaline batteries

  - Contax 167MT Data Back D-7: - two 3 V lithium batteries

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*

- TI 4120-3310, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*
- Automatic 35 mm Camera System User's Manual
- Manufacturer's instruction booklets
- Visibility Monitoring Status/Assessment Sheets
- Film canister labels

• Pen or pencil

• Grease pencil

• Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

• A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.

• The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

• If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Contax 167MT 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Contax 167MT 35 mm automatic camera system and associated components are provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Contax 167MT

- Contax 167MT Data Back D-7

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film

- Improperly secured battery or timer cable connections

- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.

2) Follow the component troubleshooting procedures described in the following subsections.

3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.

4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Contax 167MT 35 mm Camera and Paragon Timer

Standard Settings Check List		
Contax 167MT	**Contax 167MT Data Back D-7**	**Paragon Timer**
Main Switch □ Program Mode Selection AV ISO/ASA 64 Aperture Ring f8.0 Exposure Compensation 0 (Zero) Automatic Compensating Value Lever 0&0 Drive Mode Selector S	Year-Month-Day/Time	Time/Day-of-Week
Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Turn the main switch to □. Press the **MODE** and **ISO** buttons simultaneously. All the display panel indicators should come on.	• The batteries were not installed properly. • The camera battery power level is insufficient or drained. The display panel indicators are flashing or blank.
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button. The shutter should open and close, and the film and the film counter should advance one frame.	• The "main switch" is in the "OFF" position. • No film is in the camera. • Camera battery malfunction. • Camera needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3110). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3110). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3110). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3110). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart. Note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Contax 167MT camera runs on four 1.5 V AAA alkaline batteries. Under normal operating conditions, the batteries last up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the batteries before replacing, especially if they were recently replaced.

- Verify that the "main switch" camera setting is on "□". If the selection is inadvertently left in a wrong position (i.e., AEL), the batteries may drain prematurely.

To check if all systems are working properly, press the **MODE** button to observe the camera display panel. The display (Figure 4-1) should not illuminate for more than 20 seconds. If the shutter speed display continues to illuminate beyond 20 seconds, an electrical short may exist in a portion of the cable jack or in the camera itself.

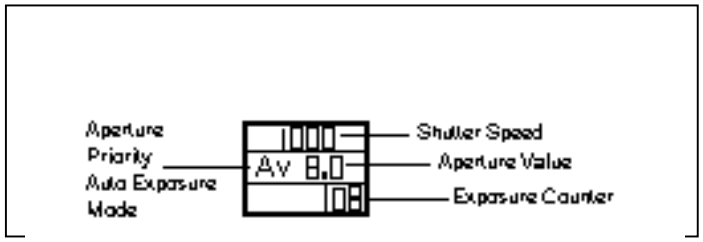

Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

DATABACK BATTERIES

The Contax 167MT Data Back Quartz D-7 runs on two 3 V coin-shaped lithium batteries. Under normal operating conditions, the batteries will last a minimum of 12 months. Replace the batteries only when film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The word "BATTERY" will be displayed or the display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or batteries before replacing, especially if they were recently replaced.

- Verify that the databack is in the "day-time" mode displaying the current date and current time.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 167MT*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3110.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the frame counter on the camera display panel. Document how many photographs were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

Observe the film advance with the back open after each film loading. Press the **SHUTTER RELEASE**. The film should engage and properly wind on the film take-up spool.

VERIFY INTERNAL CAMERA WINDER OPERATION

Check the camera battery as described in TI 4120-3110, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Contax 167MT*.

- Take a manual photograph. Press the **SHUTTER RELEASE** button; the shutter should open and close, and the film and film counter should advance one frame. If the camera will not fire manually, verify that the "main switch" is in the "□" position and the battery check is good.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire. Observe the camera display panel; after firing, the shutter speed display should not illuminate for more than 20 seconds. If the shutter speed continues to illuminate beyond 20 seconds, an electrical short may exist in a portion of the cable jack.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- the timer must be in the "RUN" mode, with the time and day-of-week displayed; colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3110.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

- Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Contax 167MT*. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3110.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3110.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3110 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - CONTAX 137 MA**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3320**
DATE	**SEPTEMBER 1993**

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REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Contax 137 MA 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Contax 137 MA automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Contax 137 MA: - four 1.5 V AA batteries

  - Contax Data Back Quartz D-5: - two 1.5 V silver oxide batteries

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*

- TI 4120-3320, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*
- Automatic 35 mm Camera System User's Manual
- Manufacturer's instruction booklets
- Visibility Monitoring Status/Assessment Sheets
- Film canister labels

• Pen or pencil

• Grease pencil

• Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

• A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.

• The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

• If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Contax 137 MA 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Contax 137 MA 35 mm automatic camera system and associated components are provided in TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Contax 137 MA

- Contax Data Back, Quartz D-5

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film

- Improperly secured battery or timer cable connections

- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.

2) Follow the component troubleshooting procedures described in the following subsections.

3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.

4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Contax 137 MA 35 mm Camera and Paragon Timer

Standard Settings Check List		
Contax 137 MA	**Contax Data Back Quartz D-5**	**Paragon Timer**
Main Switch — On (test light position) between OFF and AE LOCK Aperture Ring — f8.0 ASA Dial — 100* Exposure Compensation Dial — X1 Shutter Control Dial — A Exposure Mode Selector — S *Film remains Kodachrome 64	Day-of-Month/Time	Time/Day-of-Week
Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Turn the "main switch" in the direction of the "BC" (battery check). The "main switch" test light should light up green.	• The batteries were not installed properly. • The camera battery power level is insufficient or drained. The lamp will become dim or not light up.
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button. The shutter should open and close, and the film and the film counter should advance one frame.	• The "main switch" is in the "OFF" position. • Camera battery malfunction. • Camera needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3120). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3120). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3120). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3120). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart. Note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Contax 137 MA camera runs on four 1.5 V AA batteries. Under normal operating conditions, the batteries last up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the batteries before replacing, especially if they were recently replaced.

- Verify that the "main switch" camera setting is on "□". If the selection is inadvertently left in a wrong position (i.e., AE LOCK), the batteries may drain prematurely.

- The metering system on the camera may not be shutting off, even when the automatic camera settings are correct. Check the camera for excessive current draw.

To check if all systems are working properly, press the **CAMERA SHUTTER** halfway to observe the main lamp. The lamp should not illuminate (red) for more than 15 seconds. If the lamp continues to illuminate beyond 15 seconds, an electrical short may exist in a portion of the cable jack or in the camera itself.

DATABACK BATTERIES

The Contax Data Back Quartz D-5 runs on two 1.5 V silver oxide batteries. Under normal operating conditions, the batteries will last a minimum of 12 months. Replace the batteries only when film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The word "BATTERY" will be displayed or the display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or batteries before replacing, especially if they were recently replaced.

- Verify that the databack is in the "day-time" mode displaying the current date and current time.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3120, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3120.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the exposure counter on the top of the camera. Document the number of photographs that were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

The exposure counter on the camera will increment whether or not the film is loaded properly. To verify proper film loading, perform the following:

- Observe the rewind shaft when the shutter release is pressed. The shaft should rotate counter-clockwise.

- Pay close attention to the normal resistance when the film is rewound. If the film is improperly loaded, there will be a very slight to zero resistance during rewind. If the film was not loaded properly, open the back cover and reload the film. Review the film loading procedures described in TI 4120-3120. Document your findings on a Visibility Monitoring Status/Assessment Sheet and mail the sheet, without any film, to ARS.

VERIFY INTERNAL CAMERA WINDER OPERATION

Check the camera battery as described in TI 4120-3120, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Contax 137 MA*.

- Take a manual photograph. Press the **SHUTTER RELEASE** button; the shutter should open and close, and the film and film counter should advance one frame. If the camera will not fire manually, verify that the "main switch" is in the "ON" position and the battery check is good.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack(s).

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire. Observe the camera main lamp; the lamp should not illuminate for more than 15 seconds. If the lamp continues to illuminate beyond 15 seconds, an electrical short may exist in a portion of the cable jack.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and CABLE day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3120.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

  - Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in Ti 4120-3120, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Contax 137 MA*. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3120.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3110, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Contax 137 MA*.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3120 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - OLYMPUS OM2N**
TYPE	**TECHNICAL INSTRUCTION**
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes, including responsibilities.	April 1996	

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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Olympus OM2N 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Olympus OM2N automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Olympus OM2N: - two 1.5 V silver oxide batteries

  - Olympus Recordata Back 3 or 4: - two 1.5 V silver oxide batteries

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*

- TI 4120-3330, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*
- Automatic 35 mm Camera System User's Manual
- Manufacturer's instruction booklets
- Visibility Monitoring Status/Assessment Sheets
- Film canister labels

• Pen or pencil

• Grease pencil

• Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

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This section includes four (4) major subsections:

4.1 General Information
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4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

• A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.

• The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

• If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Olympus OM2N 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Contax 137 MA 35 mm automatic camera system and associated components are provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Olympus OM2N

- Olympus Recordata Back 3, Recordata Back 4

- Olympus Winder 2

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film
- Improperly secured battery or timer cable connections
- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.
2) Follow the component troubleshooting procedures described in the following subsections.
3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.
4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Olympus OM2N 35 mm Camera and Paragon Timer

Standard Settings Check List			
Olympus OM2N		**Olympus Recordata Back 3 or 4**	**Paragon Timer**
Aperture Ring	f8.0	Day-of-Month/Time (3)	Time/Day-of-Week
ASA Dial	64		
Exposure Compensation Dial	Zero	Year-Month-Day (4)	
Shutter Control Dial	Off		
Exposure Mode Selector	Single Shot		

Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Press the selector lever (located on the top of the camera) to the **CHECK-RESET** position. The battery check lamp should light brightly and remain steady.	• The batteries were not installed properly. • The camera battery power level is insufficient or drained (the battery check lamp will flicker or not light up).
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button on top of the winder. The camera shutter should open and close, and the film and the film counter should advance one frame.	• Power to winder is insufficient. • Winder cable needs repair. • Winder needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3130). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3130). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3130). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3130). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart to note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Olympus OM2N camera runs on two 1.5 V silver oxide batteries. Under normal operating conditions, the batteries last up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the batteries before replacing, especially if they were recently replaced.
- Verify the camera settings. If the selector level is inadvertently left in a wrong position (i.e., auto), the batteries can drain prematurely.

DATABACK BATTERIES

The Olympus OM2N Recordata Back 3 or 4 runs on two 1.5 V silver oxide batteries. Under normal operating conditions, the batteries will last a minimum of six months. Replace the batteries only when film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The word "BATTERY" will be displayed or the display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or batteries before replacing, especially if they were recently replaced.
- Verify that the Recordata Back 3 is in the "day-time" mode displaying the current day of the month and current local time. When using the Recordata Back 4, the databack should display the current year, month, and day.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Olympus OM2N*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3130.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the exposure counter on the top of the camera. Document the number of photographs that were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

If the film was not loaded correctly, the rewind shaft of the top of the camera will not rotate when a photograph is taken. Open the back cover and reload the film. Review the film loading procedures described in TI 4120-3130. Document your findings on a Visibility Monitoring Status/Assessment Sheet and mail the sheet, without any film, to ARS.

VERIFY INTERNAL CAMERA WINDER OPERATION

Check the camera battery as described in TI 4120-3130.

- Take a manual photograph. Press the winder **SHUTTER RELEASE** button; the shutter should open and close, and the film and film counter should advance one frame. If the camera will not fire, verify that the selector lever is in the "OFF" position and the battery check is good. If the camera fires but the winder does not advance, verify that the camera body is firmly mounted to the winder assembly.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the winder. If the camera fires, an electrical short may exist in a portion of the cable.

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Olympus OM2N*.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

  - Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3130. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3130, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Olympus OM2N*.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3130.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3130 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - PENTAX PZ-20**
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Pentax PZ-20 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Pentax PZ-20 automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Pentax PZ-20: - one 6 V lithium battery

  - Pentax Data Back FE: - one 3 V lithium battery

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*

- TI 4120-3340, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*
- Automatic 35 mm Camera System User's Manual
- Manufacturer's instruction booklets
- Visibility Monitoring Status/Assessment Sheets
- Film canister labels

• Pen or pencil

• Grease pencil

• Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

• A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.

• The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Pentax PZ-20 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Pentax PZ-20 35 mm automatic camera system and associated components are provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Pentax PZ-20 Operating Manual

- Pentax Data Back FE

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film
- Improperly secured battery or timer cable connections
- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.
2) Follow the component troubleshooting procedures described in the following subsections.
3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.
4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Pentax PZ-20 35 mm Camera and Paragon Timer

Standard Settings Check List			
Pentax PZ-20		**Pentax Data Back FE**	**Paragon Timer**
Main Switch	ON	Day-of-Month/Time	Time/Day-of-Week
Aperture	f8.0		
ISO/ASA	64		
Exposure Compensation	0.0		
Program Mode Selection	A		
Drive Mode Selector	□ (single)		
Lens Focus Mode	MF (manual)		

Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Check the camera display. If a battery symbol ( ) appears directly above the film-load check mark ( ) then the battery is low.	• The battery pack was not installed properly. • The camera battery power level is insufficient or drained.
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button. The shutter should open and close, and the film and the film counter should advance one frame.	• The "main switch" is in the "OFF" position. • No film is in the camera. • Camera battery malfunction. • Camera needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3140). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3140). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3140). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3140). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart to note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Pentax PZ-20 camera runs on one 6 V lithium battery pack. Under normal operating conditions, this battery lasts up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the battery pack before replacing, especially if it was recently replaced.
- Verify the "main switch" and "program mode selector" camera settings.
- The metering system on the camera may not be shutting off, even when the automatic camera settings are correct. Check the camera for excessive current draw.
- To check if all systems are working properly, press the **CAMERA SHUTTER** halfway to observe the camera display panel. The shutter speed and aperture (Figure 4-1, lower right) should not illuminate for more than 10 seconds. If the shutter speed continues to illuminate beyond 10 seconds, an electrical short may exist in a portion of the cable jack or in the camera itself.

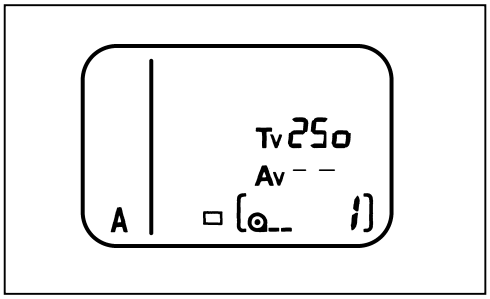

Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

DATABACK BATTERIES

The Pentax PZ-20 Data Back FE runs on one 3 V coin-shaped lithium battery. Under normal operating conditions, the battery will last a minimum of 12 months. Replace the batteries only when film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or battery before replacing, especially if it was recently replaced.

- Verify that the databack is in the "day-time" mode displaying the current day of the month, current time, and the bar mark (_) is displayed directly above the minutes. No information will be imprinted on the film when the display is in the "_____" position, or the bar mark is not present.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3140.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the exposure counter on the top of the camera. Document the number of photographs that were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

If the film was not loaded correctly, the film transport symbol and the letter "E" (E) in the LCD panel will flash and the shutter will not release. If so, open the back cover and reload the film. Review the film loading procedures described in TI 4120-3140. Document your findings on a Visibility Monitoring Status/Assessment Sheet and mail the sheet, without any film, to ARS.

VERIFY INTERNAL CAMERA WINDER OPERATION

Check the camera battery as described in TI 4120-3140, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax PZ-20.*

- Take a manual photograph. Press the **SHUTTER RELEASE** button; the shutter should open and close, and the film and film counter should advance one frame. If the camera will not fire manually, verify that the "main switch" is in the "ON" position and the battery check is good.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack)s).

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire. Observe the camera display panel; after firing, the shutter speed and aperture should not illuminate for more than 10 seconds. If they continue to illuminate beyond 10 seconds, an electrical short may exist in a portion of the cable jack.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3140.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

  - Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Pentax PZ-20*. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided in the site operator's manual and on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3140.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3140, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Pentax PZ-20*.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3140 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM - PENTAX ZX-10**
TYPE	**TECHNICAL INSTRUCTION**
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Pentax ZX-10 35 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in standard operating procedure (SOP) 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Pentax ZX-10 automatic camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.
- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.
- Provide technical support to the site operator via telephone to identify and resolve instrument problems.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.
- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.
- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Coordinate the replacement and repair of all system components and support hardware.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Pentax ZX-10: - two 3 V lithium batteries

  - Pentax Data Back: - one 3 V lithium battery

  - Paragon EC72D: - two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*

  - TI 4120-3350, *Troubleshooting and Emergency Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*
  - Automatic 35 mm Camera System User's Manual
  - Manufacturer's instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Ballpoint pen
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.
- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Pentax ZX-10 35 mm camera and Paragon EC72D automatic timer. Detailed schematic diagrams of the Pentax ZX-10 35 mm automatic camera system and associated components are provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Pentax ZX-10 Operating Manual

- Pentax Data Back

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film
- Improperly secured battery or timer cable connections
- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.
2) Follow the component troubleshooting procedures described in the following subsections.
3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.
4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Pentax ZX-10 35 mm Camera and Paragon Timer

Standard Settings Check List			
Pentax ZX-10		**Pentax Data Back**	**Paragon Timer**
Main Switch	ON	Day-of-Month/Time	Time/Day-of-Week
Aperture	f8.0		
ISO/ASA	64		
Exposure Compensation	0.0		
Mode Dial	Pict		
Drive Mode Selector	□ (single)		
Lens Focus Mode	MF (manual)		

Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera Battery	Check the camera display. If a battery symbol ( ) appears directly above the aperture priority indicator (**Av**) then the battery is low.	• The batteries were not installed properly. • The camera battery power level is insufficient or drained.
Camera Winder	Attempt to take a manual photograph. Press the **SHUTTER RELEASE** button. The shutter should open and close and the film and the film counter should advance one frame.	• The "main switch" is in the "OFF" position. • No film is in the camera. • Camera battery malfunction. • Camera needs repair.
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire.	• Camera/timer wiring is incorrect (refer to TI 4120-3150). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3150). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3150). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Press **E** repeatedly to review each event. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3150). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Review the "battery servicing record" section of the on-site documentation chart to note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The Pentax ZX-10 camera runs on two 3 V lithium batteries. Under normal operating conditions, these batteries last up to six months. Perform the following duties when servicing the batteries:

- Camera batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the battery check fails, attempt to warm the battery pack before replacing, especially if it was recently replaced.
- Verify the "main switch" and "mode dial" camera settings.
- The metering system on the camera may not be shutting off, even when the automatic camera settings are correct. Check the camera for excessive current draw.
- To check if all systems are working properly, press the **CAMERA SHUTTER** halfway to observe the camera display panel. The shutter speed and aperture should not illuminate for more than 10 seconds (see Figure 4-1). If the shutter speed continues to illuminate beyond 10 seconds, an electrical short may exist in a portion of the cable jack or in the camera itself.

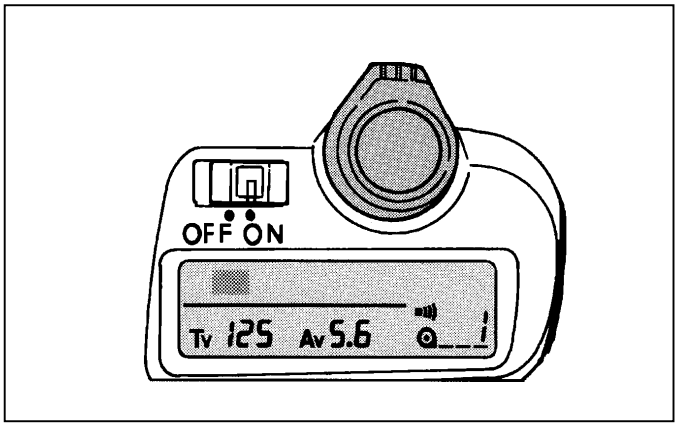

Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

DATABACK BATTERIES

The Pentax ZX-10 Data Back runs on one 3 V coin-shaped lithium battery. Under normal operating conditions, the battery will last a minimum of 12 months. Replace the battery only when film is not loaded. Verify the databack date and time setting following each battery change.

- The databack battery can easily be affected by cold weather (less than 30°F). The display will appear blank when the battery has insufficient voltage to imprint the data. Attempt to warm the databack or battery before replacing, especially if it was recently replaced.

- Verify that the databack is in the "day-time" mode displaying the current day of the month, current time, and the bar mark(¯) is displayed directly above the minutes. No information will be imprinted on the film when the display is in the "_____" position, or the bar mark is not present.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10*.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3150.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the exposure counter on the top of the camera. Document the number of photographs that were taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY PROPER FILM LOADING

If the film was not loaded correctly, the film transport symbol and the letter "E" (E) in the LCD panel will flash and the shutter will not release. If so, open the back cover and reload the film. Review the film loading procedures described in TI 4120-3150. Document your findings on a Visibility Monitoring Status/Assessment Sheet and mail the sheet, without any film, to ARS.

VERIFY INTERNAL CAMERA WINDER OPERATION

Check the camera battery as described in TI 4120-3150, *Routine Site Operator Maintenance Procedures for 35 mm Automatic Camera System - Pentax ZX-10.*

- Take a manual photograph. Press the **SHUTTER RELEASE** button; the shutter should open and close and the film and film counter should advance one frame. If the camera will not fire manually, verify that the "main switch" is in the "ON" position and the battery check is good.

- The camera must be sent to ARS for evaluation if it will not manually operate after taking the above steps. Document any discrepancies and/or corrective actions taken.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera remote jack. If the camera fires, an electrical short may exist in a portion of the cable jack)s).

- Press **C1** on the timer panel to activate the camera shutter; the camera should fire. Observe the camera display panel; after firing, the shutter speed and aperture should not illuminate for more than 10 seconds. If they continue to illuminate beyond 10 seconds, an electrical short may exist in a portion of the cable jack.

- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3150.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review.

  - Press **E** repeatedly to review each event. In normal operation, Event 1 (E:01) is 0900, Event 2 (E:02) is 1200, and Event 3 (E:03) is 1500. The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Pentax ZX-10*. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If a photograph was scheduled to occur while you were reviewing or programming information, the photograph was not taken.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided in the site operator's manual and on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3150.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3150, *Routine Site Operator Maintenance Procedures 35 mm Automatic Camera System - Pentax ZX-10*.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period (e.g., 0900 photograph) or by pressing **C1** on the timer panel. The camera should fire and advance one frame. Refer to TI 4120-3150 for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera body, lens, databack, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC CAMERA SYSTEM - MINOLTA XL 401/601**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3400**
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Minolta XL 401 or Minolta XL 601 8 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Minolta XL 401/601 8mm camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Minolta XL 401/601 and Paragon EC72D: two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*

  - TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*

  - Manufacturer's instruction booklets

  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.
- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.
- If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Minolta XL 401/601 8 mm cameras and Paragon EC72D automatic timer. Detailed schematic diagrams of the Minolta XL 401/601 8 mm automatic camera system and associated components are provided in TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Minolta XL 401/601

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film

- Improperly secured battery or timer cable connections

- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.

2) Follow the component troubleshooting procedures described in the following subsections.

3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.

4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Minolta XL 401/601 8 mm Camera and Paragon Timer

Standard Settings Check List		
Minolta XL 401/601		**Paragon Timer**
Normal/Macro Switch	NORMAL	Time/Day-of-Week
Aperture Switch	AUTO	
Filter Switch	DAYLIGHT (filter in position)	
Function Switch	INTERVALOMETER	
Interval Adjustment	60-second position (recommended)	
Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire at the set interval.	• Camera/timer wiring is incorrect (refer to TI 4120-3200). • Timer battery malfunction. • Camera/timer cable needs repair.
Camera/Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts. Battery power to the camera can be checked by turning the operation switch on the camera to the **BATTERY CHECK** position. The battery check lamp in the viewfinder should light up.	• Timer battery/configuration is incorrect (refer to TI 4120-3200). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the "RUN" mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3200). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Repeat the process by pressing **C2**. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3200). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL 401/601*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The internal camera batteries have been bypassed with internal wiring that can be directly connected to the timer board terminal block marked "camera." Under normal operating conditions, the two 6 V lantern batteries last up to six months. Perform the following duties when servicing the batteries:

- Batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the batteries fail, attempt to warm them before replacing, especially if they were recently replaced.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3200.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3200.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the film supply indicator. Document how far the film has advanced during the monitoring period. The amount of film taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY CAMERA AND TIMER CABLES

Verify the camera/timer cable connection:

- Gently shake the camera/timer cable leading into the camera. If the camera does not fire at the set interval, the cable might be malfunctioning.
- Press **C1** on the timer panel to activate the camera; the camera should fire at the set interval.
- If the camera does not fire, verify that the timer battery cable connections are secure.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.
- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3200, *Routine Site Operator Maintenance Procedures 8 mm Automatic Camera System - Minolta XL 401/601*.
- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.
- Review the programmed timer events:
  - Press **PRG** then **C1** to select Channel 1 for review. In normal operation, Event 1 (E:01) is set at the desired starting time (e.g., 0800). The remaining events are not programmed.
  - Press **C2** to select Channel 2 for review. In normal operation, Event 1 (E:01) is set at the desired stopping time (e.g., 1400). The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3200. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If the timer operations are verified during operating hours, press **C1** to resume filming.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided in the site operator's manual and on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3200, *Routine Site Operator Maintenance Procedures 8 mm Automatic Camera System - Minolta XL 401/601*.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3200.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period or by pressing **C1** on the timer panel. The camera should fire at the set interval. Refer to TI 4120-3200, *Routine Site Operator Maintenance Procedures 8 mm Automatic Camera System - Minolta XL 401/601*, for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC CAMERA SYSTEM - MINOLTA D12**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3410**
DATE	**NOVEMBER 1993**

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REVISION HISTORY			
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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by performing operational checks that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Minolta D12 8 mm camera system.

Maintaining the visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:
  - Minolta D12 8mm camera system
  - Paragon EC72D automatic timer
  - Batteries and support system components
- Notification of the field specialist or data coordinator
- System diagnosis and resulting corrective action(s)
- Installation of replacement system component(s)
- Final system verification check

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.

- Provide technical support to the site operator via telephone to identify and resolve instrument problems.

- Resolve problems reported by the site operator.

- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, his/her supervisor, project manager, and the field specialist concerning the requirements and completion of specific troubleshooting procedures.

- Identify possible instrument malfunction and contact the site operator to schedule troubleshooting procedure implementation.

- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.

- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.

- Coordinate the replacement and repair of all system components and support hardware.

- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with his/her supervisor, project manager, field specialist, and the data coordinator concerning the requirements and completion of specific troubleshooting procedures.

- Perform all procedures described in this TI.

- Thoroughly document all troubleshooting procedures on the Visibility Monitoring Status/Assessment Sheet and mail the completed sheet to the data coordinator.

- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver

- Small Phillips-head screwdriver

- Medium adjustable wrench

- Keys for enclosure and padlocks

- Voltmeter

- Backup camera and timer batteries:

  - Minolta D12 and Paragon EC72D: two 6 V lantern batteries and one 9 V transistor battery

- Watch

- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:

  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*

  - TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*

  - TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*

  - Manufacturer's instruction booklets

  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels
- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of processed film.
- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The data coordinator diagnoses the problem and suggests specific action. The operator initiates the corrective action, tests the system, and again notifies the data coordinator of his/her findings.
- If the system appears to be operating normally, the operator returns it to service and visits the site periodically before the next regularly scheduled visit.

- When the site operator cannot identify or resolve a camera-related problem or if the site operator is not available to address the malfunction, the data coordinator ships a complete backup camera system to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log. Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning unit to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Visibility Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective action taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for reoccurrences or resolution of the problem.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration. All procedures described in this TI refer to the Minolta D12 8 mm cameras and Paragon EC72D automatic timer. Detailed schematic diagrams of the Minolta D12 8 mm automatic camera system and associated components are provided in TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*.

The following manufacturers' instruction booklets are provided for reference in the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems:

- Minolta D12

- Paragon EC72, EC72D, and EC72E

4.1 GENERAL INFORMATION

The following is a partial list of common causes of data loss:

- Incorrect camera settings

- Incorrect timer settings

- Improperly loaded film

- Improperly secured battery or timer cable connections

- Drained batteries

Most of these problems are easily avoided with diligent, routine maintenance of the visibility monitoring camera system.

Technical instructions and procedures that address these common data loss errors are provided in TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*. Extensive component troubleshooting procedures are described further in Section 4.2 and summarized in Table 4-1.

The site operator can often diagnose and solve equipment problems in the field, reducing costly site visits or loss of data. Two good practices to follow in troubleshooting are: 1) start with simple checks and then progress towards the more complicated, and 2) test the system by individual testable component.

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

1) Check the problem areas listed above and in Table 4-1.

2) Follow the component troubleshooting procedures described in the following subsections.

3) Document the results of troubleshooting so the data coordinator or field specialist can review the problem accurately.

4) Refer to the Site Operator's Manual for Automatic Visibility Monitoring Camera Systems when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

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Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Visibility Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

Table 4-1

Troubleshooting Procedures for the Minolta D12 8 mm Camera and Paragon Timer

Standard Settings Check List		
Minolta D12		**Paragon Timer**
Normal/Macro Switch	N (normal)	Time/Day-of-Week
Aperture Control Switch	A (auto)	
Manual Filter Switch	No lamp symbol (daylight position)	
Auto Exposure Adjustment Dial	Red mark (no adjustment)	
Operation/Effect Selector	N (normal)	
Frame Speed Dial	S.F. (single frame)	
Battery Master Switch	OFF	
Intervalometer	ON	
Interval Adjustment	60-second position (recommended)	

Troubleshooting Procedures		
Component to be Checked	**Checking Procedure**	**Malfunction Possibilities**
Camera/Timer Cables	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Press **C1**. Camera should fire at the set interval.	• Camera/timer wiring is incorrect (refer to TI 4120-3210). • Timer battery malfunction. • Camera/timer cable needs repair.
Camera/Timer Batteries	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing). Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.	• Timer battery/configuration is incorrect (refer to TI 4120-3210). • The timer battery power level (12 V) is insufficient or drained.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	• The timer is not in the “RUN” mode. Press **RUN** on the display panel. • The timer clock needs to be reprogrammed (refer to TI 4120-3210). • Timer battery malfunction (12 V and/or 9 V). • Timer needs repair.
	Review the programmed timer events. Press **PRG** then **C1** to select channel 1 for review. Repeat the process by pressing **C2**. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.	• The timer events need to be reprogrammed (refer to TI 4120-3210). • Timer battery malfunction. • Timer needs repair.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

4.2.1 Rapid Battery Drain

Note the date the batteries were last changed. Prior to any change, test and record the voltage of the original and replacement battery(ies). Step-by-step battery replacement procedures are provided in TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D12*.

Notify the data coordinator of any inconsistencies or ongoing battery problems observed. Most reoccurring battery drain problems require a component replacement.

CAMERA BATTERIES

The internal camera batteries have been bypassed with internal wiring that can be directly connected to the timer board terminal block marked "camera." Under normal operating conditions, the two 6 V lantern batteries last up to six months. Perform the following duties when servicing the batteries:

- Batteries may drain quickly or may be temporarily inoperable when subjected to extreme cold (less than 30°F). If during cold weather the batteries fail, attempt to warm them before replacing, especially if they were recently replaced.

TIMER

The Paragon EC72D timer runs on two 6 V lantern batteries connected in series. If this power source is low or removed, the output will de-energize but the (display) time, date, and program memory will be maintained for 100 hours by an internal 9 V alkaline battery. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

- If the timer display is blank, the timer battery configuration may be incorrect or have insufficient battery power. Premature draining of the timer lantern batteries generally indicates an electrical short in the camera/timer cable circuitry. Camera/timer wiring verification procedures are provided in TI 4120-3210.

The two 6 V lantern batteries must be properly configured to provide the required voltage (12 V) to operate the timer display and signal output. A diagram depicting the Paragon timer battery configuration is shown in TI 4120-3210.

- Notify the data coordinator of any cable malfunctions or incorrect battery configurations. Most reoccurring timer battery failures require component and/or battery replacement.

4.2.2 Improper Film Advance

Observe the film supply indicator. Document how far the film has advanced during the monitoring period. The amount of film taken during the monitoring period. The number of photographs taken is often a good indicator of what component is responsible for the film not advancing properly.

VERIFY TIMER BATTERY CABLE

Verify the timer battery cable connections:

- The timer must be in the "RUN" mode, with the time and day-of-week displayed and colon flashing.

- If the timer display is blank, or the camera does not fire, the timer battery wiring is incorrect or battery power to the timer is insufficient. Timer battery verification procedures and a diagram depicting the Paragon timer battery configuration is provided in TI 4120-3210, *Routine Site Operator Maintenance Procedures 8 mm Automatic Camera System - Minolta D12*.

- Document any discrepancies and/or corrective actions taken. Most reoccurring cabling and/or timer battery failures require component replacement.

VERIFY TIMER OPERATION

The Paragon EC72D should be in the "RUN" mode displaying the local time and day-of-week, with the colon flashing.

- If the display is incorrect press **RUN** on the display panel to verify that the timer is in the "RUN" mode. If the time, date, or display is still incorrect, reset the timer.

- Review the programmed timer events:

  - Press **PRG** then **C1** to select Channel 1 for review. In normal operation, Event 1 (E:01) is set at the desired starting time (e.g., 0800). The remaining events are not programmed.

  - Press **C2** to select Channel 2 for review. In normal operation, Event 1 (E:01) is set at the desired stopping time (e.g., 1400). The remaining events are not programmed.

  If events are incorrect, reprogram the timer clock and timer events. Timer setting and programming instructions are provided in TI 4120-3210. Press **RUN** when finished reviewing or changing events to return the timer to the "RUN" mode.

- If the timer display is blank, verify the camera/timer and timer battery cable connections, as described above. If no configuration discrepancies or cable malfunctions are evident, the timer, batteries, and cabling must be sent to ARS for evaluation and repair.

  NOTE: If the timer operations are verified during operating hours, press **C1** to resume filming.

4.2.3 Camera Misalignment

The visibility monitoring camera may fall out of alignment if the tripod is not tightened properly, if the camera enclosure is subjected to repeated vibrations (such as shaking in the wind), or if the camera enclosure is forcefully jarred. To ensure proper alignment:

- Look through the viewfinder. Verify that the vista alignment matches the site-specific alignment photograph provided in the site operator's manual and on the enclosure door.

- Tighten all tripod levers and mounting screws as firmly as possible. A figure depicting the automatic camera system tripod assembly is provided in TI 4120-3210, *Routine Site Operator Maintenance Procedures 8 mm Automatic Camera System - Minolta D12*.

- If the tripod appears to be defective or the tripod levers are stripped from wear, notify ARS for a replacement.

4.2.4 Enclosure Leakage

If water or large amounts of dust are found inside the camera enclosure:

- Make sure that all perimeter clamps on the enclosure are firmly tightened after every visit. The enclosure is designed to seal out the elements and should do so if all clamps are secure.

- To determine where leaks may be occurring, examine the sealant at enclosure joints (the tops and sides of the sunshield and around the window and portal perimeters). If obvious, attempt to correct the problem and/or call ARS to discuss possible solutions. An enclosure diagram is provided in TI 4120-3210.

- Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.

- Condensation on the inside of the enclosure window is a common problem during periods of high humidity. Packages of desiccant (a substance that absorbs moisture) are available from ARS by request. When placed inside the enclosure and changed frequently, desiccant greatly reduces the amount of condensation.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period or by pressing **C1** on the timer panel. The camera should fire at the set interval. Refer to TI 4120-3210, for complete system verification procedures.

Verify the system periodically between scheduled site visits to insure ongoing operation. The data coordinator will review all processed film as soon as possible to ensure correct film exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a camera-related problem or is not available to address the malfunction, ARS ships a backup camera system or system component to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning unit to ARS for evaluation and repair. All camera systems returned to ARS are routinely cleaned and lubricated, and automatic exposures are calibrated before being placed back into service.

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged enclosure, camera, and/or automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**BIANNUAL LABORATORY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEMS**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3500**
DATE	**DECEMBER 1993**

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QA MANAGER	Gloria S. Mercer	
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Add discussion regarding assessment log.	April 1996	

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LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

The purpose of biannual laboratory maintenance is to assure quality data capture and minimize data loss by performing maintenance procedures that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes biannual laboratory maintenance procedures for 35 mm camera systems.

Maintaining the visibility monitoring camera system includes preventive maintenance by a factory-authorized repair facility to ensure the system will continue to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following scheduled maintenance tasks:

- Notification by the data coordinator that the biannual laboratory maintenance is due
- Installation of replacement camera system component(s)
- Mailing the original camera system to Air Resource Specialists, Inc. (ARS) for maintenance procedures

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems, which contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer's instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between ARS and site operators throughout all monitoring and scheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the schedule and requirements for biannual maintenance.

2.2 DATA COORDINATOR

The data coordinator shall:

- Coordinate the replacement of camera systems.
- Coordinate all aspects of biannual camera maintenance.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.3 SITE OPERATOR

The site operator shall:

- Perform all on-site procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet and mail the white copy of the completed sheet to the data coordinator.
- Report any noted inconsistencies immediately to the data coordinator.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to remove the original camera system and install a replacement system include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera and timer batteries
- Watch
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - Technical instructions for routine site operator maintenance procedures
  - Technical instructions for troubleshooting and emergency maintenance procedures
  - Automatic 35 mm Camera System User's Manual
  - Manufacturer's instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film canister labels

- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of biannual maintenance be thoroughly documented. Specific model and serial numbers of the exchanged camera body, lens, databack, and timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Biannual Laboratory Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes biannual laboratory maintenance to ensure the system continues to function properly. The biannual laboratory maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- The data coordinator contacts the site operator to inform him/her of the scheduled maintenance date.
- The data coordinator ships the replacement camera system along with a Photographic Monitoring Network Quality Assessment Log. When received, the site operator exchanges the systems and ships the system in need of servicing to ARS, and documents the exchange on the log. The documentation should include:
  - Date of installation
  - Steps taken to test system components
  - Current operational status
- All biannual laboratory maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration.

4.1 GENERAL INFORMATION

Internal quality assurance of automatic camera equipment is based primarily on visual review of processed visibility monitoring film. Film handling and review procedures are fully discussed in SOP 4305, *Collection of Scene Monitoring Photographs and Film (IMPROVE Protocol)*. Alignment, exposure, and data collection efficiency can all be assessed from processed film.

Operational camera systems are biannually cycled out of the monitoring network. Enclosures remain in place and the cameras and timers are cycled for laboratory maintenance. The laboratory maintenance ensures that the camera systems are in good working order, minimizing down time and data loss.

Throughout the monitoring effort, ARS and site operators should maintain close personal communications. Site operators should call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

4.2 BIANNUAL LABORATORY MAINTENANCE PROCEDURES

4.2.1 Equipment Exchange

The data coordinator will notify the site operator regarding the equipment exchange date. At that time, the specifics regarding replacement camera system installation and returning camera system shipping will be discussed.

The current camera system at the site (including the camera, timer, and all cables) should be removed at the next site visit following receipt of a replacement system. Perform the following steps when reinstalling:

- Load a new roll of film in the replacement camera and verify that all settings are correct. A more detailed description of preparing a camera system is presented in the technical instructions for routine site operator maintenance procedures (appropriate for each camera model).

- After taking the documentation photograph, attach the camera-timer cable and mount on the tripod head.

- Attach the timer/battery cable. Program the timer to the correct settings.

- Verify that the system is working (see Section 4.3).

- Pack the camera system requiring servicing according to the data coordinator's specifications.

- Ship the system to ARS.

4.2.2 Factory-Authorized Laboratory Maintenance

Automatic camera system maintenance is normally provided by local factory-authorized repair facilities capable of performing the following:

- Completely disassembling and thoroughly cleaning the camera, including pivot points and shutter bearings

- Troubleshooting and repairing any noted problems so that the system fully meets or exceeds the manufacturer's specifications

- Relubricating to factory specifications and reassembling

- Testing shutter speed and curtain travel time at room temperature and 25°F

- Checking the meter readout and auto exposure

- Checking the diaphragm operation and film transport

- Testing electrical current consumption

A work order accompanies each camera system to the factory-authorized repair facility. An example of a work order is presented as Figure 4-1. After repair, Camera Meter Test Logs are returned to ARS along with the camera system; an example Camera Meter Test Log is presented as Figure 4-2.

4.2.3 In-House Laboratory Maintenance

The following tests are performed on timers and cables at ARS:

- Timer exteriors are visually inspected and cleaned.

- Timers are disassembled and the interiors visually inspected and cleaned.

- All solder points are checked.

- Replacement batteries are installed.

- A continuity test is performed on all cables with a voltmeter.

- A final system verification check is performed (see Section 4.3).

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FRONT RANGE CAMERA REPAIR
WORK ORDER

DATE _____

PROJECT _____ P.O.# _____
ISSUED BY _____ INV. # _____
INVOICE ARS _____ AMOUNT $ _____

INSTRUCTIONS _____
_____
_____
_____

DATE NEEDED BY _____
_____

****

WORK DONE _____
_____

EXPOSURE TESTS SUMMARY: AMBIENT _____
COLD _____ HOT _____
CURRENT DRAW RESULTS: IDLE _____
SHUTTER _____ METER _____
DATE COMPLETED _____ BY _____

****

FOLLOW UP TESTS _____
_____

EQUIPMENT DISPOSITION _____

Figure 4-1. Example Factory-Authorized Work Order.

FRONT RANGE CAMERA REPAIR
CAMERA METER TEST

DATE: _____
TEMP: _____

BODY

_Canon EOS 630 _Contax 137MA
_Contax 167MT _Olympus OM2N
_Olympus OM2S

LENS

_Canon _Yashica _Olympus
_50mm _135mm
Other:_____

Serial #:_____ Serial #:_____

METERING COMMENTS: _____
_____

SHUTTER SPEEDS								
Indicated	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8
Opening								
Closing								
Overall								

METER READOUT ASA 25						
EV	15	14	12	11	9	6
Error						
Shutter Speed						
Aperture						

	EV15	EV12	EV9	EV6
Aperture	error/sh. sp.	error/sh. sp.	error/sh. sp.	error/sh. sp.
22.0	/	/	/	/
16.0	/	/	/	/
11.0	/	/	/	/
8.0	/	/	/	/
5.6	/	/	/	/
4.0	/	/	/	/
2.8	/	/	/	/

CURRENT DRAW

IDLE
COLD _____
HOT _____

SHUTTER
COLD _____
HOT _____

METER
COLD _____
HOT _____

Figure 4-2. Example Camera Meter Test Log.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings is made following any system maintenance. The entire camera system is assembled, tested, and stored at ARS until needed. Refer to the technical instructions for routine site operator maintenance procedures for 35 mm automatic camera system (appropriate camera model), for complete system verification procedures.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

It is imperative that any capital instrumentation changes made as a result of laboratory maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the enclosure, camera body, lens, databack, and automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**BIANNUAL LABORATORY MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC TIME-LAPSE CAMERA SYSTEMS**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4120-3510**
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
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LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

The purpose of biannual laboratory maintenance is to assure quality data capture and minimize data loss by performing maintenance procedures that will verify proper system operation and/or quickly identify the probable source of an automatic time-lapse camera system malfunction. This technical instruction (TI) describes biannual laboratory maintenance procedures for 8 mm time-lapse camera systems.

Maintaining the visibility monitoring camera system includes preventive maintenance by a factory-authorized repair facility to ensure the system will continue to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following scheduled maintenance tasks:

- Notification by the data coordinator that the biannual laboratory maintenance is due
- Installation of replacement camera system component(s)
- Mailing the original camera system to Air Resource Specialists, Inc. (ARS) for maintenance procedures

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems, which contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer's instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between ARS and site operators throughout all monitoring and scheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the schedule and requirements for biannual maintenance.

2.2 DATA COORDINATOR

The data coordinator shall:

- Coordinate the replacement of camera systems.
- Coordinate all aspects of biannual camera maintenance.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.3 SITE OPERATOR

The site operator shall:

- Perform all on-site procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet and mail the white copy of the completed sheet to the data coordinator.
- Report any noted inconsistencies immediately to the data coordinator.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to remove the original camera system and install a replacement system include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera and timer batteries
- Watch
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
  - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
  - Technical instructions for routine site operator maintenance procedures
  - Technical instructions for troubleshooting and emergency maintenance procedures
  - Automatic 8 mm Time-Lapse Camera System User's Manual
  - Manufacturer's instruction booklets
  - Visibility Monitoring Status/Assessment Sheets
  - Film cartridge labels

- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of biannual maintenance be thoroughly documented. Specific model and serial numbers of the exchanged camera body and timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Biannual Laboratory Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes biannual laboratory maintenance to ensure the system continues to function properly. The biannual laboratory maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- The data coordinator contacts the site operator to inform him/her of the scheduled maintenance date.
- The data coordinator ships the replacement camera system along with a Photographic Monitoring Network Quality Assessment Log. When received, the site operator exchanges the systems and ships the system in need of servicing to ARS, and documents the exchange on the log. The documentation should include:
  - Date of installation
  - Steps taken to test system components
  - Current operational status
- All biannual laboratory maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference.

A variety of automatic time-lapse camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration.

4.1 GENERAL INFORMATION

Internal quality assurance of automatic time-lapse camera equipment is based primarily on visual review of processed visibility monitoring film. Film handling and review procedures are fully discussed in SOP 4305, *Collection of Scene Monitoring Photographs and Film (IMPROVE Protocol)*. Alignment, exposure, and data collection efficiency can all be assessed from processed film.

Operational camera systems are biannually cycled out of the monitoring network. Enclosures remain in place and the cameras and timers are cycled for laboratory maintenance. The laboratory maintenance ensures that the camera systems are in good working order, minimizing down time and data loss.

Throughout the monitoring effort, ARS and site operators should maintain close personal communications. Site operators should call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

4.2 BIANNUAL LABORATORY MAINTENANCE PROCEDURES

4.2.1 Equipment Exchange

The data coordinator will notify the site operator regarding the equipment exchange date. At that time, the specifics regarding replacement camera system installation and returning camera system shipping will be discussed.

The current camera system at the site (including the camera, timer, and all cables) should be removed at the next site visit following receipt of a replacement system. Perform the following steps when reinstalling:

- Load a new roll of film in the replacement camera and verify that all settings are correct. A more detailed description of preparing a camera system is presented in the technical instructions for routine site operator maintenance procedures (appropriate for each camera model).

- Mount the camera on the tripod head and attach the camera cable to the timer.

- Attach the timer/battery cable. Program the timer to the correct settings.

- Verify that the system is working (see Section 4.3).

- Pack the camera system requiring servicing according to the data coordinator's specifications.

- Ship the system to ARS.

4.2.2 Factory-Authorized Laboratory Maintenance

Automatic time-lapse camera system maintenance is normally provided by local factory-authorized repair facilities capable of performing the following:

- Completely disassembling and thoroughly cleaning the camera, including pivot points and shutter bearings
- Troubleshooting and repairing any noted problems so that the system fully meets or exceeds the manufacturer's specifications
- Relubricating to factory specifications and reassembling
- Testing shutter speed and overall exposure quality
- Checking the film transport operation
- Testing electrical current consumption

A work order accompanies each camera system to the factory-authorized repair facility. An example of a work order is presented as Figure 4-1.

4.2.3 In-House Laboratory Maintenance

The following tests are performed on timers and cables at ARS:

- Timer exteriors are visually inspected and cleaned.
- Timers are disassembled and the interiors visually inspected and cleaned.
- All solder points are checked.
- Replacement batteries are installed.
- A continuity test is performed on all cables with a voltmeter.
- A final system verification check is performed (see Section 4.3).

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings is made following any system maintenance. The entire camera system is assembled, tested, and stored at ARS until needed. Refer to the technical instructions for routine site operator maintenance procedures for 8 mm automatic camera system (appropriate camera model), for complete system verification procedures.

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FRONT RANGE CAMERA REPAIR
WORK ORDER

DATE _____

PROJECT _____ P.O.# _____
ISSUED BY _____ INV. # _____
INVOICE ARS _____ AMOUNT $ _____

INSTRUCTIONS _____
_____
_____
_____

DATE NEEDED BY _____
_____

****

WORK DONE _____
_____

EXPOSURE TESTS SUMMARY: AMBIENT _____
COLD _____ HOT _____
CURRENT DRAW RESULTS: IDLE _____
SHUTTER _____ METER _____
DATE COMPLETED _____ BY _____

****

FOLLOW UP TESTS_____
_____

EQUIPMENT DISPOSITION
_____

Figure 4-1. Example Factory-Authorized Work Order.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

It is imperative that any capital instrumentation changes made as a result of laboratory maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the enclosure, camera body, and automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT DNPP - SONY SSC-S20 CAMERA, PANASONIC AG-6740 SVHS VCR, AND PANASONIC CT1384Y MONITOR** **TECHNICAL INSTRUCTION**
NUMBER	**4120-3650**
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REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance of the time-lapse video monitoring system. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the DNPP SVHS time-lapse video monitoring system comprised of a Sony SSC-20 video camera, environmental enclosure, Panasonic AG-6740 SVHS time-lapse VCR, and a Panasonic CT1384Y color monitor.

The site operator should service the video system approximately every 7 days and change the videotape cassette every 14 days. During each site visit the operator should check the performance of the video system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the project manager. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Review status/assessment sheets.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Train the site operator in all phases of video system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.

- Thoroughly document all procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.
- Package videotapes with status/assessment sheets and mail to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring system consists of a camera assembly and a video recording assembly. The components included in each assembly are:

Camera assembly components:

- Color video camera
- Environmental enclosure for the video camera with the following accessories:
  - heater
  - sun shroud
  - pole mount
  - pan/tilt mount

Video recording assembly components:

- Heated shelter
- Color review monitor
- SVHS time-lapse video recorder
- UPS power supply
- Miscellaneous cables, connectors, etc.

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure and padlocks

- Digital watch synchronized to National Institute of Standards and Technology (NIST) Time (303/499-7111)

- Time-Lapse Video Monitoring Field Procedures Notebook containing:

  - TI 4120-3650, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*

  - TI 4120-3750, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*

  - Manufacturer's instruction booklets

  - Time-Lapse Video Monitoring Status/Assessment Sheets

  - Videotape cassette labels

- Pen or pencil

- Optical cleaning supplies

- Supplemental SVHS videotape cassettes

- Padded mailing envelopes

3.2 INVENTORY

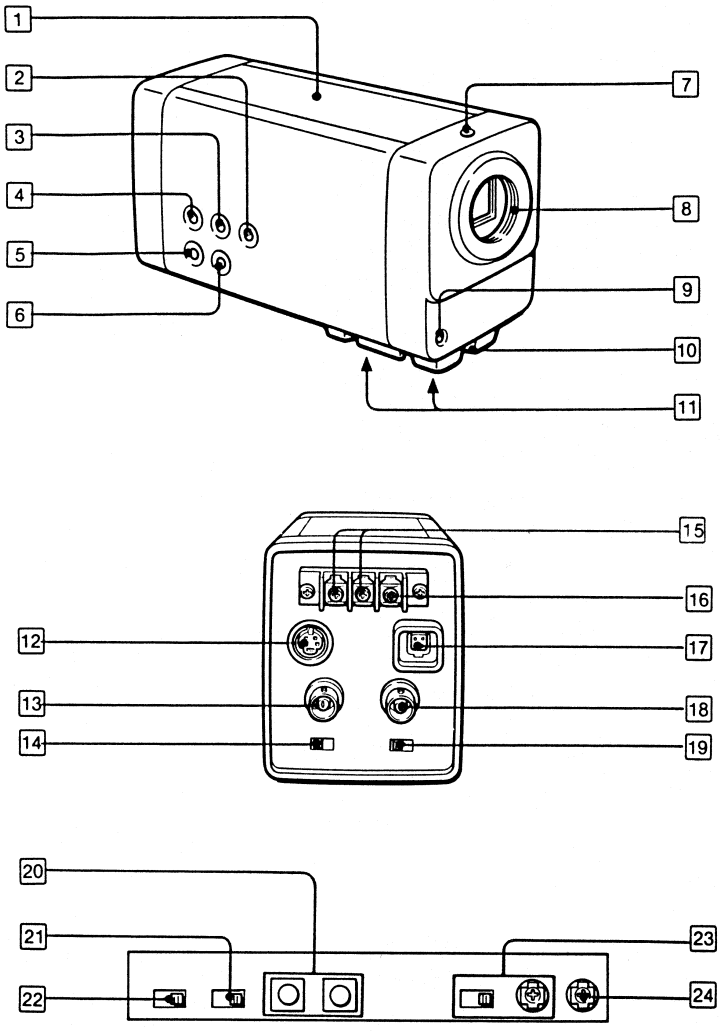
It is imperative that any capital instrumentation changes made as a result of routine or remedial maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, recorder, and/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3750, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor.*

4.0 METHODS

This section includes four (4) major subsections:

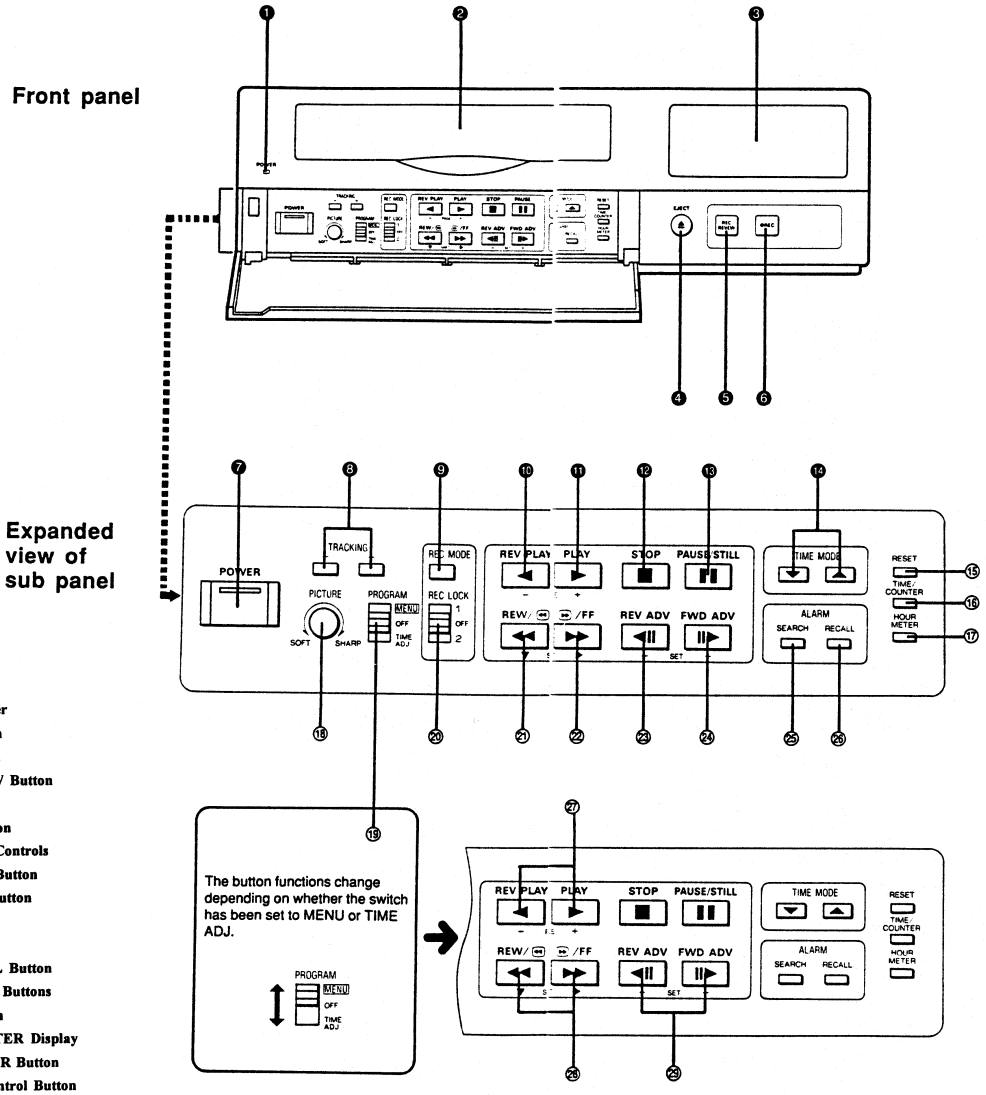
4.1 Routine Servicing
4.2 Changing the VCR Operating Times
4.3 Scheduled Preventive Maintenance
4.4 Videotape Storage

All procedures described in this TI refer to the Sony SSC-S20 camera with Panasonic AG-6740 SVHS VCR and Panasonic CT1384Y color monitor. Schematic diagrams of the video system components are provided as Figures 4-1 through 4-3.



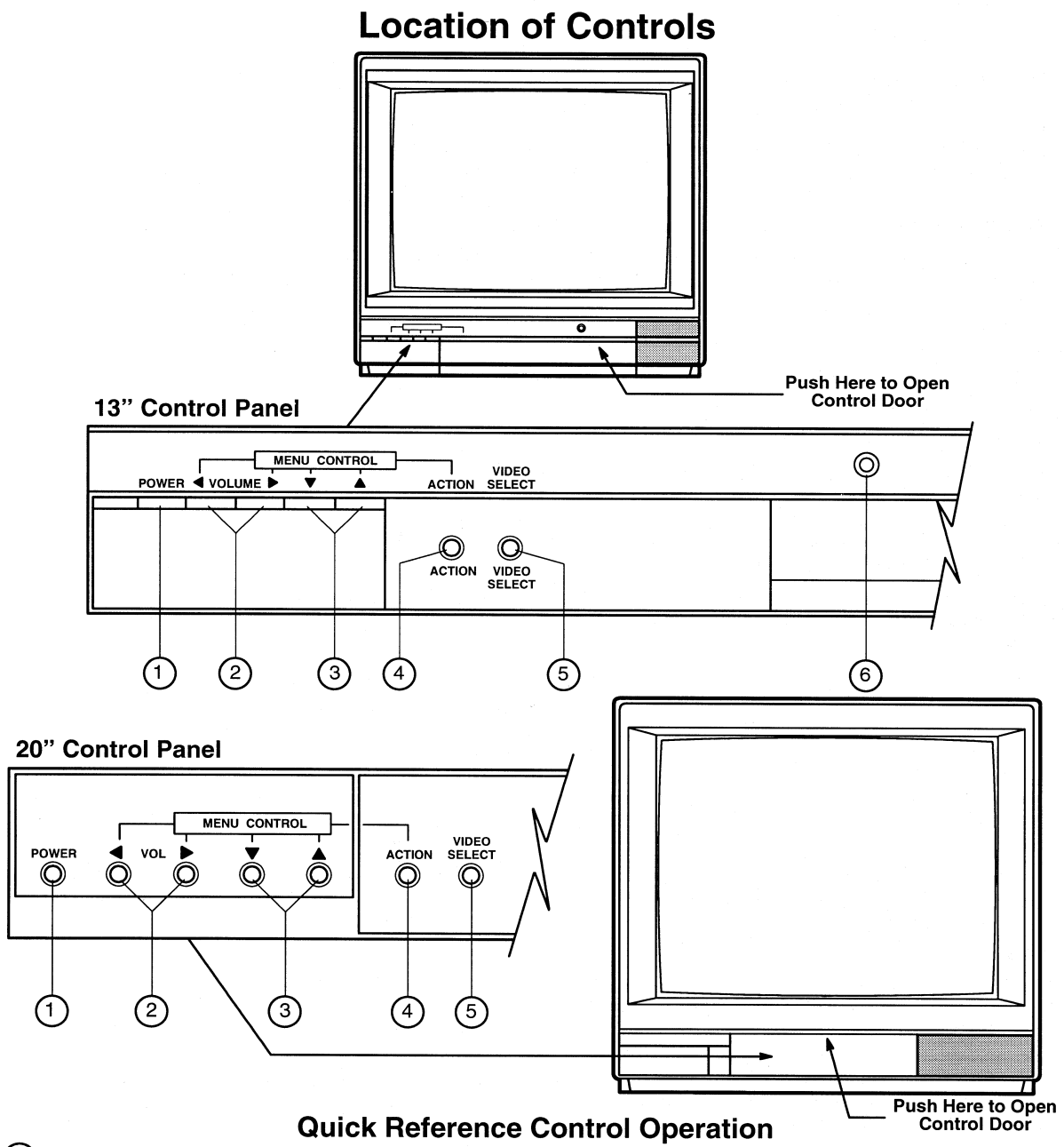
1. Top Panel
2. AGC (Automatic Gain Control)
3. SHUTTER Speed Button
4. WHITE Balance Button
5. DATE/TIME button
6. SET Button
7. Flange focal length adjustment screw
8. Lens mount
9. Power lamp
10. Mount adapter
11. Mounting screw holes
12. S VIDEO OUT connector
13. VIDEO OUT connector
14. T.D. Display
15. AC 24 V IN/DC 12 V IN terminals
16. GND (chassis ground) terminal
17. LENS Connector
18. GEN LOCK IN connector
19. MODE Selector
    - LOCK: The pre-adjusted modes are locked and the buttons are inoperative.
    - ADJ: Allows changing of settings.
    - AUTO: Automatic adjustment. Shutter = 1/60, AGC = ON, WHITE Balance = AUTO
20. CAMERA ID NO. Buttons
21. CAMERA ID NO. Switch
22. BACK UP Switch
23. SC (subcarrier) PHASE switch and control
24. H (horizontal) PHASE control

Figure 4-1. Sony CCD Camera Control Schematic.



1. Power Lamp
2. Cassette Holder
3. Display section
4. EJECT button
5. REC REVIEW Button
6. REC Button
7. POWER Button
8. TRACKING Controls
9. REC MODE Button
10. REV PLAY Button
11. PLAY Button
12. STOP Button
13. PAUSE/STILL Button
14. TIME MODE Buttons
15. RESET Button
16. TIME/COUNTER Display
17. HOUR METER Button
18. PICTURE Control Button
19. PROGRAM Switch
20. REC Lock Switch
21. REW Button
22. FF Button
23. FIELD ADV (REV) Button
24. FIELD ADV (FWD) Button
25. ALARM SEARCH Button
26. ALARM RECALL Button
27. PAGE Buttons
28. SHIFT Buttons.
29. SET Buttons

Figure 4-2. Panasonic AG-6740 Time-Lapse VCR Control Schematic.



Quick Reference Control Operation

1. **Power Button –** Press to turn ON or OFF.
2. **VOL (Volume) Buttons –** Press to adjust Sound Level. Press to adjust Video Menus and select operating features when menus are displayed.
3. **Up/Down Buttons –** Press to select desired features when menus are displayed.
4. **Action Button –** Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.
5. **Video Select Button –** Press to select one of three Video Inputs.
6. **Earphone Jack (13" Model only) –** Plug in an optional earphone for private monitoring of sound. Insertion of the earphone plug automatically cuts–off the TV speaker for personal listening. This jack accepts an earphone with an 1/8" mini plug.

Figure 4-3. Panasonic CT1384Y Color Monitor Schematic.

4.1 ROUTINE SERVICING

Weekly site visits are required to properly maintain and service the time-lapse video monitoring system. Weekly system servicing by the site operator includes:

- Inspecting and cleaning the camera assembly components and shelter.
- Inspecting the video recording assembly components and shelter.
- Verifying camera alignment.
- Reviewing videotape contents.
- Securing the system.
- Documenting the servicing visit on a Time-Lapse Video Monitoring Status/Assessment Sheet.

Biweekly videotape servicing by the site operator includes:

- Reviewing videotape contents.
- Removing recorded videotape.
- Loading new videotape.
- Documenting the videotape servicing procedures on a Time-Lapse Video Monitoring Status/Assessment Sheet.
- Mailing recorded videotape with the Time-Lapse Video Monitoring Status/Assessment Sheet to ARS.

Proper documentation of each servicing visit performed on the status/assessment sheet is required. A properly completed status/assessment sheet must accompany each videotape cassette mailed to ARS.

4.1.1 Completing the Time-Lapse Video Monitoring Status/Assessment Sheet

Figure 4-4 presents an example Time-Lapse Video Monitoring Status/Assessment Sheet for the DNPP and Garner Hill Monitoring Sites. The top section of the sheet requires information pertinent to tracking the videotape and system servicing performed during the recording period. The body of the sheet has checkboxes for each of the required system and videotape servicing procedures. Each status/assessment sheet covers three site visits; the videotape loading visit, the interim weekly servicing visit, and the videotape removal visit. The site operator should check off the procedures performed during these three visits in columns 1, 2, and 3, respectively.

TIME-LAPSE VIDEO MONITORING STATUS/ASSESSMENT SHEET
DNPP AND GARNER HILL MONITORING SITES

Location: _____ Tape No. _____

Operator: _____

Date/Time of Site Visits #1:_____ ___:____ #2:_____ ___:____ #3:_____ ____:___

Check procedures performed during each site visit in the appropriate column.

		#1	#2	#3	Comments
VIDEOTAPE LOADED					
Labeled videotape cassette		☐			_____
Loaded videotape		☐			_____
OPERATION/MAINTENANCE CHECK					
DNPP:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified camera sled alignment	☐	☐	☐	_____
	Verified adjustable head alignment	☐	☐	☐	_____
	Inspected video recording assembly	☐	☐	☐	_____
	Record tape counter #	#_____	#_____	#_____	_____
	Verified recorded image, date, and time	☐	☐	☐	_____
	****Proceed to VIDEOTAPE REMOVAL section if changing tape****				
	Repositioned tape	☐	☐	☐	_____
Garner Hill:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified pan/tilt head alignment	☐	☐	☐	_____
CHECK OPERATION SETTINGS					
INT TIMER displayed		☐	☐	☐	_____
REC displayed		☐	☐	☐	_____
(appears only if activated during recording hours)					
SECURE SYSTEM					
DNPP:	Secured camera assembly	☐	☐	☐	_____
	Secured video recording assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
Garner Hill:	Secured camera assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
VIDEOTAPE REMOVAL					
Removed videotape				☐	_____
Completed videotape cassette label				☐	_____
Mailed videotape and assessment sheet to ARS				☐	_____

ADDITIONAL COMMENTS/ACTIONS TAKEN: _____

_____

SUPPLIES NEEDED: _____

_____

Enclose this Status/Assessment Sheet with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Time-Lapse Video Monitoring Status/Assessment Sheet for the DNPP and Garner Hill Monitoring Sites.

The comment column is to be used by the operator to note any inconsistencies or general observations during each visit. Comments concerning heavy dirt buildup, camera misalignment, power failure during the servicing visit, etc., are appropriate here. It is extremely important that the site operator properly complete the Time-Lapse Video Monitoring Status/Assessment Sheet and enclose it with each videotape mailed to ARS.

4.1.2 System Servicing and Videotape Servicing Procedures

The site operator should complete the following procedures during each system servicing and videotape servicing visit. A generic, quick-look reference guide that summarizes these procedures is also provided to the operator. A copy of this quick reference, titled "Automatic Time-Lapse Video Monitoring System Users Manual" is provided in Appendix A.

INSPECT AND SERVICE CAMERA ASSEMBLY	Inspect and evaluate the camera assembly for any physical damage or abnormality. If damage is found, note it on the status/assessment sheet and call the ARS data coordinator. Clean the camera assembly enclosure exterior viewport with the supplied wipes and cleaning solution. The inside of the enclosure viewport should be inspected and cleaned only if visual inspection from the outside indicates that dirt has accumulated on the inside. To clean the inside surface of the viewport, open the Pelco camera enclosure door by inserting the key in the latch on the top-rear of the enclosure and lifting the lid. Loosen the two Phillips-head screws holding the camera mount and slide the camera back from the viewport. Clean the viewport with supplied wipes and cleaning solution. Inspect the camera lens and clean similarly if necessary. Inspect the camera enclosure air filter for any accumulation of dust or debris. The filter is a thin, gray foam material approximately 2" x 1" and is located under the viewport. If necessary, remove and clean with water. Shake out excess water (or dry) and replace.
VERIFY CAMERA ASSEMBLY ALIGNMENT	Verify and/or realign the camera assembly sled mount to the marks provided. Tighten all associated screws. Close the housing lid and properly secure the assembly. Verify that the camera assembly manual pan/tilt head is aligned properly by inspecting the alignment marks and viewing the image on the control monitor. If alignment is not correct, loosen the pan/tilt adjustment bolts and realign. Two bolts control the azimuth (vertical) alignment and one bolt controls the bearing (horizontal) alignment. Tighten the bolts snugly when alignment is complete.

Note any alignment changes on the status/assessment sheet. The camera view alignment must match the photograph provided in the "Site Specifications" section of the Time-Lapse Video Monitoring Field Procedures Notebook.

INSPECT AND SERVICE VIDEO RECORDING ASSEMBLY

Inspect the exterior and interior of the video recording assembly shelter and cables for any physical damage or abnormality. Observe and note on the status/assessment sheet the current recorder settings and status of any associated environmental control components (i.e., heater, air conditioner, power supply).

If anything suspicious is found, note it on the status/assessment sheet and call the ARS data coordinator for instructions.

REVIEW VIDEOTAPE

Turn the video recording assembly monitor ON. Stop the recorder by pressing the **REC MODE** button until the recording mode in the display is blank (i.e., INT TIMER is not displayed). Press the **STOP** button. The recording symbol (**REC**) and forward arrow (▷) should no longer be displayed. Document the current date, time, and tape counter number on the status/assessment sheet.

Do not eject the videotape. Press **REV PLAY** to rewind a small amount of videotape. Play the videotape (press **PLAY**) to verify that proper picture quality, the correct date and time, and field of view have been recorded. Press **STOP** at the point where the recording ends. Document any inaccuracies found on the status/assessment sheet. If necessary, contact the ARS data coordinator for further instructions.

If continuing on the same videotape, return the videotape to its original position. Verify proper tape positioning by using the block counter on the recorder display and observing the recorded image on the monitor. Use the **PAUSE/STILL**, **REV ADV**, and **FWD ADV** buttons to move videotape in single frame increments if necessary. Skip the "Removing and Changing Videotapes" step and proceed to "Start the Automatic Recording Sequence" step below. Turn the monitor OFF.

REMOVING AND CHANGING VIDEOTAPES

If making a videotape change, remove the tape from the recorder by pressing the **EJECT** button. Complete the videotape cassette label and status/assessment sheet; denote date, time, and videotape counter number when the tape was removed. An example videotape cassette label is provided as Figure 4-5.

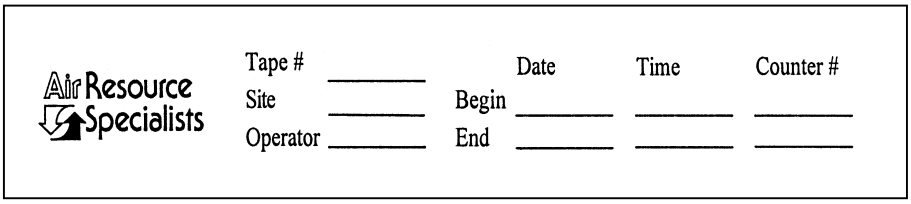


Figure 4-5. Example Videotape Cassette Label.

Complete a new videotape cassette label with the date, time, and tape counter number (should be 0000 for a new videotape) and place it on the spine of the new videotape to be inserted. Load the videotape into the VCR. Press the **TIME/COUNTER** button to show the counter, then the **RESET** button.

START THE AUTOMATIC RECORDING SEQUENCE

After the videotape has been positioned properly, restart the automatic recording sequence of the VCR by pressing the **REC MODE** button until INT TIMER is seen on the recorder display. If the recorder is placed in "Internal Timer Mode" during a scheduled recording period, REC (**REC**) will also appear in the display. If the recorder is placed in "Internal Timer Mode" during a scheduled non-recording period, the VCR will not begin recording immediately. Turn the monitor OFF.

SECURE SYSTEM

Carefully verify that the camera assembly, video recording assembly, and any other access to the time-lapse video system is secured and locked.

4.1.3 Reporting Problems to ARS

If at any time operational problems or mechanical failure occurs, contact ARS immediately at the following:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Telephone: 970/484-7941
Fax: 970/484-3423

4.2 CHANGING VCR OPERATING TIMES

This section provides instructions for changing the daily start and stop time of the Panasonic AG-6740 time-lapse recorder. Time changes are required to adjust for the variation in day length throughout the year. Site-specific times for this monitoring site are presented in Table 4-1. Timer changes should take place on the first of each month.

Table 4-1

VCR Monthly Recording Start/Stop Timer Settings
Healy Clean Coal Project, Post-Construction Visibility Monitoring Program

Healy, Yukon-Koyukuk County, Alaska (longitude W149.0° latitude N63.9°)												
Adjustment Date	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	1-Dec
Video Start*	08:30	07:00	05:30	03:30	00:00	00:00	00:00	02:30	04:30	06:00	07:30	09:30
Video Stop*	18:00	19:00	20:30	22:30	00:00	00:00	00:00	00:00	21:00	19:00	17:30	16:00

* All times are in Standard Time. Do not set the VCR time to Daylight Saving Time.

Sunrise/Sunset Reference Table

Date	31-Jan	28-Feb	31-Mar	30-Apr	31-May	22-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	22-Dec
Standard/daylight	AST	AST	AST	ADT	ADT	ADT	ADT	ADT	ADT	ADT	AST	AST
Begin civil twilight	08:40	07:18	05:29	04:27				03:39	05:47	07:18	07:45	09:29
Sunrise	09:37	08:06	06:18	05:33	03:58	03:31	03:40	05:06	06:39	08:05	08:38	10:46
Sun transit	13:09	13:08	13:00	13:53	13:54	13:58	14:00	14:02	13:56	13:45	12:39	12:55
Sunset	16:43	18:12	19:44	22:15	23:51	00:25	00:18	22:56	21:10	19:25	16:40	15:03
End civil twilight	17:40	19:00	20:34	23:23				00:20	22:02	20:12	17:33	16:20

Source:
U.S. Naval Observatory, Astronomical Applications Department
http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html

The following instructions are intended as a guide. If difficulty is encountered completing this process, refer to page 51 of the Panasonic AG-6740 time-lapse recorder manufacturer's manual. The operator should not attempt to change any other parameters in the VCR setup without direct instruction from the ARS data coordinator.

NAVIGATING THE VCR MENU SCREENS

The REV PLAY, PLAY, REW, and FF, REV ADV, and FWD ADV buttons on the front panel of the VCR serve a secondary programming purpose when in the VCR programming menu mode. There are six (6) menu screens with multiple options on each menu screen to choose from when in the programming mode. Use the gold labels under these buttons to navigate through the menus as follows:

- Place the VCR in "program mode" by sliding the PROGRAM switch to **MENU**.
- Page through the six menu screens using **REV PLAY** (-) or **PLAY** (+).
- Scroll through items on a menu screen using **REW** (▼) or **FF** (►).
- Set the value of an item on a screen using **REV ADV** (-) or **FWD ADV** (+).

SETTING THE DAILY START AND STOP TIMES

Using the navigation techniques described above, select the "Internal Timer Rec" menu. Scroll down to the DLY line and set the start and stop times as specified in Table 4-1.

Note: The VCR and all recording times are kept in standard time (i.e., DO NOT SET THE VCR TIME TO DAYLIGHT SAVING TIME).

Record the change on the status/assessment sheet.

4.3 SCHEDULED PREVENTIVE MAINTENANCE

Proper videotape storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator or project manager.

Additional servicing tasks identified by the data coordinator may include:

- Camera, VCR, monitor, or cable changes.
- Camera alignment changes.
- Revision of data collection procedures.

All scheduled preventive maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Time-Lapse Video Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

4.4 VIDEOTAPE STORAGE

To ensure proper storage, keep all videotapes in an environmentally controlled location (e.g., cool and dry). Do not store videotapes in a freezer or vehicle at any time.

Videotapes, like photographic film, are sensitive to heat and moisture. These elements can affect the videotape, altering both the quality of images and the data analysis. For example, videotape subjected to heat often has a pink or purple cast while videotape subjected to moisture has a streaky or grainy consistency.

APPENDIX A

Automatic Time-Lapse Video Monitoring System

Users Manual

AUTOMATIC TIME-LAPSE VIDEO MONITORING SYSTEM

USERS MANUAL

INTRODUCTION

Source surveillance of visible emissions is a useful enforcement tool in any pollution control program. The information gathered from time-lapse video surveillance allows a control agency to document and better understand the dynamics of source emissions. The Automated Time-Lapse Video Monitoring System can be programmed to begin and end recording at user specified times and record time-lapse images of a user specified view on video cassette for user selected time-lapse intervals. Site specific system settings and recording protocols are documented in the *Time-Lapse Video Monitoring Field Procedures Notebook*.

This manual summarizes routine maintenance procedures. It is intended to supplement detailed operating instructions found in the Time-Lapse Video Monitoring Field Procedures Notebook, and associated manufacturers instruction manuals. All routine maintenance and servicing activity should be recorded on the *TIME LAPSE VIDEO MONITORING SITE VISIT STATUS/ASSESSMENT SHEET* provided with each completed tape cassette.

SYSTEM HARDWARE

The system hardware for this installation is shown on page 3 of this user's manual.

FORMS AND SUPPLIES

The following items are necessary for efficient operation of the time-lapse camera system. **Store them in a location accessible to all system operators.** Always keep this manual, Status/Assessment Sheets, and tape cassette labels in the video recording assembly enclosure.

- W Time-Lapse Video Monitoring Field Procedures Notebook
- W Automatic Time-Lapse Video Monitoring System Users Manual
- W Video Camera Operating Instructions
- W Panasonic VCR Operating Instructions
- W Panasonic Color Monitor Operating Instructions
- W S-VHS Video Tape Cassette(s)
- W Time-Lapse Video Monitoring Site Visit Status/Assessment Sheets
- W Tape Cassette Labels
- W Padded Mailing Envelopes
- W Optical Cleaning Supplies
- W Tools

TAPE STORAGE

To ensure proper tape storage, keep all tapes in a environmentally controlled location (e.g. cool, dry). Do not store film in a freezer or vehicle at any time.

ROUTINE MAINTENANCE

A Status/Assessment Sheet must accompany each tape cassette. Document each site visit and the servicing maintenance performed in the appropriate section of the assessment sheet. Complete the following steps during tape loading, system maintenance, and tape removal.

Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat the following steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site are denoted in SMALL CAPITAL LETTERS.

1. **System Condition** - Inspect the camera assembly, video recording assembly, and cables for any physical damage or abnormality. If damage is found, call the ARS photographic data coordinator for instructions and note it on the *Status/Assessment Sheet*.

2. **Clean Camera Assembly** - Clean the camera assembly enclosure view port with the supplied wipes and cleaning solution. The inside of the enclosure view port should be inspected and cleaned only if necessary.

   To clean the inside surface of the view port, open the housing door by

turning the knob on top and lifting the lid. Loosen the 2 phillips head screws holding the camera mount and slide the camera back from the view port. Clean the view port. Also inspect the camera lens and clean if necessary.

Inspect the camera enclosure air filter for any accumulation of dust or debris. If necessary, remove and clean with water. Shake out excess water (or dry) and replace.

3. **Verify Camera Assembly Alignment -** Verify or realign the camera sled mount to the marks provided. Tighten all associated screws. Close the housing lid and properly secure the assembly.

   Verify that the camera assembly adjustable head is aligned properly by inspecting the alignment marks outside of the enclosure. If alignment is not correct, loosen the mounting bolts and realign. Tighten the bolts snugly when alignment is complete.

Note any alignment changes on the Status/Assessment Sheet. Any major alignment changes should also be noted in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook.

4. **Inspect Video Recording Assembly Components** - inspect the interior of the video recording assembly enclosure for any physical damage or abnormality. Observe current recorder settings and status of any associated environmental video recording components (heater/air conditioner, power supply).
   If anything suspicious is found, call the ARS video projects coordinator for instructions and note it on the *"Comments/Action Taken"* section of the Status/Assessment Sheet.

5. **Video Operation And Review** - *If a viewing canopy is part of the equipment for this site, use it to shield the system from sunlight. Continue to use the viewing canopy while performing the following video operation and review procedures.*
   Turn on the video recording assembly monitor. SELECT THE CORRECT SURVEILLANCE SYSTEM INPUT, BY PRESSING THE **VIDEO 1/2/3** BUTTON ON THE MONITOR PANEL.
   Stop recorder by pressing the ***REC MODE*** button until the recording mode in the display is blank (i.e. no ***INT TIMER*** displayed). Press the ***STOP*** button. The recording symbol (**REC**) and forward arrow (▷) should no longer be displayed. Do not eject the tape.
   Document the current date, time, and tape counter number in the appropriate section of the Status/ Assessment Sheet.
   Press ***REV PLAY*** to rewind a small amount of tape.
   Play the tape (press ***PLAY***)to verify that the correct date and time, field of view, and focus have been recorded.
   Press ***STOP*** at the point where recording ends.
   Document any inaccuracies found in the "Comments/Action Taken" section of the Status/ Assessment Sheet. If necessary, contact the ARS video projects coordinator for further instructions.

6. **Tape Load/Positioning**
   If continuing on the same tape - Return the tape to the original position. Verify proper positioning using the block counter on the recorder display and observing the recorded image on the monitor. Use ***PAUSE/STILL*** and the ***REV ADV*** ***FWD ADV*** buttons to move tape in one frame increments if necessary. Proceed to step 7.
   If making a tape change - After the inspection steps discussed above, remove the tape from the recorder by pressing the ***EJECT*** button. Complete the tape cassette label and Status/Assessment Sheet: denote date, time, and tape counter number when the tape was removed. Initial all documentation.
   Fill out a new tape cassette label with the date, time and tape counter number (should be 0000 for a new tape) and place it on the spine of the new tape to be inserted. Load the tape. Press the rewind button and the counter reset button.

7. **Camera Alignment** - Turn on the video recording assembly monitor if it is not already on. *Use the monitor viewing canopy as needed.* Confirm that the camera vista is aligned properly for the desired field of view. *(A reference alignment print has been provided in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook).* Be aware of both vertical and horizontal framing. If alignment is not correct, loosen the mounting bolts on the camera assembly adjustable head and realign (see step 3).

8. **Reset Recorder in Internal Timer Mode -** After the tape has been positioned properly, restart the tape by pressing the ***REC MODE*** switch until ***INT TIMER*** is seen on the recorder display. If the recorder is reset during a scheduled recording period, ***REC*** will also appear in the display. Turn the power off to the monitor. Return the monitor viewing canopy to its original storage location and close the video recording assembly enclosure.

9. **Additional Procedures For Multi-Surveillance Systems** - Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site have been denoted in SMALL CAPITAL LETTERS.

10. **Secure System** - Carefully verify that the camera assembly, video recording assembly, and any other access to the time-lapse video system is secure and locked. If the system is located in a shared facility, verify that all time-lapse video monitoring supplies are securely stored in the Video Recording Assembly enclosure or under close supervision.

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Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT GARNER HILL- SONY SSC-S20 CAMERA, PELCO PT1250 SERIES PAN/TILT, RWI 30CM MICROWAVE ANTENNA, AND PANASONIC CT1384Y MONITOR** **TECHNICAL INSTRUCTION**
NUMBER	**4120-3655**
DATE	**SEPTEMBER 1998**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Gloria S. Mercer	
PROJECT MANAGER	Lincoln E. Sherman	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance of the time-lapse video monitoring system. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the Garner Hill SVHS time-lapse video monitoring microwave transmitter system comprised of a Sony SSC-20 video camera, Pelco PT1250 pan/tilt head, RWI 30CM microwave transmitter, and a Panasonic CT1384Y color monitor.

The site operator should service the video system approximately every 7 days. During each site visit the operator should check the performance of the video system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every six months or as required by the project manager. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Review status/assessment sheets.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Train the site operator in all phases of video system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring microwave transmitter system consists of a camera assembly and a microwave transmission assembly. The components included in each assembly are:

Camera assembly components:

- Color video camera
- Microwave transmitter electronics and antenna
- Environmental enclosure for the video camera with the following accessories:
  - heater
  - heated window
  - sun shroud
  - pan/tilt mount
- Pan/tilt unit
- Rohn 45 tower

Microwave transmission assembly:

- Climate controlled shelter
- Microwave transmitter/receiver electronics and antenna
- Color review monitor
- UPS power supply
- Miscellaneous cables, connectors, etc.

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench

- Keys for enclosure and padlocks
- Climbing belt
- Digital watch synchronized to National Institute of Standards and Technology (NIST) Time (303/499-7111)
- Time-Lapse Video Monitoring Field Procedures Notebook containing:
  - TI 4120-3655, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
  - TI 4120-3755, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
  - Manufacturer's instruction booklets
  - Time-Lapse Video Monitoring Status/Assessment Sheets
- Pen or pencil
- Optical cleaning supplies

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of routine or remedial maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, and/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3755, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill - Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor.*

4.0 METHODS

This section includes two (2) major subsections:

4.1 Routine Servicing
4.2 Scheduled Preventive Maintenance

All procedures described in this TI refer to the Sony SSC-S20 camera with Panasonic CT1384Y color monitor. Schematic diagrams of the video system components are provided as Figures 4-1 and 4-2.

4.1 ROUTINE SERVICING

Weekly site visits are required to properly maintain and service the time-lapse video monitoring system. Weekly system servicing by the site operator includes:

- Inspecting and cleaning the camera assembly components and shelter.
- Verifying camera alignment.
- Securing the system.
- Documenting the servicing visit on a Time-Lapse Video Monitoring Status/Assessment Sheet.

Proper documentation of each servicing visit performed on the status/assessment sheet is required. A properly completed status/assessment sheet must accompany each videotape cassette mailed to ARS.

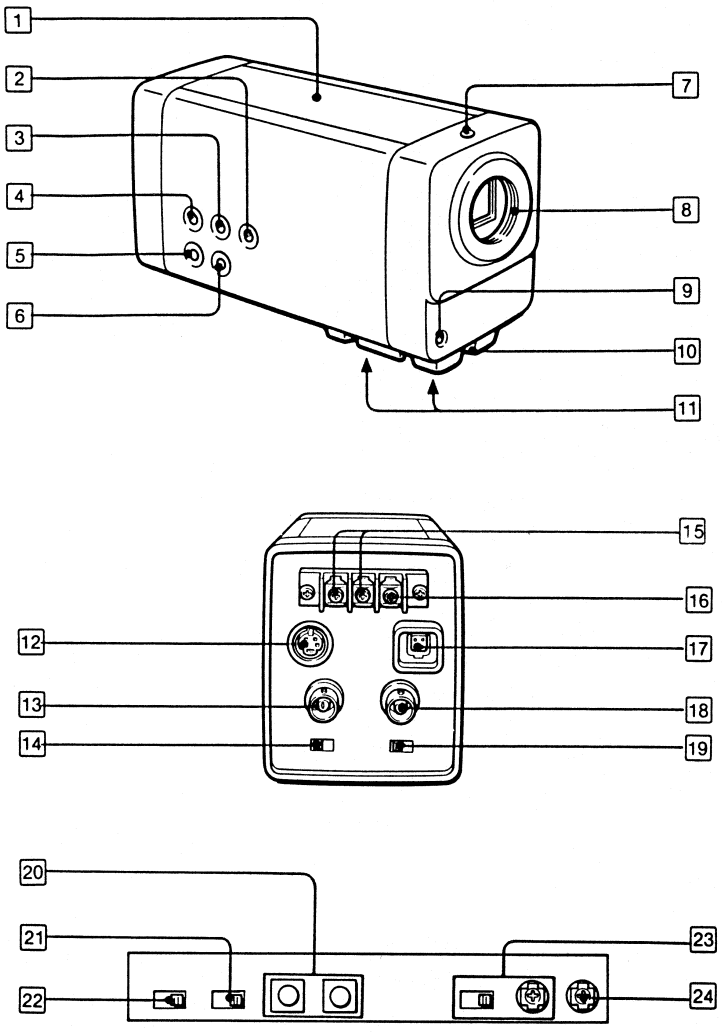
4.1.1 Completing the Time-Lapse Video Monitoring Status/Assessment Sheet

Figure 4-3 presents an example Time-Lapse Video Monitoring Status/Assessment Sheet for the DNPP and Garner Hill Monitoring Sites. The top section of the sheet requires information pertinent to tracking the videotape and system servicing performed during the recording period. The body of the sheet has checkboxes for each of the required system and videotape servicing procedures. Each status/assessment sheet covers three site visits. The site operator should check off the procedures performed during these three visits in columns 1,2, and 3, respectively.

The comment column is to be used by the operator to note any inconsistencies or general observations during each visit. Comments concerning heavy dirt buildup, camera misalignment, power failure during the servicing visit, etc., are appropriate here. It is extremely important that the site operator properly complete the Time-Lapse Video Monitoring Status/Assessment Sheet and enclose it with each videotape mailed to ARS.

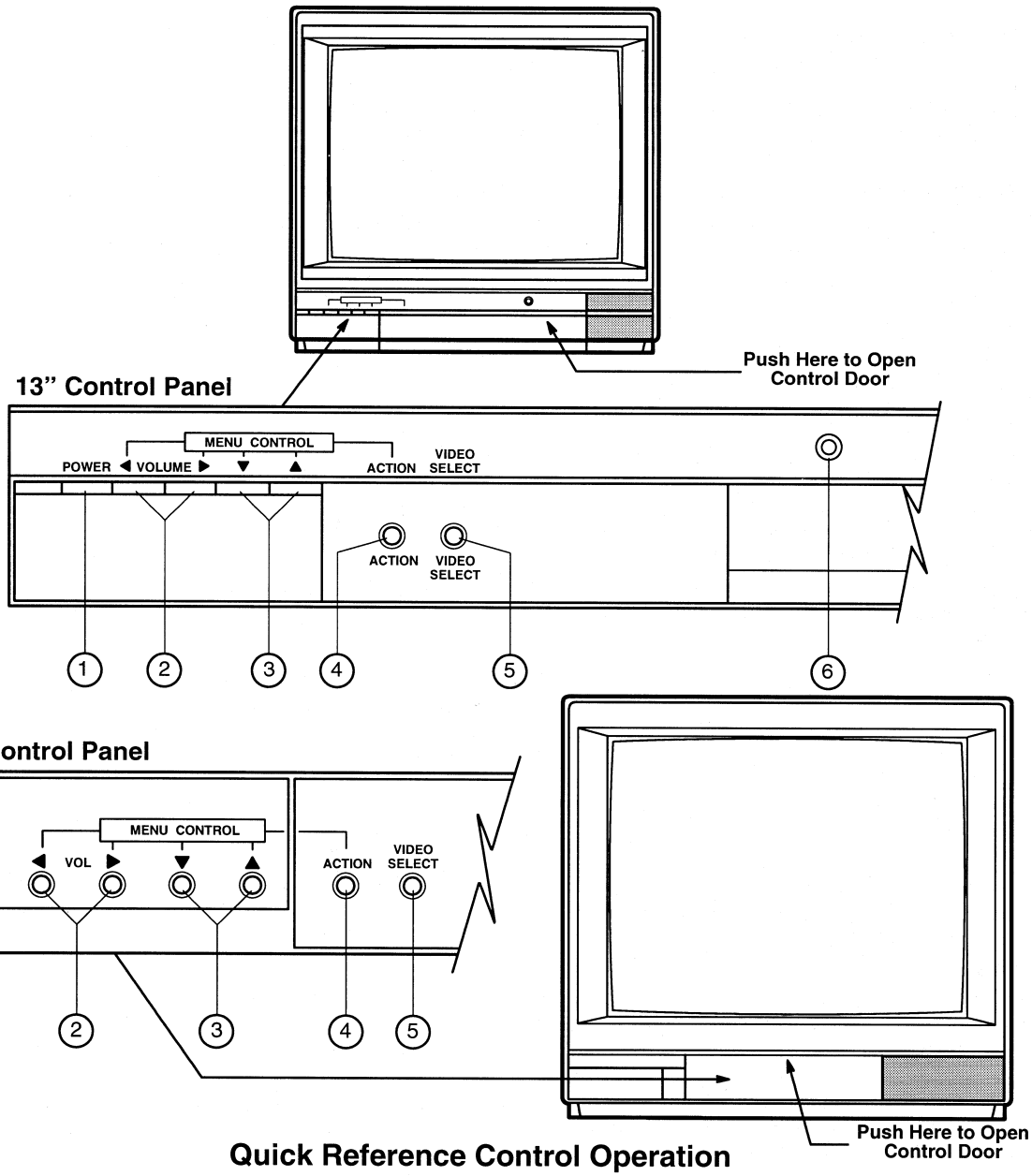
4.1.2 System Servicing Procedures

The site operator should complete the following procedures during each system servicing visit. A generic, quick-look reference guide that summarizes these procedures is also provided to the operator. A copy of this quick reference, titled “Automatic Time-Lapse Video Monitoring System Users Manual” is provided in Appendix A.



1. Top Panel
2. AGC (Automatic Gain Control)
3. SHUTTER Speed Button
4. WHITE Balance Button
5. DATE/TIME button
6. SET Button
7. Flange focal length adjustment screw
8. Lens mount
9. Power lamp
10. Mount adapter
11. Mounting screw holes
12. S VIDEO OUT connector
13. VIDEO OUT connector
14. T.D. Display
15. AC 24 V IN/DC 12 V IN terminals
16. GND (chassis ground) terminal
17. LENS Connector
18. GEN LOCK IN connector
19. MODE Selector
    - LOCK: The pre-adjusted modes are locked and the buttons are inoperative.
    - ADJ: Allows changing of settings.
    - AUTO: Automatic adjustment. Shutter = 1/60, AGC = ON, WHITE Balance = AUTO
20. CAMERA ID NO. Buttons
21. CAMERA ID NO. Switch
22. BACK UP Switch
23. SC (subcarrier) PHASE switch and control
24. H (horizontal) PHASE control

Figure 4-1. Sony CCD Camera Control Schematic.



Quick Reference Control Operation

1. **Power Button –** Press to turn ON or OFF.
2. **VOL (Volume) Buttons –** Press to adjust Sound Level. Press to adjust Video Menus and select operating features when menus are displayed.
3. **Up/Down Buttons –** Press to select desired features when menus are displayed.
4. **Action Button –** Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.
5. **Video Select Button –** Press to select one of three Video Inputs.
6. **Earphone Jack (13" Model only) –** Plug in an optional earphone for private monitoring of sound. Insertion of the earphone plug automatically cuts–off the TV speaker for personal listening. This jack accepts an earphone with an 1/8" mini plug.

Figure 4-2. Panasonic CT1384Y Color Monitor Schematic.

TIME-LAPSE VIDEO MONITORING STATUS/ASSESSMENT SHEET
DNPP AND GARNER HILL MONITORING SITES

Location: _____ Tape No. _____

Operator: _____

Date/Time of Site Visits #1:_____ ___:____ #2:_____ ___:____ #3:_____ ____:___

Check procedures performed during each site visit in the appropriate column.

		#1	#2	#3	Comments
VIDEOTAPE LOADED					
Labeled videotape cassette		☐			_____
Loaded videotape		☐			_____
OPERATION/MAINTENANCE CHECK					
DNPP:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified camera sled alignment	☐	☐	☐	_____
	Verified adjustable head alignment	☐	☐	☐	_____
	Inspected video recording assembly	☐	☐	☐	_____
	Record tape counter #	#_____	#_____	#_____	_____
	Verified recorded image, date, and time	☐	☐	☐	_____
	****Proceed to VIDEOTAPE REMOVAL section if changing tape****				
	Repositioned tape	☐	☐	☐	_____
Garner Hill:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified pan/tilt head alignment	☐	☐	☐	_____
CHECK OPERATION SETTINGS					
INT TIMER displayed		☐	☐	☐	_____
REC displayed		☐	☐	☐	_____
(appears only if activated during recording hours)					
SECURE SYSTEM					
DNPP:	Secured camera assembly	☐	☐	☐	_____
	Secured video recording assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
Garner Hill:	Secured camera assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
VIDEOTAPE REMOVAL					
Removed videotape				☐	_____
Completed videotape cassette label				☐	_____
Mailed videotape and assessment sheet to ARS				☐	_____

ADDITIONAL COMMENTS/ACTIONS TAKEN: _____

_____

SUPPLIES NEEDED: _____

_____

Enclose this Status/Assessment Sheet with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-3. Example Time-Lapse Video Monitoring Status/Assessment Sheet for the DNPP and Garner Hill Monitoring Sites.

INSPECT AND SERVICE CAMERA ASSEMBLY	Inspect and evaluate the camera assembly for any physical damage or abnormality. If damage is found, note it on the status/assessment sheet and call the ARS data coordinator. Clean the camera assembly enclosure exterior viewport with the supplied wipes and cleaning solution. The inside of the enclosure viewport should be inspected and cleaned only if visual inspection from the outside indicates that dirt has accumulated on the inside. To clean the inside surface of the viewport, open the Pelco camera enclosure door by inserting the key in the latch on the top-rear of the enclosure and lifting the lid. Loosen the two Phillips-head screws holding the camera mount and slide the camera back from the viewport. Clean the viewport with supplied wipes and cleaning solution. Inspect the camera lens and clean similarly if necessary. Inspect the camera enclosure air filter for any accumulation of dust or debris. The filter is a thin, gray foam material approximately 2" x 1" and is located under the viewport. If necessary, remove and clean with water. Shake out excess water (or dry) and replace. Close the housing lid and properly secure the assembly.
VERIFY CAMERA ASSEMBLY ALIGNMENT	Verify that the camera assembly remote pan/tilt head is aligned properly by viewing the image on the control monitor. If alignment is not correct, notify the HCCP plant operator to adjust. Note any alignment changes on the status/assessment sheet. The camera view alignment must match the photograph provided in the "Site Specifications" section of the Time-Lapse Video Monitoring Field Procedures Notebook.
SECURE SYSTEM	Carefully verify that the camera assembly and any other access to the time-lapse video system is secured and locked.

Routine procedures cannot be performed on the microwave transmitter system and dish. The site operator should contact ARS immediately if the microwave system is suspected to be malfunctioning.

4.1.3 Reporting Problems to ARS

If at any time operational problems or mechanical failure occurs, contact ARS immediately at the following:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Telephone: 970/484-7941
Fax: 970/484-3423

4.2 SCHEDULED PREVENTIVE MAINTENANCE

Periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator.

Additional servicing tasks identified by the data coordinator may include:

- Camera, monitor, or cable changes.
- Camera alignment changes.
- Revision of data collection procedures.

All scheduled preventive maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Time-Lapse Video Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

APPENDIX A

Automatic Time-Lapse Video Monitoring System

Users Manual

AUTOMATIC TIME-LAPSE VIDEO MONITORING SYSTEM

USERS MANUAL

INTRODUCTION

Source surveillance of visible emissions is a useful enforcement tool in any pollution control program. The information gathered from time-lapse video surveillance allows a control agency to document and better understand the dynamics of source emissions. The Automated Time-Lapse Video Monitoring System can be programmed to begin and end recording at user specified times and record time-lapse images of a user specified view on video cassette for user selected time-lapse intervals. Site specific system settings and recording protocols are documented in the *Time-Lapse Video Monitoring Field Procedures Notebook*.

This manual summarizes routine maintenance procedures. It is intended to supplement detailed operating instructions found in the Time-Lapse Video Monitoring Field Procedures Notebook, and associated manufacturers instruction manuals. All routine maintenance and servicing activity should be recorded on the *TIME LAPSE VIDEO MONITORING SITE VISIT STATUS/ASSESSMENT SHEET* provided with each completed tape cassette.

SYSTEM HARDWARE

The system hardware for this installation is shown on page 3 of this user's manual.

FORMS AND SUPPLIES

The following items are necessary for efficient operation of the time-lapse camera system. **Store them in a location accessible to all system operators.** Always keep this manual, Status/Assessment Sheets, and tape cassette labels in the video recording assembly enclosure.

- W Time-Lapse Video Monitoring Field Procedures Notebook
- W Automatic Time-Lapse Video Monitoring System Users Manual
- W Video Camera Operating Instructions
- W Panasonic VCR Operating Instructions
- W Panasonic Color Monitor Operating Instructions
- W S-VHS Video Tape Cassette(s)
- W Time-Lapse Video Monitoring Site Visit Status/Assessment Sheets
- W Tape Cassette Labels
- W Padded Mailing Envelopes
- W Optical Cleaning Supplies
- W Tools

TAPE STORAGE

To ensure proper tape storage, keep all tapes in a environmentally controlled location (e.g. cool, dry). Do not store film in a freezer or vehicle at any time.

ROUTINE MAINTENANCE

A Status/Assessment Sheet must accompany each tape cassette. Document each site visit and the servicing maintenance performed in the appropriate section of the assessment sheet. Complete the following steps during tape loading, system maintenance, and tape removal.

Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat the following steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site are denoted in SMALL CAPITAL LETTERS.

1. **System Condition** - Inspect the camera assembly, video recording assembly, and cables for any physical damage or abnormality. If damage is found, call the ARS photographic data coordinator for instructions and note it on the *Status/Assessment Sheet*.

2. **Clean Camera Assembly** - Clean the camera assembly enclosure view port with the supplied wipes and cleaning solution. The inside of the enclosure view port should be inspected and cleaned only if necessary.

   To clean the inside surface of the view port, open the housing door by

turning the knob on top and lifting the lid. Loosen the 2 phillips head screws holding the camera mount and slide the camera back from the view port. Clean the view port. Also inspect the camera lens and clean if necessary.

Inspect the camera enclosure air filter for any accumulation of dust or debris. If necessary, remove and clean with water. Shake out excess water (or dry) and replace.

3. **Verify Camera Assembly Alignment -** Verify or realign the camera sled mount to the marks provided. Tighten all associated screws. Close the housing lid and properly secure the assembly.

   Verify that the camera assembly adjustable head is aligned properly by inspecting the alignment marks outside of the enclosure. If alignment is not correct, loosen the mounting bolts and realign. Tighten the bolts snugly when alignment is complete.

Note any alignment changes on the Status/Assessment Sheet. Any major alignment changes should also be noted in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook.

4. **Inspect Video Recording Assembly Components** - inspect the interior of the video recording assembly enclosure for any physical damage or abnormality. Observe current recorder settings and status of any associated environmental video recording components (heater/air conditioner, power supply).
   If anything suspicious is found, call the ARS video projects coordinator for instructions and note it on the *"Comments/Action Taken"* section of the Status/Assessment Sheet.

5. **Video Operation And Review** - *If a viewing canopy is part of the equipment for this site, use it to shield the system from sunlight. Continue to use the viewing canopy while performing the following video operation and review procedures.*
   Turn on the video recording assembly monitor. SELECT THE CORRECT SURVEILLANCE SYSTEM INPUT, BY PRESSING THE **VIDEO 1/2/3** BUTTON ON THE MONITOR PANEL.
   Stop recorder by pressing the ***REC MODE*** button until the recording mode in the display is blank (i.e. no ***INT TIMER*** displayed). Press the ***STOP*** button. The recording symbol (**REC**) and forward arrow (▷) should no longer be displayed. Do not eject the tape.
   Document the current date, time, and tape counter number in the appropriate section of the Status/ Assessment Sheet.
   Press ***REV PLAY*** to rewind a small amount of tape.
   Play the tape (press ***PLAY***)to verify that the correct date and time, field of view, and focus have been recorded.
   Press ***STOP*** at the point where recording ends.
   Document any inaccuracies found in the "Comments/Action Taken" section of the Status/ Assessment Sheet. If necessary, contact the ARS video projects coordinator for further instructions.

6. **Tape Load/Positioning**
   If continuing on the same tape - Return the tape to the original position. Verify proper positioning using the block counter on the recorder display and observing the recorded image on the monitor. Use ***PAUSE/STILL*** and the ***REV ADV*** ***FWD ADV*** buttons to move tape in one frame increments if necessary. Proceed to step 7.
   If making a tape change - After the inspection steps discussed above, remove the tape from the recorder by pressing the ***EJECT*** button. Complete the tape cassette label and Status/Assessment Sheet: denote date, time, and tape counter number when the tape was removed. Initial all documentation.
   Fill out a new tape cassette label with the date, time and tape counter number (should be 0000 for a new tape) and place it on the spine of the new tape to be inserted. Load the tape. Press the rewind button and the counter reset button.

7. **Camera Alignment** - Turn on the video recording assembly monitor if it is not already on. *Use the monitor viewing canopy as needed.* Confirm that the camera vista is aligned properly for the desired field of view. *(A reference alignment print has been provided in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook).* Be aware of both vertical and horizontal framing. If alignment is not correct, loosen the mounting bolts on the camera assembly adjustable head and realign (see step 3).

8. **Reset Recorder in Internal Timer Mode -** After the tape has been positioned properly, restart the tape by pressing the ***REC MODE*** switch until ***INT TIMER*** is seen on the recorder display. If the recorder is reset during a scheduled recording period, ***REC*** will also appear in the display. Turn the power off to the monitor. Return the monitor viewing canopy to its original storage location and close the video recording assembly enclosure.

9. **Additional Procedures For Multi-Surveillance Systems** - Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site have been denoted in SMALL CAPITAL LETTERS.

10. **Secure System** - Carefully verify that the camera assembly, video recording assembly, and any other access to the time-lapse video system is secure and locked. If the system is located in a shared facility, verify that all time-lapse video monitoring supplies are securely stored in the Video Recording Assembly enclosure or under close supervision.

Air Resource Specialists, Inc.

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Attention: Video Projects Coordinator

Contact us if any questions or problems arise

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Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**ROUTINE SITE OPERATOR MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT HCCP - PANASONIC AG-6740 SVHS VCR AND SONY MONITOR** **TECHNICAL INSTRUCTION**
NUMBER	**4120-3660**
DATE	**SEPTEMBER 1998**

AUTHORIZATIONS		
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PROJECT MANAGER	Lincoln E. Sherman	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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The purpose of routine site operator maintenance is to assure quality data capture and minimize data loss by performing and documenting scheduled operational checks and preventive maintenance of the time-lapse video monitoring system. This technical instruction (TI) describes the steps of a routine site visit, scheduled maintenance, and on-site data control for the HCCP SVHS time-lapse video monitoring system comprised of a Panasonic AG-6740 SVHS time-lapse VCR and a Sony color monitor.

The site operator should service the video system approximately every 7 days and change the videotape cassette every 14 days. During each site visit the operator should check the performance of the video system, clean system components, and perform troubleshooting and/or emergency maintenance as required. Preventive maintenance site visits are performed every three months or as required by the data coordinator. The effective performance and documentation of each of these tasks is the key to quality data collection and minimal data loss.

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout the monitoring effort. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Review status/assessment sheets.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the schedule and requirements for routine and remedial maintenance.

- Train the site operator in all phases of video system maintenance.
- Provide technical support to the site operator via telephone to assure high quality site visits.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Verify that scheduled visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Resolve problems reported by the site operator.
- Enter the results of all performed procedures into the site-specific Quality Assurance Database.
- Supply the site operator with all necessary monitoring supplies.
- Coordinate the replacement and repair of all malfunctioning units.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the schedule and requirements for routine or remedial maintenance.
- Schedule regular site maintenance visits and perform all procedures described in this TI.
- Thoroughly document all procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet.
- Immediately report any noted inconsistencies to the data coordinator or field specialist.
- Package videotapes with status/assessment sheet and ship to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring system consists of a video recording assembly and a microwave receiver assembly. The transmitter assembly components are located at Garner Hill; refer to TI 4120-3655, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*. The components included in each assembly are:

Video recording assembly components:

- Color review monitor
- SVHS time-lapse video recorder
- SVHS video recorder for real time recording of declared events
- SVHS review unit
- UPS power supply
- Video distribution amplifier
- Miscellaneous cables, connectors, etc.

Microwave receiver assembly:

- Microwave transmitter/receiver electronics and antenna

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a routine site visit or scheduled maintenance include:

- Medium and small flat-blade screwdriver
- Digital watch synchronized to National Institute of Standards and Technology (NIST) Time (303/499-7111)
- Time-Lapse Video Monitoring Field Procedures Notebook containing:
    - TI 4120-3660, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*

- TI 4120-3760, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*

- Manufacturer's instruction booklets

- Time-Lapse Video Monitoring Status/Assessment Sheets

- Videotape cassette labels

- Pen or pencil
- Optical cleaning supplies
- Supplemental SVHS videotape cassettes
- Padded mailing envelopes

3.2 INVENTORY

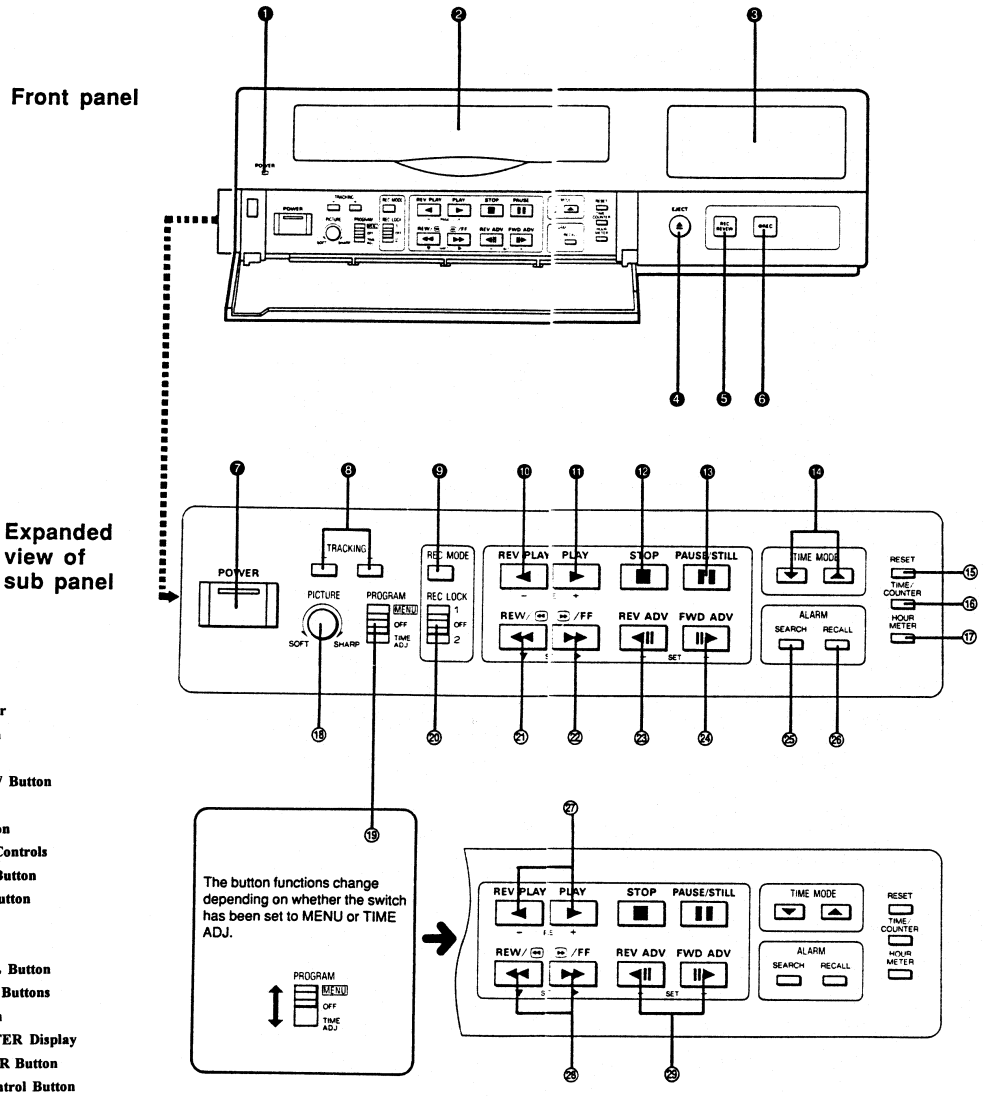
It is imperative that any capital instrumentation changes made as a result of routine or remedial maintenance be thoroughly documented. Specific model and serial numbers of the exchanged recorder and/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in TI 4120-3760, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor.*

4.0 METHODS

This section includes four (4) major subsections:

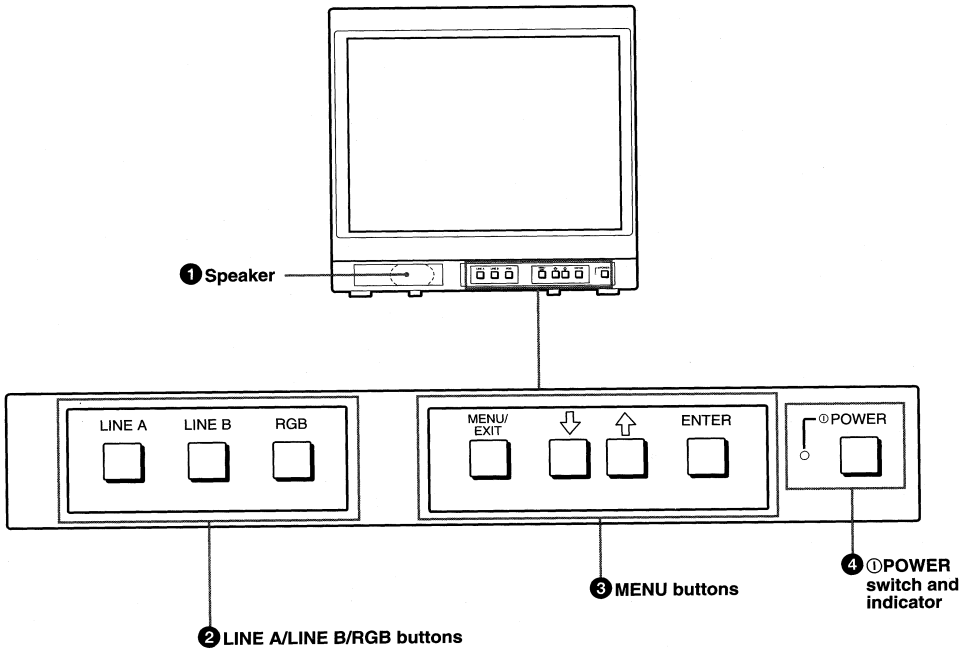
4.1 Routine Servicing
4.2 Changing the VCR Operating Times
4.3 Scheduled Preventive Maintenance
4.4 Videotape Storage

All procedures described in this TI refer to the Panasonic AG-6740 SVHS VCR and Sony color monitor. Schematic diagrams of the video system components are provided as Figures 4-1 and 4-2.



1. Power Lamp
2. Cassette Holder
3. Display section
4. EJECT button
5. REC REVIEW Button
6. REC Button
7. POWER Button
8. TRACKING Controls
9. REC MODE Button
10. REV PLAY Button
11. PLAY Button
12. STOP Button
13. PAUSE/STILL Button
14. TIME MODE Buttons
15. RESET Button
16. TIME/COUNTER Display
17. HOUR METER Button
18. PICTURE Control Button
19. PROGRAM Switch
20. REC Lock Switch
21. REW Button
22. FF Button
23. FIELD ADV (REV) Button
24. FIELD ADV (FWD) Button
25. ALARM SEARCH Button
26. ALARM RECALL Button
27. PAGE Buttons
28. SHIFT Buttons.
29. SET Buttons

Figure 4-1. Panasonic AG-6740 Time-Lapse VCR Control Schematic.



❶ Speaker

❷ LINE A/LINE B/RGB (input select) buttons

Press to select the program to be monitored.

Input signal	Press
Signal fed through the LINE A connector	LINE A
Signal fed through the LINE B connector	LINE B
Signal fed through the RGB connectors[a)]	RGB[a)]

a) Provided with the PVM-14N2A/14N2E/14N2U/20N2A/20N2E/20N2U only.

❸ MENU buttons

Press to make the menu appear.

For detailed information on MENU buttons, see "Operation through On-Screen Menus" on page 9.

❹ ⏻POWER switch and indicator

Press to turn the monitor on. The indicator lights in green.

To turn the power off, press this again.

Figure 4-2. Sony Color Monitor Schematic.

4.1 ROUTINE SERVICING

Weekly site visits are required to properly maintain and service the time-lapse video monitoring system. Weekly system servicing by the site operator includes:

- Inspecting the video recording assembly components.
- Verifying camera alignment.
- Reviewing videotape contents.
- Securing the system.
- Documenting the servicing visit on a Time-Lapse Video Monitoring Status/Assessment Sheet.

Biweekly videotape servicing by the site operator includes:

- Reviewing videotape contents.
- Removing recorded videotape.
- Loading new videotape.
- Documenting the videotape servicing procedures on a Time-Lapse Video Monitoring Status/Assessment Sheet.
- Mailing recorded videotape with the Time-Lapse Video Monitoring Status/Assessment Sheet to ARS.

Proper documentation of each servicing visit performed on the status/assessment sheet is required. A properly completed status/assessment sheet must accompany each videotape cassette mailed to ARS.

4.1.1 Completing the Time-Lapse Video Monitoring Status/Assessment Sheet

Figure 4-3 presents an example Time-Lapse Video Monitoring Status/Assessment Sheet for the HCCP Control Room. The top section of the sheet requires information pertinent to tracking the videotape and system servicing performed during the recording period. The body of the sheet has checkboxes for each of the required system and videotape servicing procedures. Each status/assessment sheet covers three site visits; the videotape loading visit, the interim weekly servicing visit, and the videotape removal visit. The site operator should check off the procedures performed during these three visits in columns 1, 2, and 3, respectively.

The comment column is to be used by the operator to note any inconsistencies or general observations during each visit. Comments concerning heavy dirt buildup, camera misalignment, power failure during the servicing visit, etc., are appropriate here. It is extremely important that the site operator properly complete the Time-Lapse Video Monitoring Status/Assessment Sheet and enclose it with each videotape mailed to ARS.

TIME-LAPSE VIDEO MONITORING STATUS/ASSESSMENT SHEET HCCP CONTROL ROOM

Location: _____ Tape No. _____

Operator: _____

Date/Time of Site Visits #1:_____ ___:____ #2:_____ ___:____ #3:_____ ____:___

Check procedures performed during each site visit in the appropriate column.

VIDEOTAPE LOADED	**#1**	**#2**	**#3**	Comments
Labeled videotape cassette	☐			_____
Loaded videotape	☐			_____
OPERATION/MAINTENANCE CHECK				
Verified camera alignment	☐	☐	☐	_____
Inspected video recording assembly	☐	☐	☐	_____
Record tape counter #	#_____	#_____	#_____	_____
Verified recorded image, date, and time	☐	☐	☐	_____
****Proceed to VIDEOTAPE REMOVAL section if changing tape****				
Repositioned tape	☐	☐	☐	_____
CHECK OPERATION SETTINGS				
INT TIMER displayed	☐	☐	☐	_____
REC displayed	☐	☐	☐	_____
(appears only if activated during recording hours)				
VIDEOTAPE REMOVAL				
Removed videotape			☐	_____
Completed videotape cassette label			☐	_____
Mailed videotape and assessment sheet to ARS			☐	_____

ADDITIONAL COMMENTS/ACTIONS TAKEN: _____

_____

SUPPLIES NEEDED: _____

_____

Enclose this Status/Assessment Sheet with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-3. Example Time-Lapse Video Monitoring Status/Assessment Sheet for the HCCP Control Room Monitoring Site.

4.1.2 System Servicing and Videotape Servicing Procedures

The site operator should complete the following procedures during each system servicing and videotape servicing visit. A generic, quick-look reference guide that summarizes these procedures is also provided to the operator. A copy of this quick reference, titled "Automatic Time-Lapse Video Monitoring System Users Manual" is provided in Appendix A.

VERIFY CAMERA ASSEMBLY ALIGNMENT	Verify that the camera assembly remote pan/tilt head is aligned properly by viewing the image on the review monitor. If alignment is not correct, realign the camera using the joystick control. Note any alignment changes on the status/assessment sheet. The camera view alignment must match the photograph provided in the "Site Specifications" section of the Time-Lapse Video Monitoring Field Procedures Notebook.
INSPECT AND SERVICE VIDEO RECORDING ASSEMBLY	Inspect the exterior and interior of the video recording assembly shelter and cables for any physical damage or abnormality. Observe and note on the status/assessment sheet the current recorder settings and status of any associated environmental control components (i.e., heater, air conditioner, power supply). If anything suspicious is found, note it on the status/assessment sheet and call the ARS data coordinator for instructions.
REVIEW VIDEOTAPE	Turn the video recording assembly monitor ON. Stop the recorder by pressing the **REC MODE** button until the recording mode in the display is blank (i.e., INT TIMER is not displayed). Press the **STOP** button. The recording symbol (**REC**) and forward arrow (▹) should no longer be displayed. Document the current date, time, and tape counter number on the status/assessment sheet. Do not eject the videotape. Press **REV PLAY** to rewind a small amount of videotape. Play the videotape (press **PLAY**) to verify that proper picture quality, the correct date and time, and field of view have been recorded. Press **STOP** at the point where the recording ends. Document any inaccuracies found on the status/assessment sheet. If necessary, contact the ARS data coordinator for further instructions. If continuing on the same videotape, return the videotape to its original position. Verify proper tape positioning by using the block counter on the recorder display and observing the recorded image on the monitor. Use the **PAUSE/STILL**, **REV ADV**, and **FWD ADV** buttons to move videotape in single frame increments if necessary. Skip the "Removing and Changing Videotapes" step

and proceed to "Start the Automatic Recording Sequence" step below. Turn the monitor OFF.

REMOVING AND CHANGING VIDEOTAPES

If making a videotape change, remove the tape from the recorder by pressing the **EJECT** button. Complete the videotape cassette label and status/assessment sheet; denote date, time, and videotape counter number when the tape was removed. An example videotape cassette label is provided as Figure 4-4.

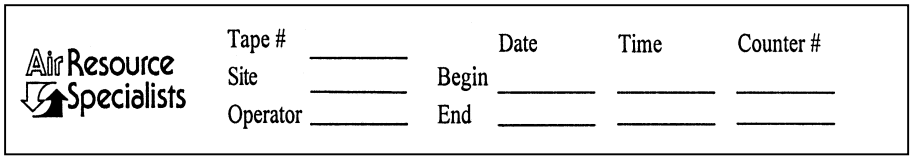


Figure 4-4. Example Videotape Cassette Label.

Complete a new videotape cassette label with the date, time, and tape counter number (should be 0000 for a new videotape) and place it on the spine of the new videotape to be inserted. Load the videotape into the VCR. Press the **TIME/COUNTER** button to show the counter, then the **RESET** button.

START THE AUTOMATIC RECORDING SEQUENCE

After the videotape has been positioned properly, restart the automatic recording sequence of the VCR by pressing the **REC MODE** button until INT TIMER is seen on the recorder display. If the recorder is placed in "Internal Timer Mode" during a scheduled recording period, REC (**REC**) will also appear in the display. If the recorder is placed in "Internal Timer Mode" during a scheduled non-recording period, the VCR will not begin recording immediately. Turn the monitor OFF.

SECURE SYSTEM

Carefully verify that thevideo recording assembly and any other access to the time-lapse video system is secured and locked.

4.1.3 Reporting Problems to ARS

If at any time operational problems or mechanical failure occurs, contact ARS immediately at the following:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Telephone: 970/484-7941
Fax: 970/484-3423

4.2 CHANGING VCR OPERATING TIMES

This section provides instructions for changing the daily start and stop time of the Panasonic AG-6740 time-lapse recorder. Time changes are required to adjust for the variation in day length throughout the year. Site-specific times for this monitoring site are presented in Table 4-1. Timer changes should take place on the first of each month.

Table 4-1

VCR Monthly Recording Start/Stop Timer Settings
Healy Clean Coal Project, Post-Construction Visibility Monitoring Program

Healy, Yukon-Koyukuk County, Alaska (longitude W149.0° latitude N63.9°)												
Adjustment Date	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	1-Dec
Video Start*	08:30	07:00	05:30	03:30	00:00	00:00	00:00	02:30	04:30	06:00	07:30	09:30
Video Stop*	18:00	19:00	20:30	22:30	00:00	00:00	00:00	00:00	21:00	19:00	17:30	16:00

* All times are in Standard Time. Do not set the VCR time to Daylight Saving Time.

Sunrise/Sunset Reference Table

Date	31-Jan	28-Feb	31-Mar	30-Apr	31-May	22-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	22-Dec
Standard/daylight	AST	AST	AST	ADT	ADT	ADT	ADT	ADT	ADT	ADT	AST	AST
Begin civil twilight	08:40	07:18	05:29	04:27				03:39	05:47	07:18	07:45	09:29
Sunrise	09:37	08:06	06:18	05:33	03:58	03:31	03:40	05:06	06:39	08:05	08:38	10:46
Sun transit	13:09	13:08	13:00	13:53	13:54	13:58	14:00	14:02	13:56	13:45	12:39	12:55
Sunset	16:43	18:12	19:44	22:15	23:51	00:25	00:18	22:56	21:10	19:25	16:40	15:03
End civil twilight	17:40	19:00	20:34	23:23				00:20	22:02	20:12	17:33	16:20

Source:
U.S. Naval Observatory, Astronomical Applications Department
http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html

The following instructions are intended as a guide. If difficulty is encountered completing this process, refer to page 51 of the Panasonic AG-6740 time-lapse recorder manufacturer's manual. The operator should not attempt to change any other parameters in the VCR setup without direct instruction from the ARS data coordinator.

NAVIGATING THE VCR MENU SCREENS

The REV PLAY, PLAY, REW, and FF, REV ADV, and FWD ADV buttons on the front panel of the VCR serve a secondary programming purpose when in the VCR programming menu mode. There are six (6) menu screens with multiple options on each menu screen to choose from when in the programming mode. Use the gold labels under these buttons to navigate through the menus as follows:

- Place the VCR in "program mode" by sliding the PROGRAM switch to **MENU**.

- Page through the six menu screens using **REV PLAY** (-) or **PLAY** (+).

- Scroll through items on a menu screen using **REW** (▼) or **FF** (►).

- Set the value of an item on a screen using **REV ADV** (-) or **FWD ADV** (+).

SETTING THE DAILY START AND STOP TIMES

Using the navigation techniques described above, select the "Internal Timer Rec" menu. Scroll down to the DLY line and set the start and stop times as specified in Table 4-1.

Note: The VCR and all recording times are kept in standard time (i.e., DO NOT SET THE VCR TIME TO DAYLIGHT SAVING TIME).

Record the change on the status/assessment sheet.

4.3 SCHEDULED PREVENTIVE MAINTENANCE

Proper videotape storage and periodic preventive maintenance will help to ensure consistent, high quality data collection. Preventive maintenance servicing visits are performed as scheduled or required by the data coordinator or project manager.

Additional servicing tasks identified by the data coordinator may include:

- Camera, VCR, monitor, or cable changes.
- Camera alignment changes.
- Revision of data collection procedures.

All scheduled preventive maintenance requested by the data coordinator or performed by the site operator must be thoroughly documented on the Time-Lapse Video Monitoring Status/Assessment Sheet and in the site-specific Quality Assurance Database.

Any equipment malfunctions or data collection discrepancies observed during a scheduled maintenance visit should be reported to ARS immediately.

4.4 VIDEOTAPE STORAGE

To ensure proper storage, keep all videotapes in an environmentally controlled location (e.g., cool and dry). Do not store videotapes in a freezer or vehicle at any time.

Videotapes, like photographic film, are sensitive to heat and moisture. These elements can affect the videotape, altering both the quality of images and the data analysis. For example, videotape subjected to heat often has a pink or purple cast while videotape subjected to moisture has a streaky or grainy consistency.

APPENDIX A

Automatic Time-Lapse Video Monitoring System

Users Manual

AUTOMATIC TIME-LAPSE VIDEO MONITORING SYSTEM

USERS MANUAL

INTRODUCTION

Source surveillance of visible emissions is a useful enforcement tool in any pollution control program. The information gathered from time-lapse video surveillance allows a control agency to document and better understand the dynamics of source emissions. The Automated Time-Lapse Video Monitoring System can be programmed to begin and end recording at user specified times and record time-lapse images of a user specified view on video cassette for user selected time-lapse intervals. Site specific system settings and recording protocols are documented in the *Time-Lapse Video Monitoring Field Procedures Notebook*.

This manual summarizes routine maintenance procedures. It is intended to supplement detailed operating instructions found in the Time-Lapse Video Monitoring Field Procedures Notebook, and associated manufacturers instruction manuals. All routine maintenance and servicing activity should be recorded on the *TIME LAPSE VIDEO MONITORING SITE VISIT STATUS/ASSESSMENT SHEET* provided with each completed tape cassette**.**

SYSTEM HARDWARE

The system hardware for this installation is shown on page 3 of this user's manual.

FORMS AND SUPPLIES

The following items are necessary for efficient operation of the time-lapse camera system. **Store them in a location accessible to all system operators.** Always keep this manual, Status/Assessment Sheets, and tape cassette labels in the video recording assembly enclosure.

- Time-Lapse Video Monitoring Field Procedures Notebook
- Automatic Time-Lapse Video Monitoring System Users Manual
- Video Camera Operating Instructions
- Panasonic VCR Operating Instructions
- Panasonic Color Monitor Operating Instructions
- S-VHS Video Tape Cassette(s)
- Time-Lapse Video Monitoring Site Visit Status/Assessment Sheets
- Tape Cassette Labels
- Padded Mailing Envelopes
- Optical Cleaning Supplies
- Tools

TAPE STORAGE

To ensure proper tape storage, keep all tapes in a environmentally controlled location (e.g. cool, dry). Do not store film in a freezer or vehicle at any time.

ROUTINE MAINTENANCE

A Status/Assessment Sheet must accompany each tape cassette. Document each site visit and the servicing maintenance performed in the appropriate section of the assessment sheet. Complete the following steps during tape loading, system maintenance, and tape removal.

Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat the following steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site are denoted in SMALL CAPITAL LETTERS.

1. **System Condition** - Inspect the camera assembly, video recording assembly, and cables for any physical damage or abnormality. If damage is found, call the ARS photographic data coordinator for instructions and note it on the *Status/Assessment Sheet*.

2. **Clean Camera Assembly** - Clean the camera assembly enclosure view port with the supplied wipes and cleaning solution. The inside of the enclosure view port should be inspected and cleaned only if necessary.

   To clean the inside surface of the view port, open the housing door by turning the knob on top and lifting the lid. Loosen the 2 phillips head screws holding the camera mount and slide the camera back from the view port. Clean the view port. Also inspect the camera lens and clean if necessary.

   Inspect the camera enclosure air filter for any accumulation of dust or debris. If necessary, remove and clean with water. Shake out excess water (or dry) and replace.

3. **Verify Camera Assembly Alignment -** Verify or realign the camera sled mount to the marks provided. Tighten all associated screws. Close the housing lid and properly secure the assembly.

   Verify that the camera assembly adjustable head is aligned properly by inspecting the alignment marks outside of the enclosure. If alignment is not correct, loosen the mounting bolts and realign. Tighten the bolts snugly when alignment is complete.

Note any alignment changes on the Status/Assessment Sheet. Any major alignment changes should also be noted in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook.

4. **Inspect Video Recording Assembly Components** - inspect the interior of the video recording assembly enclosure for any physical damage or abnormality. Observe current recorder settings and status of any associated environmental video recording components (heater/air conditioner, power supply).
   If anything suspicious is found, call the ARS video projects coordinator for instructions and note it on the *"Comments/Action Taken"* section of the Status/Assessment Sheet.

5. **Video Operation And Review** - *If a viewing canopy is part of the equipment for this site, use it to shield the system from sunlight. Continue to use the viewing canopy while performing the following video operation and review procedures.*
   Turn on the video recording assembly monitor. SELECT THE CORRECT SURVEILLANCE SYSTEM INPUT, BY PRESSING THE **VIDEO 1/2/3** BUTTON ON THE MONITOR PANEL. Stop recorder by pressing the ***REC MODE*** button until the recording mode in the display is blank (i.e. no ***INT TIMER*** displayed). Press the ***STOP*** button. The recording symbol (**REC**) and forward arrow (▷) should no longer be displayed. Do not eject the tape.
   Document the current date, time, and tape counter number in the appropriate section of the Status/ Assessment Sheet.
   Press ***REV PLAY*** to rewind a small amount of tape.
   Play the tape (press ***PLAY***)to verify that the correct date and time, field of view, and focus have been recorded.
   Press ***STOP*** at the point where recording ends. *Document any inaccuracies found in the "Comments/Action Taken" section of the Status/ Assessment Sheet. If necessary, contact the ARS video projects coordinator for further instructions.*

6. **Tape Load/Positioning**
   If continuing on the same tape - Return the tape to the original position. Verify proper positioning using the block counter on the recorder display and observing the recorded image on the monitor. Use ***PAUSE/STILL*** and the ***REV ADV*** ***FWD ADV*** buttons to move tape in one frame increments if necessary. Proceed to step 7.
   If making a tape change - After the inspection steps discussed above, remove the tape from the recorder by pressing the ***EJECT*** button. Complete the tape cassette label and Status/Assessment Sheet: denote date, time, and tape counter number when the tape was removed. Initial all documentation.
   Fill out a new tape cassette label with the date, time and tape counter number (should be 0000 for a new tape) and place it on the spine of the new tape to be inserted. Load the tape. Press the rewind button and the counter reset button.

7. **Camera Alignment** - Turn on the video recording assembly monitor if it is not already on. *Use the monitor viewing canopy as needed.* Confirm that the camera vista is aligned properly for the desired field of view. *(A reference alignment print has been provided in the Site Specifications section of the Time-Lapse Video Monitoring Field Procedures Notebook).* Be aware of both vertical and horizontal framing. If alignment is not correct, loosen the mounting bolts on the camera assembly adjustable head and realign (see step 3).

8. **Reset Recorder in Internal Timer Mode -** After the tape has been positioned properly, restart the tape by pressing the ***REC MODE*** switch until ***INT TIMER*** is seen on the recorder display. If the recorder is reset during a scheduled recording period, ***REC*** will also appear in the display. Turn the power off to the monitor. Return the monitor viewing canopy to its original storage location and close the video recording assembly enclosure.

9. **Additional Procedures For Multi-Surveillance Systems** - Some time-lapse video systems may consist of more than one surveillance camera/recorder. If more than one surveillance system is present, it will be necessary to repeat steps (1-8) for each system. Any routine maintenance procedures specific to a multi-surveillance system site have been denoted in SMALL CAPITAL LETTERS.

10. **Secure System** - Carefully verify that the camera assembly, video recording assembly, and any other access to the time-lapse video system is secure and locked. If the system is located in a shared facility, verify that all time-lapse video monitoring supplies are securely stored in the Video Recording Assembly enclosure or under close supervision.

Air Resource Specialists, Inc.

1901 Sharp Point Drive, Suite E

Fort Collins, CO 80525

(970) 484-7941

Attention: Video Projects Coordinator

Contact us if any questions or problems arise

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT DNPP – SONY SSC-S20 CAMERA, PANASONIC AG-6740 SVHS VCR, AND PANASONIC CT1384Y MONITOR**
	TECHNICAL INSTRUCTION
NUMBER	**4120-3750**
DATE	**SEPTEMBER 1998**

AUTHORIZATIONS		
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by quickly identifying the probable source of a time-lapse video monitoring system malfunction and initializing appropriate equipment repairs or replacements. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for an SVHS time-lapse video monitoring system at DNPP comprised of a Sony SSC-20 video camera, a Panasonic AG-6740 SVHS time-lapse VCR, and a Panasonic CT1384Y color monitor.

This TI serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:

  - Sony SSC-S20 Camera

  - Panasonic AG-6740 SVHS time-lapse recorder

  - Panasonic CT1384Y color monitor

- Notification of the field specialist or data coordinator

- System diagnosis and resulting corrective action(s)

- Final system verification check

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.
- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.
- Provide technical support to the site operator via telephone to identify and resolve instrument problems.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Identify possible instrument malfunctions and contact the site operator to implement troubleshooting procedures.
- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.
- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Coordinate the replacement and repair of all system components and support hardware.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Perform procedures described in this TI.
- Thoroughly document all troubleshooting procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet; mail the completed sheet to the data coordinator.
- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring system consists of a camera assembly and a video recording assembly. The components included in each assembly are:

Camera assembly components:

- Color video camera
- Environmental enclosure for the video camera with the following accessories:
  - heater
  - sun shroud
  - pole mount
  - pan/tilt mount

Video recording assembly components:

- Heated shelter
- Color review monitor
- SVHS time-lapse recorder
- UPS power supply
- Miscellaneous cables, connectors, etc.

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure, shelter, and padlocks
- Digital watch synchronized to National Bureau of Standards and Technology (NIST) Time (303/499-7111)
- Voltmeter
- 110 VAC wallplug circuit tester
- Time-Lapse Video Monitoring Field Procedures Notebook containing:
  - TI 4120-3650, *Routine Site Operator Maintenance Procedures for the SVHS Time-lapse Video Camera System at DNPP – Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*
  - TI 4120-3750, *Troubleshooting and Emergency Maintenance Procedures for the SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*
  - Manufacturer's instruction booklets
  - Time-Lapse Video Monitoring Status/Assessment Sheets
  - Videotape cassette labels
- Pen or pencil
- Optical cleaning supplies
- Supplemental SVHS videotape cassettes
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, recorder, and/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a video monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of videotapes.

- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The ARS data coordinator, in consultation with the site operator and ARS field specialists, diagnoses the problem and suggests specific actions. The operator initiates the corrective actions, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally following corrective actions, the operator returns it to service and visits the site periodically before the next regularly scheduled visit to verify system operation.

- When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, the data coordinator ships a complete backup system or specific component to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log (see Section 4.4). Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning component to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Time-Lapse Video Monitoring Status/Assessment Sheet. The documentation should include:

- Date of noted malfunction
- Actual or estimated amount of data loss
- Steps taken to test system components
- Corrective actions taken
- Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor the videotapes for recurrences or resolution of the problem.

All procedures described in this TI refer to the Sony SSC-S20 camera with Panasonic AG-6740 SVHS VCR and Panasonic CT1384Y color monitor. Schematic diagrams of the monitoring system components are provided in TI 4120-3650, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor.*

4.1 GENERAL INFORMATION

Initial diagnoses of an equipment problem should follow this troubleshooting sequence:

1) Follow the troubleshooting procedures described in the following subsections.

2) Document troubleshooting results so the data coordinator or field specialist can review the problem accurately.

3) Refer to the Time-Lapse Video Monitoring Field Procedures Notebook when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not immediately available, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during videotape review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Time-Lapse Video Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Standard settings for each component should be checked before troubleshooting procedures begin. Standard settings for the DNPP components are as follows:

- Sony high-resolution color CCD camera:
  - "MODE" selection switch should be set to **AUTO**.
- Panasonic AG-6740 time-lapse VCR:
  - "REC MODE" should be set to **INT** (internal timer).
  - "TIME MODE" should be set to **6H**.
  - Date and time should be correct.
- Panasonic CT1384Y color video monitor:
  - Press the **VIDEO SELECT** button. "VIDEO INPUT 1" should be the selected input.

If any component fails to operate properly, refer to the following discussion first. If a remedy cannot be found, or if the system components are not set correctly, consult the individual component manufacturer's manuals provided in the Time-Lapse Video Monitoring Field Procedures Notebook.

4.2.1 Video Monitor

If no picture appears or if the picture is distorted on the video monitor, it may be caused by cables, the monitor, VCR, or camera. The following troubleshooting procedures should be followed first to isolate the cause and potentially correct the problem:

POWER CAUSES	GFI circuit breakers - Verify that the circuit breaker or GFI reset buttons for the outlet and UPS power supply have not been tripped. Monitor – Verify that the monitor is plugged in and turned on.
CABLE CAUSES	Check all power and signal cable connections to verify that all connectors are properly seated and that there are no severed or damaged cables or connections.

MONITOR CAUSES	Power loss - Check the circuit breaker or GFI reset button for the outlet used. Check all power connections at the monitor, at the outlet in the bottom of the housing, and on the UPS. Check for power at the wall plug.
	Video input loss - Check the VHS cable connections from the VCR to the monitor.
	Incorrect channel selection - The monitor must be tuned to the correct input using the input selection button. The input channel where the video cables from the VCR are connected must match the channel input select button.

If no problems were identified with the monitor, an effective way to isolate the problem is to remove the "camera to VCR" cable from the back of the VCR. Connect the cable directly to the monitor. If a picture does not appear, the problem is likely camera related; proceed to Section 4.2.2 below. If a picture appears, the problem is likely with the VCR; proceed to Section 4.2.3.

4.2.2 Video Camera

NO PICTURE	Power loss – Check for power loss to the camera by inspecting the power connections at the camera within the environmental enclosure. When the camera is powered up, a red indicator light is visible on the front of the camera just below and to the left of the lens.
	Cable connections – Check the signal cable connections inside and outside of the environmental enclosure, and verify the integrity of the cable.
	No video signal – Check that the camera lens cap has been removed.
BLACK AND WHITE PICTURE	Check all power and signal cable connections to verify that all connectors are properly seated and that there are no severed or damaged cables or connections.
POOR EXPOSURE	Verify that the "MODE" selector switch on the camera is set to "AUTO".
PICTURE OUT OF FOCUS	Telephone ARS for instructions.

4.2.3 Video Cassette Recorder

VCR DOES NOT RECORD	VCR tape - Check that the read-only tab on the videotape cassette is intact. Also check that the videotape is rewound. VCR - Check that the VCR has not been placed in the pause mode.
RECORDING CANNOT BE STOPPED	If the "REC LOCK" switch is set to "1" or "2", set it to "OFF."
ERROR CODES	When error codes appear on the VCR display, refer to the manufacturer's manual in the Time-Lapse Video Monitoring Field Procedures Notebook .
DATE AND TIME NOT DISPLAYED	When the date and time do not appear on the monitor display, or if they are incorrect, reset them following the instructions on page 34 of the Panasonic AG-6740 operating instructions.

4.2.4 Programmable VCR Video Function Check

If the steps defined above do not correct the problem and the problem has been isolated to the VCR, the programmable video functions may be incorrectly set. Correct VCR function settings are shown in Table 4-1. Procedures to navigate through the VCR menu screens are discussed below. If difficulty is encountered completing this process, refer to page 51 of the Panasonic AG-6740 time-lapse recorder manufacturer's manual. The operator should not attempt to change any other parameters in the VCR setup without direct instruction from the ARS data coordinator.

NAVIGATING THE VCR MENU SCREENS

The REV PLAY, PLAY, REW, and FF, REV ADV, and FWD ADV buttons on the front panel of the VCR serve a secondary programming purpose when in the VCR programming menu mode. There are six (6) menu screens with multiple options on each menu screen to choose from when in the programming mode. Use the gold labels under these buttons to navigate through the menus as follows:

- Place the VCR in "program mode" by sliding the PROGRAM switch to **MENU**.
- Page through the six menu screens using **REV PLAY** (-) or **PLAY** (+).
- Scroll through items on a menu screen using **REW** (▼) or **FF** (►).
- Set the value of an item on a screen using **REV ADV** (-) or **FWD ADV** (+).

Table 4-1

Time-Lapse Monitoring System VCR Settings
for the DNPP Monitoring Site

Menu Screen	Switch/Option	Correct Setting		
1	(Display)			
	Mode	T/D		
	Character	WHITE		
	Position	L-BOTTOM		
	Time Select	24HOUR		
	Data	ON		
	Time Select	ON		
	T-Mode	ON		
	(Rec Indicated)			
	Not Rec	CAMERA		
2	(VTR Mode Select 1)			
	(High Density Rec)			
	Mode	ON		
	(Rec T-Mode)	OFF		
	(Tape in)	STOP		
	(Tape end)	STOP		
	Alarm in	STOP		
	(Eject Operation)			
	Mode	EJECT		
3	(VTR Mode Select 2)			
	Power Loss Memory			
	** ** ** ** **:**			
	(Video)			
	Mode	AUTO		
	In	S-VIDEO		
	S-VHS REC	ON		
	(Time Adjusting)			
	Set Time	5:00		
	Operation	MASTER		
4	(Alarm/Sensor Rec)			
	Mode	OFF		
	Duration	0.5MIN		
	Buzzer	OFF		
	Repeat in	OFF		
	(Reset Pulse)			
	Input Level	HIGH		
	(Camera SW)			
	Timing	1FIELD		
	Mode	TM2		
5	(1-Shot REC)			
	Field	1		
	Interval	3MIN		
	(Tape Remain)			
	Buzzer	OFF		
	(Rec Review)			
	Auto	OFF		
	Err Buzzer	OFF		
	(Err Warn Buzzer)	OFF		
6	(Internal Timer Rec)	Start	End	T-M
	Sun	OFF		
	Mon	OFF		
	Tue	OFF		
	Wed	OFF		
	Thu	OFF		
	Fri	OFF		
	Sat	OFF		
	DLY	(See Table 4-2)		480H
Other	Program Switch	OFF		
	Rec Lock	OFF		
	Time Mode	2H OR 6H		
	Time/Counter	COUNT		

VERIFY VCR MENU SETTINGS

Check each menu screen against the values in Table 4-1. The only parameter that can vary from the table is the Internal Timer Record settings for automatic recording times. These values are set seasonally to accommodate day-length. Make sure the Internal Timer Record start and stop times and T-M are set according to the times specified for the monitoring program.

SETTING THE DAILY START AND STOP TIMES

Using the navigation techniques described above, select the "Internal Timer Rec" menu. Scroll down to the DLY line and set the start and stop times as specified in Table 4-2.

Note: The VCR and all recording times are kept in standard time (i.e., DO NOT SET THE VCR TIME TO DAYLIGHT SAVING TIME).

Table 4-2

VCR Monthly Recording Start/Stop Timer Settings
Healy Clean Coal Project, Post-Construction Visibility Monitoring Program

Healy, Yukon-Koyukuk County, Alaska (longitude W149.0° latitude N63.9°)												
Adjustment Date	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	1-Dec
Video Start*	08:30	07:00	05:30	03:30	00:00	00:00	00:00	02:30	04:30	06:00	07:30	09:30
Video Stop*	18:00	19:00	20:30	22:30	00:00	00:00	00:00	00:00	21:00	19:00	17:30	16:00

* All times are in Standard Time. Do not set the VCR time to Daylight Saving Time.

Sunrise/Sunset Reference Table

Date	31-Jan	28-Feb	31-Mar	30-Apr	31-May	22-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	22-Dec
Standard/daylight	AST	AST	AST	ADT	ADT	ADT	ADT	ADT	ADT	ADT	AST	AST
Begin civil twilight	08:40	07:18	05:29	04:27				03:39	05:47	07:18	07:45	09:29
Sunrise	09:37	08:06	06:18	05:33	03:58	03:31	03:40	05:06	06:39	08:05	08:38	10:46
Sun transit	13:09	13:08	13:00	13:53	13:54	13:58	14:00	14:02	13:56	13:45	12:39	12:55
Sunset	16:43	18:12	19:44	22:15	23:51	00:25	00:18	22:56	21:10	19:25	16:40	15:03
End civil twilight	17:40	19:00	20:34	23:23				00:20	22:02	20:12	17:33	16:20

Source:
U.S. Naval Observatory, Astronomical Applications Department
http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period. Refer to TI 4120-3650, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor,* for complete system verification procedures.

After any adjustment, repair, or replacement, verify system operation periodically before the scheduled site visit to ensure ongoing operation. The data coordinator will review all videotapes immediately upon receipt to ensure correct tape exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, ARS will ship a backup system or system component to the site as quickly as possible. Site operators should exchange the equipment immediately upon receipt of the replacement, and ship the malfunctioning unit to ARS for evaluation and repair. ARS' shipping address is:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged equipment in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Time-lapse Video Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES

TITLE **TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT GARNER HILL – SONY SSC-S20 CAMERA, PELCO PT1250 SERIES PAN/TILT, RWI 30CM MICROWAVE ANTENNA, AND PANASONIC CT1384Y MONITOR**

TECHNICAL INSTRUCTION

NUMBER **4120-3755**

DATE **SEPTEMBER 1998**

AUTHORIZATIONS

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REVISION HISTORY

REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

TABLE OF CONTENTS

1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by quickly identifying the probable source of a time-lapse video monitoring system malfunction and initializing appropriate equipment repairs or replacements. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for an SVHS time-lapse video monitoring system at Garner Hill comprised of a. Sony SSC-S20 camera, Pelco PT1250 series pan/tilt, RWI 30CM microwave antenna, and Panasonic CT1384Y monitor.

This TI serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:

  - Sony SSC-S20 camera

  - Pelco PT1250 series pan/tilt

  - RWI 30CM microwave antenna

  - Panasonic CT1384Y color monitor

- Notification of the field specialist or data coordinator

- System diagnosis and resulting corrective action(s)

- Final system verification check

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.
- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.
- Provide technical support to the site operator via telephone to identify and resolve instrument problems.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Identify possible instrument malfunctions and contact the site operator to implement troubleshooting procedures.
- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.
- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Coordinate the replacement and repair of all system components and support hardware.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Perform all procedures described in this TI.
- Thoroughly document all troubleshooting procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet; mail the completed sheet to the data coordinator.
- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring microwave transmitter system consists of a camera assembly and a microwave transmission assembly. The components included in each assembly are:

Camera assembly components:

- Color video camera
- Microwave transmitter electronics and antenna
- Environmental enclosure for the video camera with the following accessories:
  - heater
  - heated window
  - sun shroud
  - pan/tilt mount
- Pan/tilt unit
- Rohn 45 tower

Microwave transmission assembly:

- Climate controlled shelter
- Microwave transmitter/receiver electronics and antenna

- Color review monitor
- UPS power supply
- Miscellaneous cables, connectors, etc.

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure and padlocks
- Climbing belt
- Digital watch synchronized to National Bureau of Standards and Technology (NIST) Time (303/499-7111)
- Voltmeter
- 110 VAC wallplug circuit tester
- Time-Lapse Video Monitoring Field Procedures Notebook containing:
    - TI 4120-3655, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
    - TI 4120-3755, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*
    - Manufacturer's instruction booklets
    - Time-Lapse Video Monitoring Status/Assessment Sheets
- Pen or pencil
- Optical cleaning supplies

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged enclosure, camera, an/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a video monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of videotapes.

- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The ARS data coordinator, in consultation with the site operator and ARS field specialists, diagnoses the problem and suggests specific actions. The operator initiates the corrective actions, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally following corrective actions, the operator returns it to service and visits the site periodically before the next regularly scheduled visit to verify system operation.

- When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, the data coordinator ships a complete backup system or specific component to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log (see Section 4.4). Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning component to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Time-Lapse Video Monitoring Status/Assessment Sheet. The documentation should include:

- Date of noted malfunction
- Actual or estimated amount of data loss
- Steps taken to test system components
- Corrective actions taken
- Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor the videotapes for recurrences or resolution of the problem.

All procedures described in this TI refer to the Sony SSC-20 video camera, Pelco PT1250 pan/tilt head, RWI 30CM microwave transmitter, and a Panasonic CT1384Y color monitor. Schematic diagrams of the monitoring system components are provided in TI 4120-3655, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at Garner Hill - Sony SSC-20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor.*

4.1 GENERAL INFORMATION

Initial diagnoses of an equipment problem should follow this troubleshooting sequence:

1) Follow the troubleshooting procedures described in the following subsections.

2) Document troubleshooting results so the data coordinator or field specialist can review the problem accurately.

3) Refer to the Time-Lapse Video Monitoring Field Procedures Notebook when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not immediately available, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during videotape review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Time-Lapse Video Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Standard settings for each component should be checked before troubleshooting procedures begin. Standard settings for the Garner Hill components are as follows:

- Sony high-resolution color CCD camera:
  - "MODE" selection switch should be set to **AUTO**.
- Panasonic CT1384Y color video monitor:
  - Press the **VIDEO SELECT** button. "VIDEO INPUT 1" should be the selected input.

If any component fails to operate properly, refer to the following discussion first. If a remedy cannot be found, or if the system components are not set correctly, consult the individual component manufacturer's manuals located in the Time-Lapse Video Monitoring Field Procedures Notebook.

4.2.1 Video Monitor

If no picture appears or if the picture is distorted on the video monitor, it may be caused by cables, the monitor, camera, or microwave system. The following troubleshooting procedures should be followed first to isolate the cause and potentially correct the problem:

POWER CAUSES	GFI circuit breakers - Verify that the circuit breaker or GFI reset buttons for the outlet and UPS power supply have not been tripped.
	Monitor – Verify that the monitor is plugged in and turned on.
CABLE CAUSES	Check all power and signal cable connections to verify that all connectors are properly seated and that there are no severed or damaged cables or connections.
MONITOR CAUSES	Power loss - Check the circuit breaker or GFI reset button for the outlet used. Check all power connections at the monitor, at the outlet in the bottom of the housing, and on the UPS. Check for power at the wall plug.
	Video input loss - Check the cable connections from the control panel to the monitor.

Incorrect channel selection - The monitor must be tuned to the correct input using the input selection button. The input channel where the video cables from the control panel are connected must match the channel input select button.

4.2.2 Video Camera

NO PICTURE	Power loss – Check for power loss to the camera by inspecting the power connections at the camera within the environmental enclosure. When the camera is powered up, a red indicator light is visible on the front of the camera just below and to the left of the lens. Cable connections – Check the signal cable connections inside and outside of the environmental enclosure, and verify the integrity of the cable. No video signal – Check that the camera lens cap has been removed.
BLACK AND WHITE PICTURE	Check all power and signal cable connections to verify that all connectors are properly seated and that there are no severed or damaged cables or connections.
POOR EXPOSURE	Verify that the "MODE" selector switch on the camera is set to "AUTO".
PICTURE OUT OF FOCUS	Telephone ARS for instructions.

4.2.3 Microwave Transmitter

If a good picture can be seen in the video monitor but the picture cannot be seen at HCCP, the cause is probably in the microwave transmitter system. A certified technician has installed the microwave transmitter system and dish. Troubleshooting procedures cannot be performed by the site operator on this piece of equipment. After completing troubleshooting procedures on all of the other components, the site operator should contact ARS immediately if the microwave system is suspected to be malfunctioning.

If these troubleshooting steps do not resolve the problem, the VCR may not be functioning properly. Refer to TI 4120-3760, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor.*

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period. Refer to TI 4120-3655, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at Garner Hill - Sony SSC-20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor,* for complete system verification procedures.

After any adjustment, repair, or replacement, verify system operation periodically before the scheduled site visit to ensure ongoing operation. The data coordinator will review all videotapes immediately upon receipt to ensure correct tape exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, ARS will ship a backup system or system component to the site as quickly as possible. Site operators should exchange the equipment immediately upon receipt of the replacement, and ship the malfunctioning unit to ARS for evaluation and repair. ARS' shipping address is:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged equipment in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Time-lapse Video Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR SVHS TIME-LAPSE VIDEO CAMERA SYSTEM AT HCCP – PANASONIC AG-6740 SVHS VCR AND SONY MONITOR**
	TECHNICAL INSTRUCTION
NUMBER	**4120-3760**
DATE	**SEPTEMBER 1998**

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REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

The purpose of on-site troubleshooting and emergency maintenance is to assure quality data capture and minimize data loss by quickly identifying the probable source of a time-lapse video monitoring system malfunction and initializing appropriate equipment repairs or replacements. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for an SVHS time-lapse video monitoring system at HCCP comprised of a Panasonic AG-6740 SVHS time-lapse VCR and a Sony color monitor.

This TI serves as a guideline to facilitate the following unscheduled maintenance tasks:

- On-site troubleshooting procedures for the following components:

  - Panasonic AG-6740 SVHS time-lapse recorder

  - Sony color monitor

- Notification of the field specialist or data coordinator

- System diagnosis and resulting corrective action(s)

- Final system verification check

Site operators should be fully trained and supplied with a Time-Lapse Video Monitoring Field Procedures Notebook that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer instruction booklets, a supply of Time-Lapse Video Monitoring Status/Assessment Sheets, and monitoring supplies are also provided.

Close personal communications should be maintained between Air Resource Specialists, Inc. (ARS) and site operators throughout all monitoring and unscheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the telephone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, his/her supervisor, field specialist, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.

2.2 FIELD SPECIALIST

The field specialist shall:

- Coordinate with the project manager, site operator, his/her supervisor, and data coordinator concerning the requirements and completion of specific troubleshooting procedures.
- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.
- Provide technical support to the site operator via telephone to identify and resolve instrument problems.
- Resolve problems reported by the site operator.
- Document all technical support provided to the site operator.

2.3 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the project manager, site operator, his/her supervisor, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Identify possible instrument malfunctions and contact the site operator to implement troubleshooting procedures.
- Verify that scheduled troubleshooting visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Provide technical support to the site operator via telephone to identify and resolve system problems. Document all technical support given to the site operator.
- Review documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Coordinate the replacement and repair of all system components and support hardware.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.
- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.4 SITE OPERATOR

The site operator shall:

- Coordinate with the project manager, the site operator's supervisor, data coordinator, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Perform all procedures described in this TI.
- Thoroughly document all troubleshooting procedures on the Time-Lapse Video Monitoring Status/Assessment Sheet; mail the completed sheet to the data coordinator.
- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The time-lapse video monitoring system consists of a video recording assembly and a microwave receiver assembly. The transmitter assembly components are located at Garner Hill; refer to TI 4120-3655, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*. The components included in each assembly are:

Video recording assembly components:

- Color review monitor
- SVHS time-lapse video recorder
- SVHS video recorder for real time recording of declared events
- SVHS review unit
- UPS power supply
- Video distribution amplifier
- Miscellaneous cables, connectors, etc.

Microwave receiver assembly:

- Microwave transmitter/receiver electronics and antenna

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to support a troubleshooting site visit or emergency maintenance include:

- Medium and small flat-blade screwdriver
- Digital watch synchronized to National Institute of Standards and Technology (NIST) Time (303/499-7111)
- Voltmeter
- 110 VAC wallplug circuit tester
- Time-Lapse Video Monitoring Field Procedures Notebook containing:
  - TI 4120-3660, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*
  - TI 4120-3760, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*
  - Manufacturer's instruction booklets
  - Time-Lapse Video Monitoring Status/Assessment Sheets
  - Videotape cassette labels
- Pen or pencil
- Optical cleaning supplies
- Supplemental SVHS videotape cassettes
- Padded mailing envelopes

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. Specific model and serial numbers of the exchanged recorder and/or monitor should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Time-Lapse Video Monitoring Status/Assessment Sheet. Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

4.1 General Information
4.2 Troubleshooting and Emergency Maintenance Procedures
4.3 Final System Verification Check
4.4 Capital Equipment Exchange Procedures

Maintaining a video monitoring camera system includes prompt detection and emergency maintenance when the system fails to function properly. The troubleshooting and emergency maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- A system malfunction is detected by the site operator during routine maintenance of the system or by the data coordinator during review of videotapes.

- The site operator applies defined troubleshooting procedures to test the system and notifies ARS of his/her findings. The ARS data coordinator, in consultation with the site operator and ARS field specialists, diagnoses the problem and suggests specific actions. The operator initiates the corrective actions, tests the system, and again notifies the data coordinator of his/her findings.

- If the system appears to be operating normally following corrective actions, the operator returns it to service and visits the site periodically before the next regularly scheduled visit to verify system operation.

- When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, the data coordinator ships a complete backup system or specific component to the site as quickly as possible, along with a Photographic Monitoring Network Quality Assurance Log (see Section 4.4). Site operators exchange the equipment, document the exchange on the log, and ship the malfunctioning component to ARS for evaluation and repair.

- The site operator documents all problems, troubleshooting, and corrective actions on the Time-Lapse Video Monitoring Status/Assessment Sheet. The documentation should include:

  - Date of noted malfunction

  - Actual or estimated amount of data loss

  - Steps taken to test system components

  - Corrective actions taken

  - Current operational status

- All troubleshooting and emergency maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor processed film for recurrences or resolution of the problem.

All procedures described in this TI refer to the Panasonic AG-6740 SVHS VCR and Sony color monitor. Schematic diagrams of the monitoring system components are provided in TI 4120-3660, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at HCCP - Panasonic AG-6740 SVHS VCR and Sony Monitor.*

4.1 GENERAL INFORMATION

Initial diagnoses of an equipment problem should follow this troubleshooting sequence:

1) Follow the troubleshooting procedures described in the following subsections.

2) Document troubleshooting results so the data coordinator or field specialist can review the problem accurately.

3) Refer to the Time-Lapse Video Monitoring Field Procedures Notebook when necessary.

Throughout the monitoring effort, ARS and site operators maintain close personal communications. Call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone:	970/484-7941
Fax:	970/484-3423

If the person you need to speak with is not immediately available, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

Data collection errors or discrepancies observed by the data coordinator during film review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on the Time-Lapse Video Monitoring Status/Assessment Sheet and by the data coordinator in the site-specific Quality Assurance Database.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Standard settings for each component should be checked before troubleshooting procedures begin. Standard settings for the HCCP components are as follows:

- Panasonic AG-6740 time-lapse VCR:

  - "REC MODE" should be set to **INT** (internal timer).
  - "TIME MODE" should be set to **6H**.

- Sony color video monitor:

  - The **LINE A** button should be the selected input.

If any component fails to operate properly, refer to the following discussion first. If a remedy cannot be found, or if the system components are not set correctly, consult the individual component manufacturer's provided in the Time-Lapse Video Monitoring Field Procedures Notebook.

4.2.1 Video Monitor

If no picture appears or if the picture is distorted on the video monitor, it may be caused by cables, the monitor, VCR, or microwave system. The following troubleshooting procedures should be followed first to isolate the cause and potentially correct the problem:

POWER CAUSES	GFI circuit breakers - Verify that the circuit breaker or GFI reset buttons for the outlet and UPS power supply have not been tripped. Monitor – Verify that the monitor is plugged in and turned on.
CABLE CAUSES	Check all power and signal cable connections to verify that all connectors are properly seated and that there are no severed or damaged cables or connections.
MONITOR CAUSES	Power loss - Check the circuit breaker or GFI reset button for the outlet used. Check all power connections at the monitor, at the outlet in the bottom of the housing, and on the UPS. Check for power at the wall plug. Video input loss - Check the VHS cable connections from the VCR to the monitor. Incorrect channel selection - The monitor must be tuned to the correct input using the input selection button. The input channel where the video cables from the VCR are connected must match the channel input select button.

If no problems were identified with the monitor, an effective way to isolate the problem is to remove the "microwave to VCR" cable from the back of the VCR. Connect the cable directly to the monitor. If a picture appears, the problem is likely with the VCR.

4.2.2 Video Cassette Recorder

VCR DOES NOT RECORD	VCR tape - Check that the read-only tab on the videotape cassette is intact. Also check that the videotape is rewound. VCR - Check that the VCR has not been placed in the pause mode.
RECORDING CANNOT BE STOPPED	If the "REC LOCK" switch is set to "1" or "2", set it to "OFF."
ERROR CODES	When error codes appear on the VCR display, refer to the manufacturer's manual in the Time-Lapse Video Monitoring Field Procedures Notebook.
DATE AND TIME NOT DISPLAYED	When the date and time do not appear on the monitor display, or if they are incorrect, reset them following the instructions on page 34 of the Panasonic AG-6740 operating instructions.

4.2.3 Programmable VCR Video Function Check

If the steps defined above do not correct the problem and the problem has been isolated to the VCR, the programmable video functions may be incorrectly set. Correct VCR function settings are shown in Table 4-1. Procedures to navigate through the VCR menu screens are discussed below. If difficulty is encountered completing this process, refer to page 51 of the Panasonic AG-6740 time-lapse recorder manufacturer's manual. The operator should not attempt to change any other parameters in the VCR setup without direct instruction from the ARS data coordinator.

NAVIGATING THE VCR MENU SCREENS

The REV PLAY, PLAY, REW, and FF, REV ADV, and FWD ADV buttons on the front panel of the VCR serve a secondary programming purpose when in the VCR programming menu mode. There are six (6) menu screens with multiple options on each menu screen to choose from when in the programming mode. Use the gold labels under these buttons to navigate through the menus as follows:

- Place the VCR in "program mode" by sliding the PROGRAM switch to **MENU**.
- Page through the six menu screens using **REV PLAY** (-) or **PLAY** (+).
- Scroll through items on a menu screen using **REW** (▼) or **FF** (►).
- Set the value of an item on a screen using **REV ADV** (-) or **FWD ADV** (+).

Table 4-1

Time-Lapse Monitoring System VCR Settings
for the HCCP Monitoring Site

Menu Screen	Switch/Option	Correct Setting		
1	(Display)			
	Mode	T/D		
	Character	WHITE		
	Position	L-BOTTOM		
	Time Select	24HOUR		
	Data	ON		
	Time Select	ON		
	T-Mode	ON		
	(Rec Indicated)			
	Not Rec	CAMERA		
2	(VTR Mode Select 1)			
	(High Density Rec)			
	Mode	ON		
	(Rec T-Mode)	OFF		
	(Tape in)	STOP		
	(Tape end)	STOP		
	Alarm in	STOP		
	(Eject Operation)			
	Mode	EJECT		
3	(VTR Mode Select 2)			
	Power Loss Memory			
	** ** ** ** **:**			
	(Video)			
	Mode	AUTO		
	In	LINE		
	S-VHS REC	ON		
	(Time Adjusting)			
	Set Time	5:00		
	Operation	MASTER		
4	(Alarm/Sensor Rec)			
	Mode	OFF		
	Duration	0.5MIN		
	Buzzer	OFF		
	Repeat in	OFF		
	(Reset Pulse)			
	Input Level	HIGH		
	(Camera SW)			
	Timing	1FIELD		
	Mode	TM2		
5	(1-Shot REC)			
	Field	1		
	Interval	3MIN		
	(Tape Remain)			
	Buzzer	OFF		
	(Rec Review)			
	Auto	OFF		
	Err Buzzer	OFF		
	(Err Warn Buzzer)	OFF		
6	(Internal Timer Rec)	Start	End	T-M
	Sun	OFF		
	Mon	OFF		
	Tue	OFF		
	Wed	OFF		
	Thu	OFF		
	Fri	OFF		
	Sat	OFF		
	DLY	(See Table 4-2)		480H
Other	Program Switch	OFF		
	Rec Lock	OFF		
	Time Mode	2H OR 6H		
	Time/Counter	COUNT		

VERIFY VCR MENU SETTINGS

Check each menu screen against the values in Table 4-1. The only parameter that can vary from the table is the Internal Timer Record settings for automatic recording times. These values are set seasonally to accommodate day-length. Make sure the Internal Timer Record start and stop times and T-M are set according to the times specified for the monitoring program.

SETTING THE DAILY START AND STOP TIMES

Using the navigation techniques described above, select the "Internal Timer Rec" menu. Scroll down to the DLY line and set the start and stop times as specified in Table 4-2.

Note: The VCR and all recording times are kept in standard time (i.e., DO NOT SET THE VCR TIME TO DAYLIGHT SAVING TIME).

Table 4-2

VCR Monthly Recording Start/Stop Timer Settings
Healy Clean Coal Project, Post-Construction Visibility Monitoring Program

Healy, Yukon-Koyukuk County, Alaska (longitude W149.0° latitude N63.9°)												
Adjustment Date	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	1-Dec
Video Start*	08:30	07:00	05:30	03:30	00:00	00:00	00:00	02:30	04:30	06:00	07:30	09:30
Video Stop*	18:00	19:00	20:30	22:30	00:00	00:00	00:00	00:00	21:00	19:00	17:30	16:00

* All times are in Standard Time. Do not set the VCR time to Daylight Saving Time.

Sunrise/Sunset Reference Table

Date	31-Jan	28-Feb	31-Mar	30-Apr	31-May	22-Jun	1-Jul	1-Aug	1-Sep	1-Oct	1-Nov	22-Dec
Standard/daylight	AST	AST	AST	ADT	ADT	ADT	ADT	ADT	ADT	ADT	AST	AST
Begin civil twilight	08:40	07:18	05:29	04:27				03:39	05:47	07:18	07:45	09:29
Sunrise	09:37	08:06	06:18	05:33	03:58	03:31	03:40	05:06	06:39	08:05	08:38	10:46
Sun transit	13:09	13:08	13:00	13:53	13:54	13:58	14:00	14:02	13:56	13:45	12:39	12:55
Sunset	16:43	18:12	19:44	22:15	23:51	00:25	00:18	22:56	21:10	19:25	16:40	15:03
End civil twilight	17:40	19:00	20:34	23:23				00:20	22:02	20:12	17:33	16:20

Source:
U.S. Naval Observatory, Astronomical Applications Department
http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html

If these troubleshooting steps do not resolve the problem, the microwave system or camera are not functioning properly. Refer to TI 4120-3755, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor.*

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings should be made following any component (or system) replacement or troubleshooting effort. Verify proper automatic operation by observing the system during a scheduled monitoring period. Refer to TI 4120-3660, *Routine Site Operator Maintenance Procedures for the SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor,* for complete system verification procedures.

After any adjustment, repair, or replacement, verify system operation periodically before the scheduled site visit to ensure ongoing operation. The data coordinator will review all videotapes immediately upon receipt to ensure correct tape exposure and advancement.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

When the site operator cannot identify or resolve a system-related problem or is not available to address the malfunction, ARS will ship a backup system or system component to the site as quickly as possible. Site operators should exchange the equipment immediately upon receipt of the replacement, and ship the malfunctioning unit to ARS for evaluation and repair. ARS' shipping address is:

Air Resource Specialists, Inc.
Attn: Data Coordinator
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525

Note that backup equipment and system components must be available to accommodate emergency system replacement with minimal data loss. Where no backup equipment is available, no data are collected until the system or system component can be repaired and returned to the site.

It is imperative that any capital instrumentation changes made as a result of troubleshooting or emergency maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the exchanged equipment in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Time-lapse Video Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**REAL-TIME VIDEO RECORDING FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4280**
DATE	**APRIL 1999**

AUTHORIZATIONS		
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes the procedures for real-time video recording. This SOP specifically describes procedures to:

- Initialize a VCR in real-time recording mode.
- Respond to, locate, and record in real-time, identified visual events of interest to the monitoring program.
- Deliver the recorded real-time videotapes to ARS.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of presenting program goals, objectives, and results to decision-makers and to the public. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

A video camera monitoring station can document the dynamics of visibility events or other events of interest to the monitoring program, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.
- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

The following technical instruction (TI) provides detailed information regarding specific real-time recording procedures:

- TI 4280-3500 *Real-Time Video Recording of Visual Events for the Healy Clean Coal Project*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator and data coordinator concerning the requirements for recording a real-time visual event.

2.2 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator and project manager concerning the requirements for recording a real-time visual event.
- Provide assistance to the site operator in proper videotape handling procedures.
- Supply the site operator with videotape cassettes and all necessary monitoring supplies.

2.3 SITE OPERATOR

The site operator shall:

- Coordinate with the data coordinator and project manager concerning the requirements for recording a real-time visual event.
- Mail videotape cassettes and accompanying documentation to ARS.
- Maintain a supply of videotapes properly labeled for event recording.
- Record and document reported visual events using procedures described in this TI.
- Deliver the event videotapes to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used to record real-time videotapes of visual events include:

- SVHS videotape cassettes.
- An SVHS video cassette recorder with microphone.
- A review monitor.
- A joystick transmitter/controller.
- Video Monitoring Visual Anomaly Event Logs.
- Videotape labels.
- Mailing envelopes.

4.0 METHODS

This section includes three (3) major subsections:

4.1 Preparing to Record Real-Time Events
4.2 Recording and Narrating Real-Time Events
4.3 Delivering Recorded Videotapes

4.1 PREPARING TO RECORD REAL-TIME EVENTS

When a visual event of interest is reported, the site operator should respond as quickly as possible to document the event. Specific procedures will vary depending upon the manufacturer and model of the equipment used, and are discussed in individual technical instructions.

In general, power up all monitoring components for operation, including the VCR, monitor, and video camera remote control joystick controller. Select a new videotape cassette, label it, and load it into the VCR. Configure the VCR settings for real-time recording. If any problems are encountered in the system setup, refer to the technical instructions regarding troubleshooting and emergency maintenance procedures pertinent to the specific equipment used.

4.2 RECORDING AND NARRATING REAL-TIME EVENTS

Start the VCR to begin real-time recording. As the videotape is being recorded, the same view can be seen on the monitor. Position the camera accordingly with the joystick controller and narrate the scene, as it is being recorded, using a microphone. Include verbal comments that may be of interest to the goals and objectives of the monitoring, such as:

- A description of any visible plume or haze.
- Any change in the camera attitude.
- Weather characteristics including noticeable wind, clouds, precipitation, or fog.
- Information regarding any facility operations, animal, traffic, or construction activity, etc.

Document the event on a Video Monitoring Visual Anomaly Event Log. At the conclusion of recording the visual event, stop recording and realign the video camera to its normal operating position. Complete the event log, remove the videotape from the VCR, and complete the videotape label. Turn all equipment off.

4.3 DELIVERING RECORDED VIDEOTAPES

After recording the event, the site operator must prepare the videotape and documentation for shipment to ARS. Place the videotape in a padded mailing envelope, attach the completed Video Monitoring Visual Anomaly Event Log, and mail immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**REAL-TIME VIDEO RECORDING OF VISUAL EVENTS FOR THE HEALY CLEAN COAL PROJECT**
	TECHNICAL INSTRUCTION
NUMBER	**4280-3500**
DATE	**SEPTEMBER 1998**

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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedures for real-time video recording of visual events for the Healy Clean Coal Project. This TI specifically describes procedures to:

- Initialize a VCR in real-time recording mode.
- Respond to, locate, and record in real-time, identified visual events of interest to the monitoring program.
- Deliver the recorded real-time videotape to ARS.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall coordinate with the site operator, plant operator, and data coordinator concerning the requirements for recording a real-time visual event.

2.2 DATA COORDINATOR

The data coordinator shall:

- Coordinate with the site operator, plant operator, and project manager concerning the requirements for recording a real-time visual event.
- Supply the plant operator with videotape cassettes and all necessary monitoring supplies.

2.3 SITE OPERATOR

The site operator shall:

- Coordinate with the plant operator, data coordinator, and project manager concerning the requirements for recording a real-time visual event.
- Provide assistance to the plant operator in proper videotape handling procedures.
- Mail videotape cassettes and accompanying documentation to ARS.

2.4 PLANT OPERATOR

The plant operator shall:

- Coordinate with the site operator, data coordinator, and project manager concerning the requirements for recording a real-time visual event.

- Maintain a supply of videotapes properly labeled for event recording.
- Record and document reported visual events using procedures described in this TI.
- Deliver the event videotape to the site operator for shipping to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used to record real-time videotapes of visual events include:

- SVHS videotape cassettes
- An SVHS video cassette recorder with microphone
- A review monitor
- Joystick transmitter/controller
- Video Monitoring Visual Anomaly Event Logs
- Videotape labels
- Mailing envelopes

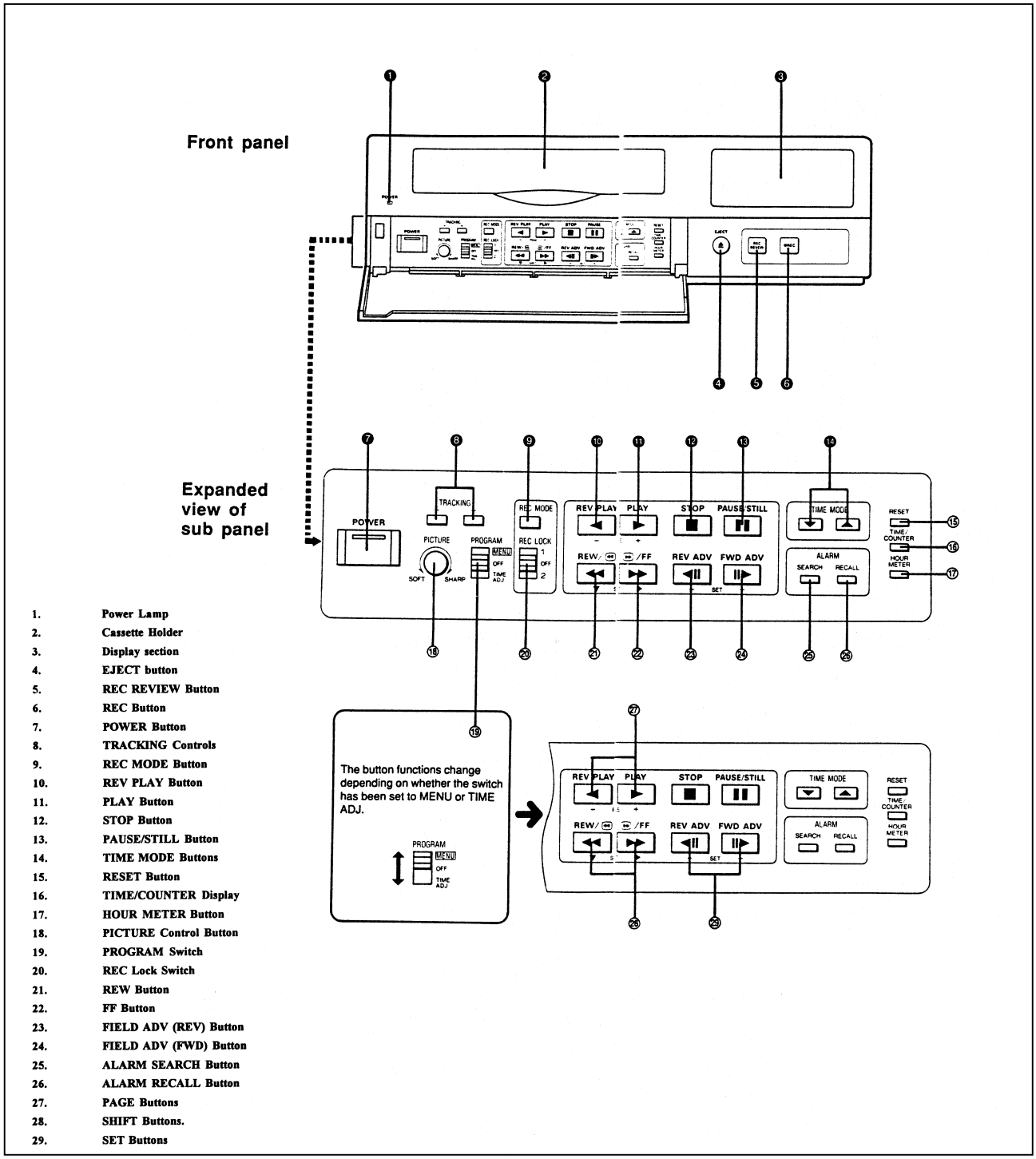
4.0 METHODS

In addition to daily automatic time-lapse video monitoring, real-time taping of visibility events can be useful in tracking and documenting events. Two (2) VCRs exist in the Healy Power Plant control room. One VCR (the time-lapse VCR) is programmed to record time-lapse images. The second VCR (the event VCR) is available for recording real-time video during identified visibility events. Visibility events are declared by National Park Service Personnel. This section presents the methods used to perform real-time video recordings of visual events for the Healy Clean Coal Project.

This section includes three (3) major subsections:

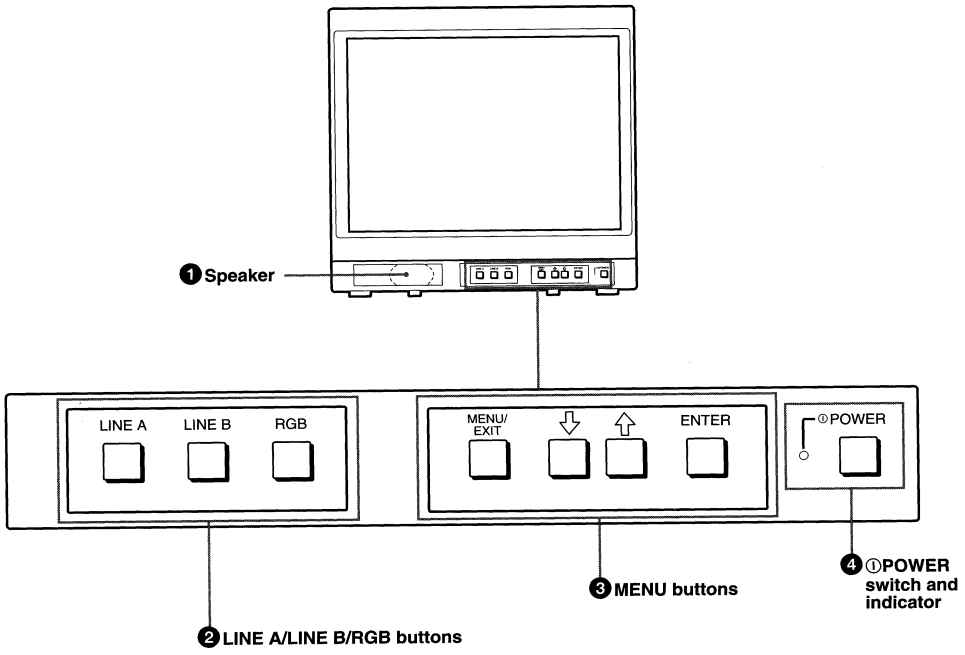
4.1 Preparing the SVHS VCR for Recording Real-Time Events
4.2 Recording and Narrating Real-Time Events
4.3 Delivering Recorded Real-Time Event Videotapes

All procedures described in this TI refer to the Panasonic AG-6740 SVHS VCR, Sony color monitor, and Pelco MPT9500 Series Transmitter/Controller. Schematic diagrams of the video system components are provided as Figures 4-1 through 4-3.



1. Power Lamp
2. Cassette Holder
3. Display section
4. EJECT button
5. REC REVIEW Button
6. REC Button
7. POWER Button
8. TRACKING Controls
9. REC MODE Button
10. REV PLAY Button
11. PLAY Button
12. STOP Button
13. PAUSE/STILL Button
14. TIME MODE Buttons
15. RESET Button
16. TIME/COUNTER Display
17. HOUR METER Button
18. PICTURE Control Button
19. PROGRAM Switch
20. REC Lock Switch
21. REW Button
22. FF Button
23. FIELD ADV (REV) Button
24. FIELD ADV (FWD) Button
25. ALARM SEARCH Button
26. ALARM RECALL Button
27. PAGE Buttons
28. SHIFT Buttons.
29. SET Buttons

Figure 4-1. Panasonic AG-6740 Time-Lapse VCR Control Schematic.



❶ Speaker

❷ LINE A/LINE B/RGB (input select) buttons

Press to select the program to be monitored.

Input signal	Press
Signal fed through the LINE A connector	LINE A
Signal fed through the LINE B connector	LINE B
Signal fed through the RGB connectors[a)]	RGB[a)]

a) Provided with the PVM-14N2A/14N2E/14N2U/20N2A/20N2E/20N2U only.

❸ MENU buttons

Press to make the menu appear.

For detailed information on MENU buttons, see "Operation through On-Screen Menus" on page 9.

❹ ⏻ POWER switch and indicator

Press to turn the monitor on. The indicator lights in green.

To turn the power off, press this again.

Figure 4-2. Sony Color Monitor Schematic.

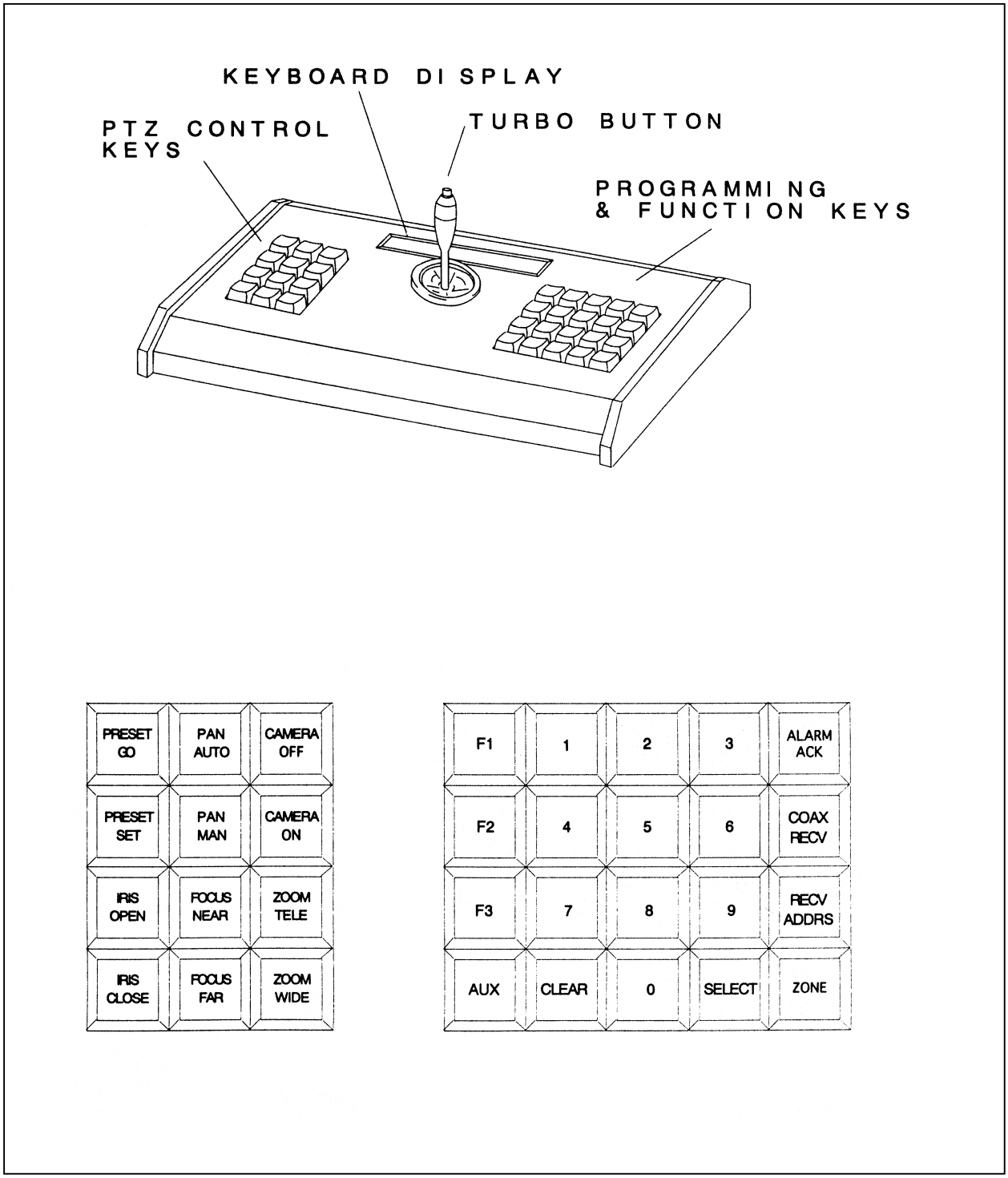


Figure 4-3. Pelco Transmitter/Controller Function Diagram.

4.1 PREPARING THE SVHS VCR FOR RECORDING REAL-TIME EVENTS

When a visual event is reported to the HCCP control room, the plant operator should respond as quickly as possible to document the event by performing the procedures below.

POWER UP THE EVENT VCR AND MONITOR

Turn the event VCR on by opening the subpanel door and pressing the **POWER** button on the subpanel. Turn the monitor on by pressing its **POWER** button.

VIDEO CAMERA REMOTE CONTROL

The display on the joystick transmitter/controller must read "RS485". If this is not displayed, press the number **1** key on the joystick transmitter/controller and then press the **RECV ADDRS** key on the same device. The display will default to the "RS485" mode after approximately 5 seconds.

VIDEOTAPE CHECK AND VCR SETTINGS

Select a blank videotape provided with the monitoring supplies. Look to make sure that it has not been used and that it is completely rewound. Rewind if necessary using the REW (◂◂) button on the VCR.

Complete a new videotape cassette label with the date, time, and tape counter number (should be "0:00:00" for a new videotape) and place it on the spine of the new videotape to be inserted. An example videotape cassette label is provided as Figure 4-4.

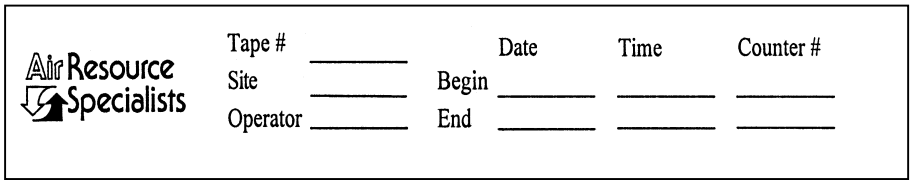


Figure 4-4. Example Videotape Cassette Label.

Load the videotape into the VCR and check the VCR's display. The tape counter should read "0:00:00". If the display is reading time, press the **TIME/COUNTER** button to display the counter. (The display toggles between the time and the counter each time the button is pressed).

Press the **RESET** button (while the counter value is displayed) to set the tape counter to "0:00:00".

The videotape speed should be set to "2H". If "2H" is not displayed, press the TIME MODE buttons (▼ and ▲) until the display reads "2H".

The monitoring system components are now configured for real-time recording. If any problems are encountered in the system setup, refer to TI 4120-3760, *Troubleshooting and Emergency Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor.*

4.2 RECORDING AND NARRATING REAL-TIME EVENTS

BEGIN RECORDING

After ensuring that the correct videotape is in the event VCR, press the red record button (● REC) on the VCR front panel. The recording symbol (REC) and forward arrow (▸) will appear in the VCR's LCD display while recording is in progress. Real-time video of the view as seen on the monitor will now be recorded on the videotape.

Begin completing a Video Monitoring Visual Anomaly Event Log by documenting the start date, time, and counter number (see Figure 4-5).

POSITION CAMERA

Use the transmitter/controller joystick to move the video camera to view the reported visual event. The view seen on the monitor screen will be the view that will be recorded.

NARRATE THE SCENE

A microphone is provided to record verbal comments on the videotape about the scene as it is recorded. The microphone is always in the "on/record" mode. Speak slowly and clearly into the microphone. Include verbal comments such as:

- A description of any visible plume or haze.
- Any change in the camera attitude.
- Weather characteristics including noticeable wind, clouds, precipitation, or fog.
- Information regarding plant operations.

STOP RECORDING AND REALIGN THE CAMERA

At the conclusion of recording the visual event, press the **STOP** (■) button on the front panel of the VCR.

Return the camera to its home position using the joystick. The HCCP plant should be centered on the monitor screen, two inches from the bottom of the screen.

COMPLETE THE EVENT LOG

Following the recording process, complete the Video Monitoring Visual Anomaly Event Log with all details requested, including the videotape stop time and counter reading.

REMOVE VIDEOTAPE

At the conclusion of recording the visible event:

- Rewind the videotape by pressing the REW button (◂◂) on the subpanel of the VCR.
- Remove the videotape from the VCR by pressing the blue EJECT (▲) button.

VIDEO MONITORING VISUAL ANOMALY EVENT LOG

Project: HCCPVID Operator: _____
Site: Healy Power Plant Video Control and Viewing Center

Date_____ Start Time _____ Count_____
Stop Time _____ Count_____

VCR Operating Mode: Real-Time Time-Lapse (circle one)

Checklist:

	✓
Power up	_____
Record mode on	_____
Is the reported visual anomaly visible to you? (y/n)	_____
Narration complete	_____
Tape stopped	_____
Tape removed	_____
Tape and hardcase labeled and stored	_____
New tape inserted	_____
Power down complete	_____
Event log complete and stored with tape	_____

Event Description:

_____
_____
_____
_____

Apparent impact to Class I area? (y/n) _____ Describe: _____

_____
_____

General Weather Conditions (give best estimate from camera view if possible):

Wind Speed: _____(calm, light, moderate, strong)
Wind Direction: _____(approximate)
Sky: _____(clear, partly clear, partly cloudy, cloudy)
Precipitation: _____(rain, drizzle, mist, fog, snow, sleet)
Temperature: _____(approximate)

Discussion:

_____
_____
_____

Enclose this Event Log with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

(video_event_log.doc 9/98)

Figure 4-5. Example Video Monitoring Visual Anomaly Event Log.

LABEL VIDEOTAPE	Complete the videotape label with the event's ending date, time, and tape counter reading.
POWER DOWN THE VCR AND MONITOR	After removing the videotape, turn the event VCR off by pressing the **POWER** button on the subpanel and closing the subpanel door. Turn the monitor off by pressing its **POWER** button.

4.3 DELIVERING RECORDED REAL-TIME EVENT VIDEOTAPES

After recording the event, the plant operator must prepare the videotape and documentation for shipment to ARS:

PREPARE VIDEOTAPE FOR SHIPMENT	Remove the videotape overwrite protection tab from the back of the videotape to prevent accidental overwriting or erasing of the tape.
DELIVER VIDEOTAPE	The plant operator should then deliver the videotape and completed Video Monitoring Visual Anomaly Event Log to the site operator.

Once the site operator receives a completed event videotape:

PREPARE THE VIDEOTAPE FOR SHIPMENT	Place the videotape in a padded mailing envelope. Attached the completed Video Monitoring Visual Anomaly Event Log. Mail the videotape immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**COLLECTION OF SCENE MONITORING PHOTOGRAPHS, FILM, AND VIDEOTAPE**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4305**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Delete references to operational timelines.	February 1996	
1.0	Change title/add SVHS video system references.	February 1999	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines the quality assurance and quality control actions associated with the collection, processing, and handling of photographic and video monitoring data. This SOP serves as a guide to assure high quality data collection from automatic camera or video monitoring stations.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visual relationships to decision-makers and to the public. Self-contained, automatic camera monitoring systems or time-lapse video monitoring systems are easily installed and operated. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

An automatic camera visibility monitoring station takes 35 mm slides of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera or an SVHS time-lapse recorder to document the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for the computer image modeling of potential impairment.
- Support color and human perception research.

Slides, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

In addition to visibility monitoring, time-lapse video systems can be used for a variety of other purposes, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.
- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

The following technical instructions (TIs) provide detailed information regarding specific photographic, film, and videotape collection, processing, and handling procedures:

- TI 4305-4000 *Collection, Processing, and Handling of 35 mm Slide Film*
- TI 4305-4003 *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*
- TI 4305-4050 *Collection, Processing, and Handling of Time-Lapse Videotapes for the Healy Clean Coal Project*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall oversee all collection, processing, and handling procedures.

2.2 DATA COORDINATOR

The data coordinator shall:

- Supply the site operator with film, videotape cassettes, and all necessary monitoring supplies.
- Verify that scheduled site visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all film and videotape documentation completed by the site operator for completeness and accuracy, and file all documentation and correspondence in the site-specific notebooks and quality assurance database.
- Oversee film and videotape tracking.
- Review all film and videotape for quantity and quality.
- Resolve problems reported by the site operator and data technician.

- Verify that all Master Log documentation for film is complete and accurate.
- Complete an Operational History Log for each videotape cassette.
- Determine collection and recovery statistics.
- Prepare all duplicate videotapes.

2.3 DATA TECHNICIAN

The data technician shall:

- Log receipt of all film rolls and videotapes mailed to Air Resource Specialists, Inc. (ARS) from site operators.
- Ship all exposed film to the Kodalux laboratory for developing.
- Log all developed film returned from Kodalux processing.
- Complete Master Log documentation for each film roll.
- Identify and chronologically label all 35 mm slides and 8 mm film rolls by site.
- Complete Visibility Monitoring Slide Logs.
- Report any noted documentation or data inconsistencies to the data coordinator.
- File all fully documented film products and videotapes.
- Distribute duplicate videotapes as specified to project participants.

2.4 SITE OPERATOR

The site operator shall:

- Report any noted inconsistencies upon site servicing and film or videotape changing to the data coordinator.
- Complete a Visibility Monitoring Status/Assessment Sheet and film canister/cartridge label for each film roll.
- Complete a Time-Lapse Visibility Monitoring Status/Assessment Sheet and videotape label for each videotape cassette.
- Mail exposed film or videotape and accompanying documentation to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 REQUIRED EQUIPMENT AND MATERIALS FOR 35 MM SLIDES

The following equipment and materials are used to collect, document, and validate 35 mm color slide film:

- Kodachrome 64 36-exposure color slide film
- Film canister labels
- Mailing envelopes
- Film processing mailers
- Automatic Camera Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Visibility Monitoring Slide Logs
- Light table
- Hand-held viewing lens
- Alpha-numeric slide number stamps
- Polyethylene slide protector sheets
- Manila and hanging file folders
- 3-ring notebooks

3.2 REQUIRED EQUIPMENT AND MATERIALS FOR 8 MM TIME-LAPSE FILM

The following equipment and materials are used to collect, document, and validate 8 mm time-lapse movie film:

- Kodachrome Super-8 color movie film
- Film cartridge labels
- Mailing envelopes
- Film processing mailers
- Time-Lapse Camera Visibility Monitoring Status/Assessment Sheets
- Master Logs
- 8 mm movie projector
- 3-ring notebooks

3.3 REQUIRED EQUIPMENT AND MATERIALS FOR TIME-LAPSE VIDEOTAPE

The following equipment and materials are used to collect, document, and validate SVHS time-lapse videotape:

- SVHS videotape cassettes
- Videotape labels
- Mailing envelopes
- Time-Lapse Video Monitoring Status/Assessment Sheets
- Operational History Logs
- SVHS video cassette player
- Review monitor
- 3-ring notebooks

4.0 METHODS

This section includes the following two (2) subsections:

4.1 Scene Monitoring Station Configurations
4.2 Collection, Processing, and Handling of Scene Monitoring Photographs, Film, and Videotape

4.1 SCENE MONITORING STATION CONFIGURATIONS

Scene monitoring station configurations are configured based on:

- Monitoring location and monitored scenic vista or view of interest.
- Frequency that various visual air quality conditions or monitoring interests occur.
- Complexity of diurnal variations and observed visibility events.
- Collocated air quality monitoring instrumentation.
- Site-specific monitoring objectives.
- Proximity to AC power if an AC SVHS time-lapse system is used.

An automatic 35 mm camera system documents observed visual air quality at user selected times throughout the day. Photographic slides often provide a quality assurance reference for collocated visibility measurements. Slides are also a quality media that can be easily replicated or digitized to support computer image modeling and perception research.

Automatic 8 mm time-lapse camera systems or SVHS time-lapse recorders document the dynamics of ongoing air quality and meteorological related events or other events.

4.2 COLLECTION, PROCESSING, AND HANDLING OF SCENE MONITORING PHOTOGRAPHS, FILM, AND VIDEOTAPE

Major steps in the data collection, processing, and handling of scene monitoring data are described below. Specific step-by-step procedures for 35 mm slides are detailed in TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film.* Specific procedures for 8 mm movie film are detailed in TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, and procedures for time-lapse videotape are detailed in TI 4305-4050, *Collection, Processing, and Handling of Time-Lapse Videotapes for the Healy Clean Coal Project*.

4.2.1 Film and Videotape Collection

All 35 mm or 8 mm film (from a single emulsion number) is purchased from a Kodalux direct distributor to cover two (2) consecutive monitoring seasons. High quality videotapes are purchased in bulk quantities. Film and videotapes are shipped to sites with specific handling and storage instructions, and supplemental monitoring supplies.

The site operator completes a film canister/cartridge label or videotape label and attaches it to each new film roll or videotape upon loading into the camera or time-lapse recorder. When the operator returns to remove the film or videotape, he or she completes the information on the label, places the film or videotape in a padded envelope, and mails it along with a Visibility (or Video) Monitoring Status/Assessment Sheet to ARS.

4.2.2 Film and Videotape Processing

4.2.2.1 Film Processing

Processing procedures for 35 mm and 8 mm film are nearly identical. Film that arrives from the field is immediately recorded on a site-specific Master Log according to the roll number and the time period the film documents. The following items are maintained on each Master Log:

- Site name
- Site operator
- Roll numbers
- Mailer numbers
- Emulsion number
- Dates when film rolls were sent to Kodalux processing and dates returned
- Beginning and ending dates and times of the photographs contained on the film roll
- Slide numbers
- Recovery statistics
- Correspondence

- Problem history
- Equipment changes
- Supplies mailed

The Visibility Monitoring Status/Assessment Sheet is thoroughly reviewed to verify proper camera operations and note any weather anomalies or requested operational supplies. Any discrepancies are documented by site and roll number on the Master Log and corrective action is initiated. Any requested monitoring supplies or equipment components are shipped.

All film is sent by courier to the Kodalux processing laboratory in Dallas. Roll and film processing mailer numbers are documented on the Master Log. All shipments are tracked and traced if necessary by mailer number.

4.2.2.2 Videotape Processing

SVHS videotape cassettes that arrive from the field are immediately recorded on an Operational History Log. The following items are maintained on each log:

- Site name
- Site operator
- Videotape number
- Date when the videotapes were received at ARS
- Comments or correspondence
- Monitoring period dates documented on each videotape
- Recovery statistics
- Videotape review status
- Delivery status of duplicate videotapes made

4.2.3 Film and Videotape Handling

Receipt of the developed 35 mm or 8 mm film from Kodalux is recorded on the site Master Log. Film rolls are stored chronologically in a pollutant-free, controlled environment.

4.2.3.1 Handling of 35 mm Slide Film

Extraneous 35 mm slides (if any) are removed and documentation and target photographs are arranged in polyethylene protector sheets by date and time. Following verification of slide arrangement, each slide is numbered sequentially and stamped with a four-letter site code. The slide set is placed in a manila folder along with a completed Visibility Monitoring Slide Log and the associated Visibility Monitoring Status/Assessment Sheet.

Slides are reviewed to verify that the vista alignment is correct, the databack date and time is recorded on the film, the slides are arranged in proper order, and that no exposure inconsistencies exist. Any discrepancies are documented by site and roll number on the Master Log and corrective action is initiated.

When all slides are collected for the monitoring season, final collection and recovery statistics are determined. Final Master Logs are stored in 3-ring notebooks.

4.2.3.2 Handling of 8 mm Movie Film

Movie film is reviewed for camera and system component operation, exposure quality, frame alignment and focus, exposure timing (including on/off times and exposure interval), film processing problems, the detection of unusual visual events or anomalies, and dirty or obscured shelter windows. Any problems or discrepancies observed are documented by site and roll number on the Master Log and corrective action is initiated.

Labeled film rolls are placed chronologically in site-specific storage boxes within storage cabinets. Final collection statistics are determined and recorded on the Master Logs. All supporting documentation including the Master Logs, Visibility Monitoring Status/Assessment Sheets, and other notes or important observations are kept in 3-ring notebooks by site, and filed alongside the film rolls.

4.2.3.3 Handling of SVHS Time-Lapse Videotapes

Videotape cassettes are reviewed for camera and system component operation, exposure quality, frame alignment and focus, timing, the detection of unusual visual events or anomalies, and dirty or obscured shelter windows. Any problems or discrepancies observed are documented by site and videotape number on the Operational History Log and corrective action is initiated.

Labeled videotape cassettes are placed chronologically in site-specific storage boxes within storage cabinets. Final collection statistics are determined and recorded on the Operational History Logs. All supporting documentation including the Operational History Logs, Time-Lapse Video Monitoring Status/Assessment Sheets, and other notes or important observations are kept in 3-ring notebooks by site, and filed alongside the videotapes.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**COLLECTION, PROCESSING, AND HANDLING OF 35 MM SLIDE FILM**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4305-4000**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Correct data recovery statistic equation.	February 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection, processing, and handling procedures for 35 mm color slide film. This TI is referenced in SOP 4305, *Collection of Scene Monitoring Photographs and Film (IMPROVE Protocol)*, specifically describes:

- Tracking and documenting 35 mm film rolls.
- Identifying and labeling 35 mm color slides.
- Validating 35 mm slide quantity and quality.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall oversee all collection, processing, and handling procedures.

2.2 DATA COORDINATOR

The data coordinator shall:

- Supply the site operator with film and all necessary monitoring supplies.
- Verify that scheduled site visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all film documentation completed by the site operator for completeness and accuracy, and file all documentation and correspondence in the site-specific quality assurance database.
- Oversee film tracking.
- Review all film for quantity and quality.
- Resolve problems reported by the site operator and data technician.
- Verify that all Master Log documentation is complete and accurate.
- Determine collection and recovery statistics.

2.3 DATA TECHNICIAN

The data technician shall:

- Log all film rolls mailed to Air Resource Specialists, Inc. (ARS) from site operators.
- Ship all exposed film to the Kodalux laboratory for developing.
- Log all developed film returned from Kodalux processing.

- Complete Master Log documentation for each film roll.
- Identify and chronologically label all slides by site.
- Complete Visibility Monitoring Slide Logs.
- Report any noted documentation or data inconsistencies to the data coordinator.
- File all slides and supporting documentation.

2.4 SITE OPERATOR

The site operator shall:

- Report any noted inconsistencies upon site servicing and film changing to the data coordinator.
- Complete a Visibility Monitoring Status/Assessment Sheet and film canister label for each film roll.
- Mail exposed film rolls and accompanying documentation to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The following equipment and materials are used to collect, document, and validate 35 mm color slide film:

- Kodachrome 64 36-exposure color slide film rolls
- Film canister labels
- Mailing envelopes
- Film processing mailers
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Visibility Monitoring Slide Logs
- Light table
- Hand-held lens
- Alpha-numeric slide number stamps
- Polyethylene slide protector sheets
- Manila and hanging file folders
- 3-ring notebooks

4.0 METHODS

The major steps in the data collection, processing, handling, analysis, and archiving of 35 mm color slide film are presented in Figure 4-1. The specific steps described in this and related TIs are highlighted in this figure. Table 4-1 summarizes the collection, processing, and handling steps described in the following subsections of this TI.

This section includes the following three (3) major subsections:

4.1 Film Collection Procedures
4.2 Film Processing Procedures
4.3 Film Handling Procedures

4.1 FILM COLLECTION PROCEDURES

4.1.1 Film Purchase and Distribution

ARS purchases Kodachrome ASA 64, 36-exposure color slide film (from a single emulsion number) from a direct Kodalux distributor. Enough film is purchased to cover two consecutive monitoring seasons. The data coordinator ships a six-month (two seasons) supply of film to each monitoring site in film storage boxes. Specific film handling and storage instructions are attached to each film storage box (see Figure 4-2). Mailing envelopes and associated photographic monitoring supplies are also provided.

4.1.2 Field Documentation

Collection procedures for 35 mm color slide film include site servicing visits to perform film changes at the required interval, and the mailing of exposed film rolls and accompanying documentation by the site operator to ARS. When servicing a site, the operator loads a film roll into the camera and takes a photograph of the photo documentation board on the first exposure of the roll. The board contains:

- Monitoring site identification
- Date
- Time
- Film roll number (numbers are consecutive)

Each camera is also equipped with a databack that records the date and time that the photograph was taken on the lower right corner of each slide.

The operator also completes a film canister label and attaches it to the film canister. An example film canister label is provided as Figure 4-3. When the film is removed upon the next site servicing visit, the operator completes the information on the canister label, places the film in a padded envelope, and mails it, along with the Visibility Monitoring Status/Assessment Sheet, to ARS via first class mail.

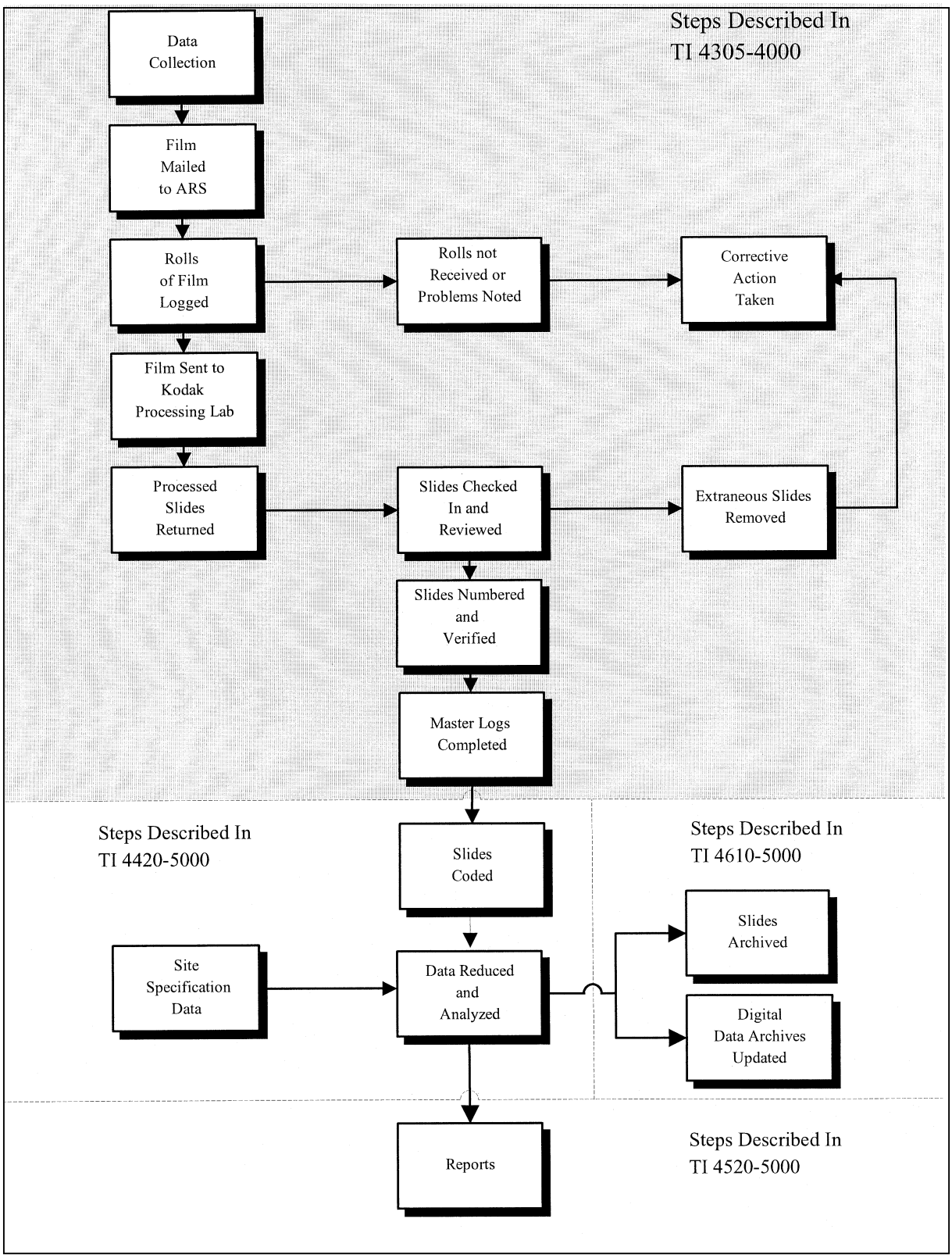

Figure 4-1. Major Steps in the Data Collection, Handling, Processing, Analysis, and Archiving of Photographic Data.

Table 4-1

Summary of Steps and Timing in the
Collection, Processing, and Handling of 35 mm Slide Film

Step	Time Path	Description
Data Collection	Overview	A batch of Kodachrome 64, 36-exposure color slide film is purchased at 6-month intervals. Operational supplies and film are distributed to the sites every 6 months, along with film handling and storage instructions. Automatic cameras are usually programmed to take photographs of a selected vista 3 times a day at 0900, 1200, and 1500 local time. The film is removed for processing every 11 days. (For this example, it is assumed that the photographic data is collected on Tuesday, 2/18/94, and this data complete a 36-exposure roll of film.)
Film Mailed to ARS	02/18/94	The operator documents all pertinent camera operations and meteorological conditions on a Visibility Monitoring Status/Assessment Sheet and completes the film canister label. The film and status/assessment sheet are mailed to ARS via first class mail.
Rolls of Film Logged	02/24/94	Film that arrives from the field is immediately recorded on a site-specific Master Log according to the roll number and the time period the film documents. Any film not received in a timely manner or discrepancies noted on the status/assessment sheet are documented by site and roll number on the Master Log and corrective action is initiated.
Film Sent to Kodak Processing Lab	02/25/94	Film is sent by courier to the Kodalux processing laboratory in Dallas.
Process Slides Returned	02/28/94	Receipt of the developed slides from Kodalux is recorded on the site Master Log.
Slides Checked-In and Reviewed	03/02/94	Extraneous slides (if any) are removed and documentation and target photographs are arranged in polyethylene sheets by date and time. Slides are reviewed to verify that the vista alignment is correct and that no equipment or exposure inconsistencies exist. Any discrepancies are documented by site and roll number on the Master Log and corrective action is initiated by the data coordinator.
Slides Numbered	03/02/94	Following verification of slide arrangement, each slide is numbered sequentially and stamped with the four-letter site code. A Visibility Monitoring Slide Log is completed with slide numbers and corresponding dates and times. The slide set (roll) and slide log are placed in a manila folder.
Slides Verified	03/05/94	Each set of slides and accompanying log is reviewed once more by the data coordinator. Preliminary data collection statistics and corrective actions taken (if any) are documented on the Master Log. The slide set is then filed according to site name and monitoring season.
Final Collection Statistics Prepared	05/01/94	Final Master Logs are prepared by the data coordinator at the completion of each season to summarize the data collected and thoroughly document data recovery and observed equipment operation discrepancies, as well as actions taken to resolve such discrepancies.

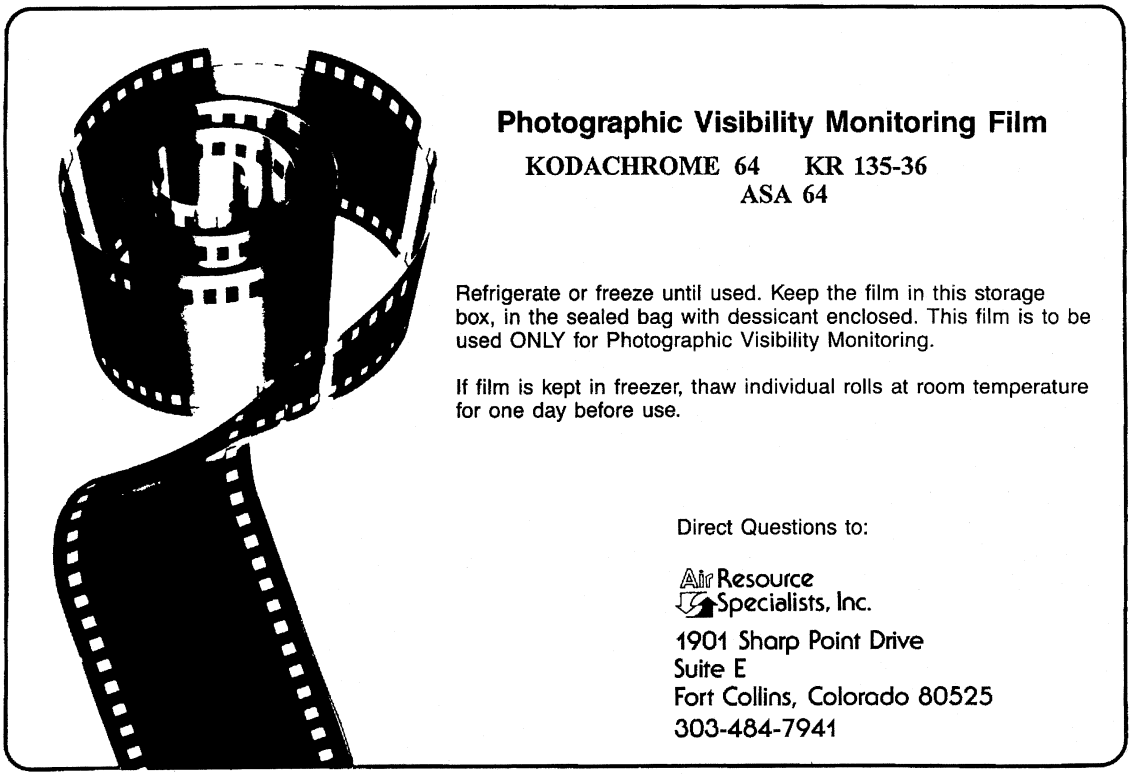

Figure 4-2. On-Site Film Handling and Storage Instructions Attached to the Film Storage Box.

LOC:_____ ROLL #_____
DATE ON:_____ TIME ON:_____
DATE OFF:_____ TIME OFF:_____
EMULSION #:_____
EXPIRATION DATE:_____

Figure 4-3. Example Film Canister Label.

An example Visibility Monitoring Status/Assessment Sheet is provided as Figure 4-4. Film should be sent immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Further details on site servicing procedures and site operator-related film collection procedures can be found in the camera-specific technical instruction for routine site operator maintenance of 35 mm automatic camera systems (TIs 4120-3100, 4120-3110, 4120-3120, 4120-3130, and 4120-3140).

4.2 FILM PROCESSING PROCEDURES

4.2.1 Master Log

Completion of the Master Log is essential to ensure quality film documentation. Information recorded on the Master Log is partially derived from site operator documentation; the remainder of the information is recorded for tracking purposes during film processing and film handling. An example Master Log is provided as Figure 4-5. The following information is entered on the Master Log:

- Season.
- Site name and abbreviation.
- Contact person (site operators).
- ROLL # - Consecutive, chronological film roll number by site.
- LOG - *Yes* if a status/assessment sheet was completed and accompanies the film roll, *no* if a status/assessment sheet was not sent with the film roll.
- SENT PROC - Date when the film was received at ARS from the site and sent to Kodalux for processing.
- MAIL # - Film processing mailer number for film tracking during processing and shipping.
- EMUL # - Film emulsion number as recorded on the film canister label.
- BACK PROC - Date when the film was received at ARS from Kodalux after being processed.
- SLIDE # - Beginning and ending slide numbers of the properly sequenced set for the monitoring period.
- # GOOD - The actual number of slides that are usable for qualitative analysis.

Location _____ Roll No. _____
Operator _____

AUTOMATIC CAMERA
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

FILM LOADED
Today's Date _____ Time _____

Yes	No	
☐	☐	Batteries tested
☐	☐	Documentation photograph taken
☐	☐	Camera main switch (circle one) A(EOS) Auto (OM2S) Off (OM2N) On(137MA) ☐(167MT) ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Lens focus on infinity
☐	☐	Databack display correct
☐	☐	Timer clocks and alarms verified
☐	☐	Camera/timer cable secure
☐	☐	Camera alignment correct
☐	☐	Film advancing properly
☐	☐	Enclosure door locked and door seal clamps tightened

FILM REMOVED
Today's Date _____ Time _____

Yes	No	
☐	☐	Camera found in proper operation
☐	☐	Camera alignment correct
☐	☐	Film advanced as expected exposure count on _____
☐	☐	Camera main switch (circle one) A(EOS) Auto(OM2S) Off(OM2N) On(137MA)☐(167MT)ON(PZ-20)
☐	☐	Aperture F8.0
☐	☐	ISO/ASA 64 (137MA ASA 100)
☐	☐	All other camera settings correct (refer to 35 mm camera checklist)
☐	☐	Camera/timer cable secure
☐	☐	Timer found in proper condition
☐	☐	Film rewound correctly
☐	☐	Film canister properly labeled

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of this roll _____
_____
_____
_____

Current % Cloud Cover _____ Temperature _____ _____ _____
Now Max Min

COMMENTS/ACTION TAKEN _____
_____
_____
_____

SUPPLIES NEEDED _____
_____

Mail white copy and 35 mm film to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-4. Example Automatic Camera Visibility Monitoring Status/Assessment Sheet.

MASTER LOG

CONTACT PERSON

_____ _____

SITE NAME AND ABBREVIATION _____

ROLL #	LOG	SENT PROC	MAIL #	EMUL #	BACK PROC	SLIDE #	# GOOD	# REC'D	# POS	DATE LOG	TIME LOG	CORRESPONDENCE	PROBLEMS	EQUIPMENT CHANGE	SUPPLIES MAILED

Figure 4-5. Example Master Log.

- # REC - The actual number of slides taken, recorded after review and validation of the film.

- # POS - Number of slides possible on the film roll, noted by the on/off dates and times the site operator recorded on the status/assessment sheet.

- DATE LOG - The beginning and ending dates of the slides contained on the film roll, as noted by the site operator on the status/assessment sheet and verified by review of the slides.

- TIME LOG - The beginning and ending times of the slides contained on the film roll, as noted by the site operator on the status/assessment sheet and verified by the review of the slides.

- CORRESPONDENCE - Notation and description of correspondence or communication pertaining to each specific film roll.

- PROBLEMS - Notation and description of problems pertaining to each specific film roll.

- EQUIPMENT CHANGE - A notation of the type and date replacement changes or modifications were made at the site, if applicable.

- SUPPLIES MAILED - A notation of the type, volume, and date supplies were sent to the site, if applicable.

The data coordinator verifies that all Master Log documentation is complete and accurate. Master Logs and any accompanying documentation are chronologically stored in 3-ring notebooks by site.

4.2.2 Visibility Monitoring Status/Assessment Sheet Review

The Visibility Monitoring Status/Assessment Sheet is thoroughly reviewed by the ARS data technician and data coordinator to verify proper camera operations and note any weather anomalies or requested operational supplies. Any discrepancies are documented by site and roll number on the Master Log and corrective action is initiated. Any requested monitoring supplies or photographic components are shipped within 24 hours, provided sufficient backup equipment/supplies are available.

4.2.3 Film Processing

After each exposed film roll has been identified and recorded on the Master Log, it is placed in an individual 35 mm film processing mailer that has a specific identification number (also recorded on the site Master Log). Site abbreviation and film roll number are noted on the mailer for further identification. Film mailers are shipped via courier to the Kodalux processing laboratory in Dallas twice a week.

The developed film is returned via courier to ARS in three to four days. If the film is not returned within seven days, ARS calls the courier to verify the arrival of the shipment, and a trace is made if any discrepancies in shipping/receiving dates are discovered.

4.3 FILM HANDLING PROCEDURES

4.3.1 Slide Check-In and Arrangement

Receipt of the developed slides is recorded on the site Master Log. All slides are visually reviewed by the data technician on a light table. Extraneous slides (if any) are removed, and documentation and target photographs are arranged in polyethylene protector sheets by date and time. Only slides that represent the standard date and time sequence of the selected vista or those taken purposely to document specific visibility events or site conditions are kept. The documentation board photograph is placed in upper left corner of the protector sheet at the beginning of each roll of film.

4.3.2 Slide Verification

Slides are further reviewed by the data technician and data coordinator to verify that:

- The vista alignment is correct.
- The number of slides corresponds to the data collection period noted on the film canister label.
- Databack date and time are recorded on the film.
- Slides are arranged in proper order.
- No exposure inconsistencies exist.
- The vista focus is correct.

All photographs are considered usable (good) for further qualitative analyses, except for:

- Supplemental visibility photographs.
- Out-of-alignment photographs (e.g., the target is not in the view).
- Extremely under- or overexposed photographs.
- Out-of-focus photographs; distinct features cannot be identified.
- Photographs taken through a fogged or icy shelter window.

Any discrepancies found are documented by site and roll number on the Master Log and corrective action is initiated by the data coordinator. (Refer to camera-specific emergency maintenance procedure TIs.) Any problems or interesting events observed on the slides are reviewed with the project manager. Qualitative review procedures are detailed in TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*.

4.3.3 Slide Numbering and Filing

Following verification of slide arrangement, each slide is numbered sequentially and stamped with the four-letter site code by the data technician. A Visibility Monitoring Slide Log is also completed to provide a quick reference, hard copy record of the slide numbers, dates, and times captured on each roll of film (see Figure 4-6). Slide-specific comments can also be included on the log if appropriate. The slide set is placed in a manila folder along with the completed Visibility Monitoring Slide Log and the associated status/assessment sheet. The folder is labeled with the site abbreviation and roll number.

Each set of slides and accompanying log is reviewed once more by the data coordinator. After the review the folder is labeled with the slide numbers and corresponding dates. Each file is then chronologically stored in a hanging file folder by site and season. Seasons are defined as:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

Refer to TI 4610-5000, *35 mm Photographic Slide Archives* for detailed archive procedures.

4.3.4 Final Collection and Data Recovery Statistics

Master Logs are completed and verified by the data coordinator at the end of each season to summarize the data collected at each site and to thoroughly document data recovery and observed equipment operation discrepancies, as well as actions taken to resolve such discrepancies. The completed Master Logs reflect final collection statistics for the period.

Data recovery statistics are compiled seasonally by the data coordinator. The primary data collection statistic calculated is:

$$\% \text{ Overall Data Recovery} = (\#\text{ REC} / \#\text{ POS})$$

Completed Master Logs are stored chronologically by site in 3-ring notebooks.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

VISIBILITY MONITORING SLIDE LOG

SITE: ____________
SEASON: _________
ROLL #: ___________

Slide	Date	Time	Comments
		DOC	
		9:00	
		12:00	
		3:00	
		9:00	
		12:00	
		3:00	
		9:00	
		12:00	
		3:00	
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		12:00	
		3:00	
		9:00	
		12:00	
		3:00	
		9:00	
		12:00	
		3:00	

Figure 4-6. Example Visibility Monitoring Slide Log.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**COLLECTION, PROCESSING, AND HANDLING OF 8 MM TIME-LAPSE MOVIE FILM**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4305-4003**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Gloria S. Mercer	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes; add film purchasing.	February 1996	

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LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection, processing, and handling procedures for 8 mm time-lapse movie film. This TI is referenced in SOP 4305, *Collection of Scene Monitoring Photographs and Film (IMPROVE Protocol)*, specifically describes:

- Tracking and documenting 8 mm film rolls.
- Identifying and labeling 8 mm film.
- Validating 8 mm film quantity and quality.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall oversee all collection, processing, and handling procedures.

2.2 DATA COORDINATOR

The data coordinator shall:

- Supply the site operator with film and all necessary monitoring supplies.
- Verify that scheduled site visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all film documentation completed by the site operator for completeness and accuracy, and file all documentation and correspondence in site-specific notebooks.
- Oversee film tracking.
- Review all film for quantity and quality.
- Resolve problems reported by the site operator and data technician.
- Complete Master Log documentation for each film roll.

2.3 DATA TECHNICIAN

The data technician shall:

- Log all film rolls mailed to Air Resource Specialists, Inc. (ARS) from site operators.
- Ship all exposed film to the Kodalux laboratory for developing.
- Log all developed film returned from Kodalux processing.
- Label and chronologically identify all film rolls by site.
- File all film rolls and supporting documentation.

2.4 SITE OPERATOR

The site operator shall:

- Report any noted inconsistencies upon site servicing and film changing to the data coordinator.
- Complete a Visibility Monitoring Status/Assessment Sheet and film cartridge label for each film roll.
- Mail exposed film rolls and accompanying documentation to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The following equipment and materials are used to collect, document, and validate 8 mm time-lapse film rolls:

- Kodachrome Super-8 color movie film
- Film cartridge labels
- Mailing envelopes
- Film processing mailers
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- 8 mm movie projector
- 3-ring notebooks

4.0 METHODS

This section includes the following three (3) major subsections:

4.1 Film Collection Procedures
4.2 Film Processing Procedures
4.3 Film Handling Procedures

4.1 FILM COLLECTION PROCEDURES

4.1.1 Film Purchase and Distribution

ARS purchases Kodachrome Super-8 color movie film from a direct Kodalux distributor. Enough film is purchased to cover two consecutive monitoring seasons. The data coordinator ships a six-month (two seasons) supply of film to each monitoring site along with mailing envelopes and associated photographic monitoring supplies.

4.1.2 Field Documentation

Collection procedures for 8 mm film include site servicing visits to perform film changes at the required interval, and the mailing of exposed film cartridges and accompanying documentation by the site operator to ARS. When servicing a site, the operator completes a film cartridge label and attaches it to the film cartridge before loading the film into the camera. An example film cartridge label is provided as Figure 4-1. When the film is removed upon the next site servicing visit, the operator completes the information on the cartridge label, places the film in a padded envelope, and mails it, along with the Visibility Monitoring Status/Assessment Sheet, to ARS via first class mail.

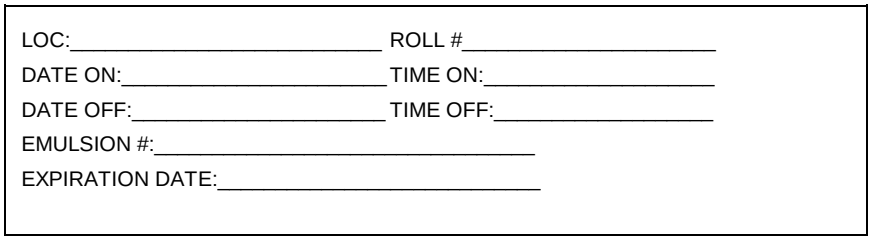

Figure 4-1. Example Film Cartridge Label.

The format of the Visibility Monitoring Status/Assessment Sheet will vary slightly according to camera type. Examples of the Visibility Monitoring Status/Assessment sheets are provided as Figures 4-2 and 4-3. Film should be sent immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

Further details on site servicing procedures and film collection procedures can be found in TI 4120-3200, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta XL-401/601*, and TI 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System - Minolta D-12*.

4.2 FILM PROCESSING PROCEDURES

4.2.1 Master Log

Completion of the Master Log is essential to ensure quality film documentation. Information recorded on the Master Log is partially derived from site operator documentation; the remainder of the information is recorded for tracking purposes during film processing and film handling. An example Master Log is provided as Figure 4-4. The following information is entered on the Master Log:

- Season.
- Site name and abbreviation.

Location _____

TIME-LAPSE CAMERA VISIBILITY MONITORING
STATUS/ASSESSMENT SHEET

Today's Date _____ Time _____ Operator _____

Roll # _____ Date On _____ Time On _____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

Describe General
Weather Conditions: _____
_____

Yes	No	
_____	_____	Monitoring target visible
_____	_____	Camera found in proper condition
_____	_____	Timer found in proper condition
_____	_____	Film advanced as expected
_____	_____	Film changed and film canister properly labeled
_____	_____	Lens and window clean
_____	_____	Settings verified

Normal/Macro Switch - NORMAL
Aperture Switch - AUTO
Filter Switch - DAYLIGHT
Function Switch - INTERVALOMETER
Interval Adjustment - 60-second position (recommended)

_____	_____	Camera alignment correct
_____	_____	Operating Switch ON

COMMENTS/ACTION TAKEN _____
_____
_____

Supplies Needed: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-2. Time-Lapse Camera Visibility Monitoring Status/Assessment Sheet For All 8 mm Camera Systems (except Minolta D-12).

Location _____

TIME-LAPSE CAMERA VISIBILITY MONITORING
STATUS/ASSESSMENT SHEET
FOR MINOLTA D-12

Today's Date _____ Time _____ Operator _____

Roll # _____ Date On _____ Time On _____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

Describe General
Weather Conditions: _____
_____

Yes	No	
_____	_____	Monitoring target visible
_____	_____	Camera found in proper condition
_____	_____	Timer found in proper condition
_____	_____	Film advanced as expected
_____	_____	Film changed and film canister properly labeled
_____	_____	Lens and window clean
_____	_____	Settings verified

Normal/Macro Switch	- N (Normal)
Aperture Control Selector	- A (Auto)
Manual Filter Switch	- No lamp symbol (Daylight position)
Auto Exposure Adjustment Dial	- Red mark (no adjustment)
Operation/Effect Selector	- N (Normal)
Frame speed dial	- S.F. (single frame)
Battery Master Switch	- OFF
Intervalometer	- ON
Interval Adjustment	- 60-second position (recommended)

_____	_____	Camera alignment correct
_____	_____	Operating Switch ON

COMMENTS/ACTION TAKEN _____
_____
_____
Supplies Needed: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource
Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-3. Time-Lapse Camera Visibility Monitoring Status/Assessment Sheet For Minolta D-12 8 mm Camera System.

MASTER LOG

CONTACT PERSON

_____ _____

SITE NAME AND ABBREVIATION _____

ROLL #	LOG	SENT PROC	MAILER #	BACK PROC	# POSS	# REC'D	DATE LOGGED	TIME LOGGED	PROBLEMS	EQUIPMENT CHANGE	SUPPLIES MAILED

Figure 4-4. Example Master Log.

- Contact person (site operators).

- ROLL # - Consecutive, chronological film roll number by site.

- LOG - *Yes* if a status/assessment sheet was completed and accompanies the film roll, *no* if a status/assessment sheet was not sent with the film roll.

- SENT PROC - Date when the film was received at ARS from the site and sent to Kodalux for processing.

- MAILER # - Film processing mailer number for film tracking during processing and shipping.

- BACK PROC - Date when the film was received at ARS from Kodalux after being processed.

- # POSS - Number of days possible the film could contain, noted by the on/off dates and times the site operator recorded on the status/assessment sheet.

- # REC'D - The actual number of days captured (received) on the film, recorded after review and validation of the film.

- DATE LOGGED - The beginning and ending dates of the photographs contained on the film roll, as noted by the site operator on the status/assessment sheet and verified by review of the film.

- TIME LOGGED - The beginning and ending times of the photographs contained on the film roll, as noted by the site operator on the status/assessment sheet and verified by review and validation of the film.

- PROBLEMS - Notation and description of problems pertaining to each specific film roll.

- EQUIPMENT CHANGE - A notation of the type and date replacement changes or modifications were made at the site, if applicable.

- SUPPLIES MAILED - A notation of the type, volume, and date supplies were sent to the site, if applicable.

Master Logs and accompanying documentation are chronologically stored in 3-ring notebooks by site.

4.2.2 Visibility Monitoring Status/Assessment Sheet Review

The Visibility Monitoring Status/Assessment Sheet is thoroughly reviewed by the ARS data coordinator to verify proper camera operations and note any weather anomalies or requested operational supplies. Any discrepancies are documented by site and roll number on the Master Log and corrective action is initiated. Any requested monitoring supplies or photographic components are shipped within 24 hours, provided sufficient backup equipment/supplies are available.

4.2.3 Film Processing

After each exposed film roll has been identified and recorded on the Master Log, it is placed in an individual 8 mm film processing mailer that has a specific identification number (also recorded on the site Master Log). Site abbreviation and film roll number are noted on the mailer for further identification. Film mailers are shipped via courier to the Kodalux processing laboratory in Dallas twice a week.

The developed film is returned via courier to ARS in three to four days. If the film is not returned within seven days, ARS calls the courier to verify the arrival of the shipment, and a trace is made if any discrepancies in shipping/receiving dates are discovered.

4.3 FILM HANDLING PROCEDURES

4.3.1 Quality Assurance Review

The quality assurance review begins with a visual review of the developed 8 mm film by the data coordinator. Film is reviewed for camera and system component operation, exposure quality, frame alignment and focus, exposure timing (including on/off times and exposure interval), film processing problems, the detection of unusual visual events or anomalies, and dirty or obscured shelter windows (due to snowfall, dirt, foreign objects, etc.). Any noted problems or inconsistencies observed on the film are recorded on the Master Log.

4.3.2 Film Verification

Any problems or interesting events observed on the film are again reviewed with the project manager. If appropriate, the data coordinator discusses corrective action with the site operator or sends replacement equipment to the site. Refer to TI 4120-3400, *Troubleshooting and Emergency Maintenance Procedures for Time-Lapse Camera System - Minolta XL601*, or TI 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for Time-Lapse Camera System - Minolta D-12*. Qualitative review procedures are detailed in TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review.*

4.3.3 Film Labeling and Filing

After each 8 mm film roll is processed by Kodalux and received at ARS, it is labeled by site, roll number, and beginning and ending dates. This labeling is written on both the film roll and on the end of the film box. This information is also entered on the Master Log. The labeled film rolls are placed chronologically in site-specific storage boxes within storage cabinets. All supporting documentation including the Master Logs, Visibility Monitoring Status/Assessment Sheets, and other notes or important observations are kept in 3-ring notebooks by site, and filed in the storage cabinets alongside the film rolls. Refer to TI 4610-5010, *8 mm Time-Lapse Movie Archives*, for detailed archive procedures.

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Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**COLLECTION, PROCESSING, AND HANDLING OF TIME-LAPSE VIDEOTAPES FOR THE HEALY CLEAN COAL PROJECT**
	TECHNICAL INSTRUCTION
NUMBER	**4305-4050**
DATE	**SEPTEMBER 1998**

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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection, processing, and handling procedures for SVHS time-lapse videotape for the Healy Clean Coal Project. This TI specifically describes:

- Tracking and documenting SVHS videotape cassettes.
- Identifying and labeling SVHS videotape cassettes.
- Validating SVHS videotape quantity and quality.
- Duplicating, distributing, and archiving videotapes.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall oversee all collection, processing, and handling procedures.

2.2 DATA COORDINATOR

The data coordinator shall:

- Supply the site operator with videotape cassettes and all necessary monitoring supplies.
- Verify that scheduled site visits are performed and notify the site operator if he/she fails to make a scheduled visit.
- Review all videotape documentation completed by the site operator for completeness and accuracy, and file all documentation and correspondence in site-specific notebooks.
- Oversee videotape tracking.
- Review all videotape for quantity and quality.
- Resolve problems reported by the site operator and data technician.
- Complete the site-specific Operational History Log for each videotape cassette.
- Prepare all duplicate videotapes.

2.3 DATA TECHNICIAN

The data technician shall:

- Log receipt of all videotapes mailed to Air Resource Specialists, Inc. (ARS) from site operators on a site-specific Operational History Log.
- File all original and master videotapes and supporting documentation.
- Distribute duplicate videotapes as specified to project participants.

2.4 SITE OPERATOR

The site operator shall:

- Report any noted inconsistencies upon site servicing and videotape changing to the data coordinator.
- Service the monitoring site as scheduled to change the videotapes and complete a Time-Lapse Video Monitoring Status/Assessment Sheet and videotape label for each videotape cassette.
- Mail videotape cassettes and accompanying documentation to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The following equipment and materials are used to collect, document, and validate SVHS videotapes:

- SVHS videotape cassettes
- Videotape labels
- Mailing envelopes
- Time-Lapse Video Monitoring Status/Assessment Sheets (both for the monitoring site and for the control room)
- Operational History Logs
- SVHS video cassette player
- Review monitor
- 3-ring notebooks

4.0 METHODS

This section includes three (3) major subsections:

4.1 Videotape Collection Procedures
4.2 Videotape Processing Procedures
4.3 Videotape Handling Procedures

4.1 VIDEOTAPE COLLECTION PROCEDURES

4.1.1 Videotape Purchase and Distribution

ARS purchases high quality videotapes in bulk quantities. ARS provides site operators with an operator's data acquisition kit that includes a 3-month supply of videotape cassettes, cassette mailers, tape labels, Time-Lapse Video Monitoring Status/Assessment Sheets, and a Time-Lapse Video Monitoring Field Procedures Notebook.

4.1.2 Field Documentation

Collection procedures for videotape include weekly site servicing visits by the site operator and bi-weekly visits to perform tape changes, and to mail videotapes and accompanying documentation to ARS. When servicing a site, the operator completes a videotape label and attaches it to the videotape cassette before loading the cassette into the VCR. An example videotape cassette label is provided as Figure 4-1. When the cassette is removed upon the next site servicing tape change, the operator completes the information on the cassette label, places the cassette in a padded envelope, and mails it, along with the Time-Lapse Video Monitoring Status/Assessment Sheet, to ARS via Federal Express.

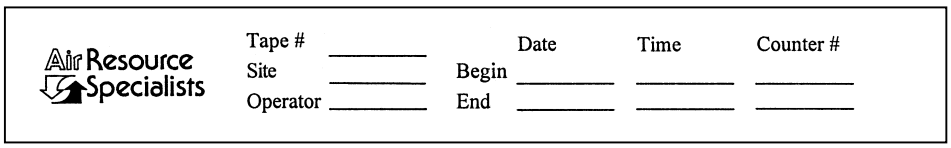

Figure 4-1. Example Videotape Cassette Label.

Example Time-Lapse Video Monitoring Status/Assessment Sheets for the HCCP control room and the DNPP and Garner Hill monitoring sites are provided as Figures 4-2 and 4-3 respectively. Videotapes should be sent immediately to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive Suite E
Fort Collins, CO 80525
Attention: Photographic Data Coordinator

TIME-LAPSE VIDEO MONITORING STATUS/ASSESSMENT SHEET HCCP CONTROL ROOM

Location: _____ Tape No. _____

Operator: _____

Date/Time of Site Visits #1:_____ ___:____ #2:_____ ___:____ #3:_____ ____:___

Check procedures performed during each site visit in the appropriate column.

VIDEOTAPE LOADED	**#1**	**#2**	**#3**	Comments
Labeled videotape cassette	☐			_____
Loaded videotape	☐			_____
OPERATION/MAINTENANCE CHECK				
Verified camera alignment	☐	☐	☐	_____
Inspected video recording assembly	☐	☐	☐	_____
Record tape counter #	#_____	#_____	#_____	_____
Verified recorded image, date, and time	☐	☐	☐	_____
****Proceed to VIDEOTAPE REMOVAL section if changing tape****				
Repositioned tape	☐	☐	☐	_____
CHECK OPERATION SETTINGS				
INT TIMER displayed	☐	☐	☐	_____
REC displayed	☐	☐	☐	_____
(appears only if activated during recording hours)				
VIDEOTAPE REMOVAL				
Removed videotape			☐	_____
Completed videotape cassette label			☐	_____
Mailed videotape and assessment sheet to ARS			☐	_____

ADDITIONAL COMMENTS/ACTIONS TAKEN: _____

_____

SUPPLIES NEEDED: _____

_____

Enclose this Status/Assessment Sheet with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-2. Example Time-Lapse Video Monitoring Status/Assessment Sheet for the HCCP Control Room Monitoring Site.

TIME-LAPSE VIDEO MONITORING STATUS/ASSESSMENT SHEET DNPP AND GARNER HILL MONITORING SITES

Location: _____ Tape No. _____

Operator: _____

Date/Time of Site Visits #1:_____ ___:____ #2:_____ ___:____ #3:_____ ____:___

Check procedures performed during each site visit in the appropriate column.

		#1	#2	#3	Comments
VIDEOTAPE LOADED					
Labeled videotape cassette		☐			_____
Loaded videotape		☐			_____
OPERATION/MAINTENANCE CHECK					
DNPP:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified camera sled alignment	☐	☐	☐	_____
	Verified adjustable head alignment	☐	☐	☐	_____
	Inspected video recording assembly	☐	☐	☐	_____
	Record tape counter #	#_____	#_____	#_____	_____
	Verified recorded image, date, and time	☐	☐	☐	_____
	****Proceed to VIDEOTAPE REMOVAL section if changing tape****				
	Repositioned tape	☐	☐	☐	_____
Garner Hill:	Inspected camera assembly	☐	☐	☐	_____
	Cleaned viewport	☐	☐	☐	_____
	Checked air filter	☐	☐	☐	_____
	Verified pan/tilt head alignment	☐	☐	☐	_____
CHECK OPERATION SETTINGS					
INT TIMER displayed		☐	☐	☐	_____
REC displayed		☐	☐	☐	_____
(appears only if activated during recording hours)					
SECURE SYSTEM					
DNPP:	Secured camera assembly	☐	☐	☐	_____
	Secured video recording assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
Garner Hill:	Secured camera assembly	☐	☐	☐	_____
	Secured shelter	☐	☐	☐	_____
VIDEOTAPE REMOVAL					
Removed videotape				☐	_____
Completed videotape cassette label				☐	_____
Mailed videotape and assessment sheet to ARS				☐	_____

ADDITIONAL COMMENTS/ACTIONS TAKEN: _____

_____

SUPPLIES NEEDED: _____

_____

Enclose this Status/Assessment Sheet with the labeled videotape cassette and send to:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-3. Example Time-Lapse Video Monitoring Status/Assessment Sheet for the DNPP and Garner Hill Monitoring Sites.

Further details on site servicing procedures and videotape collection procedures can be found in the following technical instructions:

- TI 4120-3650, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at DNPP - Sony SSC-S20 Camera, Panasonic AG-6740 SVHS VCR, and Panasonic CT1384Y Monitor*

- TI 4120-3655, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at Garner Hill – Sony SSC-S20 Camera, Pelco PT1250 Series Pan/Tilt, RWI 30CM Microwave Antenna, and Panasonic CT1384Y Monitor*

- TI 4120-3660, *Routine Site Operator Maintenance Procedures for SVHS Time-Lapse Video Camera System at HCCP – Panasonic AG-6740 SVHS VCR and Sony Monitor*

4.2 VIDEOTAPE PROCESSING PROCEDURES

4.2.1 Operational History Log

Completion of an Operational History Log is essential to ensure quality videotape documentation. Information recorded on the Operational History Log is partially derived from site operator documentation; the remainder of the information is recorded for tracking purposes during videotape handling. An example Operational History Log is provided as Figure 4-4. The following information is documented on the Operational History Log:

- Site

- Site operator

- Operating period

- Project

- TAPE # - Consecutive, chronological videotape number by site.

- DATE RECEIVED - Date when the videotape was received at ARS from the site.

- COMMENTS/CORRESPONDENCE - Notation of any comments or site operator correspondence pertaining to each specific videotape.

- MONITORING PERIOD DATES - The beginning and ending dates of the period documented on the videotape, as noted by the site operator on the status/assessment sheet and verified by review of the videotape.

- TIME ON/TIME OFF - The beginning and ending times of the period documented on the videotape, as noted by the site operator on the status/assessment sheet and verified by review of the videotape.

OPERATIONAL HISTORY LOG - TIME-LAPSE MONITORING

Site: _____ Operating Period/Interval: _____

Site Operator: _____ Project: _____

Tape #	Date Received	Comments/ Correspondence	Monitoring Period Dates	Time ON Time OFF	# Days Exp.	# Days Coll.	% of Pos.	Initial Review	Anomaly Review	Duplicate Copies				
										ADEC	AIDEA	GVEA	NPS	STEIGERS CORP.

Figure 4-4. Example Operational History Log - Time-Lapse Monitoring.

- # DAYS EXP. - Number of days that should have been captured (expected) on the videotape, as noted by the site operator on the status/assessment sheet.

- # DAYS COLL. - The actual number of days captured (collected) on the videotape, recorded after review and validation of the videotape.

- % OF POSS. - The percentage of the number of days collected divided by the number of days expected, as a collection efficiency.

- INITIAL REVIEW - Initials of the videotape reviewer, documenting that the videotape has been initially reviewed for content and correct tape operation.

- ANOMALY REVIEW - Initials of the videotape reviewer, documenting that the videotape has been reviewed for any visual anomalies.

- DUPLICATE COPIES – Checked by the data coordinator indicating that duplicate videotape copies have been delivered to:

    - ADEC – Alaska Department of Environmental Conservation
    - AIDEA – Alaska Industrial Development and Export Authority
    - GVEA – Golden Valley Electric Association
    - NPS – National Park Service in Denali, Alaska
    - Steigers Corporation – project engineers

Operational History Logs and accompanying documentation are chronologically stored in 3-ring notebooks by site.

4.2.2 Time-Lapse Video Monitoring Status/Assessment Sheet Review

The Time-Lapse Video Monitoring Status/Assessment Sheet is thoroughly reviewed by the ARS data coordinator to verify proper video system operations and note any weather anomalies or requested operational supplies. Any noted operational discrepancies are documented by site and videotape number on the Operational History Log and corrective action is initiated. Any requested monitoring supplies or photographic components are shipped within 24 hours, provided sufficient backup equipment/supplies are available.

4.3 VIDEOTAPE HANDLING PROCEDURES

4.3.1 Videotape Labeling and Filing

After each videotape is received at ARS, the label affixed to it by the site operator is verified for correct information. This information is also documented on the Operational History Log. The labeled videotapes are placed chronologically in site-specific storage boxes within storage cabinets. All supporting documentation including the Operational History Logs, Time-Lapse Video Monitoring Status/Assessment Sheets, and other notes or important observations are kept in 3-ring notebooks by site, and filed in the storage cabinets alongside the videotapes.

4.3.2 Qualitative Videotape Review

The qualitative review of videotapes occurs in three stages:

Stage-1 Continuity Review and Problem Resolution
Stage-2 Weather Condition, Anomaly, and Event Identification
Stage-3 Evaluation of Observed Anomalies and Events

During Stage-1, videotapes are reviewed for camera and system component operation, exposure quality, frame alignment and focus, timing (including on/off times and exposure interval), the detection of unusual visual events or anomalies, and dirty or obscured shelter windows (due to snowfall, dirt, foreign objects, etc.). Videotapes are reviewed within 2 days of receipt at ARS. Any noted problems or inconsistencies observed on the videotapes are recorded on the Operational History Log and the data coordinator immediately initiates corrective actions. The data coordinator discusses corrective action with the site operator and if appropriate, sends replacement equipment to the site. Refer to TI 4120-3750, TI 4120-3755, and TI 4120-3760, for troubleshooting procedures for DNPP, Garner Hill, and HCCP, respectively.

The videotapes next undergo Stage-2 and Stage-3 qualitative analyses that document observed meteorological conditions and identify and thoroughly describe visual events of interest. Stage-2 and Stage-3 qualitative review procedures are detailed in TI 4420-5050, *Qualitative Time-Lapse Videotape Review for the Healy Clean Coal Project*.

4.3.3 SVHS Videotape Duplication, Distribution, and Archives

Original videotapes are delivered to ARS every two weeks by the site operator via an express delivery service. Each tape is shipped separately with tracking numbers. ARS immediately creates two duplicates of every SVHS tape. One duplicate is retained by ARS and stored off-site. The other is returned to GVEA for storage in the Healy Viewing Center.

The original SVHS videotapes are then copied to monthly master SVHS tapes and VHS copies for delivery to the following agencies with quarterly data reports:

- ADEC – Alaska Department of Environmental Conservation
- AIDEA – Alaska Industrial Development and Export Authority
- GVEA – Golden Valley Electric Association
- NPS – National Park Service in Denali, Alaska
- Steigers Corporation – project engineers

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING QUALITATIVE DATA REDUCTION**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4420**
DATE	**OCTOBER 1993**

AUTHORIZATIONS		
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OTHER		

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0.1	Modify research scientist's responsibilities.	February 1996	
1.0	Add SVHS video system references.	February 1999	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines the steps of scene monitoring qualitative data reduction. It serves as a guide to assure quality data from automatic camera and video monitoring stations.

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visibility relationships to decision-makers and to the public. Self-contained, battery-powered, automatic camera visibility monitoring systems or time-lapse video monitoring systems are easily installed and operated at any location. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

Day-to-day variations in visual air quality captured on 35 mm color photographic slides, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for computer image modeling of potential impairment.
- Support color and human perception research.

Slides, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and affect relationships are required.

The following technical instructions (TIs) provide detailed information regarding scene qualitative data reduction:

- TI 4420-5000 *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*

- TI 4420-5010 *Qualitative 8 mm Time-Lapse Movie Film Review*
- TI 4420-5050 *Qualitative Time-Lapse Videotape Review for the Healy Clean Coal Project*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide overall coordination of the slide, film, or videotape review process.
- Provide technical assistance if required, in the interpretation of slide, film, or videotape images during the qualitative review process.
- Review all slide, film, or videotape documentation for completeness and accuracy.

2.2 DATA COORDINATOR

The data coordinator shall:

- Perform Stage-1 videotape continuity review.
- Complete an Operational History Log for each videotape.

2.3 DATA TECHNICIAN

The data technician shall:

- Perform 35mm slide coding.
- Create digital code files.

2.4 DATA ANALYST

The data analyst shall:

- Oversee film reduction.
- Review and verify 35 mm slide codes.
- Perform initial 8 mm film qualitative review.
- Perform Stage-2 qualitative videotape review.
- Prepare qualitative review tables.
- Coordinate with research/project scientist regarding review results.
- Oversee preparation and finalize qualitative review discussions.

2.5 RESEARCH/PROJECT SCIENTIST

The research/project scientist shall:

- Perform secondary 8 mm film qualitative review.
- Perform Stage-3 qualitative videotape review.
- Coordinate with the data analyst regarding review results.
- Oversee all qualitative review stages.
- Prepare initial qualitative review discussions.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 REQUIRED EQUIPMENT AND MATERIALS FOR 35 MM SLIDES

Equipment and materials used to code and validate 35 mm photographic slides include:

- Processed 35 mm slides.
- Slide Condition Code Sheets.
- A light table.
- A hand-held magnifying lens.
- An IBM PC-compatible 386/486 computer system with VGA monitor.
- A computer printer.
- ARS software; SS program, HAZE program.

3.2 REQUIRED EQUIPMENT AND MATERIALS FOR 8 MM TIME-LAPSE FILM

Equipment and materials used to review and validate 8 mm time-lapse movie film include:

- Processed 8 mm time-lapse movie film rolls.
- An 8 mm movie projector.
- Time-Lapse Camera Visibility Monitoring Status/Assessment Sheets.
- Master Logs.
- Supplemental meteorological data (if applicable).

3.3 REQUIRED EQUIPMENT AND MATERIALS FOR SVHS TIME-LAPSE VIDEOTAPE

Equipment and materials used to review and validate SVHS time-lapse videotape include:

- SVHS videotape cassettes.
- An SVHS video cassette player.
- A review monitor.
- Time-Lapse Video Monitoring Status/Assessment Sheets.
- Operational History Logs.
- Supplemental meteorological data, on-site observer comments, etc. (if applicable).

4.0 METHODS

This section includes the following three (3) subsections:

4.1 35 mm Slide Coding and Data Reduction
4.2 8 mm Time-Lapse Film Review
4.3 SVHS Time-Lapse Videotape Review

4.1 35 MM SLIDE CODING AND DATA REDUCTION

Not all 35 mm slides undergo the coding process. Slides are only coded if summaries of observed slide conditions are required by the contracting agency. Each photographic slide designated for coding is visually reviewed, chronologically numbered, and assigned a two-digit slide condition code. These qualitative slide condition codes are assigned by the data technician and are verified by the data analyst. The codes document the visual conditions present on each slide, and include observed hazes, plumes, weather conditions or unusable or missing observations.

Coding is normally performed at the end of a season on all slides collected during the season. Each valid slide is viewed on a light table with the naked eye and a hand-held magnifying lens. Codes are recorded directly on the slides and later entered into site-specific digital files. Digital files are used to prepare qualitative summaries of observed haze types and can be searched in a variety of ways to fulfill specific data reports. Slide coding and qualitative summary procedures are detailed in TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides.*

4.2 8 MM TIME-LAPSE FILM REVIEW

Qualitative film review only occurs when a summary of specific information captured on 8 mm time-lapse film is required. For example, this type of qualitative review could be required to support an EIS or other regulatory review process. Film undergoing qualitative film review is closely reviewed for general weather conditions and for the presence/absence of atmospheric anomalies. This review provides a preliminary indication of the types of visual effects observed within the individual vistas.

Original 8 mm film is reviewed primarily for anomaly identification and evaluation. Chronological review tables and comprehensive discussions of any observed anomalies are prepared. It is recommended that original 8 mm film be reviewed. Review of 8 mm film transferred to videotape is also possible, however, loss of image resolution and overall quality is likely to occur in any second-generation film or video product. Film review and procedures are detailed in TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review.*

4.3 SVHS TIME-LAPSE VIDEOTAPE REVIEW

Qualitative review of time-lapse videotape is generally performed in three stages. Stage-1 is a continuity review and problem resolution; videotapes are reviewed to verify proper camera and system component operation, proper exposure and alignment, and correct operating period. Stage-2 review includes documenting weather conditions and identifying observed visual anomalies or events of interest to the monitoring program. Stage-3 review includes evaluation of these observed anomalies or events. Detailed descriptions of the anomaly are then prepared and include related data, general weather conditions, a discussion of the dynamics of observed anomalies, and a conclusion.

For a detailed description of videotape review procedures, see TI 4305-4050, *Collection, Processing, and Handling of Time-Lapse Videotapes for the Healy Clean Coal Project*.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**QUALITATIVE SCENE CODING AND DATA REDUCTION OF 35 MM COLOR SLIDES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4420-5000**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes 35 mm slide coding and qualitative data reduction procedures. This TI is referenced in SOP 4420, *Scene Monitoring Qualitative Data Reduction*, and specifically describes:

- 35 mm slide coding procedures for observed meteorological conditions.
- 35 mm slide data reduction for preparation of qualitative analysis summaries.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall provide overall coordination of the coding and data reduction procedures.

2.2 DATA ANALYST

The data analyst shall:

- Oversee slide coding.
- Review and verify slide codes assigned by the data technician.
- Run qualitative summary program software.
- Verify qualitative summary tables.

2.3 DATA TECHNICIAN

The data technician shall:

- Perform slide coding.
- Create digital code files.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used in coding and reducing 35mm photographic slides include:

- Processed 35 mm slides
- Slide Condition Code Sheet
- Light table
- Hand-held lens
- IBM PC-compatible 386/486 computer system with VGA
- Printer
- ARS software; SS program, HAZE program

4.0 METHODS

This section includes the following two (2) subsections:

4.1 35 mm Slide Coding
4.2 35 mm Slide Data Reduction

4.1 35MM SLIDE CODING

Not all 35 mm slides undergo the coding process. Slide coding is performed only if summaries of observed slide conditions are required by the contracting agency. Condition codes qualitatively identify weather conditions, observed hazes or plumes, and unusable or missing observations. They are useful for summarizing observed conditions over defined time periods, or in searching for specific observed visibility conditions. Each valid slide that is coded is viewed on a light table with the naked eye and an eight-power, hand-held lens. Criteria used to assign the two-digit code for each slide are presented in Figure 4-1. Codes are recorded directly onto the top center of the slide frame with pencil (see Figure 4-2). The site abbreviation and slide number are also placed on top of the slide frame during the collection, processing, and handling process (refer to TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*). The codes are later entered into site-specific digital files.

Digital files are created after all slides from a season are coded. Each file contains codes from one site for one season. Standard monitoring seasons are defined as:

Season	Months	Season Code
Winter	(December, January, and February)	1
Spring	(March, April, and May)	2
Summer	(June, July, and August)	3
Fall	(September, October, and November)	4

An IBM PC-compatible computer and the SS program are used to create digital files. Files are named in the format SITEYYS.SQO, where SITE is the site abbreviation, YY is the year, and S is the season code. The files include site abbreviation, slide number, date, time, target number, slide condition code, and quality assurance codes; an example digital file is presented as Figure 4-3.

Digital files are created in the SS program (type **SS** at the DOS prompt). The user must first initialize or create a file within the SS program with the commands **SQO** (to enter and operate in the "qualitative only" mode) and **INIT** (to initialize a file). The program then prompts the user for the following information: operator initials, file name, site code, targets used, slide pattern, time codes used, and slide number increment. Figure 4-4 is an example computer screen display during the initialization process.

After initializing a file, the user must then enter the command **TA**. The system will prompt for: slide number, two-digit slide condition code, time code, day, month, and year. Each slide entry will result in the system asking the user if the slide information should be accepted, reentered, or rejected. Figure 4-5 is an example computer screen display during the entry process. When the digital file is complete, type **EXIT** to leave the SS program.

SLIDE CONDITION CODE KEY

SKY CONDITIONS

0 No clouds	No clouds visible anywhere in the sky.
1 Scattered clouds < half of sky	Less than one-half of the sky has clouds present.
2 Overcast > half of sky	More than one-half of the sky has clouds present.
3 Haze concealing scene	Atmospheric haze conditions are such that determination of the sky value is impossible.
5 Weather concealing scene	Clouds or precipitation are such that determination of the sky value is impossible.
8 Observation cannot be determined	Observation cannot be determined due to extreme exposure inconsistencies, lens (or window) condensation, misalignment, or view obstructed by a foreign object.
9 No observation	No observation taken.

LAYERED HAZE

0 No layered haze	No layered haze boundary (intensity of coloration edge) is perceptible.
1 Ground-based layered haze only	Only a single-layered haze boundary is perceptible with the haze layer extending to the surface.
2 Elevated layered haze only	An elevated layered haze with two boundaries is perceptible; e.g., horizontal plume.
3 Multiple haze layers	More than a single ground-based or elevated haze layer is perceptible. This can be multiple ground-based layers or a combination of both.
5 Weather concealing scene	Clouds or precipitation are such that determination of the presence of layered hazes is impossible.
9 No observation or cannot be determined	To be used with sky condition of 9 or if a layered haze value cannot be determined due to reasons other than weather.

NOTE: It is possible to have a sky condition of 5 and still see a layered haze in the scene.

Figure 4-1. Slide Condition Code Key.

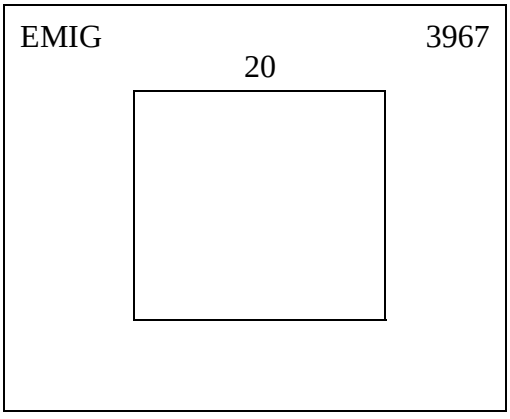

Figure 4-2. Example Slide With Codes.

Column Number

```
                    1       2       3       4       5       6
1234567890123456789012345678901234567890123456789012345678901234

EMIG 396793101211**20 0 0    0 0  0.000 0.000902901162520DGBG64*
EMIG 396793101212**20 0 0    0 0  0.000 0.000902901162544DGBG64*
EMIG 396893101221**20 0 0    0 0  0.000 0.000902901162611DGBG64*
EMIG 396893101222**20 0 0    0 0  0.000 0.000902901162640DGBG64*
EMIG 396993101231**20 0 0    0 0  0.000 0.000902901162707DGBG64*
EMIG 396993101232**20 0 0    0 0  0.000 0.000902901162725DGBG64*
```

Columns	Data
1-4	Site abbreviation
5-9	Slide number
10-15	Slide date (year/month/day)
16	Slide time code (1 = 0900, 2 = 1200, 3 = 1500 Local Time)
17	Slide target number
18-19	(Not used)
20-21	Slide condition code
22-45	(Not used)
46-51	Date codes entered (year/day/month)
52-57	Time codes entered (hour/minute/second)
58-60	Data technician initials
61-64	(not used)

Figure 4-3. Key to the Scene Qualitative Only (.SQO) Data File.

```
2-Digit Code .SQO Slide Analysis                    ARS-SQO- 64
Green
SS>>
```

```
Operator initials, 3 required: JDY          (initials of individual entering data)
Data file name (.SQO will be added): GILA933  (see Section 4.1)
Location code, 4 characters (SITE): GILA     (see Figure 4-3)
Targets to use (1 2 3 4 5 ): 1               (see Figure 4-3)
Slide pattern (1): 1                         (1 if targets are all on same slide)
Time codes to use (1 2 3 ): 1 2 3            (see Figure 4-3)
Slide number increment (1): 1                (number increments by one)
```

```
*New data file GILA933.SQO created
```

Figure 4-4. Example Initialization Screen in the SS Program.

```
Slide number, press ESC to quit ( 1050 ):
Year ( 93 ):
```

```
                        CURRENT         PREVIOUS

Site code.....          GILA            GILA
Slide number.....       1050            1049
Date of photograph.....  93 8 11         93 8 11
Time and target.....    2 1             1 1
Scene visibility code....  21            10
Slide, scene contrast.....  0 0          0 0
Sky direct.....         0               0
Clear value.....        0               0
Time of scan.....       12:10:28        12:10:23
```

```
*Slide OK? ([Y]es/[R]edo/[N]o scan/[?]help)
```

Figure 4-5. Example Coding-Entry Screen in the SS Program.

4.2 35 MM SLIDE DATA REDUCTION

Digital files are used to prepare a qualitative summary of observed haze types. Using an IBM PC-compatible computer and the HAZE program, the user is prompted for the following information: number of months to process, the specific months to process, time period for the processing (title), whether to process on a monthly or seasonal basis, file name (.SQO), and the target numbers to process.

The summary is then printed; an example qualitative haze summary table is presented as Table 4-1. When distinct haze layers are visible, they are categorized as ground-based, elevated, or simultaneous ground-based and elevated hazes. All cases where no distinct haze layer occurs are classified as uniform hazes. Cases where the scene is not visible due to haze or weather are also noted. Refer to TI 4520-5000, *Scene Monitoring Reporting of 35 mm Color Slides (IMPROVE Protocol)*, for more detailed discussions of data reporting.

Table 4-1

Example Qualitative Slide Analysis Table

Target	Month	Total Observa-tion	Uniform Haze	Ground-Based Layered Haze	Elevated Layered Haze	Multiple Layers	Target Con-cealed by Haze	Target Concealed by Weather
POWDER HILL	JUN	88	76	1	0	0	3	11
	JUL	93	82	0	1	0	0	10
	AUG	92	81	1	0	0	13	10
	TOTAL	273 (100%)	239 (88%)	2 (1%)	1 (0%)	0 (0%)	16 (6%)	31 (11%)

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**QUALITATIVE 8 MM TIME-LAPSE MOVIE FILM REVIEW**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4420-5010**
DATE	**OCTOBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Modifications to log sheet.	February 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes qualitative review procedures for 8 mm time-lapse movie film. This TI is referenced in SOP 4420, *Scene Monitoring Qualitative Data Reduction*, and specifically describes:

- Film review to determine observed meteorological conditions.
- Film review for preparation of comprehensive anomaly discussions.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide overall coordination of the film review process.
- Provide technical assistance if required, in the interpretation of time-lapse images during the film review process.
- Review all film documentation for completeness and accuracy.

2.2 DATA ANALYST

The data analyst shall:

- Perform initial 8 mm film qualitative review.
- Prepare qualitative review tables.
- Coordinate with research scientist regarding review results.
- Oversee preparation and finalize qualitative review discussions.

2.3 RESEARCH SCIENTIST

The research scientist shall:

- Perform secondary 8 mm film qualitative review.
- Coordinate with data analyst regarding review results.
- Prepare initial qualitative review discussions.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used in reviewing 8 mm time-lapse movie film include:

- Processed 8 mm time-lapse movie film rolls

- 8 mm movie projector
- Time-Lapse Camera Visibility Monitoring Status/Assessment Sheets
- Master Log sheets
- Supplemental meteorological data (if available)

4.0 METHODS

This section includes the following two (2) subsections:

4.1 Review for Observed Conditions
4.2 Preparation of Discussions

4.1 REVIEW FOR OBSERVED CONDITIONS

All 8 mm film undergoing qualitative review is manually reviewed by the data analyst using an 8 mm movie projector. It is recommended that original 8 mm film be reviewed. Review of 8 mm film transferred to videotape is also possible, however, loss of image resolution and overall quality is likely to occur in any second-generation film or video product. The objectives of the review are to document the chronological sequence, daily meteorological conditions and patterns, and detect the presence of any anomalies. Noted conditions are examined and compared with other views or other meteorological data (if available). An initial evaluation of the cause or causes of each anomaly is made.

An anomaly is defined as anything in the camera field of view, whether suspected to be man-caused or natural, that is visually unusual, interesting, or dynamic. Anomalies include plumes, smoke, fugitive dust, ground fog, surface or elevated hazes, and other visual discontinuities whose source is not clearly distinguishable in the field of view. For example, a visible plume from a visible stack in the same field of view is not considered an anomaly because the source can be clearly identified. A plume without an identifiable source in the field of view is considered an anomaly. In addition, clearly defined weather events such as a snowstorm are not considered visual anomalies.

Review tables are prepared listing day, weather conditions, presence of observed hazes or plumes, description of any observed anomaly (or observed plume), and general comments. The tables are prepared using Time-Lapse Camera Visibility Monitoring Status/Assessment Sheets (Figures 4-1 and 4-2), Master Log sheets (Figure 4-3), and review notes. Refer to TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for more detailed discussions of data reporting. An example of an 8 mm review table is provided as Figure 4-4.

Location _____

TIME-LAPSE CAMERA VISIBILITY MONITORING
STATUS/ASSESSMENT SHEET

Today's Date _____ Time _____ Operator _____

Roll # _____ Date On _____ Time On _____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

Describe General
Weather Conditions: _____
_____

Yes	No	
_____	_____	Monitoring target visible
_____	_____	Camera found in proper condition
_____	_____	Timer found in proper condition
_____	_____	Film advanced as expected
_____	_____	Film changed and film canister properly labeled
_____	_____	Lens and window clean
_____	_____	Settings verified

Normal/Macro Switch - NORMAL
Aperture Switch - AUTO
Filter Switch - DAYLIGHT
Function Switch - INTERVALOMETER
Interval Adjustment - 60-second position (recommended)

_____	_____	Camera alignment correct
_____	_____	Operating Switch ON

COMMENTS/ACTION TAKEN _____
_____
_____
Supplies Needed: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource
Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-1. Time-Lapse Camera Visibility Monitoring Status/Assessment Sheet
For All 8 mm Camera Systems (except Minolta D-12).

Location _____

TIME-LAPSE CAMERA VISIBILITY MONITORING
STATUS/ASSESSMENT SHEET
FOR MINOLTA D-12

Today's Date _____ Time _____ Operator _____

Roll # _____ Date On _____ Time On _____

Temperature _____ _____ _____ % Cloud Cover _____
(F) Now Max Min

Describe General
Weather Conditions: _____
_____

Yes	No	
_____	_____	Monitoring target visible
_____	_____	Camera found in proper condition
_____	_____	Timer found in proper condition
_____	_____	Film advanced as expected
_____	_____	Film changed and film canister properly labeled
_____	_____	Lens and window clean
_____	_____	Settings verified

Normal/Macro Switch - N (Normal)
Aperture Control Selector - A (Auto)
Manual Filter Switch - No lamp symbol (Daylight position)
Auto Exposure Adjustment Dial - Red mark (no adjustment)
Operation/Effect Selector - N (Normal)
Frame speed dial - S.F. (single frame)
Battery Master Switch - OFF
Intervalometer - ON
Interval Adjustment - 60-second position (recommended)

_____	_____	Camera alignment correct
_____	_____	Operating Switch ON

COMMENTS/ACTION TAKEN _____
_____
_____
Supplies Needed: _____

Enclose this Status/Assessment Sheet with the 8 mm movie film and send to:

Air Resource Specialists, Inc.
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Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

Figure 4-2. Time-Lapse Camera Visibility Monitoring Status/Assessment Sheet For Minolta D-12 8 mm Camera System.

MASTER LOG

CONTACT PERSON

_____ _____

SITE NAME AND ABBREVIATION _____

ROLL #	LOG	SENT PROC	MAILER #	BACK PROC	# POSS	# REC'D	DATE LOGGED	TIME LOGGED	PROBLEMS	EQUIPMENT CHANGE	SUPPLIES MAILED

Figure 4-3. Master Log.

Garner Hill South - Left View
Qualitative Review of 8 mm Film

GASL Roll 17

FILM DATE	WEATHER CONDITIONS	ANOMALY VISIBLE	DESCRIPTION	COMMENTS
01/24/93	Clear.	Yes*	Fog or plume.	
01/25/93	Clear.	Yes*	Fog or plume.	Sun glare on camera lens.
01/26/93	Cloudy. Westerly upper level winds.	Yes*	Blowing snow or smoke.	
01/27/93	Cloudy. Southwesterly upper level winds.	Yes*	Blowing snow or smoke.	Rain/snow on camera shelter window.
01/28/93	Cloudy. Southwesterly upper level winds.	No		
01/29/93	Cloudy. Southwesterly upper level winds.	No		
01/30/93	Partly cloudy. Southwesterly upper level winds.	Yes*	Fog or plume.	
01/31/93	Cloudy. Southwesterly upper level winds.	No		Poor visibility due to low clouds.
02/01/93	Clear.	No		Sun glare on camera lens.
02/02/93	Cloudy.	No		Poor visibility due to low clouds; scene obscured.
02/03/93	Clear.	Yes**	Fog or plume.	Sun glare on camera lens.
02/04/93	Cloudy. Southeasterly upper level winds.	No		
02/05/93	Unable to determine.	No		Camera ran out of film.

* Event is fully discussed in Technical Progress Report - Number 13 (January 1993).
** Refer to Section 2.4.5 for a complete discussion of event.

Figure 4-4. Example Qualitative Review of 8 mm Film Table.

4.2 PREPARATION OF DISCUSSIONS

Further film reviews are performed by a research scientist, using an 8 mm movie projector. Supplemental reviews focus on the anomalies previously noted and listed in the review tables. Anomalies are evaluated using supplemental meteorological data, 35 mm slides, and site documentation (if available).

It is important to note that this information is limited and that not all observed atmospheric anomalies can be clearly explained from available information. The film is viewed several times at various projector speeds to confirm the estimates of timing, duration, size, and appearance of each anomaly. Detailed discussions describing the anomaly and probable cause are constructed. Detailed discussions of the daily meteorological factors are used in conjunction with discussion of anomalies. Anomalies are classified as: 1) naturally-occurring weather patterns, 2) undetermined given the available information, 3) originating from the observed pollution source, or 4) originating from other identifiable sources.

All of the interpretations are based on a subjective evaluation of the data available. An example anomaly discussion is provided as Figure 4-5. The project manager and research scientist collaborate, review, and finalize all anomaly discussions before reporting. Refer to TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for more detailed discussions of data reporting.

Date and Time:	April 20, 1993	
35 mm Slide Numbers:	Denali North view	(DENN #3761 - 3769)
8 mm Film Roll Numbers:	Denali North view	(DENN #131)
	Garner Hill East, Left view	(GAEL #34)
	Garner Hill East, Right view	(GAER #34)
	Garner Hill South, Left view	(GASL #34)
	Garner Hill South, Right view	(GASR #34)

Noted Event: Blowing dust or fog.
The Garner Hill East, left view 8 mm film depicts whitish, ground-based features resembling blowing dust. The features are visible late in the morning and early afternoon.

In Class I area: No

General Weather: Healy weather observations document good visibility with clear skies. Temperatures ranged from 34°F at 0545 and 0645 to 45°F at 1615. Light to moderate southeasterly winds occurred between 0545 and 0745. Strong southwesterly winds occurred at 0945, and turned to strong southeasterly at 1145, moderate southerly at 1615, and strong southeasterly from 1745 through the remainder of the day. Data from the ambient monitoring station at DNPP are not available.

Discussion: The Garner Hill East, left view 8 mm film depicts no plume from Unit No. 1. Faint streaks resembling blowing dust or fog appear near Unit No. 1 early in the morning and travel northward. The film depicts generally clear, windy skies.

The Denali North view 8 mm film depicts cloudy skies and moderately windy conditions. The Denali North view 35 mm photographs generally clear skies and good visibility.

Conclusion: The ground-based features appearing in the Garner Hill East, left view 8 mm film are blowing dust or glacial till from the river banks. The appearance of the feature documented in the film and weather record supports this conclusion.

Figure 4-5. Example Discussion of an Observed Anomaly.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**QUALITATIVE TIME-LAPSE VIDEOTAPE REVIEW FOR THE HEALY CLEAN COAL PROJECT**
	TECHNICAL INSTRUCTION
NUMBER	**4420-5050**
DATE	**SEPTEMBER 1998**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	Lincoln E. Sherman	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the qualitative review procedures for time-lapse videotape for the Healy Clean Coal Project. This TI specifically describes qualitative videotape review procedures to:

- Document observed meteorological conditions.
- Identify observed events of interest to the monitoring program.
- Prepare comprehensive anomaly or event discussions.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Provide overall coordination of the qualitative videotape review process.
- Provide technical assistance if required, in the interpretation of time-lapse images during the videotape qualitative review process.
- Review all videotape documentation for completeness and accuracy.

2.2 DATA COORDINATOR

The data coordinator shall:

- Perform Stage-1 videotape continuity review to verify proper camera and system component operation, exposure, alignment, and timing.
- Complete an Operational History Log for each videotape.

2.3 DATA ANALYST

The data analyst shall:

- Perform Stage-2 qualitative videotape review to document weather conditions and events.
- Prepare qualitative review tables.
- Coordinate with the project scientist regarding review results.
- Oversee preparation and finalize qualitative review discussions.

2.4 PROJECT SCIENTIST

The project scientist shall:

- Perform Stage-3 qualitative videotape review to evaluate observed anomalies and events.
- Coordinate with the data analyst regarding review results.
- Provide oversight of all qualitative review stages.
- Prepare initial qualitative review discussions.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used to review time-lapse videotapes include:

- SVHS videotape cassettes from DNPP and Garner Hill.
- An SVHS video cassette player.
- A review monitor.
- Time-Lapse Video Monitoring Status/Assessment Sheets.
- Operational History Logs.
- Supplemental meteorological data, Bison Gulch monitoring data, information regarding plant operations, and any on-site observer comments.

4.0 METHODS

This section presents the methods used to perform qualitative review of time-lapse videotapes for the Healy Clean Coal Project and to report the results of the review.

This section includes two (2) major subsections:

4.1 Review for Observed Conditions
4.2 Preparation of Discussions

4.1 REVIEW FOR OBSERVED CONDITIONS

Qualitative review of time-lapse videotapes is generally performed in three stages as detailed in the following subsections. All videotape review is performed using a high-resolution color monitor and SVHS VCR.

4.1.1 Stage-1 – Continuity Review and Problem Resolution

The data coordinator performs Stage-1 videotape review. SVHS videotapes received from the field are first checked for proper labeling (identified by site, date and time the videotape began filming, and data and time the videotape ended filming). The videotapes are then reviewed to verify proper camera and system component operation, proper exposure and alignment, and correct operating period. If problems are noted, the data coordinator promptly contacts the site operator to initiate corrective actions. Videotape dates and times, and site operator comments noted on the status/assessment sheets are verified with the videotape images.

Videotapes are reviewed for continuity within two days of receipt at ARS and any required corrective actions are implemented immediately thereafter. Results of the continuity review are entered in site-specific Operational History Logs. For a detailed description of the Operational History Log and continuity review procedures, see TI 4305-4050, *Collection, Processing, and Handling of Time-Lapse Videotapes for the Healy Clean Coal Project*.

4.1.2 Stage-2 – Weather Condition, Anomaly, and Event Identification

After Stage-1 review, the data analyst performs Stage-2 review to document weather conditions and identify visual anomalies and events observed on the videotapes. An anomaly is defined as anything in the camera field of view, whether suspected to be human-caused or natural, that was visually unusual, interesting, or dynamic. Anomalies include unusual steam/ice plumes, smoke, fugitive dust, ground fogs, surface or elevated hazes, and other visual discontinuities. The view from DNPP will be the focus of anomaly identification. Anomalies noted in the Garner Hill view, however, will also be noted. Standard day-to-day occurrences such as short steam plumes emanating from the power plant stacks will not be considered anomalies. An event is a recorded period that identifies visibility impacts in DNPP that are believed to be attributable to the power plant.

Golden Valley Electric Association (GVEA) has developed a procedure to document events that are reported to plant operators. Plant operators use the "event" recording system in the HCCP control room. These videotapes are immediately sent to ARS for review and analysis.

The data analyst then prepares a summary table for each site and month. Table 4-1 is an example of this Stage-2 qualitative review summary table. Copies of the summary table and videotape for each site are forwarded to GVEA monthly for evaluation and review.

It is important to note that videotapes can only be used to document the presence of observed conditions. The cause of the condition generally must be obtained from supplemental data or from interpretation of other conditions observed in the vista. For example, though videotape can document that a visible plume emanated from a stack, the chemical constituents of the plume cannot be directly determined from the videotape.

Table 4-1

Example Stage-2 Qualitative Review of Time-Lapse Video Images
Garner Hill and DNPP

Date and Time Period of Anomaly or Event		Weather Conditions	Anomaly Visible	Event Declared	In or Affecting Class I Area	Description
01/13/98	1400 – 1530	*Garner Hill view:* Cloudy with poor visibility. *DNPP view:* Cloudy with strong up valley winds, turning partly cloudy with sunshine at midday. Poor visibility all day.	Yes	No	No	*Garner Hill view:* Three white, steam plumes are visible all day. The plumes travel up valley in the morning, at a 45-degree angle, with a height to just below the background ridge. The longest plume, from HCCP, dissipates outside the camera's field of view, and extends above the background ridge by 1230. The plumes change direction several times in the afternoon. A dark, ground-based haze layer appears in the Healy area between 1130 and 1315. *DNPP view:* Moody Gap appears dark and hazy between 1100 and 1300, then becomes obscured by haze and clouds. The gap is visible again and appears dark between 1400 and 1530. During this period, a dynamic, rolling feature appears low in the gap, and travels towards the Class I area, but does not reach it.
01/15/98	1300 – 1500	*Garner Hill view:* Cloudy with poor visibility. Upper level clouds travel down valley in the afternoon. *DNPP view:* Cloudy in the morning turning mostly sunny by noon, and partly cloudy in the afternoon. Slight winds travel down valley.	Yes	No	No	*Garner Hill view:* At least three white plumes are visible and travel up valley all day, rising 45-degrees to the height of the background ridge. Between 1200 and 1330, visibility worsens as a white layer settles in the valley. By 1500, the plume from Unit #1 appears very short, while the larger two plumes (from HCCP and the roof vent), rise to an inversion layer above the background ridge and travels up valley. *DNPP view:* A dark, yellow haze appears in Moody Gap between 1100 and 1130. Visibility is poor in the gap at 1300. At this time, a dark, elevated, dynamic feature appears on the left side of the gap, and becomes more prominent by 1430. It may enter the Class I area, but this is not clearly evident in the video.

4.2 PREPARATION OF DISCUSSIONS

4.2.1 Stage-3 - Evaluation of Observed Anomalies

After Stage-2 review, an ARS project scientist further reviews the videotapes that contain the identified anomalies. The evaluation includes a description of the anomaly, related data, general weather conditions, a discussion of the dynamics of observed anomalies, and a conclusion. The conclusions state if the anomalies can be attributed to the power plant or other sources. These summaries are included in the quarterly data reports. An example Stage-3 anomaly summary is provided as Figure 4-1.

4.2.2 Stage-3 - Evaluation of Observed Events

In addition to the events observed on the time-lapse videotapes, ARS will summarize any real-time event chosen and documented by the GVEA operator in response to an on-site observation or complaint. The format for the event summaries will be the same as the Stage-3 anomaly summary and will reference additional documentation as appropriate. These summaries, along with the images, verbal description by the GVEA operator, data from the post-construction monitoring instruments at the Bison Gulch Monitoring Station, Healy Power Plant stack emissions data, and other pertinent information will be compiled for each selected event and included in the quarterly data reports. . Figure 4-2 is an example Stage-3 event summary.

ANOMALY SUMMARY

Date and Time:	April xx, 19xx 10a.m. to 2 p.m.
View:	Denali National Park (DNPP)
Noted Anomaly:	Blowing dust or fog. Video images depict whitish, ground-based features resembling blowing dust. The features are visible late in the morning and early afternoon.
In Class I Area:	No

General Weather:	Healy weather observations document good visibility with clear skies. Temperatures ranged from 24°F at 0545 and 0645 to 45°F at 1615. Light to moderate southeasterly winds occurred between 0545 and 0745. Strong southwesterly winds occurred at 0945, and turned to strong southeasterly at 1145, moderately southerly at 1615, and strong southeasterly from 1745 through the remainder of the day. Data from the ambient monitoring station are not available.
Discussion:	The Denali National Park view depicts cloudy skies and moderately windy conditions. Faint streaks resembling blowing dust or fog appear along the river valley. The Garner Hill view depicts no plume from Unit No. 1. Faint streaks resembling blowing dust or fog appear near ground level near Unit No. 1 early in the morning and travel northward. The video depicts generally clear and windy conditions. Plant emission data show no inconsistencies or upsets.
Conclusion:	The ground-based features appearing in the Denali National Park and Garner Hill views are blowing dust or glacial till from the river banks. The appearance of the feature documented in the video and weather record supports this conclusion.

Figure 4-1. Example Anomaly Summary.

EVENT SUMMARY

Date and Time:	January xx, 19xx 10a.m. to 2 p.m.
View:	Garner Hill
Noted Event:	Fog or plume. Video images depict whitish, ground-based and elevated layers resembling fog. The features are visible throughout the day.
In Class I Area:	No
General Weather:	Healy weather observations document fair visibility and generally clear skies. Temperatures ranged from -39°F at 0550 to -29°F at 1145. Calm conditions prevailed except for light northwesterly winds at 1345 and 1545. Visibility through the Nenana Valley was marginal for VFR (visual flight rules) aviation at 1345 and 1545. The ambient monitoring station at Bison Gulch registered calm or light northeasterly winds, and stable, very cold temperatures.
Discussion:	The Garner Hill view depicts the plume from HCCP as long, with high plume rise. The plume travels vertically, then creates an upvalley trail. The view depicts a thick, whitish layer traveling upvalley through the field of view. The view is initially obscured by fog. The HCCP operator tracked the plume upvalley with real-time video and observed the plume moving through Moody Gap at 1400. Stack emissions data showed all monitored parameters to be within emission limits. The Bison Gulch monitoring station indicated elevated atmospheric scattering throughout. The SO_2 monitor recorded background levels all day. Plots of the stack emission data and Bison Gulch are attached. The Denali National Park view clearly depicts a white layer extending through Moody Gap. The white layer does not appear to reach the Class I area boundary.
Conclusion:	The whitish, elevated layer appearing in the Garner Hill and DNPP views is a portion of the water plume from HCCP that has drifted upvalley. The extreme cold temperatures cause the plume to appear opaque, and the calm conditions allow the plume to travel a great distance before dispersing in the DNPP view. The plume is attributable to HCCP but does not reach the Class I area.

Figure 4-2. Example Event Summary.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING DATA REPORTING**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4520**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
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OTHER		

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines the quality assurance and quality control actions associated with the reporting of photographic monitoring data. This SOP serves as a guide to assure high quality, consistent, data reporting for automatic camera stations operated according to IMPROVE Protocol.

The IMPROVE Program has partitioned visibility-related characteristics and measurements into three groups: optical, scene, and aerosol. This SOP pertains only to scene monitoring data reporting.

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visibility relationships to decision-makers and to the public. Self-contained, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location. Camera-based visibility monitoring is an effective, economical component of any visibility monitoring program.

The automatic camera visibility monitoring station takes 35 mm slides of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera to record the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides or 8 mm color movie film can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for the computer image modeling of potential impairment.
- Support color and human perception research.

Slides and movie film do not, however, provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

Data reports are prepared in a format that generally conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Specific contents of each 35 mm or 8 mm report, however, are defined by the contracting agency. Qualitative 35 mm slide film reports provide supplemental data to further analyze collocated optical and/or aerosol monitoring equipment data. Time-lapse (8 mm) monitoring data are often used to summarize short-term special studies or site-specific visual anomalies.

The following technical instructions (TIs) provide detailed information regarding specific 35 mm and 8 mm reporting procedures:

- TI 4520-5000 *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*
- TI 4520-5010 *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project- specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final data reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables for inclusion in the data reports.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall:

- Provide site status and operational information to the data analyst.

- Review collected slide data to select slides representative of good, medium, and poor visibility conditions.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.

- Coordinate with the data analyst for complete report information, format, and statistics.

- Prepare final, approved reports for photocopying and distribution.

- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect) with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Data for each monitoring instrument type (nephelometer, transmissometer, or camera) are released in separate data reports. Data reports are prepared in a format that conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Reporting consists of various text discussions and graphics presentations concerning the instrumentation and collected data. Specific contents of the seasonal and/or annual report are defined by the contracting agency COTR. This section includes four (4) subsections:

4.1 Seasonal Data Reporting
4.2 Annual Data Reporting
4.3 Other Reporting and Supplemental Data Products
4.4 Distribution

4.1 SEASONAL DATA REPORTING

Seasonal reporting is completed within three months after the end of a monitoring season. Standard meteorological monitoring seasons are defined as:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

Scene data are typically presented in the following formats for each reporting season:

- Overview of monitoring program goals and objectives, and a description of the monitoring networks.
- Comprehensive discussion of data collection, reduction, processing, and archive procedures.
- Brief overview of monitoring configuration(s) and description of instrumentation.
- Map of all site locations and site abbreviations.
- Table of monitoring instrumentation history at each site.
- Table of site specifications and operating period for each site operational during the reporting season.
- Qualitative review summary of observed weather conditions, regional and layered haze, and plumes for each site operational during the reporting season.
- Detailed explanation of data presentations included as summary plots.
- Text discussions of observed events and visual anomalies (8 mm film reports only).
- Operation summary table listing data collection losses, problems, and problem resolution for each site.
- Discussion of events and circumstances influencing data recovery, specific for each site.

Refer to TI 4520-5000, *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*, and TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for detailed discussions regarding each type of data presentation.

4.2 ANNUAL DATA REPORTING

Annual reporting is completed within three months after the end of the last season to be reported. Scene data are typically presented in the following formats for each annual reporting period:

- Executive Summary containing specific program objectives, summary of observed visual and meteorological conditions, future considerations, and monitoring program objectives.
- Overview of monitoring program goals and objectives, and a history of the program.
- Comprehensive discussion of data collection, reduction, processing, and archive procedures.
- Brief overview of site configuration and description of instrumentation, including operator training, field servicing, and completion of status/assessment sheets.

- Map of all site locations and site abbreviations.

- Table of site specifications and operating period for each site operational during the annual reporting period.

- Brief discussion of routine field operations for each type of instrumentation, including operator training, field servicing, and completion of status/assessment sheets.

- Brief discussion of quality control procedures.

- Qualitative review summary of observed weather conditions regional and layered haze, and plumes for each site and season during the annual reporting period.

- Comprehensive discussion of observed events, visual anomalies, and probable causes (8 mm film reports only).

- Summary of scene monitoring data collected over the history of each monitoring site.

- Conclusions and future monitoring considerations derived from experience and insights gained through operation of the network and qualitative review of data collected.

Refer to TI 4520-5000, *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*, and TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for detailed discussions regarding each type of data presentation.

4.3 OTHER REPORTING AND SUPPLEMENTAL DATA PRODUCTS

Contracting agencies will periodically request additional data reports. Cases or events of special scientific, legal, or political importance to the NPS or other cooperating agencies may occur during the term of the project. New techniques, hardware, software, or other technical advances may also occur that will be applicable to the visibility monitoring program. Additional data reporting or analyses may be required to address these special circumstances and will be executed according to project-specific direction.

Contracting agencies may also request that supplemental data products be provided with seasonal and/or annual data reports. Supplemental data products may include:

- Slide duplicates representative of good, medium, and poor visibility conditions for each season that sufficient data are available for qualitative review.

- PC-compatible diskettes of seasonal slide condition code files (35 mm slide data only).

- VHS videotape of transferred 8 mm movie film data collected for the seasonal and/or annual reporting period.

- Optical (nephelometer/transmissometer) data summaries for collocated optical monitoring equipment.

4.4 DISTRIBUTION

Reports and supplemental data products are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING REPORTING OF 35 MM SLIDES (IMPROVE PROTOCOL)**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4520-5000**
DATE	**JANUARY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
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PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes. Added reference section.	May 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedures and methods for presenting and preparing written reports of 35 mm slide film. This TI is referenced from Standard Operating Procedure (SOP) 4520, *Scene Monitoring Data Reporting* and specifically describes:

- Reporting frequency and contents of seasonal 35 mm film reports.
- Reporting contents of annual 35 mm film reports.
- Provision of supplemental data products.
- Report distribution requirements.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall:

- Provide site status and operational information to the data analyst.
- Review collected slide data to select slides representative of good, medium, and poor visibility conditions.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.
- Coordinate with the data analyst for complete report information, format, and statistics.
- Prepare final, approved reports for photocopying and distribution.
- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect), with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Major steps in the data collection, handling, processing, analysis, reporting, and archiving of 35 mm color slide film are presented in Figure 4-1. The specific type of data reporting described in this TI is highlighted in this figure.

Reports are prepared in a format that generally conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). However, specific contents of each 35 mm report are defined by the contracting agency COTR. Reporting consists of various text discussions and graphics presentations concerning operational aspects of 35 mm camera monitoring sites and film review. This section includes four (4) major subsections:

4.1 Seasonal Reporting
4.2 Annual Reporting
4.3 Supplemental Data Products
4.4 Report and Data Product Distribution

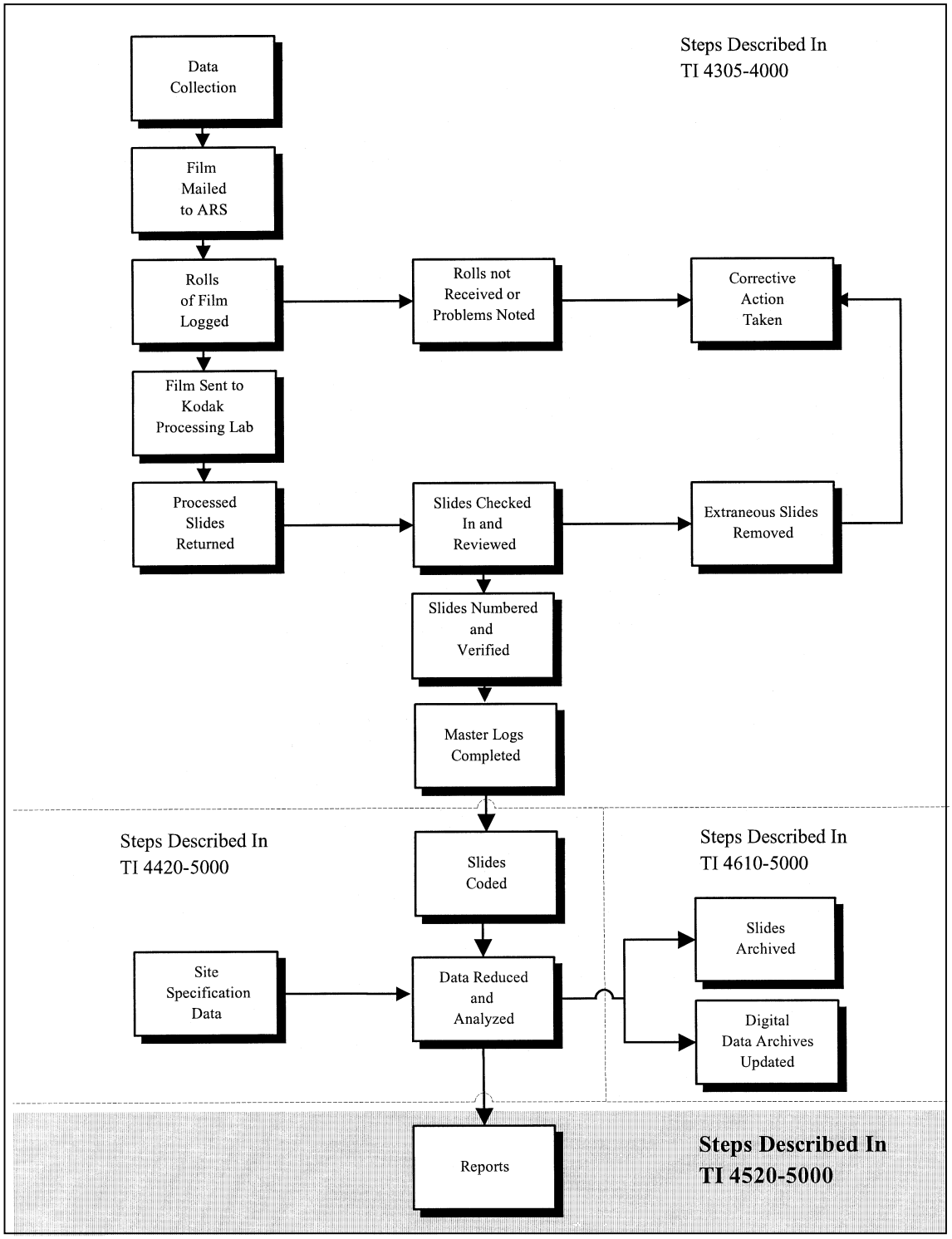


Figure 4-1. Major Steps in the Data Collection, Handling, Processing, Analysis, Reporting, and Archiving of Photographic Data.

4.1 SEASONAL REPORTING

Seasonal 35 mm film reporting is completed within three months after the end of a season. Standard meteorological monitoring seasons are defined as:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

Seasonal reports contain four (4) major sections:

1.0 Introduction
2.0 Data Collection and Reduction
3.0 Photographic Data Summaries
4.0 References

Information and presentation formats included in each section are summarized in the following subsections.

4.1.1 Introduction

The introduction contains a conceptual overview of the purpose of the monitoring program and specific objectives and tasks of the program.

4.1.2 Data Collection and Reduction

Data collection and reduction is presented in two subsections, Site Configuration and Data Reduction.

4.1.2.1 Site Configuration

Automatic camera system components and basic system operation protocols are briefly discussed in each seasonal report. A detailed description of automatic camera system components and operation protocols are presented in Standard Operating Procedure (SOP) 4055, *Site Selection of Scene Monitoring Equipment*.

Also included is a map of the United States depicting the location of each monitoring site, and a monitoring history summary table describing each monitoring site, the type of optical and/or scene instrumentation installed, and the historical periods of operation for each instrument. An example Network Location Map and Visibility Monitoring History Table are provided as Figure 4-2 and Table 4-1, respectively.

4.1.2.2 Data Reduction

The data reduction section of each seasonal report contains two subsections that briefly describe how the slides are reduced and analyzed as well as quality control and quality assurance procedures applied during the data collection and reduction process. Qualitative analysis of 35 mm slides is only performed if specifically requested by the contracting agency.

IMPROVE SITES

SITE ABRV.	SITE NAME
1. ACAD	Acadia NP
2. BIBE	Big Bend NP
3. BOWA	Boundary Waters Canoe Area W
4. BRCN	Bryce Canyon NP
5. BRID	Bridger W
6. CANY	Canyonlands NP
7. CARO	Cape Romain NWR
8. CHIR	Chiricahua NM
9. CRLA	Crater Lake NP
10. DENA	Denali NP
11. DOSO	Dolly Sods W
12. EBFO	Edwin B. Forsythe NWR
13. GLAC	Glacier NP
14. GRCA	Grand Canyon NP
15. GRSM	Great Smoky Mountains NP
16. JARB	Jarbidge W
17. LYBR	Lye Brook W
18. MACA	Mammoth Cave NP
19. MEVE	Mesa Verde NP
20. MORA	Mount Rainier NP
21. OKEF	Okefenokee NWR
22. ROMO	Rocky Mountain NP
23. SAGO	San Gorgonio W
24. SHEN	Shenandoah NP
25. SHRO	Shining Rock W
26. SIPS	Sipsey W
27. TONT	Tonto NM
28. UPBU	Upper Buffalo W
29. WEMI	Weminuche W
30. YOSE	Yosemite NP

NON-IMPROVE SITES TO BE OPERATED ACCORDING TO IMPROVE PROTOCOL

SITE ABRV.	SITE NAME
1. BADL	Badlands NP
2. BAND	Bandelier NM
3. GRBA	Great Basin NP
4. GRSA	Great Sand Dunes NM
5. GUMO	Guadalupe Mountains NP
6. HALE	Haleakala NP
7. HAWA	Hawaii Volcanoes NP
8. LASS	Lassen Volcanic NP
9. NACA	National Capital-Central
10. PEFO	Petrified Forest NP
11. PINN	Pinnacles NM
12. PORE	Point Reyes NS
13. REDW	Redwood NP
14. YELL	Yellowstone NP

SITE NAME KEY

NP National Park
NM National Monument
NS National Seashore
NWR National Wildlife Refuge
W Wilderness

Figure 4-2. Example Visibility Network Location Map.

Table 4-1

Example Visibility Monitoring History Table

Network	Site Name	Teleradiometer				Camera				Transmissometer		Nephelometer	
		MANUAL		AUTO		MANUAL		AUTO					
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
IMPROVE	Acadia NP			12/80	02/86	01/80	10/84	04/85		11/87	06/93	06/93	
IMP Pro.	Badlands NP							08/87		01/88			
IMP Pro.	Bandelier NM	07/78	09/84			06/79	06/85	07/87		10/88			
IMPROVE	Big Bend NP	07/78	02/86			09/81	06/86	06/86		12/88			
IMPROVE	Boundary Waters Canoe Area W							10/85				05/93	
IMPROVE	Bridger W							09/86		07/88			
IMPROVE	Bryce Canyon NP	06/78	11/83	12/83	02/86	01/79	11/83	11/79					
IMPROVE	Canyonlands NP	09/78	02/86			07/82	01/87	01/87		12/86			
IMPROVE	Cape Romain NWR												
IMPROVE	Chiricahua NM	06/81	02/86			06/81	06/86	06/86		02/89			
IMPROVE	Crater Lake NP	07/81	09/82			08/82	09/82	06/85		09/88	09/91		
IMPROVE	Denali NP							06/88					
IMPROVE	Dolly Sods W							09/85				05/93	
IMPROVE	Edwin B. Forsythe NWR							05/92				04/93	
IMPROVE	Glacier NP	04/83	05/85	06/85	02/86	07/82	06/85	06/85		02/88			
IMPROVE	Grand Canyon NP (South Rim)	09/78	08/83	08/83	02/86	10/79	11/83	11/83		12/86			
IMPROVE	Grand Canyon NP (In-Canyon)									12/89			
IMP Pro.	Great Basin NP	06/82	02/86			06/82	05/86	05/86		08/92			
IMP Pro.	Great Sand Dunes NM							07/87					
IMPROVE	Great Smoky Mountains NP			11/83	11/85			01/84				04/93	
IMP Pro.	Guadalupe Mountains NP			02/82	02/86			06/83		11/88			
IMP Pro.	Haleakala NM							07/87					
IMP Pro.	Hawaii Volcanoes NP							10/86					
IMPROVE	Jarbidge W							09/86				04/93	
IMP Pro.	Lassen Volcanic NP	06/82	11/83			08/82	11/83	06/87					
IMPROVE	Lye Brook W							05/87				08/93	
IMPROVE	Mammoth Cave NP							03/92				03/93	
IMPROVE	Mesa Verde NP	07/78	02/86			09/79	07/86	07/86		09/88	06/93		
IMPROVE	Mount Rainier NP			06/85	10/85			06/85				02/93	
IMP Pro.	National Capital-Central							12/88					
IMPROVE	Okefenokee NWR							04/92				02/93	
IMP Pro.	Petrified Forest NP							07/86		04/87			
IMP Pro.	Pinnacles NM							08/86		03/88	06/93		
IMP Pro.	Point Reyes NS							06/87					
IMP Pro.	Redwood NP							06/87					
IMPROVE	Rocky Mountain NP	06/80	02/86					10/85		11/87			
IMPROVE	San Gorgonio W							08/86		04/88			
IMPROVE	Shenandoah NP	05/80	11/85			05/80	10/86	10/86		12/88			
IMPROVE	Shining Rock W												
IMPROVE	Sipsey W							11/88	07/92				
IMPROVE	Tonto NM							04/89		04/89	06/93		
IMPROVE	Upper Buffalo W							11/88				02/93	
IMPROVE	Weminuche W							08/86					
IMP Pro.	Yellowstone NP	06/81	06/82			09/81	06/82	09/86		07/89	06/93		
IMPROVE	Yosemite NP	09/82	07/83	01/84	10/85	09/82	09/83	09/84		08/88			

NETWORK KEY

IMPROVE - IMPROVE site
IMP Pro. - Non-IMPROVE site to be operated according to IMPROVE Protocol

SITE NAME KEY

NP - National Park
NM - National Monument
NS - National Seashore
NWR - National Wildlife Refuge
W - Wilderness

The qualitative analysis subsection contains a brief discussion of the 35 mm slide data reduction and reporting procedures. The discussion includes a description of the slide review and coding process, as well as the compilation of the Qualitative Slide Condition/Haze Code Summary table. Refer to TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*, for a complete description of these procedures.

The quality assurance subsection describes the quality control and quality assurance procedures applied in the photographic data collection and reduction process.

4.1.3 Photographic Data Summaries

Photographic data are presented in various forms depending on contracting agency requirements. Supplemental data products are described in Section 4.3. Each type of data summary is accompanied by an explanation. The following four (4) subsections are typically included in the seasonal report and detail each data presentation provided.

4.1.3.1 Site Specifications and Operating History

Each seasonal report contains a Site and Target Specifications Summary Table, listing complete target and site specifications for each scene monitoring site operational during the period. An example Site and Target Specifications Summary Table is provided as Table 4-2. Site specifications include the following:

- Site name and abbreviation
- Latitude, longitude, and elevation of the camera monitoring site
- Target name, target elevation, distance, azimuth, and elevation angle of the site path
- Number of observations taken per day
- Operating period during the season reported

4.1.3.2 Qualitative Slide Condition/Haze Code Summary

The Qualitative Slide Analysis Summary Table provides a site-by-site accounting of observed haze and target-concealed conditions for each site that operated during the reporting season. An example Qualitative Slide Analysis Summary Table is presented as Table 4-3.

4.1.3.3 Data Archival

This subsection contains a brief discussion of how the 35 mm slide film and digital slide condition/haze code files are archived. Refer to TI 4610-5000, *35 mm Photographic Slide Archives*, for a full discussion of 35 mm slide and digital file archiving procedures.

Table 4-2

Example Site and Target Specifications Summary Table

SITE NAME	SITE ABRV	CAMERA SYSTEM			SIGHT PATH					OBS. PER DAY	OPERATING PERIOD DURING SUMMER 1993
		LAT (°N)	LONG (°W)	ELEV (M)	TARGET NAME	ELEV (M)	DIST (KM)	AZIM (°)	ELEV ANGLE (°)		
ACADIA NP	ACAC	44°20'50"	68°13'40"	466	BLUE HILL	285	30.75	287	-0.34	3	06/01/93 - 08/31/93
BADLANDS NP	BADL	43°52'19"	102°13'51"	960	SHEEP MOUNTAIN	950	33.50	231	0.02	3	06/01/93 - 08/31/93
BANDELIER NM	BAND	35°47'20"	106°16'45"	2018	SANDIA CREST	3255	65.00	192	1.09	2	06/01/93 - 08/31/93
BIG BEND NP	BIBE	29°19'22"	103°12'27"	1165	DAGGER MOUNTAIN	1272	28.00	19	0.22	3	06/01/93 - 08/31/93
BOUNDARY WATERS CANOE AREA W	BWCA	47°56'48"	91°29'45"	515	GYPO LAKE RISE	463	30.00	316	-0.11	1	06/01/93 - 08/31/93
BRIDGER W	BRID	42°58'05"	109°44'50"	2860	MOUNT BONNEVILLE	3830	35.80	107	1.60	3	06/01/93 - 08/31/93
BRYCE CANYON NP	BRCN	37°28'00"	112°13'40"	2710	NAVAJO MOUNTAIN	3018	130.00	109	0.14	3	06/01/93 - 08/31/93
CANYONLANDS NP	CANY	38°29'10"	109°48'10"	1800	CATHEDRAL BUTTE	2420	58.70	171	0.60	3	06/01/93 - 08/31/93
CAPE ROMAIN NWR	CARO	**	**	**	**	**	**	**	**	-	------
CHIRICAHUA NM	CHIR	32°01'00"	109°20'30"	2070	MICA MOUNTAIN	2620	117.00	281	0.27	3	06/01/93 - 08/31/93
CRATER LAKE NP	CRLA	42°54'45"	122°08'30"	2165	THE PALISADES	2057	8.88	42	-0.70	3	06/01/93 - 08/31/93
DENALI NP	DENA	63°29'25"	150°53'00"	646	MOUNT MCKINLEY	6194	47.50	189	6.66	3	06/01/93 - 08/31/93
DOLLY SODS W	DOSO	39°00'00"	79°19'25"	1265	BIG RUN #4172	1256	15.32	245	-0.03	3	06/01/93 - 08/31/93
EDWIN B. FORSYTHE NWR	EBFR	39°28'05"	74°27'13"	5	*	*	*	150	*	3	06/01/93 - 08/31/93
GLACIER NP	GLAG	48°32'10"	113°59'00"	960	GARDEN WALL	2194	29.50	46	2.39	3	06/01/93 - 08/31/93
GRAND CANYON NP	GRCT	36°02'21"	111°49'48"	2290	MOUNT TRUMBULL	2393	124.00	290	0.05	3	06/01/93 - 08/31/93
GREAT BASIN NP	GRBA	39°00'20"	114°13'10"	2085	NOTCH PEAK	2943	72.00	77	0.68	3	06/01/93 - 08/31/93
GREAT SAND DUNES NM	GRSA	37°42'10"	105°32'15"	2423	CEDAR CREEK PEAK	3360	44.50	339	1.21	3	06/01/93 - 08/31/93
GREAT SMOKY MOUNTAINS NP	GRSM	35°37'52"	83°56'38"	792	PARSON BALD	1432	14.00	157	2.62	3	06/01/93 - 08/31/93
GUADALUPE MOUNTAINS NP	GUMO	31°50'00"	104°48'30"	1650	SIERRA PRIETA	1585	43.00	226	-0.07	3	06/01/93 - 08/31/93
HALEAKALA NP	HALE	20°43'00"	156°15'13"	2947	HANAKAUHI	2715	7.57	77	-1.76	3	06/01/93 - 08/31/93
HAWAII VOLCANOES NP	HAWA	19°25'20"	155°17'10"	1220	KAIHOLENA	1158	41.25	230	-0.09	3	06/01/93 - 08/31/93

* Indicates that target specifications are not available.

** Indicates that the site has not yet been installed.

SITE NAME KEY

NP National Park
NM National Monument
NS National Seashore
NWR National Wildlife Refuge
W Wilderness

Table 4-3

Example Qualitative Slide Analysis Summary Table

Site Name	Site Abbr.	VISTA/TARGET Name	Total Obser-vation	SUMMARIES BY NUMBER AND PERCENT (%)					
				Uniform Haze	Ground-Based Layered Haze	Elevated Layered Haze	Multiple Layers	Target Concealed by Haze	Target Concealed by Weather
ACADIA NP	ACAC	BLUE HILL	161	141 (88)	1 (1)	0 (0)	0 (0)	0 (0)	20 (12)
BADLANDS NP	BADL	SHEEP MOUNTAIN	161	141 (88)	1 (1)	0 (0)	0 (0)	0 (0)	29 (18)
BANDELIER NM	BAND	SANDIA CREST	168	123 (73)	6 (4)	6 (4)	1 (1)	0 (0)	32 (19)
BIG BEND NP	BIBE	DAGGER MOUNTAIN	198	112 (57)	24 (12)	3 (2)	2 (1)	5 (3)	57 (29)
BOUNDARY WATERS	BWCA	GYPO LAKE RISE	267	245 (92)	3 (1)	1 (0)	0 (0)	0 (0)	18 (7)
BRIDGER W	BRID	MOUNT BONNEVILLE	267	245 (92)	3 (1)	1 (0)	0 (0)	0 (0)	30 (11)
BRYCE CANYON NP	BRCN	NAVAJO MOUNTAIN	254	208 (82)	4 (2)	0 (0)	0 (0)	0 (0)	42 (17)
CANYONLANDS NP	CANY	CATHEDRAL BUTTE	269	251 (93)	2 (1)	5 (2)	0 (0)	0 (0)	11 (4)
CHIRICAHUA NM	CHIR	MICA MOUNTAIN	125	103 (82)	1 (1)	0 (0)	1 (1)	0 (0)	20 (16)
CRATER LAKE NP	CRLA	THE PALISADES	99	97 (98)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
DENALI NP	DENA	MOUNT MCKINLEY	233	144 (62)	60 (26)	1 (0)	2 (1)	19 (8)	49 (21)
DOLLY SODS W	DOSO	BIG RUN #4172	233	145 (62)	60 (26)	1 (0)	2 (1)	13 (6)	29 (12)
GLACIER NP	GLAG	GARDEN WALL	241	209 (87)	0 (0)	0 (0)	0 (0)	0 (0)	20 (8)
GRAND CANYON NP	GRCT	MOUNT TRUMBULL	57	28 (49)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
GREAT BASIN NP	GRBA	NOTCH PEAK	275	251 (91)	2 (1)	3 (1)	0 (0)	1 (0)	57 (21)
GREAT SAND DUNES NM	GRSA	CEDAR CREEK PEAK	275	252 (92)	2 (1)	3 (1)	0 (0)	0 (0)	21 (8)
GREAT SMOKEY MTNS NP	GRSM	PARSON BALD	91	85 (93)	0 (0)	0 (0)	0 (0)	0 (0)	6 (7)
HALEAKALA NP	HALE	HANAKAUHI	183	140 (77)	2 (1)	0 (0)	0 (0)	0 (0)	26 (14)
HAWAII VOLCANOES NP	HAWA	KAIHOLENA	185	129 (70)	20 (11)	1 (1)	1 (1)	0 (0)	35 (19)

4.1.3.4 Events and Circumstances Influencing Data Collection

Each seasonal report contains a discussion of the events and circumstances that influence data recovery. Operational summaries for each site are presented in a Data Collection Statistics and Operation Summary Table, provided as Table 4-4. The table includes the following:

- Site name and abbreviation
- Data collection period that the site was operational
- Number of total possible observations for the operational period
- The collection efficiency (number and percent) for the operational period
- A description of the cause or causes of data loss or problem description
- Resolutions and/or recommendation comments relating to the noted operational problems

4.1.4 References

References are presented in two subsections: Technical References, and Related Reports and Publications. Technical references are those documents that are cited in the seasonal report. Related reports and publications include all prior reports pertaining to the monitoring program, produced by Air Resource Specialists, Inc. (ARS).

4.2 ANNUAL REPORTING

Annual 35 mm reports summarize one year of standard meteorological monitoring seasons as defined by the contracting agency. Annual reporting is completed within three months after the end of the last season to be reported. Annual reports contain the eight (8) major sections listed below:

Executive Summary
1.0 Introduction
2.0 Operational Procedures
3.0 Data Collection and Analysis Procedures
4.0 Standard Seasonal Reporting Procedures
5.0 Photographic Data Summaries
6.0 Conclusions, Recommendations, and Future Considerations
7.0 References

Information and data presentation formats included in each section are summarized in the following subsections.

4.2.1 Executive Summary

An executive summary is prepared that summarizes the annual report and specific program objectives for the annual monitoring period. Observed visual and meteorological conditions, as well as future considerations and monitoring program objectives are also summarized in this section for quick reference.

Table 4-4

Example Data Collection Statistics and Operation Summary Table

SITE NAME	SITE ABBRV	DATA COLLECTION PERIOD	DATA COLLECTION BY NUMBER AND PERCENT (%)			PROBLEM RESOLUTIONS/ COMMENTS
			TOTAL POSS.	COLLECTION EFFICIENCY	DATA COLLECTION LOSSES/ PROBLEM DESCRIPTION	
ACADIA NATIONAL PARK	ACAC	06/01/93 - 08/31/93	276	238 (86%)	Improper cable connection	Operator corrected connection
BADLANDS NATIONAL PARK	BADL	06/01/93 - 08/31/93	276	174 (63%)	Improper film loading	
					Camera malfunction	Operator replaced camera
BANDELIER NATIONAL MONUMENT	BAND	06/01/93 - 08/31/93	184	184 (100%)		
BIG BEND NATIONAL PARK	BIBE	06/01/93 - 08/31/93	276	255 (92%)		
BOUNDARY WATERS CANOE AREA WILDERNESS	BWCA	06/01/93 - 08/31/93	92	92 (100%)		
BRIDGER WILDERNESS	BRID	06/01/93 - 08/31/93	276	258 (93%)		
BRYCE CANYON NATIONAL PARK	BRCN	06/01/93 - 08/31/93	276	226 (82%)	Late film change	Personnel shortage
CANYONLANDS NATIONAL PARK	CANY	06/01/93 - 08/31/93	276	209 (76%)	Improper film rewinding	
					Improper cable connection	Operator corrected connection
CAPE ROMAIN NATIONAL WILDLIFE REFUGE	CARO	-----				
CHIRICAHUA NATIONAL MONUMENT	CHIR	06/01/93 - 08/31/93	276	124 (45%)	Improper film loading	ARS instructed new operator
CRATER LAKE NATIONAL PARK	CRLA	06/01/93 - 08/31/93	276	269 (97%)		
DENALI NATIONAL PARK	DENA	06/01/93 - 08/31/93	276	276 (100%)		
DOLLY SODS WILDERNESS	DOSO	06/01/93 - 08/31/93	276	270 (98%)		
EDWIN B FORSYTHE NATIONAL WILDLIFE REFUGE	EBFR	06/01/93 - 08/31/93	276	274 (99%)		
GLACIER NATIONAL PARK	GLAG	06/01/93 - 08/31/93	276	276 (100%)		
GRAND CANYON NATIONAL PARK	GRCT	06/01/93 - 08/31/93	276	229 (83%)	Drained timer batteries	Operator replaced batteries
					Incorrect camera settings	Operator corrected settings
GREAT BASIN NATIONAL PARK	GRBA	06/01/93 - 08/31/93	276	273 (99%)		
GREAT SAND DUNES NATIONAL MONUMENT	GRSA	06/01/93 - 08/31/93	276	239 (86%)	Late film changes	Personnel shortage
GREAT SMOKY MOUNTAINS NATIONAL PARK	GRSM	06/01/93 - 08/31/93	276	169 (61%)	Improper film loading	
					Cable malfunction	Operator replaced cable
GUADALUPE MOUNTAINS NATIONAL PARK	GUMO	06/01/93 - 08/31/93	276	227 (82%)	Timer malfunction	Operator replaced timer
					Improper film loading	
HALEAKALA NATIONAL MONUMENT	HALE	06/01/93 - 08/31/93	276	247 (89%)	Late film change	
HAWAII VOLCANOES NATIONAL PARK	HAWA	06/01/93 - 08/31/93	276	275 (99%)		
JARBIDGE WILDERNESS	JARB	06/01/93 - 08/31/93	257	85 (33%)	Incorrect camera settings	Operator corrected settings
LASSEN VOLCANIC NATIONAL PARK	LAVO	06/01/93 - 08/16/93	230	180 (78%)	Late film changes	Personnel shortage;site shut down for relocation
LYE BROOK WILDERNESS	LYBW	06/01/83 - 08/31/93	276	211 (76%)	Late film changes	Film not received at ARS until 10/12/93

4.2.2 Introduction

The introduction is presented in three subsections, Purpose of the Visibility Monitoring Program, History of the Visibility Monitoring Program, and Report Outline.

4.2.2.1 Purpose of the Visibility Monitoring Program

Similar to the seasonal reports, the annual report introduction contains a conceptual overview of the purpose of the monitoring program, including the overall goal (as presented from the Clean Air Act to federal land managers) to prevent any future and remedy any existing visibility impairment in Class I areas.

4.2.2.2 History of the Visibility Monitoring Program

The program's monitoring history is presented, including the scene, optical, and aerosol monitoring networks and monitoring technology changes over the term of the program. This section also includes a monitoring history summary table as described in Section 4.1.2.1.

4.2.2.3 Report Outline

Each annual report presents a brief discussion of the contents of the report, listing the major sections and appendices, and other delivered products that accompany the report.

4.2.3 Operational Procedures

Operational procedures are presented in five (5) subsections: General Network Description, Instrumentation and Siting Protocols, Routine Field Operations, Operator Training, and Quality Assurance.

4.2.3.1 General Network Description

This section of the annual report describes the monitoring sites that were operational during the reporting period. Included is a map of the United States depicting the location of each monitoring site operational during the annual period, and a tabular list of each monitoring site name, abbreviation, and monitoring configuration (e.g., IMPROVE, IMPROVE Protocol). An example Network Location Map is presented as Figure 4-2.

4.2.3.2 Instrumentation and Siting Protocols

Similar to the seasonal reports, automatic camera system components and basic system operation protocols are discussed in each annual report. A detailed description of automatic camera system components and operational and siting protocols are presented in SOP 4055, *Site Selection of Scene Monitoring Equipment*.

4.2.3.3 Routine Field Operations

Each annual report contains a discussion of routine field operations and scheduled and unscheduled servicing requirements. Routine field servicing requirements described are summarized in Table 4-5. Detailed discussions of routine site operator maintenance and field operations are presented in instrument-specific technical instructions (TIs). Reference SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* for the TI that best describes the required automatic camera system configuration.

Table 4-5

Automatic Camera System Routine Field Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheet.
  - Document any equipment or monitoring discrepancies found.
  - Document all servicing or maintenance actions performed.
  - Describe weather conditions.
  - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

Unscheduled Maintenance performed as required:

- If the operator notes a problem, he/she calls or notifies the field specialist and/or data coordinator. If ARS notes a problem, the data coordinator calls the site operator.

- The site operator, in communication with ARS, applies troubleshooting and emergency maintenance procedures.

- If necessary, ARS express mails a replacement camera/timer system to the site.

- The site operator replaces the system and returns the malfunctioning unit to ARS.

ARS may be reached at the following numbers:

Telephone: 970/484-7941
FAX: 970/484-3423

4.2.3.4 Operator Training

Operator training procedures are presented for the monitoring program. The discussion includes monitoring program staff responsible for installations and training, scheduling of training sessions, and training procedures followed.

4.2.3.5 Quality Assurance

This subsection describes the quality control and quality assurance procedures applied in the photographic data collection and reduction process. Each annual report also contains a description of immediate and long-term corrective actions followed if monitoring problems are detected or reported.

4.2.4 Data Collection and Analysis Procedures

Data collection and analysis procedures are typically presented in three subsections: Field Documentation, Internal Documentation and Data Handling, and Qualitative Data Analysis. The data analysis section may be omitted if qualitative analysis of 35 mm slides is not requested by the contracting agency.

4.2.4.1 Field Documentation

This section of the annual report describes the identification and documentation procedures followed by site operators for each roll of 35 mm film.

4.2.4.2 Internal Documentation and Data Handling

The annual report contains a step-by-step description of data handling procedures and internal documentation used in the collection of 35 mm slide film. Detailed discussions of collection and data handling procedures can be found in TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*.

4.2.4.3 Qualitative Data Analysis

This section contains a brief discussion of the 35 mm slide data reduction and reporting procedures requested by the contracting agency.

4.2.5 Standard Seasonal Reporting Procedures

Seasonal data are presented in various forms, depending on contracting agency requirements. Identical to each seasonal report, this section describes the photographic data summaries provided in each seasonal report, and the standard meteorological seasons which make up the annual report. Supplemental data products that may be provided with the annual report are described in Section 4.3 below.

4.2.5.1 Qualitative Slide Summary

This section further describes the slide review and coding process, as well as the compilation of the Qualitative Slide Analysis Summary Table. Refer to TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*, for a complete description of these procedures.

4.2.5.2 Seasonal Archive Procedures

Each annual report contains a brief discussion of how the 35 mm slide film and digital slide condition/haze code files are archived. Refer to TI 4610-5000, *35 mm Photographic Slide Archives*, for a full discussion of 35 mm slide and digital file archiving procedures.

4.2.6 Photographic Data Summaries

Photographic data summaries for each meteorological monitoring season in the annual reporting period are combined and summarized in two sections: Site Specifications and Operation Summaries, and Qualitative Slide Condition/Haze Code Summaries.

4.2.6.1 Site Specifications and Operation Summaries

Each annual report contains a Site and Target Specifications Summary (see Table 4-2). Data Collection Statistics and Operation Summaries are also provided for each meteorological monitoring season in the annual period. Each summary table includes the site name, abbreviation, data collection period, and data collection efficiency statistics for each site operational during the reported monitoring season. An example Data Collection Statistics and Operation Summary Table is presented in Table 4-6.

4.2.6.2 Qualitative Slide Condition/Haze Code Summaries

Seasonal qualitative slide analysis summary tables for each meteorological monitoring season in the annual period are included in this section of the annual report. An example Qualitative Slide Analysis Summary Table is presented in Table 4-3.

4.2.7 Conclusions, Recommendations, and Future Considerations

Conclusions, Recommendations, and future considerations are presented in three subsections. This portion of the annual report provides a written summary of the data collected during the annual period, and details recommendations and future considerations that would enhance future network and program operations.

4.2.7.1 Conclusions

The annual report contains a written summary of all data collection, reduction, and reporting efforts during the annual period. Included are:

- Historical data collection efficiencies
- Qualitative statements regarding monitoring procedures and collection efficiencies
- Limitations of 35 mm scene monitoring
- Monitoring configuration changes made over the period
- Uses of 35 mm color slide film data
- Standards and miscellaneous protocols followed during the reporting period

Table 4-6

Example Data Collection Statistics and Operation Summary Table
as Presented in the Annual Report

SITE NAME	SITE ABBRV	DATA COLLECTION		
		Operating Period	Total Possible	Collection Efficiency
ACADIA NP	ACAC	06/01/91 - 08/31/91	276	263 (95%)
ARCHES NP	ARCH	06/01/91 - 08/31/91	276	273 (99%)
BADLANDS NP	BADL	06/01/91 - 08/31/91	276	213 (77%)
BANDELIER NM	BAND	06/01/91 - 08/31/91	184	160 (87%)
BIG BEND NP	BIBE	06/01/91 - 08/31/91	276	83 (30%)
BOUNDARY WATERS CANOE AREA W	BWCA	06/01/91 - 08/31/91	92	62 (67%)
BRIDGER W	BRID	06/01/91 - 08/31/91	276	165 (60%)
BRYCE CANYON NP	BRCN	06/01/91 - 08/31/91	276	276 (100%)
BUFFALO NR	BUFF	06/01/91 - 08/31/91	184	182 (99%)
CANYONLANDS NP	CANY	06/01/91 - 08/31/91	276	267 (97%)
CAPE ROMAIN NWR	CARO	------		
CAPITOL REEF NP	CARE	06/01/91 - 08/31/91	276	276 (100%)
CAPULIN VOLCANO NM	CAMO	06/01/91 - 08/31/91	276	207 (75%)
CARLSBAD CAVERNS NP	CACA	06/01/91 - 08/31/91	276	272 (99%)
CHACO CULTURE NHP	CHCU	06/01/91 - 08/31/91	276	270 (98%)
CHIRICAHUA NM	CHIR	06/01/91 - 08/31/91	276	192 (70%)
COLORADO NM	COLM	06/01/91 - 08/31/91	276	268 (97%)
CRATER LAKE NP	CRLA	06/28/91 - 08/31/91	162	154 (95%)
CRATERS OF THE MOON NM	CRMO	06/01/91 - 08/31/91	276	83 (30%)
DEATH VALLEY NM	DEVA	06/01/91 - 08/31/91	276	264 (96%)
DENALI NP	DENA	06/26/91 - 08/31/91	200	137 (68%)
DINOSAUR NM	DINO	06/01/91 - 08/31/91	276	276 (100%)
DOLLY SODS W	DOSO	06/01/91 - 08/31/91	276	274 (99%)
EDWIN B. FORSYTHE NWR	EBFR	------		
GLACIER NP	GLAG	06/01/91 - 08/31/91	276	276 (100%)
GLEN CANYON NRA	GLCA	06/01/91 - 08/31/91	276	264 (96%)
GRAND CANYON NP	GRCT	06/01/91 - 08/31/91	276	244 (88%)
GRAND TETON NP	GRTE	06/01/91 - 08/31/91	276	276 (100%)
GREAT BASIN NP	GRBA	06/01/91 - 08/31/91	276	272 (99%)
GREAT SAND DUNES NM	GRSA	06/01/91 - 08/31/91	276	274 (99%)
GREAT SMOKY MOUNTAINS NP	GRSM	06/01/91 - 08/31/91	276	259 (94%)
GUADALUPE MOUNTAINS NP	GUMO	06/01/91 - 08/31/91	276	262 (95%)
HALEAKALA NM	HALE	06/01/91 - 08/31/91	276	256 (93%)
HAWAII VOLCANOES NP	HAWA	06/01/91 - 08/31/91	276	218 (79%)
ISLE ROYALE NP	ISRO	06/01/91 - 08/31/91	276	218 (79%)
JARBIDGE W	JARB	06/01/91 - 08/31/91	276	237 (86%)
JOSHUA TREE NM	JOTR	06/01/91 - 08/31/91	276	252 (91%)
LAKE MEAD NRA	LAME	06/01/91 - 08/31/91	276	185 (67%)
LASSEN VOLCANIC NP	LAVO	06/01/91 - 08/31/91	276	276 (100%)
LAVA BEDS NM	LABE	06/01/91 - 08/31/91	276	272 (98%)
LINVILLE GORGE W	LIGO	06/01/91 - 08/31/91	276	264 (96%)
LYE BROOK W	LYBR	06/01/91 - 08/31/91	276	209 (76%)
MAMMOTH CAVE NP	MACA	------		
MESA VERDE NP	MEVE	06/01/91 - 08/31/91	276	185 (67%)
MOUNT RAINIER NP	MORA	------		
NATIONAL CAPITAL-CENTRAL	NACA	06/01/91 - 08/31/91	276	173 (63%)
NORTH CASCADES NP	NOCA	06/01/91 - 08/31/91	276	228 (83%)
OKEFENOKEE NWR	OKEF	------		
OLYMPIC NM	OLYA	06/01/91 - 08/31/91	276	276 (100%)
OLYMPIC NM	OLYM	06/01/91 - 08/31/91	92	92 (100%0
PETRIFIED FOREST NP	PEFO	06/01/91 - 08/31/91	276	190 (69%)
PINNACLES NM	PINN	06/01/91 - 08/31/91	276	251 (91%)
POINT REYES NS	PORE	06/01/91 - 08/31/91	276	178 (64%)

4.2.7.2 Recommendations

Recommendations are provided by ARS and the contracting agency to offer assistance in addressing monitoring network goals and program objectives. Specific recommendations may include: network design and coverage of Class I areas, assurance of quality monitoring equipment and site operator training, and encouragement to cooperate and share findings with other federal agencies.

4.2.7.3 Future Considerations

Future considerations are provided by ARS that would enhance future network and program operations. Future considerations may include suggestions for improved data collection efficiencies, encouragement to improve communication between federal agencies as well as individual monitoring sites, and potential opportunities to improve existing 35 mm slide film archive methods.

4.2.8 References

Identical to the seasonal reports, references are presented in two subsections: Technical References, and Related Reports and Publications. Technical references are those documents that are cited in the annual report. Related reports and publications include all prior reports pertaining to the monitoring program, produced by ARS.

4.3 SUPPLEMENTAL DATA PRODUCTS

Supplemental data products are provided as requested by the contracting agency. Supplemental data products may consist of (but not limited to) representative slide duplicates, PC-compatible diskettes of qualitative slide data, and supplemental optical data summary plots (of associated optical monitoring equipment). Each of these data products are described in the following subsections.

4.3.1 Representative Slide Duplicates

The data coordinator and project manager thoroughly review all collected slide data for the season to select a series of slides that best represent good, medium, and poor visibility conditions, provided that sufficient data (more than 20% of days of the season) are available for analysis. If optical quantitative analysis values are available (from collocated nephelometer or transmissometer instruments), slides will be selected that best represent reported cumulative frequency SVR or deciview values. Duplicate slides are made as requested by the contracting agency. Each slide duplicate is labeled with corresponding slide number, date and time of observation, and representative slide category.

Accompanying all provided slide duplicates is a table of corresponding slide numbers, dates and times of observations, and written comments of any observed notable anomalies determined during the review process. An example Summary Table of Slides Representative of Observed Good, Medium, and Poor Visibility Conditions is provided as Table 4-7.

Table 4-7

Example Summary Table of
Slides Representative of Observed
Good, Medium, and Poor Visibility Conditions

Site Name	Date	Time	Slide No.	Number of Duplicates Provided	Representative Visibility Category	Observed Notable Anomalies
Bob Marshall South	07/22/90	1500	312	3	Good	
Bob Marshall South	08/04/90	1500	348	3	Medium	
Bob Marshall South	08/06/90	1500	354	3	Poor	
Bob Marshall South	09/11/90	1500	498	0		Extremely clean day
Bob Marshall South	09/04/90	0900	477	1	Episode	Phils Creek Wildfire (9/4/90 - 9/8/90)
Bob Marshall South	08/18/90	0900	390	0		Elevated smoke plume on distant horizon

4.3.2 PC-Compatible Diskettes of Seasonal Qualitative Slide Data

If requested by the contracting agency, slide condition codes are assigned to each collected slide by the data technician. Codes are recorded directly on the slides and later entered into site-specific digital files. Slide coding and qualitative summary procedures are detailed in TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*.

Qualitative review, digital data files are provided on PC-compatible diskettes as requested by the contracting agency. A key to the slide condition code file is provided with each diskette. An example key to the qualitative-only (.SQO) data file is provided as Figure 4-3.

4.3.3 Optical (Nephelometer/Transmissometer) Data Summary Plots

Seasonal cumulative frequency and data collection statistics for collocated optical monitoring equipment (nephelometer or transmissometer) are provided with scene monitoring reports as requested by the contracting agency. All data are provided in the form of a data summary plot. An example Seasonal Transmissometer Data Summary is presented as Figure 4-4. Detailed descriptions of the optical data summaries are provided in TI 4500-5000, *Nephelometer Data Reporting (IMPROVE Protocol)*, and TI 4500-5100, *Transmissometer Data Reporting (IMPROVE Protocol)*.

Column Number

```
         1         2         3         4         5         6
12345678901234567890123456789012345678901234567890123456789012345678901234

MEMO 396789111611**55 0 0   0   0 0.000 0.000902901162520DGBG64*
MEMO 396789111612**20 0 0   0   0 0.000 0.000902901162544DGBG64*
MEMO 396889111621**10 0 0   0   0 0.000 0.000902901162611DGBG64*
MEMO 396889111622**10 0 0   0   0 0.000 0.000902901162640DGBG64*
MEMO 396989111631**55 0 0   0   0 0.000 0.000902901162707DGBG64*
MEMO 396989111632**20 0 0   0   0 0.000 0.000902901162725DGBG64*
```

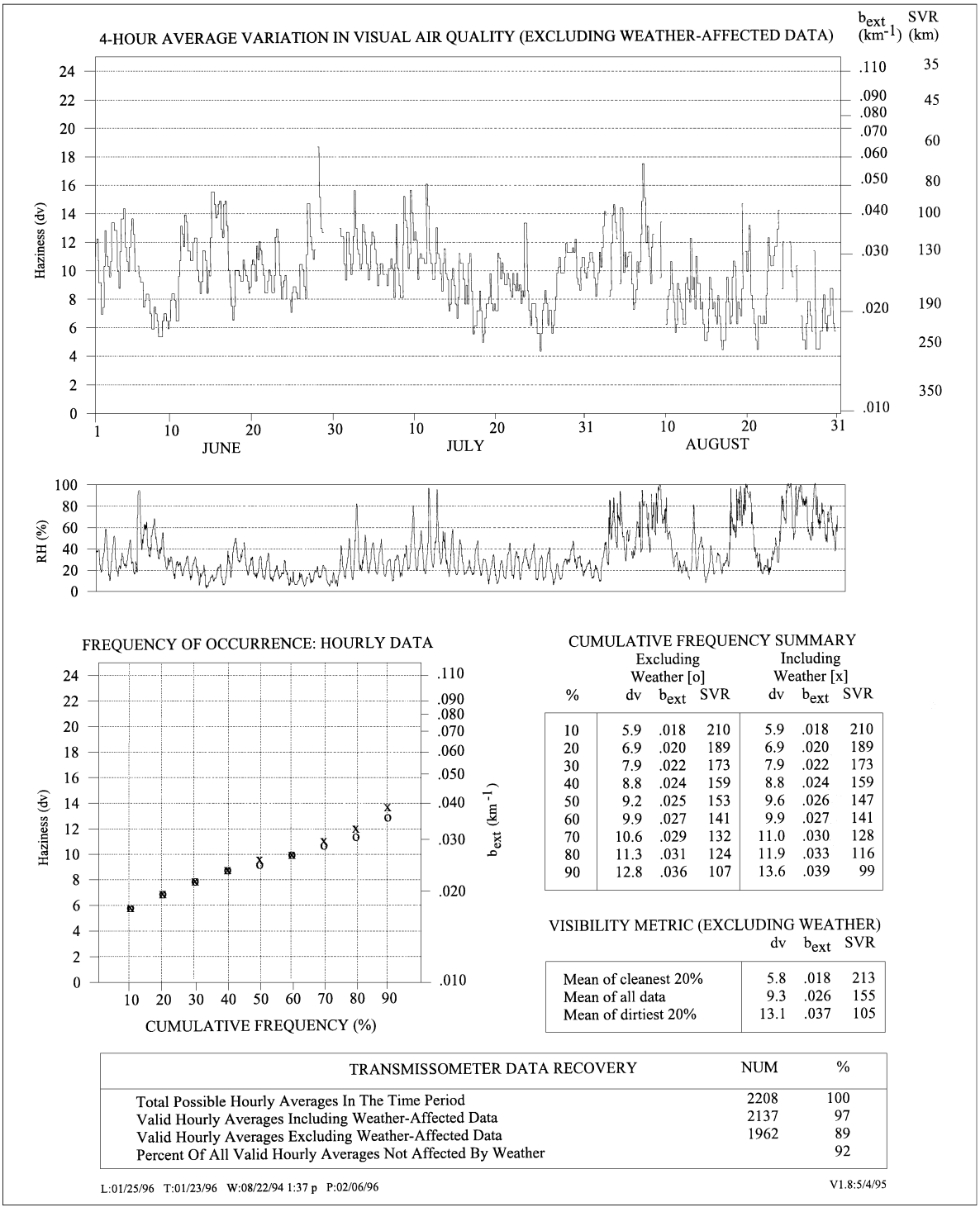
Columns	Data
1-4	Site abbreviation
5-9	Slide number
10-15	Slide date (year/month/day)
16	Slide time code (1=0900, 2=1200, 3=1500 Local Time)
17	Slide vista code
18-19	(Reserved for future use)
20-21	Slide condition code (two digit)
22-45	(Reserved for future use)
46-51	Date slide reviewed (year/day/month)
52-57	Time slide reviewed (hour/minute/second)
58-60	Densitometer data technician initials
61	Wavelength option (R=red, G=green, B=blue)
62-63	ASA film speed
64	(Reserved for future use)

Figure 4-3. Key to the Qualitative-Only (.SQO) Data File.

GRAND CANYON NATIONAL PARK (SOUTH RIM), ARIZONA

Transmissometer Data Summary

Summer Season: June 1, 1993 - August 31, 1993



CUMULATIVE FREQUENCY SUMMARY

%	Excluding Weather [o] dv	b_{ext}	SVR	Including Weather [x] dv	b_{ext}	SVR
10	5.9	.018	210	5.9	.018	210
20	6.9	.020	189	6.9	.020	189
30	7.9	.022	173	7.9	.022	173
40	8.8	.024	159	8.8	.024	159
50	9.2	.025	153	9.6	.026	147
60	9.9	.027	141	9.9	.027	141
70	10.6	.029	132	11.0	.030	128
80	11.3	.031	124	11.9	.033	116
90	12.8	.036	107	13.6	.039	99

VISIBILITY METRIC (EXCLUDING WEATHER)

	dv	b_{ext}	SVR
Mean of cleanest 20%	5.8	.018	213
Mean of all data	9.3	.026	155
Mean of dirtiest 20%	13.1	.037	105

TRANSMISSOMETER DATA RECOVERY	NUM	%
Total Possible Hourly Averages In The Time Period	2208	100
Valid Hourly Averages Including Weather-Affected Data	2137	97
Valid Hourly Averages Excluding Weather-Affected Data	1962	89
Percent Of All Valid Hourly Averages Not Affected By Weather		92

L:01/25/96 T:01/23/96 W:08/22/94 1:37 p P:02/06/96

V1.8:5/4/95

Figure 4-4. Example Seasonal Transmissometer Data Summary.

4.4 REPORT AND DATA PRODUCT DISTRIBUTION

Reports and any provided supplemental data products are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING REPORTING OF 8 MM TIME-LAPSE MOVIE FILM**
TYPE	**TECHNICAL INSTRUCTION**
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REVISION HISTORY			
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0.1	Minor changes. Added reference section.	May 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedures and methods for presenting and preparing written reports of 8 mm time-lapse movie film. This TI is referenced from Standard Operating Procedure (SOP) 4520, *Scene Monitoring Data Reporting* and specifically describes:

- Reporting frequency and contents of seasonal 8 mm film reports.
- Reporting contents of annual 8 mm film reports.
- Report distribution requirements.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall provide site status and operational information to the data analyst.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.
- Coordinate with the data analyst for complete report information, format, and statistics.
- Prepare final, approved reports for photocopying and distribution.
- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect), with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Reports are prepared in a format that conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Reporting consists of various text discussions and graphics presentations concerning operational aspects of camera monitoring sites and film review. This section includes three (3) major subsections:

4.1 Seasonal Reporting
4.2 Annual Reporting
4.3 Report Distribution

4.1 SEASONAL REPORTING

Seasonal 8 mm film reporting is completed within three months after the end of a monitoring season. Standard meteorological monitoring seasons are defined as:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

Seasonal reports contain the five (5) major sections listed below:

1.0 Introduction
2.0 Film Collection and Validation
3.0 Qualitative Reduction
4.0 Film Review Summaries
5.0 References

The information and film presentation formats included in each section are summarized in the following subsections.

4.1.1 Introduction

The introduction contains a conceptual overview of the purpose of the monitoring program and specific objectives and tasks of the program.

4.1.2 Film Collection and Validation

Film collection and validation is presented in five subsections: Site Specifications, Site Status, Exposure Schedule, Film Tracking, and Film Archiving.

4.1.2.1 Site Specifications

Complete site specifications are detailed in a brief discussion which accompanies a photograph of each camera's view. Specifications for 8 mm camera sites include site name and abbreviation, the number of observations taken per day, and the azimuth, elevation, latitude, and longitude of the camera system. An example site photograph and specifications are provided as Figure 4-1. Site configuration is presented in a text discussion, detailing all 8 mm camera system components and general viewing orientation. The location of each 8 mm photographic site is presented on a map of the region, enabling a visual presentation of the general location of each site, their physical relation to one another, and viewing orientation. An example map is provided as Figure 4-2.

4.1.2.2 Site Status

Each seasonal report discusses the current operational status of each site, including equipment status and other factors that may be instrumental in operations, such as local weather conditions. The discussion also includes operational problems and problem resolutions during the reporting period.

4.1.2.3 Exposure Schedule

The 8 mm camera systems may have a flexible observation schedule designed specifically for the monitoring program. This exposure schedule is presented in tabular form, and displays by month, the number of daylight hours available, the beginning and ending hours of camera operation, and the required film change interval (in days). An example exposure schedule table is provided as Table 4-1.

4.1.2.4 Film Tracking

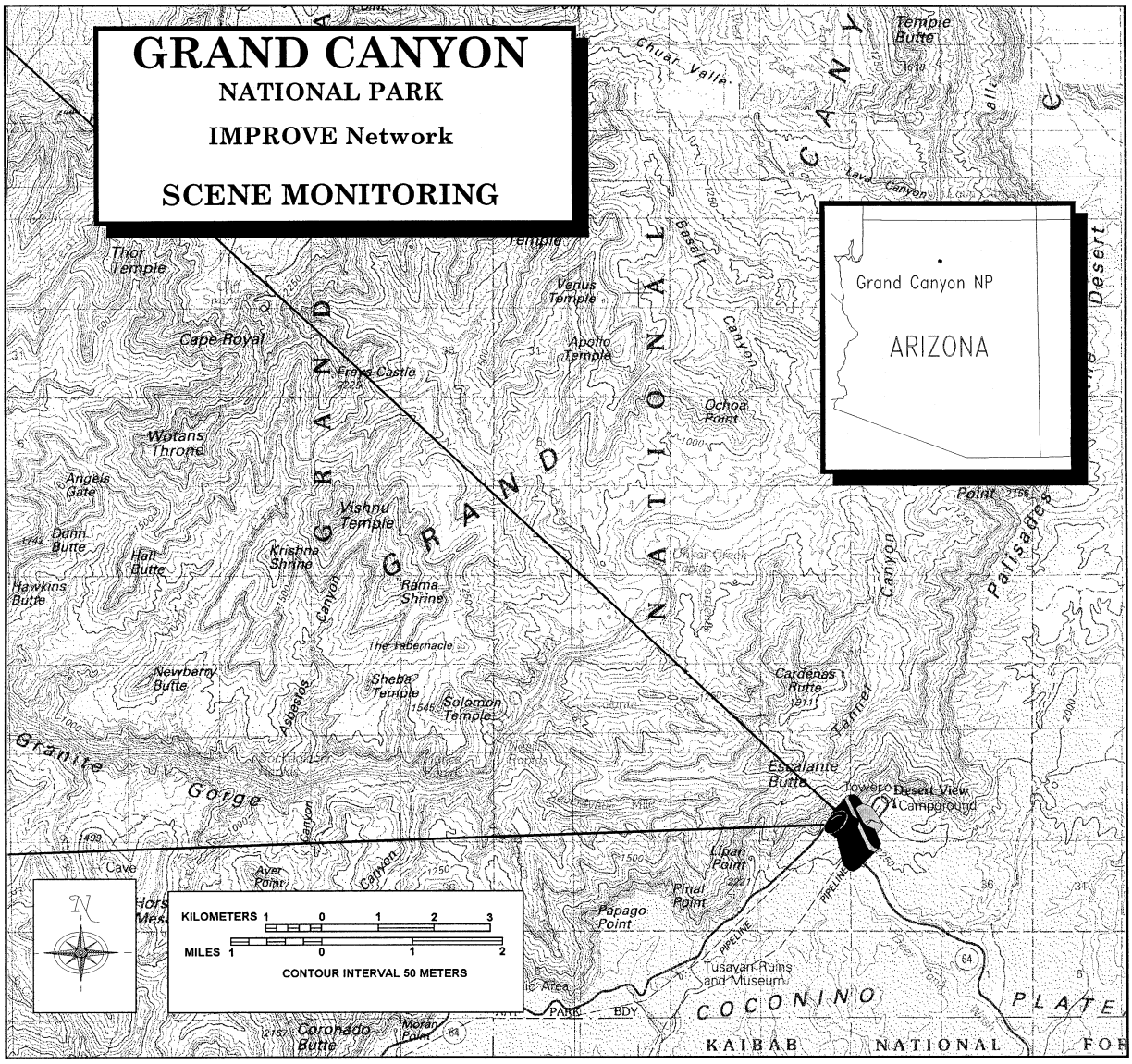
Each seasonal report provides an account of film collection by roll, in tabular form. These tables provide by site, for each roll, the roll numbers, dates and times the roll began and ended, date received at Air Resource Specialists, Inc. (ARS) from the site, date received from Kodalux processing, the number of days possible on the film roll, the number of actual days captured on the film, and comments for each film roll. An example Summary of Film Tracking Table is provided as Table 4-2. Refer to TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, for a complete discussion of film collection and tracking procedures.

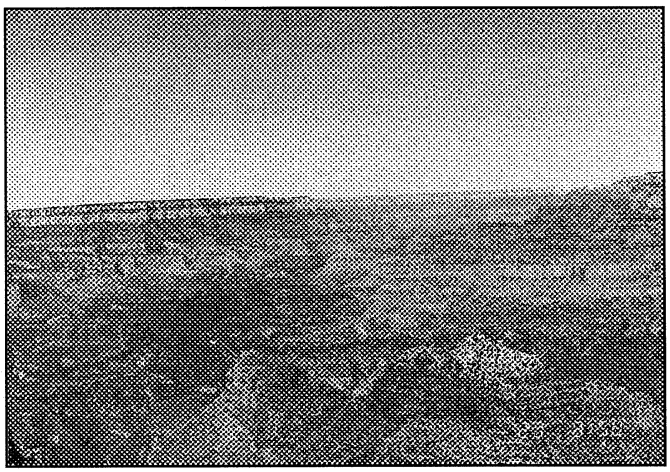
4.1.2.5 Film Archiving

Each seasonal report contains a brief discussion of film archiving procedures. Refer to TI 4610-5010, *8 mm Time-Lapse Film Archives*, for a full discussion of archiving procedures.

Site Name:	Denali National Park - North View
Site Abbreviation:	DENN
Observations/Day:	Varies with daylight hours
Azimuth:	25°
Elevation (m):	590 m (1935 ft)
Longitude:	148° 53' 10"
Latitude:	63° 44' 15"
Map Reference:	Mount McKinley National Park (USGS) 1:250,000

Figure 4-1. Example Site Photograph and Specifications.





SITE SPECIFICATIONS

Site Abbreviation: GRCT

Instrument: Automatic 35mm Camera with 50 mm lens

Elevation:	2290 m
Longitude:	111^0 49' 48"
Latitude:	36^0 02' 21"
Bearing:	290^0
Map Reference:	Tuba City, Arizona 1:100,000 1983 36111-A1-TM-100

Figure 4-2. Example Map of Monitoring Locations and View Orientations.

Table 4-1

Example Exposure Schedule

MONTH	TWILIGHT/ DAYLIGHT HOURS	8 MM TIME-LAPSE SYSTEM			FILM CHANGE INTERVAL IN DAYS
		TOTAL HOURS	START HOUR*	END HOUR*	
AUG	19	18	5	23	3
SEP	17	16	6	22	3
OCT	13	12	8	20	4
NOV	9	8	9	17	6
DEC	7	6	10	16	8
JAN	7	6	10	16	8
FEB	9	8	9	17	6
MAR	13	12	7	19	4
APR	17	16	6	22	3
MAY	19	18	5	23	3
JUN	24	23	3	2	2
JUL	24	23	3	2	2

* Hundred hours, using 24-hour clock with Daylight Savings Time adjustment for April through October.

Table 4-2

Example Summary of Film Tracking Table

SITE ABBRV.	ROLL NO.	DATE/TIME ON	DATE/TIME OFF	RECEIVED AT ARS	RECEIVED FROM PROCESSING	NO. DAYS POSSIBLE	NO. DAYS RECEIVED	COMMENTS
GAEL	29	03/31/93 1135	04/05/93 1020	04/13/93	04/26/93	6	6	
GAEL	30	04/05/93 1135	04/08/93 1100	04/13/93	04/26/93	4	4	Exposure schedule change; on at 0600-2200.
GAEL	31	04/08/93 1110	04/11/93 1616	04/23/93	05/05/93	4	4	
GAEL	32	04/11/93 1636	04/15/93 1325	04/23/93	05/05/93	5	5	
GAEL	33	04/15/93 1335	04/18/93 1825	04/28/93	05/10/93	4	4	Sun glare on camera lens.
GAEL	34	04/18/93 1835	04/22/93 1425	04/28/93	05/10/93	5	5	Sun glare on camera lens.
GAEL	35	04/22/93 1435	04/25/93 1620	05/14/93	06/07/93	4	4	
GAEL	36	04/25/93 1630	04/28/93 1115	05/14/93	06/07/93	4	4	
GAEL	37	04/28/93 1125	05/03/93 1230	05/14/93	06/07/93	6	5	Camera ran out of film; end of monitoring.

4.1.3 Qualitative Film Review

Each seasonal report contains a comprehensive discussion covering 8 mm time-lapse film review procedures. The review procedures are described in TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review.* The discussion includes subjective analysis procedures regarding weather dynamics, observed plumes, and visual discontinuities evident on the time-lapse film. Discussion also includes natural meteorological characteristics that are specific to each site. Noted conditions are examined and compared with other views or other meteorological data (if available). Qualitative review tables for each film roll are prepared for each site, as described below.

4.1.4 Film Review Summaries

4.1.4.1 Qualitative Review Tables

Each seasonal report presents qualitative review tables for each film roll, that document date, weather conditions, presence of observed plumes, description of any observed anomaly (or observed plume) and general comments. The tables may also define anomalies visible both inside the entire camera field of view or visible inside Class I areas only. Refer to TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review,* for a detailed discussion on table preparation. Example review tables are presented as Tables 4-3 and 4-4.

4.1.4.2 Discussions of Observed Events

Following the review tables, individual text discussions are presented for each observed anomaly or plume event observed on the 8 mm film during the reporting period and noted in the review tables. The anomaly discussions include the date, time, and roll number of the observed anomaly, a brief description of the anomaly, whether or not it was visible inside the Class I area, and a comprehensive discussion of general weather conditions, the characteristics and appearance of the anomaly, and the probable cause or causes of it. Supplemental meteorological data such as hourly weather observations, hourly meteorological data, and 35 mm slide observations are used if available. Refer to TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review,* for detailed procedures on preparation of the discussions. An example anomaly discussion is provided as Figure 4-3.

4.1.4.3 Summary of Observed Visual Anomalies

For each reporting season, a summary of the observed anomalies or events and probable causes is presented in tabular form. The tables list the date of each observed event, the camera view(s) it was observed in, and the probable cause of the event. Tables may be created for events both within the entire camera view and within Class I areas only. An example summary table is provided as Table 4-5.

Additional discussion of observed anomalies or events involves only those events which were deemed attributable to the observed monitoring factor or pollution source. The discussion includes further insight into the cause and extent of the event. Monitoring programs that operate with several 8 mm cameras and monitor with a panoramic view can document the extent of travel of an event. A summary table is prepared that presents coherent plume or event tracking, and lists by date, the camera views (in panoramic sequence) and extent of travel of each event. An example coherent plume tracking table is presented as Table 4-6.

Table 4-3

Example Qualitative Review of 8 mm Film
(With and Without Class I Areas)

FILM DATE	WEATHER CONDITIONS	ENTIRE SCENE		CLASS I AREAS ONLY		COMMENTS
		ANOMALY VISIBLE	DESCRIPTION	ANOMALY VISIBLE	DESCRIPTION	
04/28/93	Cloudy. Northerly upper level winds.	No		No		
04/29/93	Cloudy. Northerly upper level winds.	Yes	Blowing dust or fog.	No		
04/30/93	Cloudy. Southerly lower level winds.	No		No		
05/01/93	Cloudy. Southerly upper level winds.	Yes	Smoke plume.	No		
05/02/93	Cloudy. Southerly upper and lower level winds.	No		No		

Table 4-4

Example Qualitative Review of 8 mm Film
(Entire Scene)

FILM DATE	WEATHER CONDITIONS	ANOMALY VISIBLE	DESCRIPTION	COMMENTS
01/24/93	Clear.	Yes	Fog or plume.	
01/25/93	Clear.	Yes	Fog or plume.	Sun glare on camera lens.
01/26/93	Cloudy. Westerly upper level winds.	Yes	Blowing snow or smoke.	
01/27/93	Cloudy. Southwesterly upper level winds.	Yes	Blowing snow or smoke.	Rain/snow on camera shelter window.
01/28/93	Cloudy. Southwesterly upper level winds.	No		
01/29/93	Cloudy. Southwesterly upper level winds.	No		
01/30/93	Partly cloudy. Southwesterly upper level winds.	Yes	Fog or plume.	
01/31/93	Cloudy. Southwesterly upper level winds.	No		Poor visibility due to low clouds.
02/01/93	Clear.	No		Sun glare on camera lens.

Date and Time:	April 20, 1993	
35 mm Slide Numbers:	Denali North view	(DENN #3761 - 3769)
8 mm Film Roll Numbers:	Denali North view	(DENN #131)
	Garner Hill East, Left view	(GAEL #34)
	Garner Hill East, Right view	(GAER #34)
	Garner Hill South, Left view	(GASL #34)
	Garner Hill South, Right view	(GASR #34)

Noted Event: Blowing dust or fog.
The Garner Hill East, left view 8 mm film depicts whitish, ground-based features resembling blowing dust. The features are visible late in the morning and early afternoon.

In Class I area: No

General Weather: Healy weather observations document good visibility with clear skies. Temperatures ranged from 34°F at 0545 and 0645 to 45°F at 1615. Light to moderate southeasterly winds occurred between 0545 and 0745. Strong southwesterly winds occurred at 0945, and turned to strong southeasterly at 1145, moderate southerly at 1615, and strong southeasterly from 1745 through the remainder of the day. Data from the ambient monitoring station at DNPP are not available.

Discussion: The Garner Hill East, left view 8 mm film depicts no plume from Unit No. 1. Faint streaks resembling blowing dust or fog appear near Unit No. 1 early in the morning and travel northward. The film depicts generally clear, windy skies.

The Denali North view 8 mm film depicts cloudy skies and moderately windy conditions. The Denali North view 35 mm photographs generally clear skies and good visibility.

Conclusion: The ground-based features appearing in the Garner Hill East, left view 8 mm film are blowing dust or glacial till from the river banks. The appearance of the feature documented in the film and weather record supports this conclusion.

Figure 4-3. Example Discussion of Observed Anomaly.

Table 4-5

Example Summary of Anomalies and Probable Causes

Date	Probable Source of Observed Anomaly								
	Camera Views					Probable Cause			
	Denali North 35 mm	Denali South 35 mm	Denali North 8 mm	Garner Hill Left	Garner Hill Right	Naturally-occurring	Undetermined *	Unit No. 1	Other Sources
01/18/92			x			x			
01/20/92			x			x			
01/23/92	x		x				x		
01/23/92		x				x			
01/25/92		x					x		
01/27/92	x		x				x		
01/31/92	x		x				x		
02/03/92	x		x			x			
02/04/92	x		x			x			
02/07/92	x						x		
02/11/92	x					x			
02/14/92	x					x			
02/15/92		x				x			
02/16/92	x					x			
02/17/92		x					x		
02/22/92	x		x			x			
03/01/92					x		x		
03/3-4/92				x	x		x		
03/07/92	x					x			
03/27/92	x					x			
03/30/92		x					x		
03/31/92		x				x			
04/03/92		x					x		
04/13/92		x					x		
04/15/92		x				x			
04/19/92		x				x			
04/20/92	x					x			
04/28/92		x				x			
04/28/92			x	x	x		x		
05/05/92	x		x						x
05/06/92	x		x				x		
05/19/92	x		x						x
05/20/92	x		x						x
05/28/92	x		x						x

* The cause of undetermined anomalies is most likely naturally-occurring anomalies or weather patterns, and are not likely caused by Unit No. 1.

Table 4-6

Example Coherent Plume Tracking Table

COHERENT STEAM/ICE PLUME TRACKING (x indicates the existence of a coherent steam/ice plume traceable to Unit No. 1)					
Date	Visible in Class II Area				Visible in Class I Area
	Garner Hill East Left View	Garner Hill East Right View	Garner Hill South Left View	Garner Hill South Right View	
10/16/92	x	x	x	x	
10/17/92	x	x			
10/18/92	x	x			
10/29/92	x	x	x		
11/03/92	x	x			
11/04/92	x	x			
11/05/92	x	x	x	x	
11/06/92	x	x	x	x	
11/20/92	x	x			
12/06/92	x	x	x		
12/12/92	x	x	x	x	
12/25/92	x	x			
01/19/93	x	x	x		
01/20/93	x	x	x	x	x
01/21/93	x	x	x	x	x
01/22/93	x	x			
01/23/93	x	x			
01/24/93	x	x	x	x	x
01/25/93	x	x	x		
01/29/93	x	x			
01/30/93	x	x	x		
01/31/93	x	x			
02/01/93	x	x	x		
02/03/93	x	x	x		
02/06/93	x	x			
02/10/93	x	x			
02/17/93	x	x	x		
02/26/93	x	x			
03/04/93	x	x			
Total 29	29	27	15	7	3

4.1.5 References

References are presented in two subsections: 1) Technical References and 2) Related Reports and Publications. Technical references are those documents that are cited in the seasonal reports. Related reports and publications include all prior reports pertaining to the monitoring program, produced by ARS.

4.2 ANNUAL REPORTING

Annual reports contain the five (5) major sections listed below:

Executive Summary
1.0 Introduction
2.0 Operational Procedures
3.0 Collection and Review Procedures
4.0 Monitoring Summary

The information and film presentation formats included in each section are summarized in the following subsections.

4.2.1 Executive Summary

An executive summary is prepared for each annual report, and presents a detailed summary of the entire 8 mm monitoring effort. It contains specific program objectives, a statistical summary of observed findings, and a summary of visual and meteorological conditions observed during the annual period. The executive summary presents observed findings that are stated in the body of the report.

4.2.2 Introduction

The introduction is presented in three subsections: Visibility Monitoring Program, Overview of the Monitoring Network, and Report Contents and Deliverable Products.

4.2.2.1 Visibility Monitoring Program

Similar to the seasonal reports, the annual report introduction contains a conceptual overview of the purpose of the monitoring program.

4.2.2.2 Overview of the Monitoring Network

Each annual report contains discussion of specific objectives of the monitoring program. Also discussed are ARS' qualifications, and specific monitoring goals.

4.2.2.3 Report Contents and Deliverable Products

Each annual report presents a brief discussion of the contents of the report, listing the major sections within the report, and other delivered products that accompany the report.

4.2.3 Operational Procedures

Operational procedures are presented in four subsections: Site Specifications, Instrumentation, Operator Training, and Field Servicing.

4.2.3.1 Site Specifications

Identical to each seasonal report, annual reports contain complete site specifications in the form of text, maps, and photographs (see Section 4.1.2.1).

4.2.3.2 Instrumentation

Site instrumentation is presented for each monitoring location. A description and listing of each camera, system components, enclosure components, and power requirements is provided for each site. Refer to TIs 4120-3200 and 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System (Minolta XL-401/601 and Minolta D12*, respectively) for details regarding instrumentation and routine site operator maintenance procedures.

4.2.3.3 Operator Training

Operator training procedures are presented for the monitoring program. Discussion includes identification of individual site operators, personnel who trained them, and what manuals were used for the training and site servicing. Refer to TIs 4120-3200 and 4120-3210 for specific routine site servicing procedures, and TIs 4120-3400 and 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System (Minolta XL 401/601 and Minolta D12*, respectively) for troubleshooting and emergency maintenance procedures.

4.2.3.4 Field Servicing

Field servicing procedures are discussed in each annual report. Discussion includes the exposure schedule (see Section 4.1.2.3), frequency of servicing visits, and what procedures were performed during the visit. Refer to TIs 4120-3200 and 4120-3210 for routine site operator maintenance procedures.

4.2.4 Collection and Review Procedures

Collection and review procedures are presented in four subsections: Exposure Schedule, Film Tracking, Qualitative Film Review, and Archive.

4.2.4.1 Exposure Schedule

The 8 mm camera systems may have a flexible observation schedule designed specifically for the monitoring program. This exposure schedule is presented in tabular form, and displays by month, the number of daylight hours available, the beginning and ending hours of camera operation, and the required film change interval (in days) (see Section 4.1.2.3).

4.2.4.2 Film Tracking

Film tracking procedures are briefly discussed in each report (see Section 4.1.2.4). Detailed discussions of collection and tracking procedures can be found in TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, and TI 4420-5010, *Qualitative 8 mm Movie Film Review.*

4.2.4.3 Qualitative Film Review

Specific film review procedures are discussed in detail in each annual report, and are defined in four review stages. The first review stage contains a detailed discussion of film continuity review and problem resolution procedures, and identifies specific ARS personnel who perform this review. The review includes film labeling and initial visual review to determine proper camera and system component operation, proper exposure and alignment, and correct operating period for each film roll.

The second review stage contains a detailed discussion of preliminary continuity verification and anomaly identification procedures, and identifies specific ARS personnel who perform this stage of review. This review stage includes film review to document chronological sequence, daily meteorological conditions and patterns, and detect the presence of any anomalies. Initial evaluation of the cause or causes of each anomaly is also made, and the qualitative review tables (Tables 4-3 and 4-4) are prepared.

The third review stage contains further film reviews to evaluate the observed anomalies and prepare anomaly discussions, and identifies the ARS personnel who are responsible performing these tasks. The subjective analysis procedures during this film review stage involve identifying weather dynamics, observed plumes, and visual discontinuities evident on the time-lapse film. This review provides a preliminary indication of the types of visual effects observed within the individual vistas. Noted conditions are examined and compared with other views or other meteorological data (if available). Anomaly discussions are prepared (see Figure 4-3).

The fourth and final review stage discusses final review and report preparation procedures, and identifies the personnel who are responsible at this review stage.

4.2.4.4 Archive

Each annual report contains a brief discussion of film archiving procedures (see Section 4.1.2.5).

4.2.5 Monitoring Summary

The monitoring summary is presented in four subsections: Monitoring Considerations, Data Collection, Problems and Problem Resolution, and Classification and Summary of Observed Visual Anomalies.

4.2.5.1 Monitoring Considerations

Annual reports contain a summary of the 8 mm camera monitoring operation. The summary includes special or unique monitoring considerations, limitations of 8 mm photography, total number of observations obtained within the reporting period, exposure factors due to observations taken near dawn and dusk time periods, and other factors specific to the monitoring program.

4.2.5.2 Data Collection

Data collection statistics for the annual period are presented for each site, including the number of film rolls, days possible, days collected, and data collection efficiency percentage for the period. Text discussion includes an overall, annual collection percentage, and significant problems which caused a notable data collection loss. An example data collection statistics table is provided as Table 4-7.

Table 4-7

Example Data Capture Statistics Table

SITE	NUMBER OF FILM ROLLS	DAYS POSSIBLE	DAYS COLLECTED	DATA COLLECTION EFFICIENCY
DENN	134	473 days	404 days	85%
GARL	95	273 days	264 days	97%
GARR	95	273 days	257 days	94%
GAEL	37	201 days	197 days	98%
GAER	37	201 days	184 days	92%
GASL	37	201 days	190 days	95%
GASR	37	201 days	189 days	94%

4.2.5.3 Problems and Problem Resolution

Operational problems and problem resolutions during the reporting period are also presented both in text and tabular form, and includes local weather conditions and other factors that affect data collection. An example operational summary table is presented, and includes a summary of observation losses, operational problems, and problem resolutions for each camera site during the annual reporting period. The table includes site name, roll number, periods of data collection losses, problem description, and problem resolution. An example operational summary table is provided as Table 4-8.

4.2.5.4 Classification and Summary of Observed Visual Anomalies

Each annual report contains a comprehensive discussion that includes a summary of observed findings compiled during the annual period, which is also included in the executive summary. A statistical summary is prepared of the observed anomalies and existing visual conditions. Individual discussions of each monitoring site provide a summary of anomaly and meteorological findings on a seasonal basis.

The monitoring summary also contains those anomaly discussions, that were presented in the seasonal reports, which were notable or of special interest to the monitoring program. Similar to the seasonal reports, a table depicting the observed anomalies/events and probable causes is provided for the annual period. The table lists the date of each observed event, camera view it was observed in, and the probable cause of the event (whether naturally-occurring, undetermined, due to the monitored pollution source, or other sources). Tables are created for anomalies/events both within the entire camera view and within Class I areas only (see Table 4-5).

Table 4-8

Example Operational Summary Table

SITE	SYSTEM TYPE	ROLL #	DATA COLLECTION LOSSES	PROBLEM DESCRIPTION	PROBLEM RESOLUTIONS
DENN	8 mm	4	02/04/92 - 02/11/92	Camera turned off	Operator aware of error
		5	02/11/92 - 02/17/92	Kodalux processing error	
		17	04/03/92 - 04/07/92	Loose camera/timer cable connection	Operator tightened connection
		18	04/07/92 - 04/10/92	Drained batteries	Operator replaced batteries
		19	04/10/92 - 04/15/92	Drained batteries	Operator replaced batteries
		20	04/15/92 - 04/18/92	Drained batteries	Operator replaced batteries
		21	04/18/92 - 04/22/92	Drained batteries	Operator replaced batteries
		22	04/22/92 - 04/24/92	Drained batteries	Operator replaced batteries
		23	04/24/92 - 04/27/92	Drained batteries	Operator replaced batteries
		37	06/02/92 - 06/03/92	Shutter malfunction	Camera replaced
		87	09/11/92 - 09/14/92	Drained batteries	Operator replaced batteries
		91	09/23/92 - 09/25/92	Drained batteries	Operator replaced batteries
		92	09/26/92 - 09/28/92	Drained batteries	Operator replaced batteries
		95	10/12/92	Late film change	
		99	10/24/92 - 10/27/92	Camera malfunction	
		100	10/27/92 - 11/01/92	Camera malfunction	
		101	11/01/92 - 11/03/92	Camera malfunction	
		102	11/03/92 - 11/08/92	Camera malfunction	Camera replaced
		134	05/03/93	Late film change	End of monitoring

Similar to the seasonal reports, a summary table is prepared that presents coherent plume or event tracking, and lists by date, the camera views (in panoramic sequence) and extent of travel of each event (see Table 4-6).

4.3 REPORT DISTRIBUTION

Reports are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report; for example, 15 seasonal reports and 5 annual reports are delivered to the NPS.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING ARCHIVES**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4610**
DATE	**SEPTEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes to materials section	April 1996	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) is a guide to archiving and maintenance of scene visibility monitoring photographic film, digital data, and support documentation.

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in visibility sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visibility relationships to decision-makers and to the public. Self-contained, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location. Camera-based visibility monitoring, referred to as scene monitoring by the IMPROVE Program, is an effective, economical component of any visibility monitoring program.

Day-to-day variations in visual air quality captured on 35 mm color photographic slides or 8 mm color movie film can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for computer image modeling of potential impairment.
- Support color and human perception research.

The following separate technical instructions (TIs) provide detailed information regarding scene monitoring archiving:

- TI 4610-5000 35 mm Photographic Slide Archives
- TI 4610-5010 8 mm Time-Lapse Film Archives
- TI 4610-5020 Slide Spectrum Archives
- TI 4610-5030 Photographic-Based Teleradiometric Data Archives

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Ensure that archives are accessible, orderly, complete, and current.
- Inform the data archivist when seasonal data have been finalized and reported and are ready to be archived.
- Document and distribute duplicate archive tapes to off-site locations.

2.2 DATA TECHNICIAN

The data technician shall:

- Place 35 mm slides and accompanying documentation in folders.
- File the slides in file cabinets by site and season.
- File 8 mm time-lapse film in storage cabinets by site and roll number.
- Maintain additional support documentation in file cabinets.

2.3 DATA ARCHIVIST

The data archivist shall:

- Obtain and compile ASCII data to be archived as directed by the project manager.
- Perform periodic archives.
- Maintain data archive records.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 35 MM FILM STORAGE

The 35 mm slide archives are designed to allow accessibility and to maintain maximum film quality for the life of the film. Equipment and materials used include:

- 35 mm photographic slides
- Polyethylene slide protector sheets
- Manila file folders
- Hanging file folders
- Standard file cabinets

3.2 8 MM FILM STORAGE

Equipment and materials used for 8 mm film storage include:

- 8 mm film rolls
- VHS videotape (if applicable)
- Storage boxes (3.5" computer diskette storage boxes)
- Metal storage cabinets with adjustable shelves

3.3 SUPPORTING HARD COPY DOCUMENTATION

Equipment and materials used for maintaining photographic documentation archives include:

- Three-ring notebooks
- Manila file folders
- Hanging file folders
- Standard file cabinets
- Plastic magnetic tape holders
- Storage cabinets
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Miscellaneous hard copy documentation

3.4 DIGITAL ARCHIVES

Scene monitoring archives of slide-derived digital data are performed on IBM-PC compatible systems. The required computer system components include the following:

- IBM compatible 386/486 computer system with VGA and minimum 80 megabyte hard disk
- Hewlett Packard Jetstore 6000 Digital Audio Tape Drive
- 4 mm DAT cartridges
- Cheyenne Software's ARCserve program

- WordPerfect software

- HP Laserjet printer

4.0 METHODS

This section includes two (2) subsections:

4.1 Physical Archives
4.2 Computer Archives

These subsections describe the procedures for archiving scene monitoring products and digital data. Archiving of film and support documentation is performed continually. Archiving of digital data is performed on a seasonal basis, after data have been finalized and reported.

4.1 PHYSICAL ARCHIVES

Scene monitoring products consist of 35 mm photographs, 8 mm time-lapse film, Slide Coding Log Sheets, Photographic Visibility Monitoring Status/Assessment Sheets, Master Logs, and correspondence or other miscellaneous documentation. Specific TIs as noted in Section 1.0 will detail the procedures used for physical archives.

4.2 COMPUTER ARCHIVES

Through the Fall 1993 season, scene monitoring digital data files include quantitative scene monitoring slide data in the form of raw teleradiometric data (.SLD files) and processed teleradiometric data (.SVR files). In December 1994 the IMPROVE Program chose to no longer support quantitative estimates of standard visual range derived by slide-based densitometry (teleradiometric methods). Beginning with the Winter 1994 season, the following digital file types exist in relation to photographic-based quantitative or qualitative-only data requested:

- .SLD files - contain qualitative slide code data and raw densitometry (teleradiometric) data.

- .SVE files - contain processed teleradiometric data and associated uncertainty ranges in standard visual range units.

- .EXT files - contain processed teleradiometric data and associated uncertainty ranges in atmospheric extinction units.

- .SQO files - contain only qualitative scene monitoring slide code data.

ASCII files are produced for each season for each site. Archiving of all raw and processed data for a given season is performed on a seasonal basis, after data have been finalized and reported. Files are stored in the original format (non-compressed) on magnetic tape. Refer to TI 4610-5030, *Photographic-Based Teleradiometric Data Archives*, for detailed procedures used for computer archives.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**35 MM PHOTOGRAPHIC SLIDE ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5000**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes to materials section	April 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) is a guide to the archiving and maintenance of 35 mm color photographic slides. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with photographic slides.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall ensure that archives are accessible, orderly, complete, and current.

2.2 DATA TECHNICIAN

The data technician shall:

- Place 35 mm slides and accompanying documentation in folders.
- File the slides in file cabinets by site and season.
- Maintain additional support documentation in file cabinets.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The 35 mm slide archives are designed to allow accessibility and to maintain maximum film quality for the life of the film. Equipment and materials used include:

- 35 mm photographic slides
- Polyethylene slide protector sheets
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Miscellaneous hard copy documentation
- Manila file folders
- Hanging file folders
- Standard file cabinets

4.0 METHODS

This section includes three (3) subsections:

4.1 Physical Film Archives
4.2 Supporting Hard Copy Documentation Archives
4.3 Photographic Digital Data Archives

4.1 PHYSICAL FILM ARCHIVES

All 35 mm slides are labeled by site and slide number and stored chronologically in polyethylene slide sheets (such as Vue-all Slide Saver sheets). Slides for each film roll are placed in a manila file folder, along with a Slide Coding Log Sheet and the corresponding Visibility Monitoring Status/Assessment Sheet. Refer to TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*, for detailed handling and labeling procedures. The manila folders for each site are labeled with the site abbreviation, roll number, and slide numbers (e.g., GRCA 148 1593-1613), then placed in hanging folders for each season. The hanging folders are placed in standard file cabinets chronologically, by season. Standard monitoring seasons are:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

4.2 SUPPORTING HARD COPY DOCUMENTATION ARCHIVES

Supporting hard copy documentation for 35 mm slides includes the Visibility Monitoring Status/Assessment Sheets, Slide Coding Log Sheets, Master Logs, and data coordinator/operator correspondence. The Visibility Monitoring Status/Assessment Sheets and Slide Coding Log Sheets are filed with the corresponding 35 mm slides in the manila folder. Refer to TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*, for detailed documentation procedures. All other supporting documentation is stored in hanging file folders in standard file cabinets, in chronological order by site.

4.3 PHOTOGRAPHIC DIGITAL DATA ARCHIVES

Digital data produced from 35 mm photographic slides (qualitative condition codes, slide contrast values, and standard visual range values) are archived as detailed in TI 4610-5030, *Photographic-Based Teleradiometric Data Archives*.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**8 MM TIME-LAPSE FILM ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5010**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) is a guide to the archiving and maintenance of 8 mm time-lapse movie film. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with time-lapse film.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall ensure that archives are accessible, orderly, complete, and current.

2.2 DATA TECHNICIAN

The data technician shall:

- File 8 mm time-lapse film in storage cabinets by site and roll number.
- Maintain additional support documentation in storage cabinets.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The 8 mm film archives are designed to allow accessibility and to maintain maximum film quality for the life of the film. Equipment and materials used include:

- 8 mm film rolls
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Miscellaneous hard copy documentation
- Storage boxes (3.5" computer diskette storage boxes)
- Metal storage cabinets with adjustable shelves
- VHS videotapes (if applicable)
- Three-ring notebooks

4.0 METHODS

This section includes two (2) subsections:

4.1 Physical Film Archives
4.2 Supporting Hard Copy Documentation Archives

4.1 PHYSICAL FILM ARCHIVES

All 8 mm time-lapse film rolls are labeled by site and roll number. Refer to TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, for detailed handling and labeling procedures. Film rolls are maintained in the Kodalux roll boxes, then stored by site and chronological sequence (roll number) in cardboard storage boxes (3.5" computer diskette storage boxes), and storage cabinets (six foot metal storage cabinet with adjustable shelves). The cardboard storage boxes are labeled by site, roll number, and date. Supporting hard copy documentation is stored alongside the film rolls in three-ring notebooks.

If duplicate film rolls or film transferred onto videotape is required, these duplicate copies are also stored in the same configuration as the original 8 mm film rolls.

4.2 SUPPORTING HARD COPY DOCUMENTATION ARCHIVES

Supporting hard copy documentation for 8 mm time-lapse movie film includes the Visibility Monitoring Status/Assessment Sheets, Master Logs, and data coordinator/operator correspondence. Refer to TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, for detailed documentation procedures. All supporting documentation is stored in three-ring notebooks by site and filed in storage cabinets alongside the film rolls.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**HISTORICAL SLIDE SPECTRUM ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5020**
DATE	**NOVEMBER 1999**

AUTHORIZATIONS		
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS

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LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

1.0 PURPOSE AND APPLICABILITY

In 1995, the IMPROVE (Interagency Monitoring of Protected Visual Environments Steering Committee formed a consensus that five years of scene monitoring at a location where visual air quality is not rapidly changing yields sufficient examples of most visual air quality conditions. To secure a representative set of observed air quality conditions, a series of slides for each site is selected from the visibility database and archived on CD-ROM. The series of slides making up this historical archive (spectrum) consists of clear sky slides that represent the range of visibility conditions observed at the site during the morning and afternoon hours, a selection of the cleanest clear sky slides to represent pristine conditions for each monitoring season, specific slides that show the most scenic views of the vista during the historical monitoring period, and selected visibility events.

The total number of slides selected for each site depends on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and completeness of the slide database. All historical slide spectrums are reproduced digitally on photo-CD, by site, to yield a long-term digital storage media. A master CD is produced for each site containing all photo-CD images as well as graphic images of the monitoring location, descriptions of the site and historical monitoring period, and plots, tables, and/or data listings of data collected at the site. Multiple copies of the master CD are produced as needed.

The 35 mm historical spectrum archives are produced to provide a representative set of historical photographic data that can be maintained at maximum archive quality for many years beyond the life of the original 35 mm film. The CD-ROM archive medium was chosen to provide end-users convenient access to the historical archive without any loss in image quality (first generation duplication).

This technical instruction (TI) is a guide to archiving 35 mm color photographic slides and associated graphic and data presentations in the form of historical slide spectrums. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with producing a historical 35 mm slide archive.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific archive and distribution requirements.
- Oversee the slide selection process, review all spectrum series and selections prior to permanent archive.
- Coordinate with the data technician and secretary to oversee the preparation of associated graphic and data presentations, and the production of master CD-ROMs.
- File and maintain all support documentation.
- Verify that completed master CD-ROMs are properly distributed.
- Archive and maintain all original historical slide series.

2.2 DATA TECHNICIAN

The data technician shall:

- Review all photographic slides available from each site and create a subset of all initial historical spectrum selections from the 35 mm film archive.
- Compile a series of morning and afternoon spectrums, pristine, scenic, layered hazes, etc., for the project manager's review.
- Scan and estimate contrast values for each slide in the morning and afternoon spectrum series.
- Compile all historical monitoring specifications and graphic data as required.
- Coordinate with the project manager and secretary for the preparation of monitoring location site descriptions and historical photographic monitoring specifications.
- Verify that all unused original slides are properly returned to the 35 mm slide archives (as described in TI 4610-5000, *35 mm Photographic Slide Archives*.

2.3 SECRETARY

The secretary shall:

- Coordinate with the project manager and data technician for complete documentation information, format, and word processing procedures.
- Word process all graphic and tabular materials into a final document.
- Produce final documents in Portable Digital Format (.PDF) for archive to CD-ROM.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The slide spectrums are taken to a photographic dealer for production onto CD-ROMs. Equipment and materials needed to select spectrum slides include:

- 35 mm photographic slides
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Historical photographic data request correspondence
- Polyethylene slide protector sheets
- Light table
- Hand-held lens

Equipment and materials used to compile historical monitoring specifications and associated graphic and data presentations include:

- Photographic site and target specifications
- U.S.G.S. topographic maps
- ARS Monitoring History Database records
- IMPROVE historical aerosol total reconstructed extinction data
- Windows-based personal computer with the following system requirements:
  - x86-based personal computer (486DX minimum, Pentium, or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphics card
  - Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, or Microsoft Windows NT 3.51 or 4.0
  - Adobe Acrobat 3.01 or better (including Acrobat Exchange and Acrobat Reader), Kodak QuickSolve Browser, Microsoft Word, Lotus WordPro, and Microsoft Excel
  - 8 MB application RAM
  - 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
  - True Color (32-bit) display and 2 MB video RAM recommended for optimal viewing
- Polaroid SprintScan 35/LE Scanner
- PolaColor Insight scanning software
- ARS software OLDHAZE.EXE (image haze simulation for windows)
- ARS software CONTRAST.EXE

4.0 METHODS

Historical slide spectrum archives are produced on CD-ROM, and contain, for each monitoring site:

- Morning and afternoon spectrum slides
- Pristine slides
- Scenic view and visibility events slides
- Monitoring site specifications
- Visibility conditions summary and cumulative frequency statistics

This section includes four (4) subsections:

4.1 Selecting Slides for the Historical Spectrum
4.2 Creating Other Materials Included With the Spectrum
4.3 Producing the CD-ROM
4.4 Archiving Spectrum Materials

4.1 SELECTING SLIDES FOR THE HISTORICAL SPECTRUM

To secure a representative set of observed air quality conditions, a series of slides for each site is selected from the visibility database and archived on CD-ROM. The slide series comprising this historical archive (spectrum) consists of:

- Clear sky slides that represent the range of visibility conditions observed at the site during the morning and afternoon hours.
- Pristine condition clear sky slides to serve as masters for computer imaging or modeling applications (WinHaze, 1997).
- Scenic views and meteorological conditions observed during the historical monitoring period.
- Selected visibility events regardless of illumination conditions such as layered hazes (surface and elevated), coherent plumes, and intense visibility degradation associated with fires, meteorology, or pollution episodes.

The total number of slides selected for each site depends on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and completeness of the slide database.

4.1.1 Review of Photographic Visibility Database and Initial Slide Selections

All 35 mm color slides in the entire archive of each site and vista are reviewed. This archive usually includes slides for at least 5 years of monitoring at three times a day.

4.1.1.1 Morning and Afternoon Clear Sky Selections

Clear sky slides that represent range of visibility conditions observed at a site during the morning and afternoon hours are selected and categorized using the following criteria:

- Only clear sky slides are selected. Predominant clouds, layered haze, or fog layers should not be evident in the photographs.
- Slide exposure must be reasonable. No extremely overexposed or underexposed slides are selected for the spectrum.
- Slide exposure and scenic color must be consistent.
- Slides should be properly aligned on the selected vista. Slides where the vista is extremely off-center, or out-of-alignment should not be selected.
- If possible to determine, no slide should contain a precipitation/weather-related event or total domination of the scene by precipitation/weather.
- Slides should represent a time of day with the most consistent exposure and adequate number of clear-sky events to choose from, preferably 0900 and 1500.

Selected slides are grouped according to observation time period and consistent exposure and alignment. No more than three groupings are compiled for any time period. Each grouping is arranged, by eye, in order of best to worst visual air quality. Grouped slides are then placed in polyethylene slide protector sheets for the project manager's review and slide spectrum analysis.

Selecting an incremental series of slides consistent in composition, time of day, and exposure can be difficult due to the limited amount of data available, variable nature of meteorology, associated lighting, and film response conditions. Most visibility spectrums for the western United States consist of 10-20 slides each. Spectrums for eastern U.S. sites typically consist of 8-15 slides each.

4.1.1.2 Pristine Selections

Clear sky slides to represent pristine conditions for one or more monitoring seasons are selected in the same manner as above. An effort is made to select the cleanest of the cleanest slides to represent one or more time periods (i.e., 0900, 1200, 1500). Pristine slides often serve as the basis for image-processing and/or modeling applications such as WinHaze - Level 1 Visual Air Quality Modeler.

4.1.1.3 Scenic and Visibility Event Selections

In addition to clear sky images, slides are also selected for the historical spectrum to represent unique scenic conditions and dynamic visibility events and/or episodes. Scenic selections often include scenic qualities such as interesting cloud formations, seasonal color, or storms. Visibility event and episode selections often include layered haze, plumes, intense regional hazes, as well as periods of ongoing dynamic visibility impairment that has occurred at the site. The final number of slides selected to represent scenic and visibility events is quite variable. Most historical spectrums contain 10-30 slides in this category.

4.1.2 Slide Spectrum Analysis

4.1.2.1 History of Slide-Based Visibility Measurements

A primary goal of visibility monitoring is to quantify how well the image-forming information in a vista is transmitted through the atmosphere to an observer some distance away. Determining how well the information is transmitted and assigning a quantitative value to that information is known as quantitative visibility analysis. Historically, 35 mm color photographic slides were used to obtain quantitative estimates of "visual range," defined as how far a black object could be seen on a distant horizon. Quantitative visibility estimates from color slides are based on densitometry measurements of the sky/target contrast of selected horizon features within a photographic vista. Sky/target contrasts are measured in the 550 nm (green) wavelength. The 550 nm wavelength is used because it is the most dominant visible wavelength in the solar spectrum. These measurements are reduced and reported as visual range (km) or extinction b_{ext} values. The equations and considerations used to calculate visual range (km) and extinction from measured sky/target contrasts are based on various derivations and approximations by visibility scientists (Middleton, 1958; Malm, 1979; Allard and Tombach, 1981; ARS, 1994).

Although used in the past, quantitative estimates of b_{ext} or visual range from slides can have substantial error due primarily to naturally-occurring variations in the condition and illumination of the sky, target, and site path. Estimated errors in individual slide-based measurements also leads to a systematic bias in reported slide-based cumulative frequency values. The exact magnitude of cumulative frequency bias is not easily quantifiable; however, it is apparent that reported "clean" values are too clean, reported "dirty" values are too dirty, and median cumulative frequency values for large data sets are reasonably accurate. For this reason, the slide spectrum analysis results should be used, reported, or publicized with extreme caution.

All calculated slide spectrum visual range estimates are rounded for precision. All cumulative frequency values presented are derived from historical aerosol data summaries rather than 35 mm densitometry data summaries. It should also be noted that all visual range summaries and spectrum grouping archives should remain intact and be referenced only in relation to other slides in the same grouping.

4.1.2.2 Slide Spectrum Archive Visibility Measurements

The project manager reviews each visibility grouping selected (i.e., 0900 and 1500). One final clear sky spectrum is selected to represent each data collection period. Any supplemental groupings are retained as "runner-ups" in the circumstance that the selected set shows too many inconsistencies or is damaged (e.g., scratched) in some way.

Each final grouping is returned to the data technician for scanning and contrast calculations. Individual slides are scanned and archived as low resolution digital .TIF (or .TGA) files using the Polaroid SprintScan 35/LE scanner and associated software. Red, green, and blue wavelength pixel statistics are obtained for the selected target and sky areas of the image using image haze simulation software. Contrast measurements can then be calculated given the green target/sky pixel statistics and associated 10-step grayscale calibration curve. An automated version of all necessary contrast calculations is available in the CONTRAST.EXE batch program. All red-green-blue wavelength pixel statistics and associated contrast estimations are documented for further reference. Detailed scanning and contrast calculation procedures are outlined in Appendix A.

The project manager reviews all the estimated contrast values. Any inconsistencies in measured values and actual visual (by eye) appearance are investigated and rescanned, or thrown out of the selected spectrum grouping. All remaining spectrum slides and associated slide contrasts are charted, using the Microsoft Excel table shown in Figure 4-1. Comparisons are made between the measured contrast values of the selected spectrum and the calculated density curve, given the known target distance and estimated inherent contrast (Figure 4-2). Excess slides with repetitive contrasts are removed. If a large gap is apparent, or if the set does not uniformly represent visibility conditions from good to bad, then the "runner-up" spectrum grouping is scanned or individual "runner-up" slides are used to supplement the draft grouping.

Once the final spectrum slide sets have been selected and scanned, all associated slide numbers, dates of observation, and contrast estimates are charted in the final Excel table (Figure 4-1). Given the selected target distance, pristine contrast value, calculated target inherent contrast and individual slide contrast, the visual range, deciview, and b_{ext} (Mm^{-1}) are calculated automatically within the Excel table for each documented slide.

The final step in spectrum analysis consists of determining the frequency of occurrence of the given slide's visibility condition in relation to IMPROVE aerosol data collected at the site. If no aerosol data are available, then this step is excluded and no cumulative frequency data are documented. Site-specific total reconstructed extinction (Mm^{-1}) data should be obtained from the IMPROVE aerosol data contractor in a tabular cumulative frequency format, by season and all seasons combined, for the entire period of record. An example summary of aerosol cumulative frequency data is shown in Figure 4-3. Individual spectrum b_{ext} (Mm^{-1}) values are compared with the provided aerosol cumulative frequency values for all seasons combined. Corresponding cumulative frequency values are documented in the "Aero Cum Freq %" column of the Excel table. Note: it may be necessary to carry the spectrum b_{ext} (Mm^{-1}) calculations to two decimal places in order to more closely match the provided aerosol cumulative frequency statistics. The project manager makes a final review of the data to ensure that spectrum selection also represents an even distribution of aerosol cumulative frequency data.

4.1.3 35 mm Slide Selection Archive

The primary purpose of the historical slide spectrum archive is to secure a representative set of observed air quality conditions for many years to come. Because film emulsions degrade with time, a medium other than 35 mm slide film or prints was chosen. To better preserve a portion of the original visual information, all selected slides are digitized in high-resolution format and stored on a Kodak Photo CD. Once digitized, multitudes of data management and reproduction options are available with no loss to the quality or integrity of the original digitized image.

Up to 105, 35 mm slide images can be archived on a single Kodak Photo CD in Photo CD (.PCD) format. The project manager makes a final review of all the selected spectrum groupings, pristine, scenic, layered haze, and visibility episode slides selected to represent the site. The set is checked for its overall consistency, representativeness, and exposure quality. All gray scales used for slide spectrum analysis are also included as a calibration medium for future reproduction. If more than 105 slides have been selected for archive, either the scenic or episode selections will be reduced in size or a judgement to create a two-volume CD site-specific archive will be made. All selected slides are thoroughly cleaned (air-blown and/or cleaned with film cleaner) and organized in polyethylene slide protector sheets in the following order:

Visibility Condition Summary
Slide Contrast/Extinction Calibration Curve

Site Name	Slide #	Slide Date	Time Code	Target Code	RGB Slide Contrast	bext	Est bext	Est Contrast	Est VR	Rounded VR	dv	b_{ext} (Mm^{-1})	Aero # (Cum Freq %)		
Canyonlands NP	7898	7/1/91	3	1	0.459		0.011		341	340	1	12	< 1%	Cleanest Slide Contra	0.5
Visibility Condition Summary	7984	6/20/91	3	1	0.448		0.012		331	330	2	12	< 1%	Target Distance	58.7
	10792	6/8/94	3	1	0.404		0.014		287	290	3	13	< 1%	Cathedral Butte	0
	6186	7/18/89	3	1	0.374		0.015		262	260	4	15	1%	Co1	0.90
	10814	6/15/94	3	1	0.357		0.016		249	250	4	16	2%		
	7870	6/22/91	3	1	0.321		0.018		223	220	6	18	5%		
	10626	4/15/94	3	1	0.264		0.021		187	190	7	21	10%		
	10638	4/19/94	3	1	0.207		0.025		156	160	9	24	30%		
	10623	4/14/94	3	1	0.160		0.029		133	130	11	30	60%		
	10869	7/5/94	3	1	0.137		0.032		122	120	12	33	70%		
	5206	9/1/88	3	1	0.116		0.035		112	110	13	36	80%		
	6158	7/9/89	3	1	0.031		0.067		68	70	17	56	97%		
	7704	5/19/91	3	1	0.000		#NUM!		#NUM!	50	21	78	> 99%		
Runner Ups, pulled from final	10736	5/21/94	3	1	0.441		0.012		322	320	2	12			
	10795	6/9/94	3	1	0.423		0.013		304	300	3	13			
	10779		3	1	0.458		0.011		340	340	1	11			
	7895		3	1	0.401		0.014		284	284	3	14			
	5085		3	1	0.380		0.015		267	267	4	15			
	7867		3	1	0.271		0.020		191	191	7	20			
	6183		3	1	0.256		0.021		183	183	8	21			
							#NUM!		#NUM!		#DIV/0!	#DIV/0!			
Canyonlands NP	7867		3	2	0.600		0.024		163		#DIV/0!	#DIV/0!		Cleanest Slide Contra	0.92
Visibility Condition Summary	5205		3	2	0.662		0.043		91		#DIV/0!	#DIV/0!		Target Distance	10
???? These contrast values	10623		3	2	0.698		0.036		104		#DIV/0!	#DIV/0!		Foreground Ridge	
	10869		3	2	0.716		0.035		112		#DIV/0!	#DIV/0!		Co1	1.02
	6158		3	2	0.733		0.033		120		#DIV/0!	#DIV/0!			
	7704				0.724		0.034		115		#DIV/0!	#DIV/0!			
							#NUM!		#NUM!	Round up or down to nearest 10 (above 100)					
							#NUM!		#NUM!	100 +- 10-50 , 200 +-20 , 100+-10 , 50 +-5 , 25 +-5					
							#NUM!		#NUM!	Miles and deciview calculated automatically					

4/16/99 11:50 AM
CANY1500.xls

Figure 4-1. Example Visibility Condition Summary .

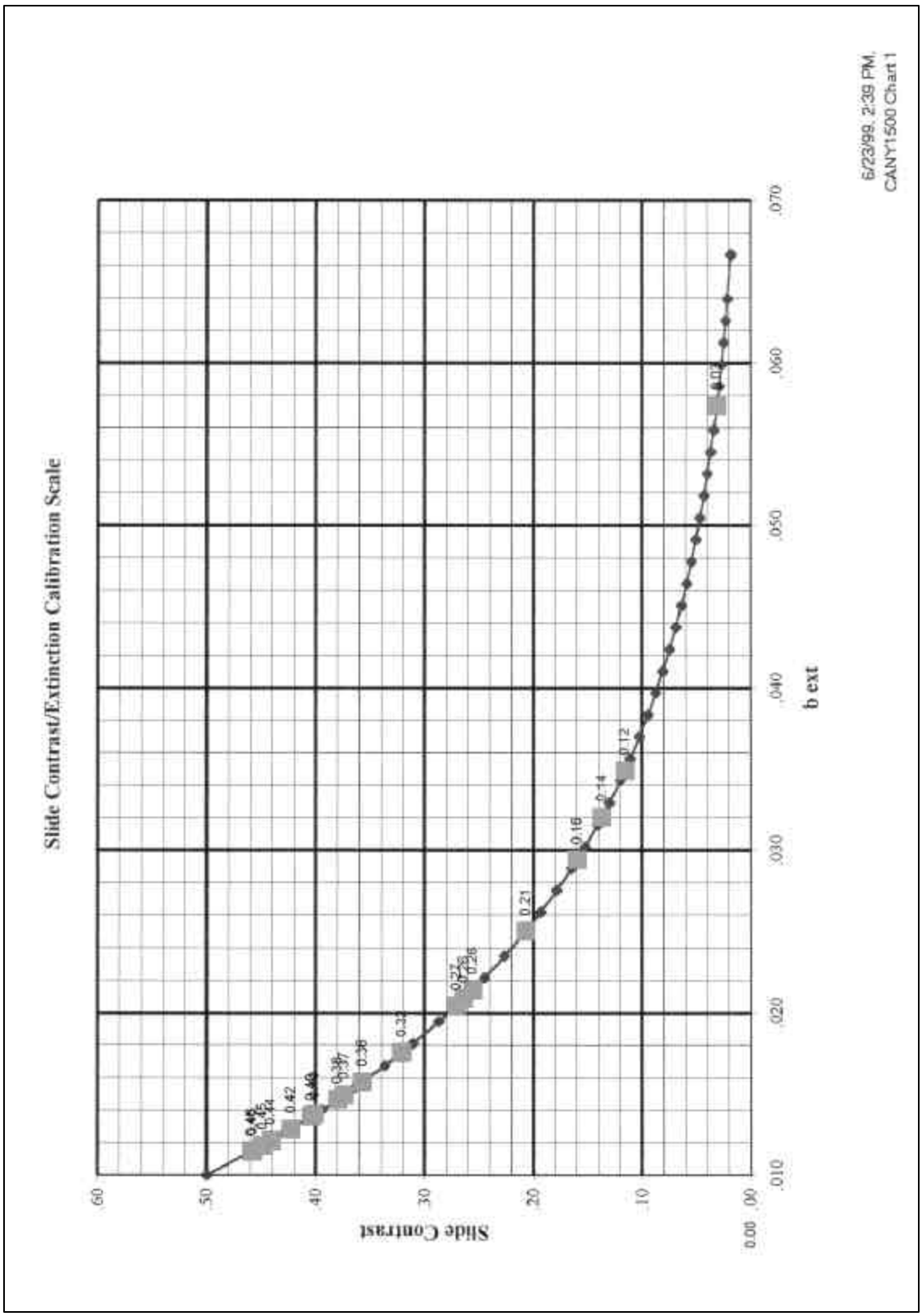

Figure 4-2. Example Slide Contrast/Extinction Calibration Scale.

3/88-2/97 4.00
SITE=BRID

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	13.22	13.80	14.14	15.14	15.84	16.09	17.71	20.23	22.19	23.83
2	summer	13.73	14.92	16.08	16.37	16.72	17.42	19.65	22.59	24.99	26.01
3	autumn	12.34	13.12	14.09	14.60	14.83	15.33	16.80	18.64	20.43	21.92
4	winter	12.12	12.36	12.62	12.86	13.15	13.20	13.51	14.66	15.33	16.14
5	ANNUAL	12.12	12.86	13.22	13.56	13.78	14.09	15.41	17.47	19.42	21.50

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	25.44	28.06	30.60	33.43	37.16	42.04	42.81	43.26	44.47	47.46	48.08
2	27.71	29.67	30.79	32.93	37.30	43.58	44.81	53.98	56.03	58.08	58.50
3	24.19	26.50	28.96	31.74	37.06	40.02	40.51	43.99	46.50	48.82	52.98
4	17.32	18.42	19.25	21.35	24.28	27.75	29.30	31.51	33.43	38.47	42.26
5	23.87	26.02	28.48	31.43	35.89	39.34	41.27	43.16	44.81	50.94	58.50

3/88-2/97 5.00
SITE=CANY

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	14.75	14.84	15.40	16.35	16.74	17.01	19.40	21.86	23.04	24.41
2	summer	17.41	19.29	20.19	20.84	20.92	21.54	24.18	25.41	26.84	28.44
3	autumn	13.03	13.16	16.79	17.23	17.40	17.45	18.35	20.71	23.17	25.20
4	winter	14.66	14.74	15.11	15.29	15.50	15.90	17.92	21.50	24.12	26.56
5	ANNUAL	13.03	14.91	15.51	16.73	17.10	17.42	19.35	22.60	24.54	26.17

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	25.94	27.33	30.27	32.99	36.81	39.98	42.29	45.36	48.01	55.58	64.12
2	29.80	31.45	32.83	35.32	41.22	45.51	47.68	51.18	52.02	53.08	63.57
3	26.70	29.21	31.79	33.68	37.87	39.00	39.14	40.11	40.75	42.61	46.89
4	29.64	32.38	36.04	42.78	53.90	60.35	61.38	64.99	69.03	73.24	79.27
5	28.11	30.31	32.37	35.37	40.73	48.01	51.26	53.84	57.73	63.57	79.27

3/88-2/97 6.00
SITE=CHIR

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	14.97	16.67	17.07	17.68	19.76	20.04	22.43	24.50	25.83	27.19
2	summer	18.03	23.01	23.82	24.81	25.90	26.21	27.56	30.50	33.08	35.34
3	autumn	17.72	18.36	18.53	18.55	19.32	19.82	21.99	24.64	26.21	27.93
4	winter	14.74	15.53	16.38	17.03	17.16	17.49	19.49	21.54	23.05	24.86
5	ANNUAL	14.74	16.95	17.68	18.21	18.99	19.62	21.65	24.52	26.50	28.53

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	30.03	32.44	35.05	38.19	43.48	45.93	46.55	48.19	48.79	61.31	61.33
2	38.06	39.80	42.89	47.05	53.02	56.44	58.71	59.35	65.13	89.90	95.07
3	29.38	32.32	36.16	39.11	42.61	47.03	47.46	49.77	51.26	55.18	84.86
4	27.16	28.92	30.88	34.39	38.53	43.80	46.11	46.91	50.07	53.00	61.49
5	30.80	33.64	36.89	39.89	45.45	50.07	51.31	53.63	56.41	61.33	95.07

Prepared by JS
Thursday 12/18/97 11:13

aerosol_example.xls, 4/16/99

Figure 4-3. Example Summary of Aerosol Cumulative Frequency Data.

- Range of visibility spectrums (0900, 1200, and/or 1500)
- Layered haze
- Visibility episodes
- Pristine and scenic
- Miscellaneous original slides of interest (e.g., data requests of national interest)

If a slide repeats anywhere in the selection, a placeholder is inserted identifying the slide and its residing location in the set. Each site-specific image is archived onto a Kodak Photo CD by a Kodak processing lab. A detailed description of how the Photo CD image archive is cataloged and combined with site-specific graphic and data presentation materials is provided in Section 4.3.

4.2 CREATING OTHER MATERIALS INCLUDED WITH THE SPECTRUM

To establish a self-contained scene monitoring archive, all site-related monitoring information and spectrum analysis statistics associated with the archived images are also maintained. This section describes the procedures and formats used to compile the associated graphic and data presentation materials. The type and amount of materials archived varies depending upon the site and the client's needs. The primary items considered are outlined below.

4.2.1 Scene Monitoring Site Specifications

A Scene Monitoring Site Specification Summary, shown in Figure 4-4, is created to identify the monitoring site location and field of view, summarized by the historical spectrum images. A graphic depiction (topographic map) is included to give the user an idea of the terrain surrounding the photographic site path, as well as the location of additional air quality monitoring instruments. A tabular summary of all scene monitoring (35 mm, 8 mm, and special study) that has occurred within the region is also provided for additional reference. A "Period Reviewed" summary denotes the period of data evaluated to establish the historical range of visibility spectrums for the summarized vista.

If a site has monitored more than one photographic vista during its history, then only the vista(s) included in the spectrum analysis data summaries are included in the CD archive presentation.

4.2.2 Spectrum Visibility Condition Summary and Cumulative Frequency Statistics

A tabular summary of all slide spectrum analysis results (compiled in Section 4.1.2.2) for each range of visibility grouping is also provided in the final archive. Shown in Figure 4-5, the information summarized includes:

- Spectrum sequence number
- The representative visibility condition for each archived image, in units of deciview (dv), b_{ext} (Mm^{-1}), and VR (km).
- The frequency of occurrence of the given image's visibility condition in relation to IMPROVE aerosol data collected at the site.

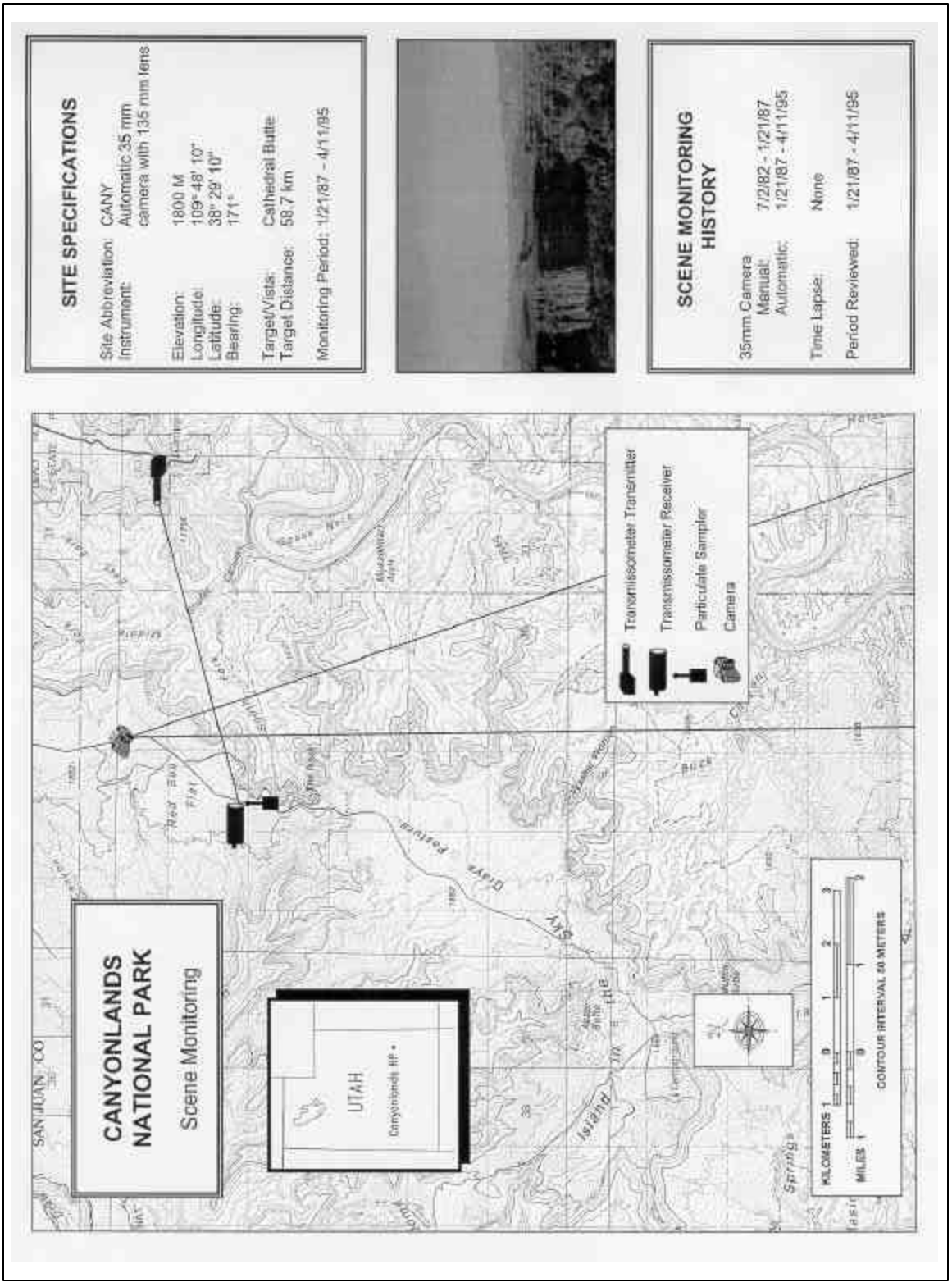

Figure 4-4. Example Scene Monitoring Site Specification Summary.

Canyonlands National Park, Utah
0900 Slide Spectrum Series (1987 – 1995)
Cumulative Frequency Summary

Spectrum Sequence #	Representative Visibility Condition Summary			Representative Cumulative Frequency of Reconstructed Extinction IMPROVE Aerosol Data (1988 – 1997)
	dv	b_{ext} (Mm^{-1})	VR (km)	
1 of 11	2	13	310	< 1%
2 of 11	3	13	300	< 1%
3 of 11	4	15	260	1%
4 of 11	5	17	230	4%
5 of 11	6	19	210	10%
6 of 11	8	23	170	20%
7 of 11	10	26	150	40%
8 of 11	11	30	130	60%
9 of 11	14	39	100	90%
10 of 11	15	46	85	90%
11 of 11	17	56	70	97%

Canyonlands National Park, Utah
1500 Slide Spectrum Series (1987 – 1995)
Cumulative Frequency Summary

Spectrum Sequence #	Representative Visibility Condition Summary			Representative Cumulative Frequency of Reconstructed Extinction IMPROVE Aerosol Data (1988 – 1997)
	dv	b_{ext} (Mm^{-1})	VR (km)	
1 of 13	1	12	340	< 1%
2 of 13	2	12	330	< 1%
3 of 13	3	13	290	< 1%
4 of 13	4	15	260	1%
5 of 13	4	16	250	2%
6 of 13	6	18	220	5%
7 of 13	7	21	190	10%
8 of 13	9	24	160	30%
9 of 13	11	30	130	60%
10 of 13	12	33	120	70%
11 of 13	13	36	110	80%
12 of 13	17	56	70	97%
13 of 13	21	78	50	> 99%

Figure 4-5. Example Summary of Slide Spectrum Analysis Results.

4.2.3 CD-ROM Archive-Related Presentation Materials

4.2.3.1 Table of Contents

A detailed CD-ROM Table of Contents is provided as shown in Figure 4-6. Included is a list of image, graphic presentation, and software files that may be searched for by the user. A complete description of each image includes: image file name, image description, slide number, date and time the image was taken, comments related to the vista or past use of the image, and the path description where the file can be found on the CD. It is necessary to maintain a unique site-specific file name, in the instance that all National Park Service data are someday combined in a one-image database. Graphic and data presentation descriptions include the software required to access the file(s) and a brief description of the information contained. The Table of Contents is compiled in an Excel file and then reformatted to Adobe Acrobat Reader format (.PDF) for the final CD-ROM archive.

A second copy of all tabular information associated with the historical spectrum images is prepared and retained in Excel. Label descriptors are reduced to 25 characters/field for a graphic pitch of 6.0, or 17 characters/field for a graphic pitch of 8.0. During the final archive process, described in Section 4.3, this Excel file is imported into the Kodak QuickSolve image database (Qbrowser). Within the Qbrowser database, each image is labeled with the abbreviated image descriptions, associated slide number, date and time, as well as any comments related to the vista or past use of the image.

4.2.3.2 Title Slide/Cover Sheet

A Title Slide file is created to serve as a header for the graphic and data presentation materials included on the CD (Figure 4-7). Included in the Title Slide is the full site name, monitoring period reviewed, and any associated contract, preparation date, or ARS archive information.

4.2.3.3 CD Cover

The CD cover, like the Title Slide, provides an informative summary of the contents of the CD (Figure 4-8). It should include the full site name, monitoring period reviewed, and any associated contract, preparation date, or ARS archive information.

4.2.3.4 CD Access Instructions

A file summarizing the CD contents, type of file formats, and access requirements is provided as a courtesy to the user. Recipients of the historical CD may or may not be familiar with computer access related information. The CDINFO document, shown in Figure 4-9, provides a brief overview of what types of image and graphic files are provided, as well as how the images can be best accessed or printed for future use. In order to view CDINFO the user must launch the provided Adobe Acrobat software and open file CDINFO.PDF.

Table of Contents

Canyonlands National Park
Permanent Photographic Archive
1987-1995
Kodak Master ID - 7314-3252-1468 (2/24/98)

Pathname d: = CD-ROM drive	File name	Catalog #	File/Image Description			File Type	Comments
d:	CDINFO.PDF		Contents and access information related to this disk			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	READ1st.PDF		Software and system requirements related to this disk			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	READ1st.TXT		Software and system requirements related to this disk			ASCII Text File	
d:	CONTENTS.PDF		Detailed table of contents containing all file access information			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	HISTDATA.PDF		Title slide, site specifications, and spectrum cumulative frequency summaries			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:\catalog	PHOTOS.CAT		Kodak Qbrowser catalog file containing reference to all archived PCD images			Kodak QuickSolve Browser	
d:\images	IMG0001.JPG	1	Regional Haze Spectrum #1 of 11	7/2/91, 9:00	7899	JPEG Image	Cathedral Butte 1987 - 1995 (all 135mm lens unless noted otherwise)
d:\images	IMG0002.JPG	2	Regional Haze Spectrum #2 of 11	8/8/91, 9:00	8004	JPEG Image	Cathedral Butte
d:\images	IMG0003.JPG	3	Regional Haze Spectrum #3 of 11	7/9/94, 9:00	10880	JPEG Image	Cathedral Butte
d:\images	IMG0004.JPG	4	Regional Haze Spectrum #4 of 11	6/28/94, 9:00	10846	JPEG Image	Cathedral Butte
d:\images	IMG0005.JPG	5	Regional Haze Spectrum #5 of 11	8/2/94, 9:00	10953	JPEG Image	Cathedral Butte
d:\images	IMG0006.JPG	6	Regional Haze Spectrum #6 of 11	7/13/89, 9:00	6168	JPEG Image	Cathedral Butte
d:\images	IMG0007.JPG	7	Regional Haze Spectrum #7 of 11	7/20/89, 9:00	6190	JPEG Image	Cathedral Butte
d:\images	IMG0008.JPG	8	Regional Haze Spectrum #8 of 11	7/17/89, 9:00	6181	JPEG Image	Cathedral Butte
d:\images	IMG0009.JPG	9	Regional Haze Spectrum #9 of 11	7/11/89, 9:00	6162	JPEG Image	Cathedral Butte
d:\images	IMG0010.JPG	10	Regional Haze Spectrum #10 of 11	7/6/94, 9:00	10870	JPEG Image	Cathedral Butte
d:\images	IMG0011.JPG	11	Regional Haze Spectrum #11 of 11	7/5/94, 9:00	10867	JPEG Image	Cathedral Butte
d:\images	IMG0012.JPG	12	Regional Haze Spectrum #1 of 13	7/1/91, 15:00	7898	JPEG Image	Cathedral Butte
d:\images	IMG0013.JPG	13	Regional Haze Spectrum #2 of 13	6/20/91, 15:00	7864	JPEG Image	Cathedral Butte
d:\images	IMG0014.JPG	14	Regional Haze Spectrum #3 of 13	6/8/94, 15:00	10792	JPEG Image	Cathedral Butte
d:\images	IMG0015.JPG	15	Regional Haze Spectrum #4 of 13	7/18/89,15:00	6186	JPEG Image	Cathedral Butte
d:\images	IMG0016.JPG	16	Regional Haze Spectrum #5 of 13	6/15/94, 15:00	10814	JPEG Image	Cathedral Butte
d:\images	IMG0017.JPG	17	Regional Haze Spectrum #6 of 13	6/22/91, 15:00	7870	JPEG Image	Cathedral Butte
d:\images	IMG0018.JPG	18	Regional Haze Spectrum #7 of 13	4/15/94, 15:00	10826	JPEG Image	Cathedral Butte
d:\images	IMG0019.JPG	19	Regional Haze Spectrum #8 of 13	4/19/94, 15:00	10836	JPEG Image	Cathedral Butte
d:\images	IMG0020.JPG	20	Regional Haze Spectrum #9 of 13	4/14/94, 15:00	10823	JPEG Image	Cathedral Butte
d:\images	IMG0021.JPG	21	Regional Haze Spectrum #10 of 13	7/5/94, 15:00	10869	JPEG Image	Cathedral Butte
d:\images	IMG0022.JPG	22	Regional Haze Spectrum #11 of 13	9/1/88, 15:00	5205	JPEG Image	Cathedral Butte
d:\images	IMG0023.JPG	23	Regional Haze Spectrum #12 of 13	7/9/89, 15:00	6158	JPEG Image	Cathedral Butte
d:\images	IMG0024.JPG	24	Regional Haze Spectrum #13 of 13	5/19/91, 15:00	7764	JPEG Image	Cathedral Butte

Figure 4-6. Example Historical Spectrum CD Table of Contents.

Table of Contents

Canyonlands National Park
Permanent Photographic Archive
1987-1995
Kodak Master ID - 7314-3252-1468 (2/24/98)

Pathname d: = CD-ROM drive	File name	Catalog #	File/Image Description			File Type	Comments
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d:\images	IMG0026.JPG	26	Episodes - Layered Haze	12/11/87, 9:00	3394	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0027.JPG	27	Episodes - Layered Haze	1/10/87, 9:00	3481	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0028.JPG	28	Episodes - Layered Haze	12/3/88, 12:00	5459	JPEG Image	Cathedral Butte
d:\images	IMG0029.JPG	29	Episodes - Layered Haze	1/20/89, 9:00	5656	JPEG Image	Cathedral Butte
d:\images	IMG0030.JPG	30	Episodes - Layered Haze	1/30/89, 12:00	5688	JPEG Image	Cathedral Butte
d:\images	IMG0031.JPG	31	Episodes - Layered Haze	1/26/92, 9:00	8495	JPEG Image	Cathedral Butte
d:\images	IMG0032.JPG	32	Episodes - Layered Haze	1/26/92, 12:00	8498	JPEG Image	Cathedral Butte
d:\images	IMG0033.JPG	33	Scenic	10/30/82, 9:00	CA255	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0034.JPG	34	Scenic	1/4/83, 15:00	CA397	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0035.JPG	35	Scenic	7/26/83, 15:00	CA837	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0034.JPG	36	Scenic	8/17/83, 15:00	CA883	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0037.JPG	37	Scenic	9/23/83, 9:00	CA967	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0038.JPG	38	Scenic	10/13/83, 9:00	CA1008	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0039.JPG	39	Scenic	9/21/84, 9:00	1672	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0040.JPG	40	Scenic	12/11/84, 15:00	1845	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0041.JPG	41	Scenic	1/30/84, 9:00	1939	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0042.JPG	42	Scenic	11/6/87, 14:00	4394	JPEG Image	Cathedral Butte
d:\images	IMG0043.JPG	43	Scenic	11/14/87, 14:00	4418	JPEG Image	Cathedral Butte
d:\images	IMG0044.JPG	44	Scenic	11/23/88, 15:00	5429	JPEG Image	Cathedral Butte
d:\images	IMG0045.JPG	45	Scenic	12/23/88, 12:00	5520	JPEG Image	Cathedral Butte
d:\images	IMG0046.JPG	46	Scenic	11/5/90, 9:00	7243	JPEG Image	Cathedral Butte
d:\images	IMG0047.JPG	47	Scenic	1/8/92, 12:00	8441	JPEG Image	Cathedral Butte
d:\images	IMG0048.JPG	48	Scenic	12/19/93, 12:00	10297	JPEG Image	Cathedral Butte
d:\images	IMG0049.JPG	49	Colo. Plateau Report 4/97 - Good	7/25/89, 9:00	6205	JPEG Image	Cathedral Butte
d:\images	IMG0050.JPG	50	Colo. Plateau Report 4/97 - Medium	7/13/87, 9:00	6181	JPEG Image	Cathedral Butte
d:\images	IMG0051.JPG	51	Colo. Plateau Report 4/97 - Poor	7/5/94, 9:00	10867	JPEG Image	Cathedral Butte
d:\qbrowser	QBROWSER.EXE		Kodak QuickSolve Browser - abbreviated version			Executable file	Used to view JPEG images
d:\qbrowser	SETUP.EXE		Kodak QuickSolve Browser installation for Windows			Executable file	
d:\qbrowser	BROWSHLP.HLP		Help file, accessible through QBROWSER			Windows based help file	
d:\qbrowser	README\QB.WRI		Software and system requirements related to Kodak QuickSolve Browser			Windows based text file	
d:\reader\win\reader	SETUP.EXE		Adobe Acrobat Reader 3.0 installation for Windows			Executable file	Used to view Portable Document Format (PDF) files
d:\reader	README.TXT		Software and system requirements related to Adobe Acrobat			ASCII Text File	

Figure 4-6 (continued). Example Historical Spectrum CD Table of Contents.

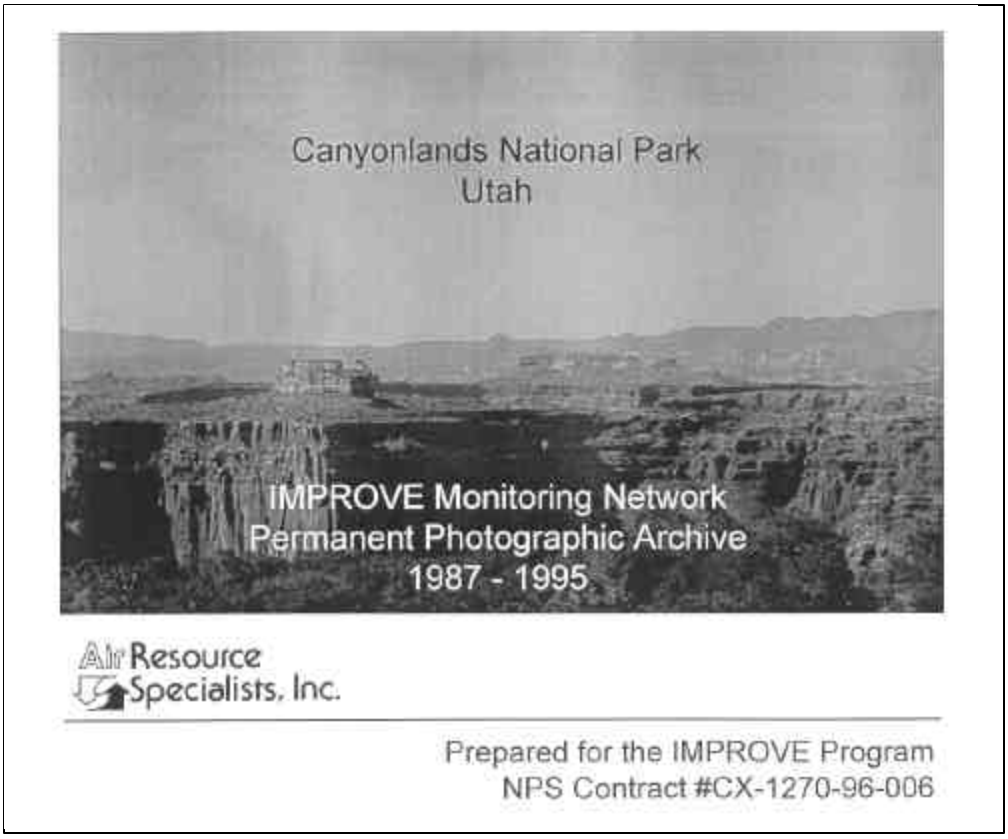
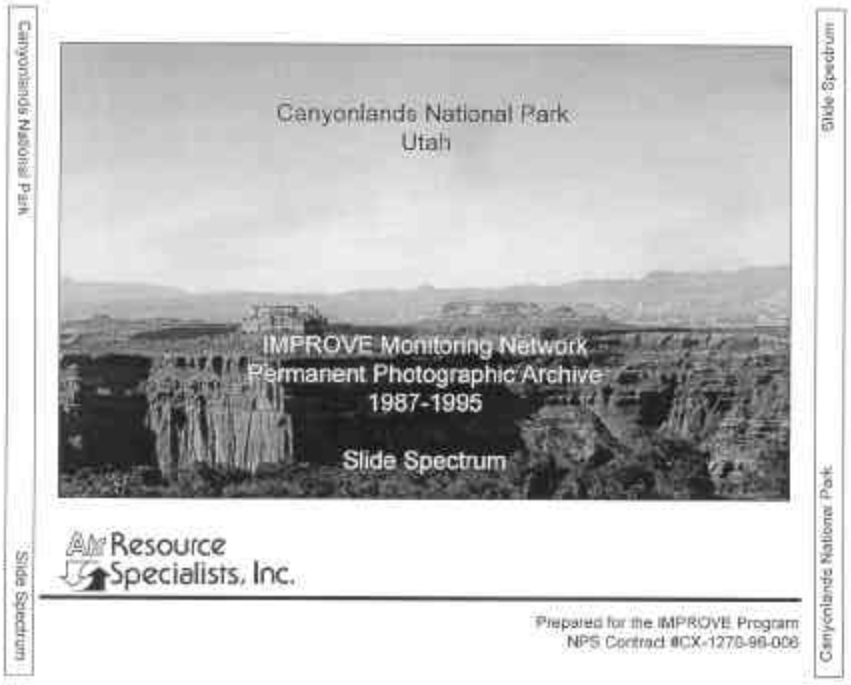


Figure 4-7. Example Title Slide.



IMPROVE Monitoring Network
Permanent Photographic Archive

This CD-ROM contains Acrobat Reader 3.0 and Kodak QuickSolve Browser (QBROWSER) software as well as a series of readme text (TXT) files, PDF (Portable Document Format) files, and JPEG and PCD (Photo CD) images. Acrobat Reader 3.0 or later must be installed prior to viewing any PDF file. Qbrowser software can be accessed directly from the CD, however optimal performance is obtained by installing Qbrowser directly on your hard drive.

System Requirements

- x86-based personal computer (486DX minimum, Pentium or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphic card
- Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, Microsoft Windows NT 3.51 or 4.0
- 8 MB application RAM
- 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
- True Color (32-bit) display and 2 MB video RAM recommended for optimal viewing

Recommended Reading

- READ1st.TXT located on the root directory of this CD.
- CDINFO.PDF located on the root directory of this CD.

Prepared by Air Resource Specialists, Inc.
for the IMPROVE Program
1998

Figure 4-8. Example CD Cover (Front and Back).

CD INFORMATION

CONTENTS OF THE CD

This CD includes a series of readme.txt (.TXT) files, PDF (Portable Document Format) files, and JPEG (Joint Photographic Expert Group) and PCD (Photo CD) images.

TXT Format Files
Readme.txt files describe the software and system requirements for reading the provided information. The file READ1st.TXT (or READ1st.PDF) documents software and system requirements specific to the historical photographic archive provided on this CD.

PDF Format Files
all text and graphic files, including this CD information description, the fully referenced table of contents, site specifications, and spectrum cumulative frequency summaries have been archived in PDF format. Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. PDF files can be accessed using the Adobe Acrobat Reader provided in the Adobe Acrobat folder on this CD.

JPEG Format Files
All photographs have been archived in JPEG High resolution (512 X 768) format. JPEG images are recommended for viewing and Internet transmission purposes. JPEG images can be viewed with the Kodak QuickSolve Browser (QBROWSER) provided in the Qbrowser folder on this CD.

PCD Format Files
For hard-copy printing purposes, all photographs have also been provided in high resolution (2048 X 3072) Photo CD format. Photo CD (PCD) images provide the highest resolution possible for printing. To access or print these PCD images, contact a local photo processing laboratory with digital capabilities or Air Resource Specialists, Inc.

ACCESS INSTRUCTIONS

Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. To install Acrobat Reader 3.0 for Windows, run the SETUP.EXE program in the Reader\Win\Reader folder (directory) of this CD-ROM. Additional directions are available in the README files located in the Acrobat Reader folders.

-- continued --

Figure 4-9. CDINFO Document Included on the CD-ROM.

ACCESS INSTRUCTIONS (Continued)

Kodak QuickSolve Browser (QBROWSER) is also included on this CD-ROM to view the provided JPEG photographic archive. It is not necessary to install any Kodak software prior to running QBROWSER; however, optimal performance is obtained if QBROWSER is installed directly on your hard drive. To install Kodak QuickSolve Browser for Windows, run the SETUP.EXE program in the Qbrowser folder (directory) of this CD-ROM. Additional information regarding Kodak QuickSolve software is available in the README file located in the Qbrowser folder.

Additional system requirements are documented in the READ1st.txt (or READ1st.PDF) files located in the root directory of this CD.

TABLE OF CONTENTS

To view the fully referenced Table of Contents double-click the CONTENTS.PDF file in the root directory, or launch the installed Acrobat Reader and open the file named CONTENTS.PDF.

SITE SPECIFICATION AND SPECTRUM CUMULATIVE FREQUENCY SUMMARIES

To view these documents, double-click the HISTDATA.PDF file in the root directory, or launch the installed Acrobat Reader and open the file named HISTDATA.PDF.

PHOTOGRAPHIC ARCHIVE

To launch the photograph browser, go to the Qbrowser folder and launch QBROWSER.EXE. From Qbrowser, open the catalog file names PHOTOS.CAT.

Figure 4-9 (Continued). CDINFO Document Included on the CD-ROM.

4.2.3.5 Hardware/Software Requirements

A document specifically addressing the hardware and software requirements necessary to access the image and graphic files is provided in the archived file READ1st, shown in Figure 4-10. The READ1st file is provided in both Acrobat (.PDF) and Text (.TXT) formats to better ensure the user success in obtaining the hardware and software requirements necessary to read the provided historical archive data. Hardware and software requirements to use the CD are provided in Figure 4-10.

4.2.4 Archive

To maintain a cohesive record of all the materials and data associated with the historical archive, all the compiled graphics and data presentation materials (outlined in Sections 4.2.1 through 4.2.3) are archived on CD-ROM with the historical spectrum images. All created files are archived in Adobe Acrobat .PDF format, using Acrobat Writer software. This format is readable on any computer format. A shareware version of Adobe Acrobat Reader 3.0 is also provided on the CD-ROM, should a user not have access to the software to view and/or print the site-specific materials.

4.3 PRODUCING THE CD-ROM

Once all the selected images have been archived in Photo CD format (Section 4.1.3), and all associated data presentations and CD-ROM archive descriptors have been archived in Acrobat format, (Section 4.2.4), the final CD-ROM archive is prepared. A final review of all archive descriptors, data files, and data presentation images should be made by the project manager prior to compilation. Computer Outfitters of Fort Collins, Colorado, currently conducts this final compilation process and produces the spectrums on CD-ROMs. The final CD-ROM spectrum archives could be performed at ARS, however, time and experience limitations have warranted that the procedure be subcontracted at this time.

Figure 4-11 outlines the organization of the compiled historical archive materials. ARS provides all files on one or more 3.5" high-density diskettes. All images are provided on one or more Photo CDs. Note that site-specific title pages, site specification graphics, and cumulative frequency summaries are compiled into one Acrobat file (HISTDATA) for the final CD-ROM archive. A thumbnail layout of the HISTDATA contents displays to the user (Figure 4-12) whenever the file is launched. From the display the user can then maximize any one of the associated graphic presentations.

Computer Outfitters creates an archive of the original spectrum images in both Photo CD and JPEG format. In addition, all JPEG files are compiled in a Kodak QuickSolve database (Qbrowser) for easy user access, sorting, and on-screen image descriptor association. If necessary, a uniform contrast adjustment is made to the databased JPEG images. Figure 4-11 shows Qbrowser labeling instructions are of primary importance in relation to what image descriptor information appears when the user launches the Qbrowser image database. A limit of four lines of information can be displayed for each image. Figure 4-13 shows the thumbnail layout that displays to the user whenever the Qbrowser catalog file (photos.cat) is launched.

READ1st.PDF

Software Requirements

Adobe Acrobat Reader 3.0

Acrobat Reader 3.0 allows anyone to view, navigate through, and print a document in the Adobe Portable Document Format (PDF).

To install Acrobat Reader 3.0 for Windows, run the SETUP.EXE program located in the Reader\Win\Reader folder (directory) of this CD-ROM. Additional directions are available in the README files located in the Acrobat Reader folders.

You may make and distribute unlimited copies of the Acrobat Reader software, including copies for commercial distribution, as long as each copy that you make and distribute includes the following:

- Acrobat Reader installer, exactly as provided by Adobe
- Acrobat Reader Electronic End User License Agreement
- Copyright and other proprietary notices included in Acrobat Reader

Once installed, full instructions on using Acrobat Reader 3.0 can be viewed in the Acrobat Reader 3.0 Online Guide. The Acrobat Reader 3.0 Online Guide can be accessed via the Acrobat Reader or Acrobat Exchange Help menu.

Kodak QuickSolve Browser

Kodak QuickSolve Browser software can be used to retrieve JPEG (JPG) images stored on the master disk.

QuickSolve Browser software allows you to:

- View provided catalog files (e.g., Photos.CAT).
- Display, copy, and print thumbnails in a Database Thumbnail Viewer window.
- Display, zoom, crop, copy, rotate, and print JPEG resolution (512 X 768) images displayed in photo windows.
- Create slide shows of your imagery.

For full instructions on using the Kodak QuickSolve Browser, go to the Qbrowser folder and launch QBROWSER.EXE. Access the Help menu within Qbrowser for a detailed listing of topics.

-- continued --

Figure 4-10. READ1st File Included on the CD-ROM.

System Requirements

- x86-based personal computer (486DX minimum, Pentium or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphic card
- Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, Microsoft Windows NT3.51 or 4.0
- 8 MB application RAM
- 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
- True Color (32-bit) display and 2 MB video ram recommended for optimal viewing
- For viewing PDF files inside of a Web browser: Netscape Navigator 3.0 or later (3.0.1 or later recommended) or Microsoft Internet Explorer 3.0 or later. Netscape Navigator 2.0.2 can also be used with limitations; e.g. it will not allow you to submit a PDF form. You may also be able to use other Web browsers that fully support the Netscape APIs.

Other Information related to this CD

This CD-ROM contains Acrobat Reader 3.0 and Kodak QuickSolve Browser (QBROWSER) software. Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. Qbrowser software can be accessed directly from the CD. It is not necessary to install QuickSolve Browser on your hard drive. Additional software related issues are addressed in the folder-specific README files provided by the software vendors.

In order to view the contents of this CD; launch any of the Adobe Acrobat files by double clicking any .PDF extension file. Photographic images can be accessed via the Kodak QuickSolve Browser: go to the Qbrowser folder and launch QBROWSER.EXE. Additional project-specific contents and access information can be viewed by opening the file titled CDINFO.PDF.

This CD was created by Air Resource Specialists, Inc. for the IMPROVE Program under contract to the National Park Service (NPS), Air Resources Division. The National Park Service is the copyright owner of all provided images. Any commercial use or duplication of this material without prior approval or licensing is forbidden. Use of the provided images should reference the IMPROVE Program. Additional information regarding the IMPROVE and NPS Air Quality Programs can be obtained by accessing the NPS AIRWeb site at http://www.aqd.nps.gov/natnet/ard/.

Prepared by Air Resource Specialists, Inc.
for the IMPROVE Program
1998

Figure 4-10 (Continued). READ1st File Included on the CD-ROM.

Project Title: Canyonlands National Park

Date Submitted: 3/17/98 Date Reviewed: 3/27 KS

Quantity: Original + 10 copies

Date Complete:

ARS PO # 16853

ARS Project: IMPROVE3

Due Date:

ADI Computer Outfitter Invoice #: 27073CD

Writable CD File		ARS files to include (in order of appearance)			
Name	Type	File Orntn #	File Orntn #	File Orntn #	File Orntn #
CDINFO	PDF	cdinfo.pdf P/2			
READ1st	PDF	read1st.pdf P/2			
READ1st	TXT	Read1st.txt P/2			
CONTENTS	PDF	Canycont.pdf L/2			
HISTDATA	PDF	Canytitl.pdf L/1	Canyspec.pdf L/1	Canyfreq.pdf P/1	
					thumbnail layout

Images: 51

Non-Cataloged Images (greyscales): 2 (#53 & 52)

Photo CD #: 7314-3252-1468

Image Density Adjustment: Y N

CD Contents Reference File: canycont.pdf

Excel CD Reference File: canycont.xls (sheet #1)

QBrowser Labeling (limit 25 char. @ 6pt, 17 char. @8pt)	Order of Appearance (limit 4 lines)
Project: Canyonlands National Park	# 1
Series #: full description	
Truncated Series Name: see Excel series value	# 2
Category – Date/Time: 7/2/91, 9:00 7899	# 3
Catalog #: comment field enter for all	
Image ID: however only display for #	# 4 only for 49, 50, & 51
Data Field #1:	
Data Field #2:	

Notes: Analyze greyscales, but do not include in QBrowser catalog
ARS Greyscales 32 step #9, 24 step #10

G:/project/improve/spectrum/adiottfrm.doc
2/98

Figure 4-11. Example Organization of Compiled Archive Materials.

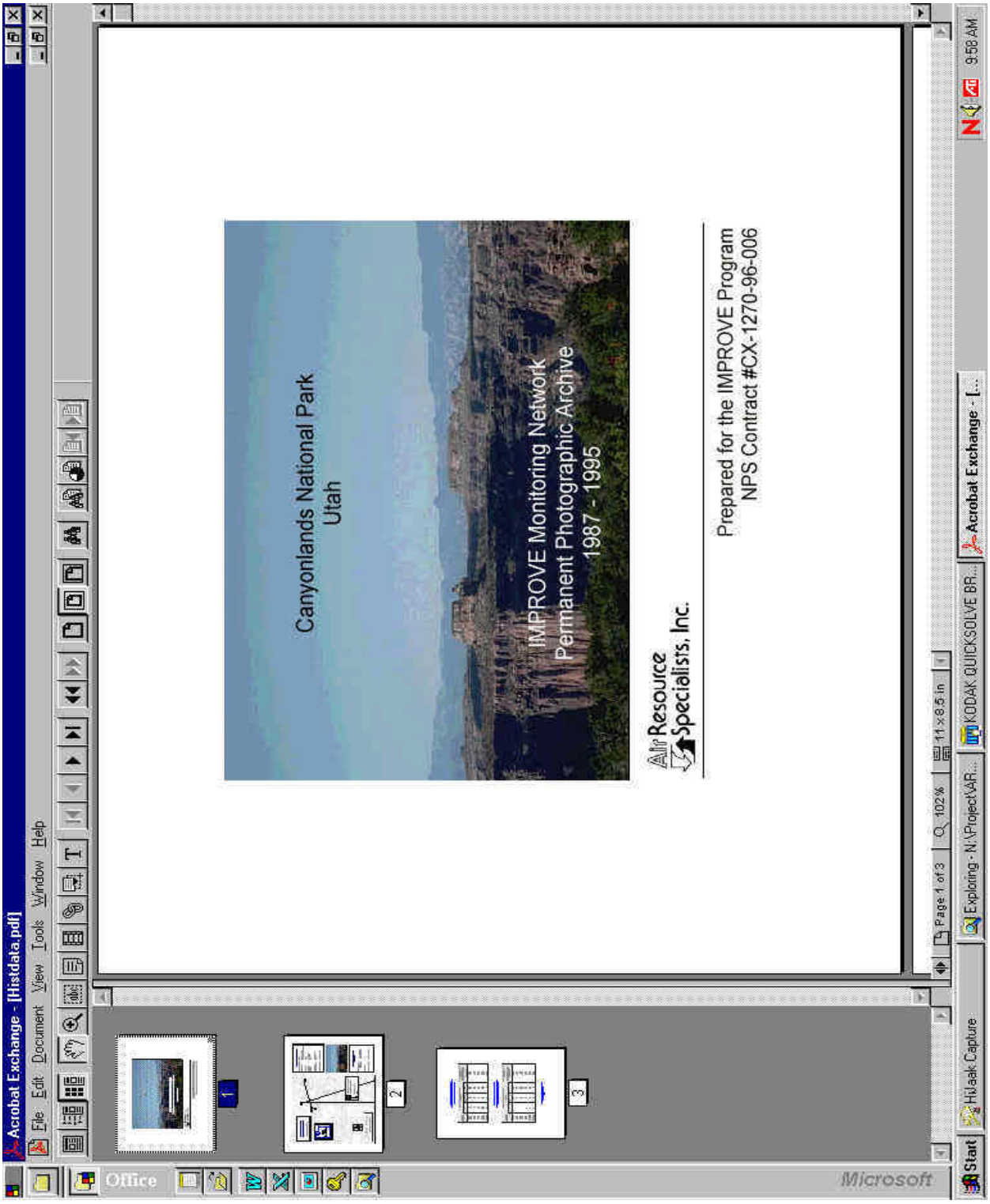


Figure 4-12. Layout of HISTDATA Acrobat File.

Figure 4-13. Layout of Kodak Qbrowser Catalog File (photos.cat).

One master copy of the final CD-ROM archive is prepared and reviewed. Figure 4-14 lists the file structure and contents that should be verified for each site-specific archive. Copies of the approved master are prepared and checked again. Each CD copy is labeled and fitted with the site-specific CD cover information described in Section 4.2.3. Be certain to identify the master copy separately.

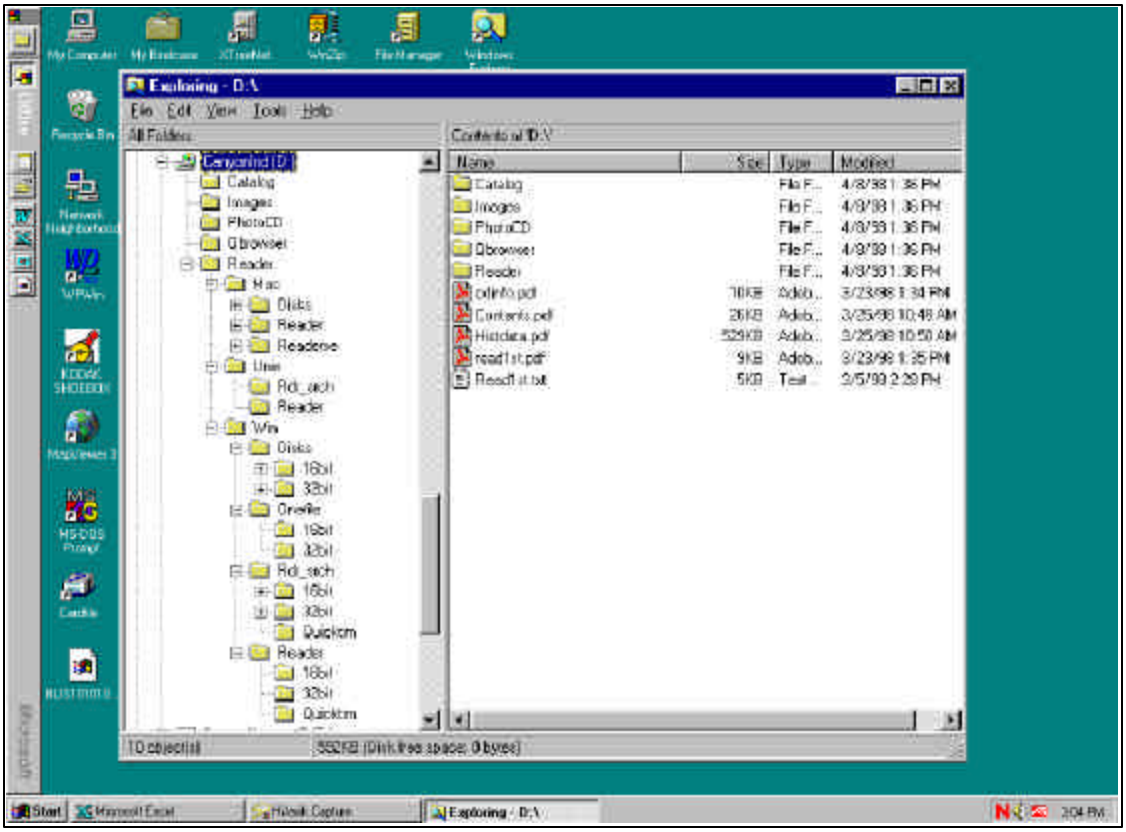


Figure 4-14. Example File Structure and Contents for Each Archive.

4.4 DISTRIBUTION

Final CD-ROM archive originals and copies are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR (e.g., Dee Morse, NPS Denver) for distribution requirements and provides the CD-ROM product(s) as directed. ARS' current distribution of NPS spectrum archives is:

Recipient	Agency	Number of Copies
Dee Morse	NPS, Air Resources Division (COTR)	5
Dr. William Malm	NPS, CIRA Division	1
Rich Damberg	EPA	1
Marc Pitchford	NOAA/EPA (IMPROVE Program Director)	1
ARS Archives		4

A letter detailing CD-ROM contents, file descriptors, access considerations, and product recipients must be prepared for shipment with the CD(s). Figure 4-15 shows an example letter used for the delivery of 6 completed CD-ROM archives. All items are packaged and shipped as directed.

4.5 ARCHIVING SPECTRUM MATERIALS

To maintain a long-term archive of the historical spectrum images and data presentation materials compiled, all materials should be organized and archived in an air-tight filing container. Materials included are organized as follows:

- Original 35 mm slide selections are stored in polyethylene slide protector sheets. Each slide is clearly marked with the slide archival number, date, and time the image was taken. At no time is an original slide permanently removed from the archival.

- Three sets of 35 mm slide duplicates are created from the original 35 mm Kodachrome slides. Each set is stored in polyethylene slide protector sheets and are labeled with the associated spectrum description, slide archival number, and date and time the image was taken. Included in the duplicate sets are copies of the gray scales used during the spectrum analysis process. These sets are created for future distribution purposes.

- One copy of all graphic and presentation materials included in the final CD-ROM archive are stored for reference in the air-tight container.

- One copy of the final CD-ROM archive is stored as the digital copy of all graphic presentation materials, and PCD and JPEG image archive. The master CD-ROM and original Photo CD are stored in the Historical Spectrum CD Archive located at ARS.

All unused images are returned to their point of origin or the permanent 35 mm slide storage area. Copies of all correspondence, purchase orders, or in-house working notes are maintained in the project-specific contract files.

A 168 mm archive tape of all slide spectrum analysis scanning files is maintained on a bi-monthly basis. Should an image need to be rescanned or reviewed, the pertinent files should be obtained from these backup tapes located in ARS' computer room.

5.0 REFERENCES

Air Resource Specialists, Inc., 1994, Preliminary Analysis of Uncertainty Associated With Extinction Estimates From 35mm Color Slide Densitometry of Natural Targets.

Allard, D., and I. Tombach, 1981, The Effects of Non-Standard Conditions on Visibility Measurement, Atmospheric Environment, 15:1847-1857.

Malm, W., 1979, Considerations in the Measurement of Visibility, APCA Journal, 29: 1042-1052.

Middleton, W.E.K., 1958, Vision Through the Atmosphere, 2nd Ed. Toronto, Canada: University of Toronto Press.

Molenar, J. (Air Resource Specialists, Inc.), 1997, WinHaze – Level 1 Visual Air Quality Modeler.

Air Resource Specialists, Inc.

1901 Sharp Point Drive
Suite E
Fort Collins, Colorado 80525
970-484-7941
FAX: 970-484-3423

December 4, 1998

Dee Morse
National Park Service, Air Resources Division
12795 W Alameda Parkway
Lakewood, CO 80228

Dear Dee,

In accordance with NPS Contract 1270-96-006, enclosed are five (5) copies of Visibility Slide Spectrum CDs for each of the following IMPROVE photographic monitoring sites:

Monitoring Location	Period Reviewed	# CD's Provided
Badlands National Park, SD	1987 - 1995	5
Chiricahua National Park, AZ (Hatchett Peak vista)	1986 - 1989	5
Chiricahua National Park, AZ (Mica Mountain vista)	1989 - 1995	5
Glacier National Park, MT	1985 – 1995	5
Rocky Mountain National Park, CO	1985 – 1995	5
Yellowstone National Park, WY	1986 – 1995	5

Please distribute these CDs to the parks, Tom Dotts (NPS), and any appropriate NPS Air Resources Division personnel at your earliest convenience. One (1) set of CDs has been shipped to Bill Malm (NPS/CIRA), Rich Damberg (EPA) c/o Vasu Kilaru, and Marc Pitchford (NOAA/EPA). Three (3) sets will remain here at Air Resource Specialists, Inc. with the original slide archives.

Digital images on each CD include: visibility condition spectrums (images selected to represent the range of visibility conditions at a site); regional haze, layered haze, and visibility episode examples; and scenic images. The number of spectrums and total number of slides selected for each spectrum vary for each site depending on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and the completeness of the slide database. Supporting documentation on each CD includes: site specifications and associated photographic monitoring history, slide spectrum visibility condition summaries (in units of $b_{ext}(Mm^{-1})$, VR, and dv), and representative cumulative frequency values of associated reconstructed extinction IMPROVE aerosol data (compiled 10/98).

Figure 4-15. Example Distribution Letter.

All images and documentation are self-contained on the provided CDs. Photographic images are provided in both JPEG (compressed 512 x 768) and high resolution PCD (2048 x 3072) format. All images are cataloged and accessible through the provided Kodak QuickSolve Browser. All graphics and documentation have been archived in portable digital format (PDF) for easy display, printing, and Internet application. Each CD also contains Acrobat Reader 3.0 and Kodak QuickSolve Browser software as well as a series of readme text (TXT) files. Acrobat Reader 3.0 must be installed prior to viewing any PDF file. The QuickSolve Browser software can be accessed directly from the CD, however optimal performance is obtained by installing it directly on your hard drive. Reference the files READ1st.TXT and CDINFO.PDF on the root directory of the provided CDs for more information.

We are excited about the numerous applications of these CDs and their use for ongoing photographic data requests of the National Park Service and IMPROVE Program. I appreciate your patience awaiting the delivery of final products. Please feel free to call me if you have any comments or problems accessing the data.

Sincerely,

Kristi Savig

Kristi Savig
Project Manager

KS:ks
Enclosure

cc: B. Malm (NPS), M. Pitchford (EPA/IMPROVE)
R. Damberg (EPA, c/o Vasu Kilaru)

Figure 4-15 (Continued). Example Distribution Letter.

APPENDIX A

SLIDE SCANNING PROCEDURES

USING THE POLAROID SPRINTSCAN 35/LE SLIDE SCANNER

A.1 SCANNING PHOTOGRAPHIC SLIDES

A.1.1 Maintenance and Start-up

Use extreme caution around the Polaroid scanner. Avoid excessive dust, food, or lint particles near the instrument; dust is the leading cause of image imperfections while scanning.

The slide chamber should be kept clean at all times. On a weekly basis before turning on the computer or scanner, lift the front scanner panel and blow canned air into the 35 mm slide chamber. To begin scanning, launch the PolaColor Insight (Version 3.1) software.

A.1.2 Scanner Calibration

The scanner needs to be calibrated each time a new slide set is introduced. All of the settings associated with the calibration/scanning job can be saved to a job file for future access. It may be necessary to calibrate the scanner more than once for large slide sets. When a set covers a wide range of visibility, the exposure will also change substantially from extremely clean (crisp, deep blue skies) to extremely dirty (bright overexposures with milk-colored skies). Each calibration will be associated with a corresponding gray scale slide and scan job file. Scanner calibration includes adjusting the settings, defining a job, creating a file, and scanning a gray scale slide. These procedures are as follows:

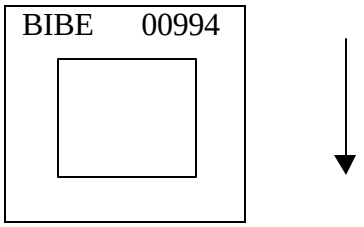
SET THE PROGRAM SETTINGS

Choose **Preferences** from the drop-down "Edit" menu and select the **Scanning** tab. Verify that *default resolution* and *perform auto exposure* are selected.

DEFINE SCAN JOB

Select a slide from the set that represents the overall coloration and exposure/visibility ranges. If the set covers a wide extreme of conditions, select one slide to represent the clean end and one to represent the dirty end.

Air-blow the slide for any dust particles. Insert the chosen slide into the 35 mm slide chamber.



Select the **Preview tab**. Set the scanning "Profile Input" to **Kodachrome** and the "Display" to **Monitor, PC**. Define the calibration (preview) crop box for the image displayed. Select the **Preview button** to cache the image. The slide will enter the chamber and be scanned. Note that there are two types of scans: the Preview scan and the Final scan. Only the Final scan creates a disk file that is used for the contrast calibration process.

Select the **Tone** tab. Deselect the **Split View** box. Select the **Auto Exposure** button. The image will be adjusted to best calibrate the lightness and contrast corrections for scanning. Document the lightness and contrast settings defined. These can be manually adjusted during the calibration (job definition) process. Figure A-1 shows the Polaroid SprintScan software window.

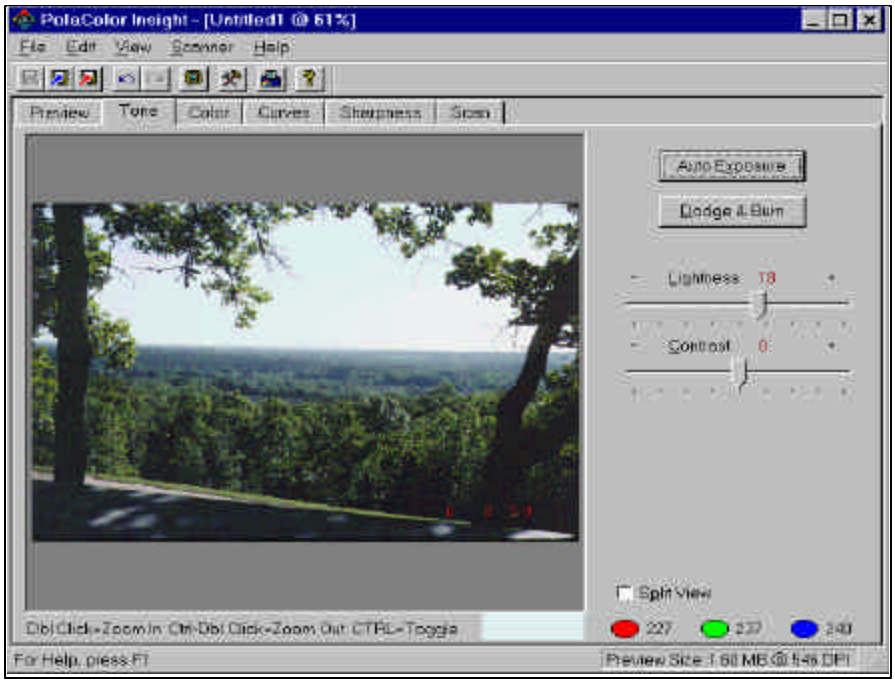


Figure A-1. Polaroid SprintScan Software Window (With Default PolaColor Insight Control Settings).

Select the **Scan** tab. All output formats are defined here. Adjust the crop box around the portion of the image to be scanned. (This should be defined by the project manager prior to scanning).

- Set the image output dimensions. A width of 3" to 4" should be selected to allow for scanning/contrast estimations.
- Select a resolution of **300** dpi. (Width and height dimensions may change slightly).
- Select the **Fixed Size** box.
- Perform a final scan of the auto calibration image. Select the **Scan** button. Save the scanned image to a .TIF file with the following naming convention:

##_0011aut.tif

Where ## represents the spectrum sequence number, *0011* represents the corresponding slide number, and *aut* denotes the slide as the auto-calibration reference.

Save the file in the site-specific subdirectory that is associated with the spectrum being scanned (e.g., CANY\900\04_0011aut.tif). Document the slide scanned and saved file name on the Slide Scanning Log. Denote "auto" in the comments section of the scanning log.

EXPORT JOB SETTINGS TO A JOB FILE

The auto-calibration described above defines the job settings for the specific site and required scanning output (scanning area). It is necessary to save the defined settings to a file that can be used for future slide scans of the same set.

Turn off the *Auto Exposure* preference to assure that all slide spectrum and gray scale scans for the set will use the same autoexposure setting as the calibration slide.

Choose **Preferences** from the drop-down “Edit” menu and select the **Scanning** tab. Change the selections to **Default Resolution** and **Use Current Tools**.

Choose **Export Settings** from the drop-down “File” menu. Save the job file with the following naming convention:

SITE0011_jjj

Where *SITE* represents the spectrum site abbreviation, *0011* represents the corresponding auto-calibration slide number, and *jjj* denotes the Julian date the job settings were defined.

Save the file for future reference in the site-specific subdirectory that is associated with the spectrum being scanned (e.g., CANY\900\CANY0011_161.bsf). Document the job name on the Slide Scanning Log.

Exit the PolaColor Insight software.

SELECT AND SCAN GRAY SCALE SLIDE

Every spectrum set and auto-calibration slide must have an associated gray scale slide scanned and archived for future reference measurements.

Select the ARS gray scale slide that will be associated with the spectrum set. Both 24-step and 32-step gray scale slides are available with calibrated transmission measurements. (Direct gray scale transmission measurements must be obtained from a fully calibrated densitometer, such as the ESE Speedmaster located at the CIRA office of the National Park Service).

Launch the PolaColor Insight software. Select **Import Settings** from the drop-down "File" menu, and import the associated job file (e.g., CANY0011_161.bsf) from the site-specific subdirectory.

Select **Preferences** from the drop-down "Edit" menu, to verify that the *Auto Exposure* is off and the scanning setting is set *to Use Current Tools*.

Air-blow and insert the gray scale slide into the 35 mm slide chamber.

Select the **Preview tab** and **Preview button**. The slide will enter the chamber and be scanned. Set the crop box around the entire gray scale image in the preview window.

Select the **Tone** tab. The image will be adjusted to the same lightness and contrast settings as the auto-calibration slide. DO NOT depress the "Auto Exposure" button.

Select the **Scan** tab. Verify that the crop box surrounds the entire gray scale image to be scanned. If necessary, deselect the fixed size box to frame the entire gray scale. You must reselect the fixed size box to hold the new frame dimensions. Scan and save the gray scale file as *g###_0011jjj.tif* in the appropriate site-specific subdirectory. Where *###* represents the ARS gray scale number, *0011* represents the associated auto-calibration slide number, and *jjj* represents the Julian date the job file was created.

(NOTE: full slide scans (i.e., the entire preview screen) create very large .TIF files. It is important to backup data created during the scanning process on a bi-monthly basis).

Denote the saved file name on the Slide Scanning Log and the specific Gray Scale Scanning Log associated with the auto-calibration.

Resetting the crop box and scanning output dimensions will alter the loaded job file. DO NOT save these altered job settings if asked to do so.

A.1.3 Scanning Selected Slides

Scanning complete spectrum sets includes loading the defined job settings (obtained during scanner calibration), performing individual scans, and saving scan files as outlined below:

LOAD JOB SETTINGS	Launch the PolaColor Insight software. Select **Import Settings** from the "File" menu and import the settings of the associated job file (e.g., CANY0011_161.bsf) from the site-specific subdirectory.

SCAN A SLIDE

Select **Preferences** from the "Edit" menu to verify that "Auto Exposure" is off and the "scanning tab" is set to *Use Current Tools*.

Air-blow and insert the chosen slide into the 35 mm slide chamber.

Select the **Preview tab** and **Preview button**. The slide will enter the chamber and be scanned. Verify that the crop box correctly frames the target/vista area defined by the project manager. (Wait while the scanner calibrates for the image).

Select the **Tone** tab. Verify that the image lightness and contrast settings match those of the auto-calibration slide. DO NOT depress the "Auto Exposure" button.

Select the **Scan** tab.

- Verify that the crop box correctly frames the target/vista area defined by the project manager. Changes to the width and height of the crop box are reflected in the "Width and Height" values boxes displayed in the viewing window.
- Select the **Scan** button. Save the scanned image to a .TIF file with the following naming convention:

  ##_0011.tif

  Where *##* represents the spectrum sequence number and *0011* represents the corresponding slide number.

SAVE SCANNED FILE

Save the file in the site-specific subdirectory associated with the spectrum being scanned (e.g., CANY\900\05_0235.tif). Document the slide scanned and saved file name on the Slide Scanning Log.

Wait for the scanning process to complete. Remove the slide from the Polaroid SprintScan slide chamber and return the 35 mm slide to its original archive location.

SCAN ADDITIONAL SLIDES

Additional slides may be scanned by inserting a new slide into the scanning chamber and follow the same procedures as outlined above.

A.1.4 Terminating Scanning

To exit the PolaColor Insight Software, select **Exit** from the drop-down "File" menu or select the **X** in the upper-right window. Use caution if asked to change or save the default job settings. DO NOT save any job setting changes unless you are aware that the changes will be appropriately applied to the auto-calibration and gray scale scans. Convert all .TIF formatted files to .TGA files using the Adobe 5.0 Action Macro "tif to tga."

A.2 OBTAINING PIXEL STATISTICS

Red, green, and blue wavelength pixel statistics are obtained from a digital low resolution scan using ARS' Image Haze Simulation for Windows (OLDHAZE.EXE). The following procedures are used to determine the reported slide spectrum visibility measurements.

A.2.1 Spectrum Image Pixel Statistics

Specific target and sky areas to be measured should be defined by the project manager prior to scanning. Target and sky measurements are obtained as follows:

MEASURE TARGET AREA

Launch the OLDHAZE (Image Haze Simulation for Windows) software.

Select **Open Image** from the drop-down "File" menu, and open the scanned image (.TGA file) to be measured. Maximize the window size for the best viewing.

Select **Show Pixel Statistics** from the drop-down "Options" menu. Move the pixel statistics window away from the image window.

Using the visible cross-hatch (+), drag and drop a small box over the *identified target area*, as shown in Figure A-2.

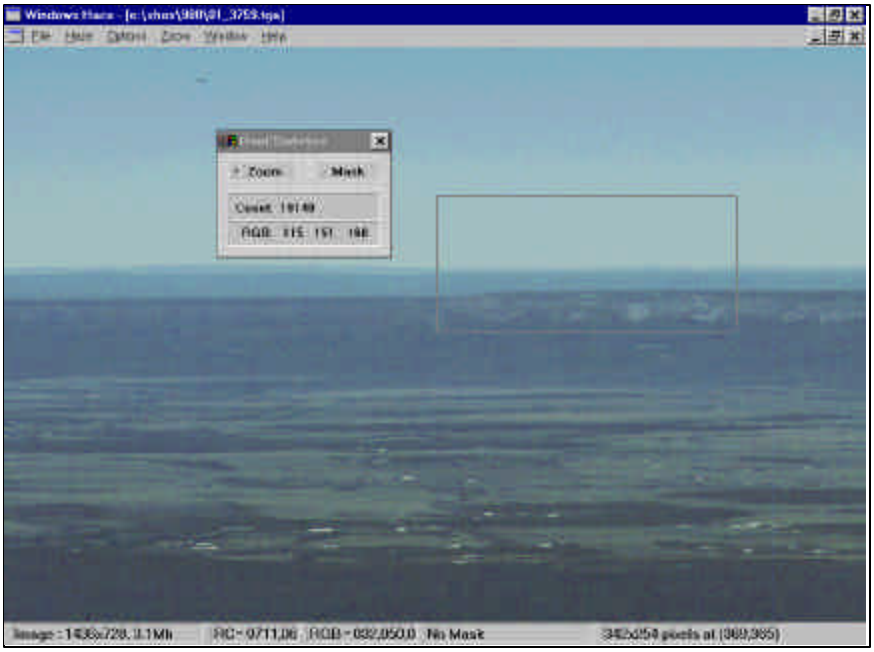


Figure A-2. Image Haze Simulation (OLDHAZE) Window. Example Display of Pixel Statistics.

Repeat this procedure two to three times to verify that a consistently exposed area is read (e.g., avoid shadowed ridges, cloud banks, etc.).

Document the red, green, and blue numbers displayed in the viewing window in the *target column* of the Slide Spectrum Scanning Log (Figure A-3).

Click the right-mouse button to return to the full scanned image.

MEASURE SKY AREA

Using the visible cross-hatch (+) drag and drop a small box over the *identified sky area*, as shown in Figure A-2.

Repeat this procedure two to three times to verify that a consistently exposed area is read (e.g., avoid clouds, lens flare, etc.).

Document the red, green, and blue numbers displayed in the viewing window in the *sky column* of the Slide Spectrum Scanning Log (Figure A-3).

Click the **right-mouse** button to return to the full scanned image.

Up to 3 targets may be analyzed for each slide vista. Repeat the above steps for all identified target and sky areas.

A.2.2 Gray Scale Pixel Statistics

Pixel statistics must be obtained for each scanned gray scale associated the spectrum set's calibration. A Gray Scale Scanning Log should have been initiated during the calibration process described in Section A.1.

MEASURE STEP 1

Launch the OLDHAZE (Image Haze Simulation for Windows) software.

Select **Open File** from the drop-down "File" menu, and open the gray scale calibration file associated with the given site-specific spectrum set. Maximize the window size for the best viewing of the entire gray scale image.

Select **Show Pixel Statistics** from the drop-down "Options" menu. Move the pixel statistics window away from the image window.

Using the visible cross-hatch (+), drag and drop a small box over the center section of the upper-left gray scale cube (Step 1).

Document the red, green, and blue numbers shown on the "Step 1" line of the Gray Scale Scanning Log, as shown in Figure A-4.

Click the **right mouse** button to return to the full gray scale frame.

REPEAT FOR STEPS 2 THROUGH 24

Repeat the red, green, and blue measurement for each cube of the gray scale; left to right, top to bottom, Steps 1 through 24 (or 1-32).

Select **Exit** from the drop-down "File" menu to exit the OLDHAZE program.

Slide Spectrum Scanning Log
Polaroid SprintScan 35 Format

Site Name/Time: Shenandoah Dickey Ridge 0900

Job Name: SHED0023 254.bsf

Pixel Frame Dimensions/Resolution/Lightness Contrast:
4.88 x 2.19 @ 300 dpi

Date/Initials: 9/11/99 KS

	File Data		Target				Sky				
SLIDE NUMBERS	SLIDE DATE	GRAY SCALE	TARGET #	RED	GREEN	BLUE	RED	GREEN	BLUE	CONTRAST	COMMENTS
SHED0494		G24A_0	T1	53	66	100	140	162	178	-.875	
		98-24A	T2	43	49	64	152	173	186	-.940	
SHED0023			T1	68	95	121	123	150	166	-.701	auto exp
			T2	48	61	78	131	157	172	-.884	l=14 c=0
											manually changed
SHED0029			T1	72	105	141	119	147	172	-.593	
			T2		65			153		-.858	
SHED0303			T1	85	107	151	119	142	176	-.529	
			T2		68			144		-.817	
SHED0343			T1		134			149		-.247	
			T2		100			146		-.637	
SHED0090			T1		131			138		-.127	
			T2		105			135		-.488	
SHED0082			T2	93	121	147	118	145	166	-.374	
SHED0311		G24A_0	T2	96	120	147	131	152	176	-.472	auto exp
		98-241									l=18 c=0
											manually changed
SHED0279			T2	97	118	156	117	138	171	-.344	
SHED0074			T2		134	?		144	?	-.166	target not visible

Figure A-3. 35 mm Slide Image, Pixel Statistics, and Contrast Estimations (Excel format).

Gray Scale Scanning Log
Red, Green, Blue Pixel Statistics

ARS Gray Scale ID#: ___98-24a_____ Reference Site: ___SHED_____

Date Scanned/Gray Scale File: _____9/11/99 g24a-0023254____ Calibration Slide #: __0023_____

GRAY SCALE STEPS	RED	GREEN	BLUE
Step: 1	230	237	231
Step: 2	225	234	226
Step: 3		226	
Step: 4		218	
Step: 5		206	
Step: 6		191	
Step: 7	176	185	179
Step: 8		170	
Step: 9		157	
Step: 10	144	144	143
Step: 11		131	
Step: 12		120	
Step: 13		117	
Step: 14		108	
Step: 15		96	
Step: 16		87	
Step: 17	67	74	83
Step: 18		65	
Step: 19		51	
Step: 20		45	
Step: 21		37	
Step: 22		31	
Step: 23	27	27	43
Step: 24		28	

Figure A-4. Example Gray Scale Slide Spectrum Analysis Log (Excel format).

A.3 CALCULATING SLIDE CONTRASTS

All documented slide spectrum image and gray scale pixel statistics (Section A.2) are input into ARS' CONTRAST.EXE software to determine associated slide spectrum contrasts. Each set or subset of spectrum images should have an associated Gray Scale Analysis Log.

CALCULATE CONTRASTS

Launch the CONTRAST.EXE program.

Select the **Reset Calibration Curve** tab.

Enter 10 steps of the gray scale *green pixel values* (Density Numbers) into the contrast calculation window. Note that the steps do not need to be consecutive, just sequential.

Enter the corresponding step gray scale *green density values* from the documented Gray Scale Calibration Form, as shown for ARS gray scale 98-24a in Figure A-5.

Select the **Accept Calibration Curve** tab. Note that an "unacceptable density error may occur following the calibration process. If so, re-evaluate the 10 steps chosen. Verify that the green wavelength numbers do not exceed 255. Exit the program and begin again.

REPEAT FOR EACH SLIDE

For each slide associated with the calibration gray scale continue with the following procedures.

Enter the *sky DN* (density number) pixel statistics documented for the green wavelength on the Slide Spectrum Analysis Log.

Enter the *target DN* (density number) pixel statistics documented for the green wavelength on the Slide Spectrum Analysis Log.

Select the **Calculate Contrast** tab in the contrast viewing window.

Document the resulting target contrast on the Slide Spectrum Analysis Log.

Continue to enter the sky and target density numbers for each target and slide documented on the log.

The calibration curve must be reset for the appropriate gray scale associated with each spectrum. Note that it is often necessary to exit the CONTRAST.EXE program in order to reset the calibration.

24 Step Gray Scale

98 – 24a

Step	Red	Green	Blue	Target
1	0.33	0.27	0.29	0.20
2	0.39	0.29	0.33	0.30
3	0.45	0.36	0.43	0.40
4	0.51	0.43	0.51	0.50
5	0.60	0.52	0.59	0.60
6	0.72	0.63	0.71	0.70
7	0.78	0.67	0.72	0.80
8	0.87	0.77	0.83	0.90
9	0.94	0.88	0.93	1.00
10	1.03	0.98	1.03	1.10
11	1.18	1.10	1.14	1.20
12	1.30	1.18	1.20	1.30
13	1.36	1.22	1.25	1.40
14	1.46	1.30	1.35	1.50
15	1.58	1.43	1.47	1.60
16	1.69	1.53	1.59	1.70
17	1.80	1.63	1.76	1.80
18	1.96	1.77	1.92	1.90
19	2.14	1.97	2.08	2.00
20	2.31	2.05	2.12	2.10
21	2.45	2.16	2.20	2.20
22	2.70	2.41	2.43	2.35
23	2.95	2.76	2.71	2.55
24	3.04	2.99	2.94	2.75

Figure A-5. Example ARS Gray Scale and Values.

Air Resource
Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**PHOTOGRAPHIC-BASED TELERADIOMETRIC DATA ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5030**
DATE	**SEPTEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Betsy Davis-Noland	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor changes to equipment and file types.	April 1996	

TABLE OF CONTENTS

LIST OF FIGURES

1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) is a guide to the archiving and maintenance of teleradiometric data derived from quantitative analysis of 35 mm slides using a slide scanning densitometer or qualitative data. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes archive procedures associated with photographic digital data files.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Ensure that archives are accessible, orderly, complete, and current.
- Issue a Data Archive Request form to the data archivist when data have been finalized and reported and are ready to be archived.
- Document and distribute duplicate archive tapes to off-site locations.

2.2 DATA ARCHIVIST

The data archivist shall:

- Obtain and compile ASCII data files to be archived as directed on the Data Archive Request form.
- Perform archives as described in this TI.
- Maintain data archive records.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Scene monitoring archives of slide-derived digital data are performed on IBM-PC compatible systems. The required computer system components and materials include:

- An IBM-compatible 386/486 computer system with VGA and minimum 80 megabyte hard disk connected to the ARS computer network
- Hewlett Packard (HP) Jetstore 6000 Digital Audio Tape (DAT) Drive
- One or more 4 mm DAT cartridges
- Cheyenne Software's ARCserve program, version 4
- ARCserve and WordPerfect software for creating, editing, and maintaining data archive records
- Hewlett-Packard Laserjet printer

Other required materials include:

- Three-ring notebooks
- Plastic tape holders
- Storage boxes
- Metal storage cabinet

4.0 METHODS

Through the Fall 1993 season, scene monitoring digital data files included quantitative scene monitoring slide data in the form of raw teleradiometric data (.SLD) files and processed teleradiometric data (.SVR files). In December 1994 the IMPROVE Program chose to no longer support quantitative estimates of standard visual range derived by slide-based densitometry (teleradiometric methods). Beginning with the Winter 1994 season, the following digital file types exist in relation to photographic-based quantitative or qualitative-only data requested:

- .SLD files - contain qualitative slide code data and raw densitometry (teleradiometric) data.
- .SVE files - contain processed teleradiometric data and associated uncertainty ranges in standard visual range units.
- .EXT files - contain processed teleradiometric data and associated uncertainty ranges in atmospheric extinction units.
- .SQO files - contain only qualitative scene monitoring slide code data.

ASCII files are produced for each season for each site. Archiving of all raw and processed data for a given season is performed on a seasonal basis, after data have been finalized and reported. Files are stored in the original format (non-compressed) on magnetic tape. Two copies of each archive tape are created; one tape is stored at ARS and the other off-site.

The archiving of teleradiometric data is a two-part process. First, the project manager issues a Data Archive Request form to the data archivist. Second, with the information provided on the form, the data archivist can produce quality archives of the data set in a timely manner. These two processes are detailed in the following two (2) major subsections:

4.1 Data Archive Request Form
4.2 Archiving Procedure

4.1 DATA ARCHIVE REQUEST FORM

The project manager will issue a Data Archive Request form to the data archivist after the data have been finalized and reported (see Figure 4-1). The project manager will provide the following information on the form:

Air Resource Specialists, Inc.

DATA ARCHIVE REQUEST

Date: _____ Project/Study: _____

To: _____ Period: _____

From: _____ # of tape copies: _____

General Data Description: _____

New Tape _____ or Label of Tape to Append: _____

Disposition: _____

Files to be archived (include full path) or attach listing:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

To Be Completed by Data Archivist

Archive date: _____ # of tapes per copy: _____ # of copies: _____

Tape Label(s): _____

Disposition: _____

Notes: _____

_____

_____

_____

archive.req 12/94

Figure 4-1. Data Archive Request Form.

- Current date
- Name of person to receive the data archive request (the data archivist)
- Name of person who initiated the data archive request (the project manager)
- Project name or account codes
- Data period (e.g., Summer 1993)
- Number of archive tape copies required
- A general description of the data (e.g., "digital data files for scene monitoring from the Summer 1995 season for the IMPROVE project")
- Note if a new archive tape is to be created or if an existing tape is to be appended or overwritten
- Disposition of the tapes
- Specific files to be archived (e.g., "all .SLD, .SVE, .EXT, and .SQO files in the subdirectories under g:/users/fsvis/395" or an attached directory listing of the files to be archived)

The data archivist will archive the data within two weeks after receiving the Data Archive Request form and will complete the form with the following information:

- Archive date
- Number of archive tapes made
- Tape labels
- Disposition of the tapes
- Additional notes concerning the archive

4.2 ARCHIVING PROCEDURE

4.2.1 The ServerDat Program

The data are archived using the following steps:

1) If this is a new tape, initialize the tape by holding the **EJECT** button while inserting the tape into the HP tape drive. When the left LED flashes, release the button. When the orange LED lights, press the **EJECT** button again. When the initialization is complete, the tape is ejected automatically.

2) Insert the 4 mm DAT archive tape into the HP tape drive.

3) From any network workstation, enter the Arcserve program by typing **ARCSERVE** at the DOS prompt.

4) Select **SCHEDULE ATTENDED JOBS** from the Main Menu.

5) Select **BACK UP TO TAPE** from the Attended Operations Menu.

6) Select **SPEED ENTRY** from the Selection Method Menu.

7) Select the volume that contains the source files (SYS is drive F:, VOL1 is drive G:).

8) Mark the directories/files to archive by highlighting the directory/file name and pressing **F5**. Press **F2** when all directories/files to archive have been marked.

9) Fill in the Attended Back Up To Tape Job Entry Form on the computer screen display (see Figure 4-2) with the following information:

- Tape name (maximum of 24 characters). This name is written to the tape header if new or matched for an append. Place an asterisk here if this is an append.
- Mode (append or overwrite).
- The report directory and name (the report lists the archived files and any error messages generated during the job). This file will be used later for hard copy documentation of the archive.

The remaining fields on the Job Entry Form should hold the following values:

- Include Files - This can be used to selectively archive certain files by standard DOS wildcard criteria. If all files in the directories marked in Step 8 are to be archived, leave this field blank.
- Back Up Hidden Files = **NO**
- Back Up System Files **NO**
- Clear Archive Bit = **NO**
- Verify Method = **COMPARE TAPE TO DISK**
- Back Up Method = **COMPLETE: ALL FILES**
- Track Files = **YES**
- Create Script = **NO**
- Delete Source Files = **YES** or **NO**. Select **YES** only if the files are no longer needed on the network drive. Use caution with this option.

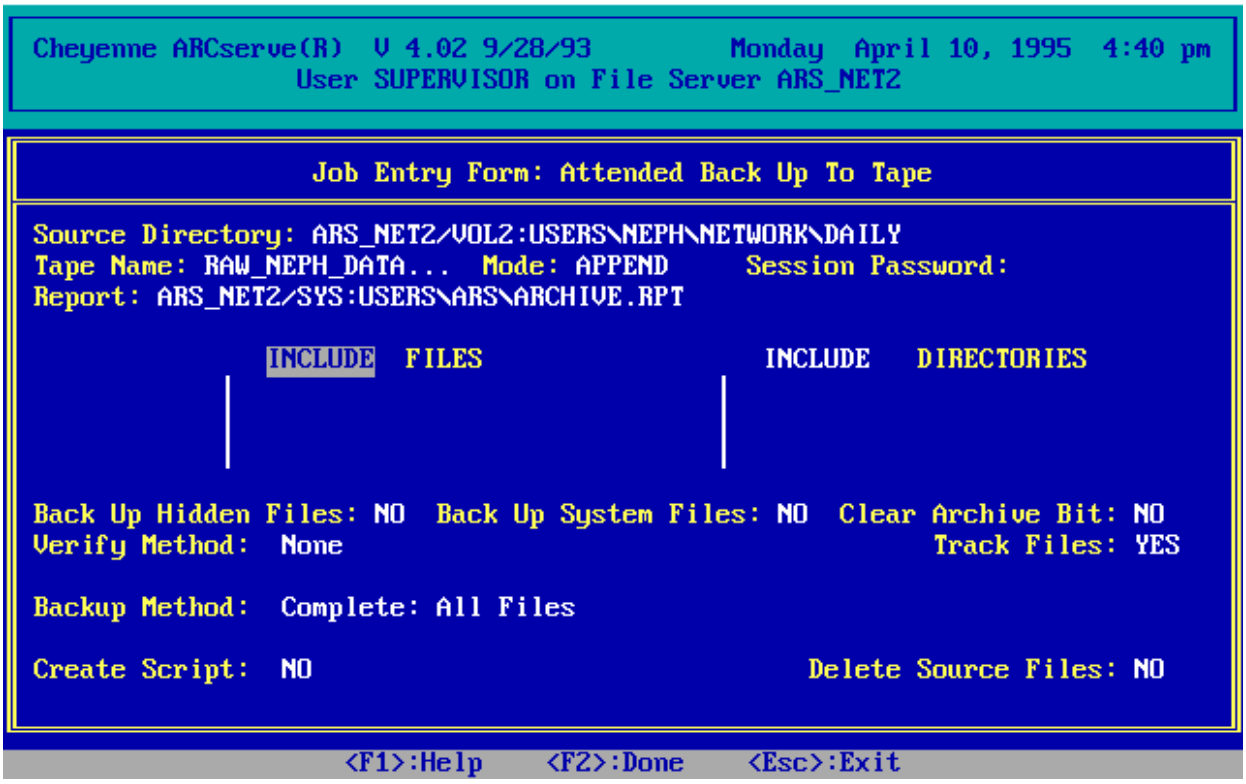


Figure 4-2. Attended Backup to Tape Job Entry Form (Screen Display).

10) Press **F2** to begin the job once the Job Entry Form is complete. The program displays the archiving activity on the screen in real-time, giving the total number of files, bytes and blocks, and the specific file and its size as the job is processed.

11) If the Delete Source Files field in the Job Entry Form was set to **YES**, the program will ask whether or not to delete the source files. The deletion can be confirmed if the files are no longer needed on the network. The source files should not be deleted if additional archives are still required.

12) Press any key when the job is done to return to the Attended Operations Menu.

13) Press the **EJECT** button on the tape drive to remove the tape cartridge.

14) Label both the tape cartridge and the cartridge case.

15) Repeat all steps to create duplicate tapes.

4.2.2 The Data Archive Report

The data archive report is the file named in Step 9 in Section 4.2.1. The report can be printed by running ARCHRPT.BAT, a DOS batch file that loads WordPerfect and runs a WordPerfect macro to reformat and print the report. To run the batch file:

- At a DOS prompt on the network, type and enter **ARCHRPT**.
- When prompted, enter the report file name as entered in Step 9 in Section 4.2.1.
- The report will be sent to the HP Laserjet printer.

Photocopy the report and store one copy with each archive tape. Store an additional copy in the three-ring Data Archive Log notebook.

4.2.3 Disposition of Tapes and Data Archive Records

The disposition of archive tapes and records is as follows:

- At least one copy of each archive tape created is stored at ARS in the archive storage cabinet. The tape is placed in a plastic protector pouch with a copy of the archive report, then into a storage box with other archive tapes. The storage box will reside in the archive storage cabinet at ARS for no less than five years.
- At least one copy of the archive tape is returned to the project manager with a copy of the archive report and a copy of the completed Data Archive Request form. Additional archive tapes are also returned as directed in the Data Archive Request form. The project manager is responsible for documenting and distributing duplicate archives for on- or off-site storage.
- One copy of the archive report and one copy of the completed Data Archive Request form will be placed in the Data Archive Log notebook. The Data Archive Log notebook resides in the archive storage cabinet.