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TYPE	STANDARD OPERATING PROCEDURE
NUMBER	4120
DATE	MARCH 1993

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	2
2.1	Project Manager	2
2.2	Field Specialist	3
2.3	Data Coordinator	3
2.4	Site Operator	4
3.0	REQUIRED EQUIPMENT AND MATERIALS	4
3.1	Site Visit Equipment	4
3.2	Inventory	5
4.0	METHODS	5
4.1	Routine Site Operator Maintenance Procedures	7
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.3	Biannual Laboratory Maintenance Procedures	10

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Automatic Camera System Field Quality Control Procedures	6

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. Web-based high-resolution digital camera systems collect digital images for display on a Web page. 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 film, compact memory cards (with varying storage capacity), 8 mm color movie film, SVHS videotape, or CD-ROMs 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 files, 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 camera or video monitoring systems.
- Resolve problems reported by the site operator regarding camera or video monitoring systems.
- Document all technical support provided to the site operator regarding camera or 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 batteries
- Spare timer batteries
- Spare personal digital assistant (PDA) batteries (for digital camera systems)
- Various size and type screwdrivers
- Adjustable wrench
- Keys for enclosure and any padlocks
- Watch
- Optical cleaning supplies
- Site operator's manual
- Visibility Monitoring Status/Assessment Sheets

- Pen or pencil
- Grease pencil
- Film rolls or SVHS videotape cassettes
- Memory cards (digital camera systems)
- 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, Sony, and Kodak 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 emergency 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.

Automatic Camera System Field Quality Control Procedures

Regular Maintenance performed at each film, digital image memory card, or videotape change:

- Inspect overall system and clean shelter window.
- Verify that film or videotape advanced and settings are correct.
- Review controller interface (via PDA) and digital camera display menus for correct settings and proper image data collection.
- Rewind and remove film or videotape (complete film canister or videotape label).
- Load new film or videotape, or exchange digital memory card (complete label).
- Inspect and clean camera lens.
- Check system batteries and system AC power source where applicable.
- Check camera and databack settings.
- Check timer and time-lapse system alarm settings.
- Photograph film documentation board.
- Verify proper camera alignment (and digital light meter on digital systems).
- Verify system operation.
- Complete status/assessment sheet:
 - Document any equipment or monitoring discrepancies found.
 - Document all servicing or maintenance actions performed.
 - Describe current weather conditions and conditions observed during the monitoring period.
 - Describe current visibility conditions and conditions observed during the monitoring period.
- Close and lock enclosure.
- Mail film, digital memory card, 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 and 35 mm and 8 mm timer batteries every 6 months.
- Change PDA batteries every month.
- Check hard drive on high-resolution digital camera system computer and archive and delete files.
- 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.

Site operators are trained and supplied with a *Site Operator's Manual for Automatic Visibility Monitoring Camera Systems*, *Site Operator's Manual for Remote High-Resolution Digital Camera Systems*, or *Site Operator's Manual for High-Resolution Digital Camera Systems*. These manuals contain standard operating procedures and technical instructions applicable to the specific camera or video monitoring equipment located at the sites. 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 or digital 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 (digital cameras require exchanging the memory card), 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, memory cards, 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, memory card, or videotape. If operator entries on the sheet indicate that further action is necessary, immediate corrective action will be taken by the data coordinator.

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 using the following methods:

Telephone: 970/484-7941
Fax: 970/484-3423
E-mail: info@air-resource.com

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*
- TI 4120-3800 *Routine Site Operator Maintenance Procedures for Remote High-Resolution Digital Camera Systems (RDCS-100)*
- TI 4120-3850 *Routine Site Operator Maintenance Procedures for the High-Resolution Digital Camera System (HRDC)*

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, memory card, videotape, or during review of image postings on the Internet.

- 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 or replacement components 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*
- TI 4120-3900 *Troubleshooting and Emergency Maintenance Procedures for Remote High-Resolution Digital Camera Systems (RDCCS-100)*
- TI 4120-3950 *Troubleshooting and Emergency Maintenance Procedures for the High-Resolution Digital Camera System (HRDC)*

4.3 BIENNIAL LABORATORY MAINTENANCE PROCEDURES

Internal quality assurance of automatic camera equipment is based primarily on visual review of developed film, archived digital image files, or videotape. Photographic media handling and review procedures are fully discussed in SOP 4305, *Collection of Scene Monitoring Photographic Film, Videotape, and Digital Images*. Alignment, exposure, and data collection efficiency can all be assessed from review of collected media. 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 photographic media 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 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 4120-3510 *Biannual Laboratory Maintenance Procedures for 8 mm Automatic Time-Lapse Camera Systems*

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
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	-- continued --		

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	12
4.3	Final System Verification Check	12
4.4	Capital Equipment Exchange Procedures	12

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Display Panel Depicting Shutter Speed Reading	8

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Canon EOS 35 mm Camera and Paragon Timer	7

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.

- 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
Aperture	f8.0	Time/Day-of-Week
ISO/ASA	64	
Exposure	0 (Zero)	
Compensation		
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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Timer battery/configuration is incorrect (refer to TI 4120-3100). The timer battery power level (12 V) is insufficient or drained. A 9v battery was accidentally left attached to the timer.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	<ul style="list-style-type: none"> 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). 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.	<ul style="list-style-type: none"> 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.

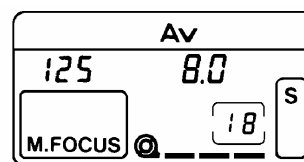


Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

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. 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 OPERATION

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 counter 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.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	11
4.3	Final System Verification Check	12
4.4	Capital Equipment Exchange Procedures	12

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Display Panel Depicting Shutter Speed Reading	8

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Contax 167MT 35 mm Camera and Paragon Timer	7

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.

- 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 <input type="checkbox"/>	Year-Month-Day/Time	Time/Day-of-Week
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		
Troubleshooting Procedures		
Component to be Checked	Checking Procedure	Malfunction Possibilities
Camera Battery	Turn the main switch to <input type="checkbox"/> . Press the MODE and ISO buttons simultaneously. All the display panel indicators should come on.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Timer battery/configuration is incorrect (refer to TI 4120-3110). The timer battery power level (12 V) is insufficient or drained. A 9v battery was accidentally left attached to the timer.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	<ul style="list-style-type: none"> 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). 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.	<ul style="list-style-type: none"> 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.

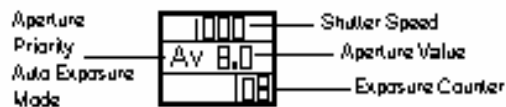


Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

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.

DATABACK BATTERIES
(continued)

- 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. 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*.

VERIFY INTERNAL
CAMERA WINDER
OPERATION (continued)

- 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.

VERIFY TIMER
OPERATION (continued)

- 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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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	11
4.3	Final System Verification Check	12
4.4	Capital Equipment Exchange Procedures	12

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Contax 137 MA 35 mm Camera and Paragon Timer	7

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.

- 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.

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.

DATABACK BATTERIES
(continued)

- 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. 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
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 4120-3120.
- 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.

VERIFY TIMER
OPERATION (continued)

- 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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	-- continued --		

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	11
4.3	Final System Verification Check	11
4.4	Capital Equipment Exchange Procedures	12

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Olympus OM2N 35 mm Camera and Paragon Timer	7

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.

- 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.

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 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Camera/timer wiring is incorrect (refer to TI 4120-3130). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	<p>Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).</p> <p>Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.</p>	<ul style="list-style-type: none"> • Timer battery/configuration is incorrect (refer to TI 4120-3130). • The timer battery power level (12 V) is insufficient or drained. • A 9v battery was accidentally left attached to the timer.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	<ul style="list-style-type: none"> • 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). • Timer needs repair.
	<p>Review the programmed timer events.</p> <p>Press PRG then C1 to select channel 1 for review. Press E repeatedly to review each event.</p> <p>Press RUN when finished reviewing or changing events to return the timer to the "RUN" mode.</p>	<ul style="list-style-type: none"> • 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. Under normal operating conditions the 6 V lantern batteries should operate sufficiently up to six months.

TIMER (continued)

- 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.

VERIFY CAMERA AND
TIMER CABLES
(continued)

- 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.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES FOR 35 MM AUTOMATIC CAMERA SYSTEM – PENTAX PZ-20
TYPE	TECHNICAL INSTRUCTION
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REVISION HISTORY			
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	12
4.3	Final System Verification Check	12
4.4	Capital Equipment Exchange Procedures	12

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Display Panel Depicting Shutter Speed Reading	8

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Pentax PZ-20 35 mm Camera and Paragon Timer	7

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.

- 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 <input type="checkbox"/> (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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Timer battery/configuration is incorrect (refer to TI 4120-3140). • The timer battery power level (12 V) is insufficient or drained. • A 9v battery was accidentally left attached to the timer.
Timer	Verify that the timer is in the “RUN” mode (time and day-of-week displayed and colon flashing).	<ul style="list-style-type: none"> • 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). • 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.	<ul style="list-style-type: none"> • 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.

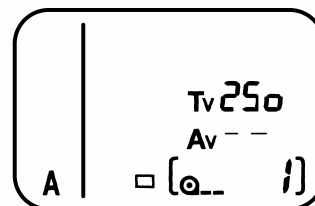


Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

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. 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” ( 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.

- VERIFY TIMER BATTERY CABLE (continued)
- 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	
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	2
2.3	Data Coordinator	2
2.4	Site Operator	3
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	4
4.0	METHODS	4
4.1	General Information	5
4.2	Troubleshooting and Emergency Maintenance Procedures	8
4.2.1	Rapid Battery Drain	8
4.2.2	Improper Film Advance	9
4.2.3	Camera Misalignment	11
4.2.4	Enclosure Leakage	12
4.3	Final System Verification Check	12
4.4	Capital Equipment Exchange Procedures	12

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Display Panel Depicting Shutter Speed Reading	8

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Pentax ZX-10 35 mm Camera and Paragon Timer	7

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.

- 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 <input type="checkbox"/> (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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Camera/timer wiring is incorrect (refer to TI 4120-3150). • Timer battery malfunction. • Camera/timer cable needs repair.
Timer Batteries	<p>Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).</p> <p>Test and record the voltage of the timer batteries. The measurement should be approximately 12 volts.</p>	<ul style="list-style-type: none"> • Timer battery/configuration is incorrect (refer to TI 4120-3150). • The timer battery power level (12 V) is insufficient or drained. • A 9v battery was accidentally left attached to the timer.
Timer	Verify that the timer is in the "RUN" mode (time and day-of-week displayed and colon flashing).	<ul style="list-style-type: none"> • 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). • Timer needs repair.
	<p>Review the programmed timer events.</p> <p>Press PRG then C1 to select channel 1 for review. Press E repeatedly to review each event.</p> <p>Press RUN when finished reviewing or changing events to return the timer to the "RUN" mode.</p>	<ul style="list-style-type: none"> • 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.

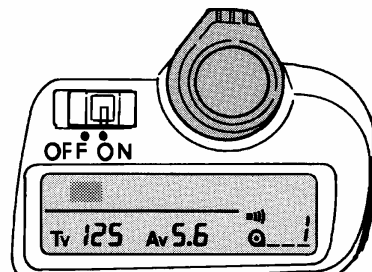


Figure 4-1. Camera Display Panel Depicting Shutter Speed Reading.

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. 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” (⓪_ £) 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.

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	1
2.3	Data Coordinator	1
2.4	Site Operator	2
3.0	REQUIRED EQUIPMENT AND MATERIALS	2
3.1	Site Visit Equipment	2
3.2	Inventory	3
4.0	METHODS	4
4.1	General Information	4
4.2	Troubleshooting and Emergency Maintenance	5
4.2.1	Camera	9
4.2.2	Controller	11
4.2.3	Personal Digital Assistant (PDA)	12
4.2.4	Power Supply	14
4.2.5	Enclosure	14
4.3	Final System Verification Check	15
4.4	Capital Equipment Exchange Procedures	15

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Display on Top of Camera	10
4-2	Diagram of Proper Port Alignment	11
4-3	View Controller Status Menu	11

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedures for the Remote High-Resolution Digital Camera System (RDCS-100)	6

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 a camera system malfunction. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the Remote High-Resolution Digital Camera System (RDCS-100), and is referenced in SOP 4120, *Automatic Camera System Maintenance*.

Site operators should be fully trained and supplied with a *Site Operator's Manual for Remote High-Resolution Digital Camera Systems* that contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system 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 by e-mail 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, the site operator, his/her supervisor, and data coordinator concerning the schedule and requirements of specific troubleshooting procedures.
- Train the site operator in all phases of specific troubleshooting procedures necessary for on-site resolution of instrument problems.
- 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 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 or his/her supervisor 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.
- Coordinate the replacement and repair of all system components and support hardware.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Enter 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, the project manager, 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 Visibility Monitoring Status/Assessment Sheet; mail the white copy of the completed sheet to the data coordinator and maintain the yellow copy on site.
- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator.

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
- Spare camera batteries (4 AA Ni-MH)
- Spare Personal Digital Assistant (PDA) batteries (2 AAA alkaline)
- Paperclip for resetting the PDA
- Lens tissue and cleaner
- Voltmeter
- Site Operator's Manual for Remote High-Resolution Digital Camera Systems, containing:
 - SOP 4120, *Automatic Camera System Maintenance*
 - TI 4120-3800, *Routine Site Operator Maintenance Procedures for the Remote High-Resolution Digital Camera System (RDCCS-100)*
 - TI 4120-3900, *Troubleshooting and Emergency Maintenance Procedures for the Remote High-Resolution Digital Camera System (RDCCS-100)*
 - Manufacturer's instruction booklets
 - Visibility Monitoring Status/Assessment Sheets
- Pen or pencil

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, solar panel, and/or Personal Digital Assistant (PDA) 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

All procedures described in this TI refer to the Remote High-Resolution Digital Camera System (RDCS-100), which consists of five major components:

- A high-resolution digital camera with zoom lens and integrated scripting
- A custom-designed controller
- A PDA (Personal Digital Assistant) palm computer interface
- A battery-backed power system (AC or solar power)
- A lockable environmental enclosure

Many AC-powered remote high-resolution digital camera systems also contain a system heater and window defroster kit. These supplemental components assure ongoing data collection and minimize window condensation for sites located in colder northern climates.

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

4.1 GENERAL INFORMATION

Maintaining a 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 memory card images.
- 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 system-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. (A backup inventory of 5% - 10% of the total network is recommended (e.g., 1 backup system for every 10 units)).

- 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 communication documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor images for reoccurrence or resolution of the problem.

Site operators 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.

The following manufacturers' instruction booklets provide additional reference and are located in the Site Operator's Manual for Remote High-Resolution Digital Camera Systems:

- Kodak digital camera instruction booklet
- PDA palmtop computer instruction booklet

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

- 1) Check the problem areas listed 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 can review the problem accurately.
- 4) Refer to the Site Operator's Manual for Remote High-Resolution Digital Camera Systems when necessary.

Table 4-1

Troubleshooting Procedures for the
Remote High-Resolution Digital Camera System (RDCS-100)

Standard Settings/Operational Requirements Checklist	
Camera	Capture mode; power OFF Capture menu standard settings: Picture Type: Still White Balance: Daylight Watermark: None Advanced Exposure Modes: Programmed AE Advanced Focus Modes: Manual focus (infinity) Preferences: Standard time Kodak Scripts: Resolution series (high, 1792 x 1200 pixels) (super quality, minimal compressed JPG) Flash option: OFF Operational requirements: 4 AA size 1.5-volt alkaline or 4 AA size 1.2-volt Ni-MH rechargeable batteries (32° to 104°F temperature range)
Controller	Green light flashing, cable connections secure to all components Operational requirements: 10-14V battery voltage
PDA (Personal Digital Assistant)	Power OFF, connection to controller is not critical to operate RDCS-100 Operational requirements: 2 AAA size 1.5-volt alkaline batteries

Troubleshooting Procedures		
Component to be Checked	Problem	Malfunction Possibilities/Corrective Action
Camera	Camera shuts off unexpectedly	<ul style="list-style-type: none"> • Check and replace internal AA camera batteries.
	Ready light is red	<ul style="list-style-type: none"> • Memory card is not inserted into camera.
	Camera won't take automatic photograph	<ul style="list-style-type: none"> • Check cable connections. • Verify that the camera is on. • The Status Display reads Full. The memory card is full. • Take test photo using PDA
	Camera won't take manual photograph	<ul style="list-style-type: none"> • Verify that the camera is on, by pressing top of solenoid. • Automatic script was not stopped. • Take test photo using PDA
	Camera does not turn on	<ul style="list-style-type: none"> • Batteries are not installed properly. • Check cable connections to camera and solenoid.
	Picture is too light	<ul style="list-style-type: none"> • Verify that the flash is off. • Verify that the light meter is properly aligned with enclosure portal.
	Stored pictures are damaged	<ul style="list-style-type: none"> • The memory card was removed when the Ready light was blinking.
	Picture is not clear	<ul style="list-style-type: none"> • The lens is dirty. • Verify Capture menu focus settings.

Table 4-1 (Continued)

Troubleshooting Procedures for the
Remote High-Resolution Digital Camera System (RDCS-100)

Troubleshooting Procedures		
Component to be Checked	Problem	Malfunction Possibilities/Corrective Action
Controller	Time is incorrect	<ul style="list-style-type: none"> Check controller date and time in Troubleshooting menu on the PDA. If off by > 1 minute, reset the controller date and time in same menu.
	Site code is incorrect	<ul style="list-style-type: none"> If site code display is incorrect on View Controller Status menu, reset in Enter Site Information menu. Incorrect site code will adversely affect both the .dat file and off-site data handling procedures.
	Power/light not flashing	<ul style="list-style-type: none"> Verify proper controller 12v battery cable connections. Disconnect and replug into power if necessary.
	Program not functioning	<ul style="list-style-type: none"> Retrieve temperature/battery voltage and verify 2-way communication between PDA and controller. Check cable connections. Review controller cycle counter in the Troubleshooting menu on the PDA.
PDA (Personal Digital Assistant)	Screen display is blank	<ul style="list-style-type: none"> Check to ensure the power button is turned on. Tap the contrast button and adjust contrast (refer to PDA manufacturers' manual). Ensure batteries are fresh and properly installed. Change batteries monthly; an icon on top of the screen in the Main menu shows the battery supply status. Perform a soft reset. Use a paperclip to gently press the reset button on the back of the PDA.
	Cannot access PalmCam menu	<ul style="list-style-type: none"> Go to the Main menu and make sure All is displayed at the top. Scroll down if it is not and select the PalmCam icon. If PalmCam icon is not displayed then the software has been erased and needs to be re-installed from a PC using a HotSync operation. A hard reset was performed on the PDA and erased the programming.
	PalmCam menu experiences "Fatal Exception" error	<ul style="list-style-type: none"> Exit and re-entry of PalmCam software malfunctioned. Perform a soft reset by using a paperclip to gently press the reset button on the back of the PDA.

Table 4-1 (Continued)

Troubleshooting Procedures for the
Remote High-Resolution Digital Camera System (RDCS-100)

Troubleshooting Procedures		
Component to be Checked	Problem	Malfunction Possibilities/Corrective Action
Power Supply:	Do not have power (using AC power/battery)	<ul style="list-style-type: none"> • Check cable connections from the battery charger. • Check LED light on battery charger; green indicates power is on and charging, red indicates fully charged. • The gel cell is a rechargeable battery. Check voltage with PDA. • Check gel cell battery voltage with a voltage meter.
	Do not have power (using solar power)	<ul style="list-style-type: none"> • Check that the LED light is on to DC charge regulator. • Check fuse inside yellow inline fuse holder. Replace if dead (5 amp). • Check voltage output with voltage meter; connected to battery should be 15-20 volts. Without battery connection to DC charge regulator should be 22volts on a sunny day.
Enclosure	Condensation appears in the enclosure	<ul style="list-style-type: none"> • Check for leaks or improperly tightened door seal clamps. • If applicable: verify that the window defroster component is functioning properly.

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 using the following methods:

Telephone: 970/484-7941
FAX: 970/484-3423
E-mail: info@air-resource.com

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). You may also leave an e-mail message, especially after business hours or for a step-by-step follow-up.

Data collection errors or discrepancies observed by the data coordinator during image 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.

4.2.1 Camera

Various camera problems may be caused and remedied by the following:

CHANGE BATTERIES

To change the camera batteries:

- Open the battery door.
- Slide the inside battery cover toward the back of the camera and then lift it away from the camera.
- Insert fresh batteries as indicated on the battery cover.
- Close and lock the inside battery cover and battery door.

EXCHANGE MEMORY CARD

To exchange the memory card:

- Open the memory card door.
- Insert the memory card so that the pin-connector edge of the card enters the camera first.
- Ensure the small lip on the memory card is toward the front of the camera.

SECURE CABLES

Check to ensure all cables are properly and securely connected.

The interface cable (yellow) runs from the controller to the camera serial port. It provides the connection between the controller and the Kodak camera scripting program to activate the camera, store images and .DAT file information on the internal memory card, and power down the camera.

The camera power cable (red) runs from the controller to the camera AC adapter port and solenoid shaft. It powers the camera in addition to the camera's internal 4 AA Ni-MH batteries. The cable also powers the solenoid shaft to depress the camera's power button.

TURN OFF FLASH

The display on the top of the camera shows the current settings. The camera must be turned on and in the Capture mode to view and interact with the standard Capture menu (Table 4-1) settings.

Ensure the flash is off. (See Figure 4-1).

TURN OFF FLASH (continued)

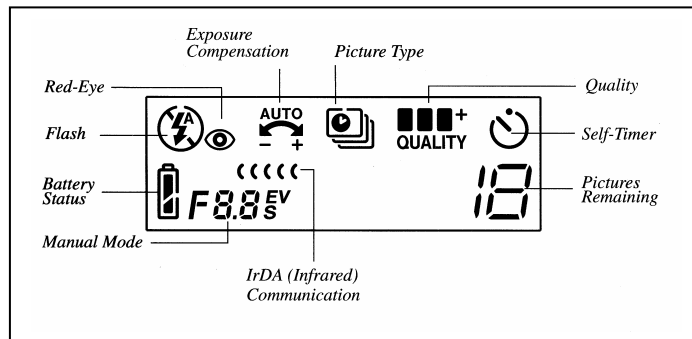


Figure 4-1. Camera Display on Top of Camera.

To change the flash:

- Press the **solenoid** to power the camera. Press the **Stop Script** button when the camera display appears on the back of the camera.
- Set the Mode dial to **Capture**.
- Press **Scroll** (located on the top of the camera) to scroll through the first four functions on the Status display: Flash, Exposure, Picture Type, and Quality.
- When the function you want to change is flashing, press **Select** (located on the top of the camera) to toggle through the choices for the active function.

RESET ALIGNMENT

The camera alignment must remain constant from one memory card to the next. To ensure proper alignment:

- Observe the display on the back of the camera during the process of an automatic or test photograph. Verify that the vista alignment matches the site-specific alignment photograph provided in the site operator's manual.
- Access the PDA Enter Site Information menu. Highlight the **Verify Camera Alignment** item to activate the instructions for manually viewing the current and adjusted vista alignment.

Note: manual alignment procedures display the vista for a 50mm zoom setting only. Verify final zoom setting and alignment by taking a test or automatic photograph with the PDA, and observing the alignment displayed on the back of the camera.

RESET ALIGNMENT (continued)

Proper alignment with the enclosure port is important with respect to vista alignment as well as proper light metering. Observe the camera lens and light meter from the front exterior of the enclosure. The port alignment must be such that the camera lens and light meter are as close to center (unobstructed as possible). Refer to Figure 4-2. Both components must be clearly visible to properly meter and photograph the observed vista.

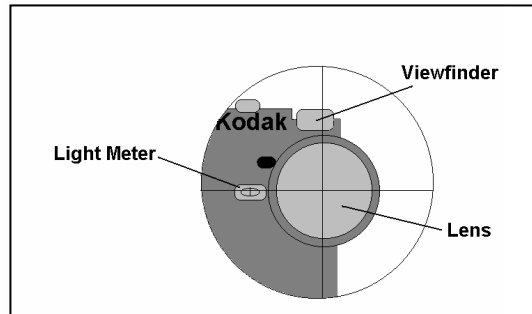


Figure 4-2. Diagram of Proper Port Alignment.

4.2.2 Controller

The controller controls the camera functions. Controller settings are displayed on the PDA Controller Status menu. Various controller discrepancies can be reviewed and/or modified under the PDA Troubleshooting menu.



Figure 4-3. View Controller Status Menu.

SET CONTROLLER DATE AND TIME

Verify on the Controller Status menu that the date and time correctly displays and is <1 minute different than displayed PDA time.

- Go to the Troubleshooting menu and set the controller date and time.

**OBSERVE CONTROLLER
CYCLE COUNTER** During normal operations the controller may experience a power surge or mis-synchronized with communication from the camera.

The controller will automatically reset itself and clock; however, the cycle counter will increment for each reset.

- Report any major (>2) increases observed in the cycle counter to the ARS data coordinator.
- Reset the controller cycle counter when problems (if any) have been resolved.

SECURE CABLES Check to ensure all cables are properly and securely connected.

The PDA HotSync cable (black) runs from the palmtop HotSync connection to the controller. It transfers the PalmCam remote configuration information and activation commands to the controller. The controller can operate independently of the PDA after the initial transfer is completed. This cable can be disconnected at the palmtop end if necessary.


4.2.3 Personal Digital Assistant (PDA)

Various camera problems may be caused and remedied by the following:

CHANGE BATTERIES To install fresh batteries in the PDA:

- Press the latch on the battery door and lift the battery door away from the PDA.
- Install two AAA alkaline batteries into the battery compartment.
- Insert the battery door back into place so that it is flush with the back of the PDA and “clicks” into position. NOTE: When changing batteries, replace them quickly. The built-in backup power maintains memory of your data for a period of up to one minute.

**VERIFY SITE
PARAMETERS** Verify correct site parameters by accessing the PDA Enter Site Information menu:

- To change any site information documented, highlight the recorded item and press the **Text** icon  on the PDA.
- Use the PDA keyboard to correct the item.

VERIFY SITE
PARAMETERS (continued)

- To change the number of observations collected, select the *site-specific data collection schedule* of your choice from the drop-down menu.
- Press the **Save** button to save any changes made. Wait for the *Database Updated* message to appear. Note you must have the PDA connected to the cable in order to update the controller's memory.

Observe the exposure counter on the top of the camera and verify with the exposure counter on the Controller Status menu. Document the number of images that were taken during the monitoring period.

TROUBLESHOOTING

Access the Troubleshoot menu on the PDA. A series of system checks are available. To test any item, highlight the item and press the **OK** button. Document observed readings on the Visibility Monitoring Status/Assessment Sheet.

RESET

If the PDA or system locks up during any test, perform the following steps:

- Wait up to 2 minutes to allow the PDA to time-out, or wait up to 5 minutes for the camera to time-out.
- Disconnect the HotSync cable at the PDA jack. Attempt to activate the PalmCam Remote interface from the PDA Home menu. Wait for the database to be read successfully. Return to the Troubleshoot menu and try another system check.

If the PDA still does not respond to pushed buttons or tapping the screen, you may need to perform a soft reset to get the PDA running again.

- Use the tip of an unfolded paper clip (or similar object without a sharp tip), to gently press the **Reset** button inside the hole on the back panel of the PDA palmtop.

SECURE CABLES

Check to ensure all cables are properly and securely connected.

The PDA HotSync cable (black) runs from the palmtop HotSync connection to the controller. It transfers the PalmCam remote configuration information and activation commands to the controller. The controller can operate independently of the PDA after the initial transfer is completed. This cable can be disconnected at the palmtop end if necessary.

4.2.4 Power Supply

Check the 12 volt rechargeable battery with a voltmeter. The battery should read between 12 and 14 volts.

Verify all cable connections are correct and secure.

12V BATTERY CABLE (GREEN)	This cable runs from the +/- connections of the 12V battery to the controller. It provides continuous power to the controller, as well as supporting power from the controller to other components.
SOLAR (DC) BATTERY CHARGER CABLE (BLUE)	This cable runs from the photovoltaic charge controller to the 12V battery cable jack. It provides solar power through the charge control device to the 12V rechargeable battery.
AC BATTERY CHARGER CABLE (BLUE)	This cable runs from the AC battery charger to the 12V battery cable jack. It provides AC power through the AC battery charger to the 12V rechargeable battery.

4.2.5 Enclosure

If water or large amounts of dust are found inside the camera enclosure:

TIGHTEN CLAMPS	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.
EXAMINE SEALANT	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.
EXAMINE SYSTEM COMPONENTS	Carefully examine the camera system components for signs of damage from water or dirt. If damage is suspected, call ARS for instructions.
CONDENSATION	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.

A supplemental window-defroster kit is available for AC-powered RDCS-100 systems. To obtain this component, contact the ARS data coordinator or program manager.

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 (i.e., when the camera is scheduled to take an image) or by verifying settings in the controller's menus. The camera should snap an image.

Verify the system periodically between scheduled site visits to ensure ongoing operation. The data coordinator will review all memory cards as soon as possible to ensure correct image exposure and camera function.

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 tested for correct operation 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.

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	PURPOSE AND APPLICABILITY	1
2.0	RESPONSIBILITIES	1
2.1	Project Manager	1
2.2	Field Specialist	1
2.3	Data Coordinator	2
2.4	Site Operator	2
3.0	REQUIRED EQUIPMENT AND MATERIALS	3
3.1	Site Visit Equipment	3
3.2	Inventory	3
4.0	METHODS	3
4.1	General Information	6
4.2	Troubleshooting and Emergency Maintenance Procedures	7
4.2.1	Remedial Procedures for Specific Instruments	10
4.3	Final System Verification Check	11
4.4	Capital Equipment Exchange Procedures	11

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
4-1	Camera Subsystem Interior	4
4-2	High-Resolution Digital Camera (HRDC) System Components	5
4-3	Power Supply Subsystem and Camera Control Computer Subsystem	6

LIST OF TABLES

<u>Table</u>		<u>Page</u>
4-1	Troubleshooting Procedure for the High-Resolution Digital Camera System (HRDC)	8

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 a camera system malfunction.. This technical instruction (TI) describes on-site troubleshooting and emergency maintenance procedures for the High-Resolution Digital Camera System (HRDC), and is referenced in SOP 4120, *Automatic Camera System Maintenance*.

The digital camera system contains two major components, a high-resolution digital camera and a personal computer. The system is designed to acquire images from a digital camera subsystem and upload the images to an FTP site on the Internet for subsequent display on a Web page. System software controls the camera functions and upload process to the Internet, and calls external dataloggers to acquire associated air quality or visibility data (if collected) to be displayed on the Web page with the images.

Site operators should be fully trained and supplied with a *Site Operator's Manual for High-Resolution Digital 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 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 by e-mail or 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, the 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.
- 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 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 of his/her supervisor 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.
- Coordinate the replacement and repair of all system components and support hardware.
- Review all site documentation completed by the site operator for accuracy and completeness. File all documentation and correspondence.
- Enter 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, the project manager, data coordinator, and field specialist concerning the requirements and completion of specific troubleshooting procedures.
- Perform all procedures described in this TI.
- Report any noted inconsistencies and troubleshooting efforts immediately to the data coordinator.

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
- Spare camera batteries (4 AA)
- Voltmeter
- Lens cleaner and lens paper
- *Site Operator's Manual for High-Resolution Digital Camera Systems*, containing:
 - SOP 4120, *Automatic Camera System Maintenance*
 - TI 4120-3850, *Routine Site Operator Maintenance Procedures for the High-Resolution Digital Camera System (HRDC)*
 - TI 4120-3950, *Troubleshooting and Emergency Maintenance Procedures for the High-Resolution Digital Camera System (HRDC)*
 - TI 4610-5040, *Digital Camera Image and Data Archives*
 - High-Resolution Digital Camera System User's Manual
 - Site configuration and settings
 - Manufacturer's manuals
- Pen or pencil

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 computer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

All procedures described in this TI refer to the High-Resolution Digital Camera System (HRDC), which consists of three subsystems:

- Camera subsystem
 - Pelco camera enclosure with sun shield, thermal insulation, and thermostatically controlled resistive heaters, fan, and window defroster
 - High-resolution digital camera
 - Camera power circuitboard
 - Thermostat circuitboard
 - 24-volt AC or DC power cable
 - RS232 signal cable or USB cable

- Power supply subsystem
 - Outdoor power supply
 - AC power cable
- Camera control computer subsystem
 - Personal computer
 - Uninterruptible power supply
 - ARS_DIGICAM software
 - Optional enclosure

Detailed photographs and diagrams of the system and associated components are provided in Figures 4-1 through 4-3.

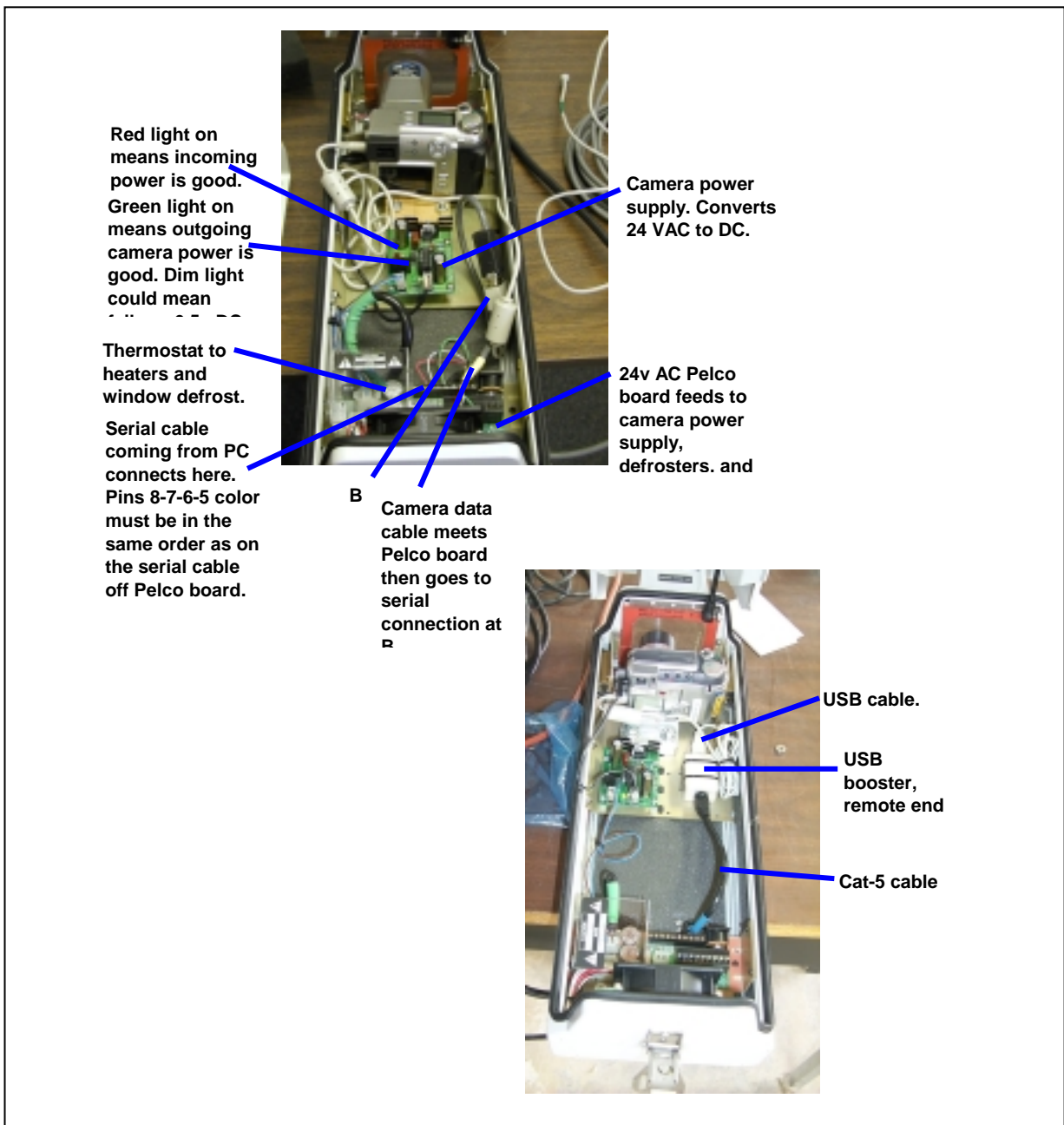


Figure 4-1. Camera Subsystem Interior.

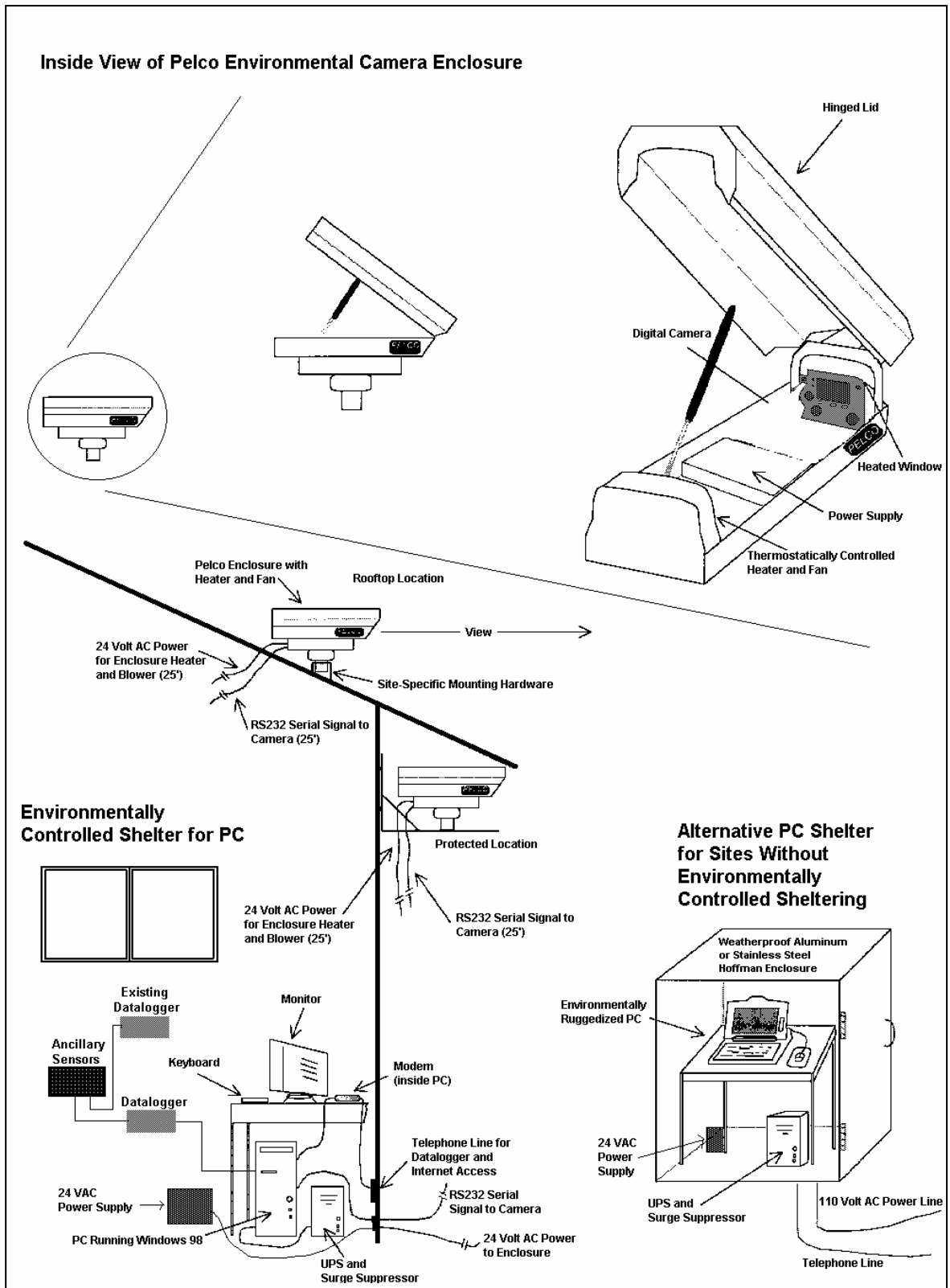


Figure 4-2. High-Resolution Digital Camera (HRDC) System Components.

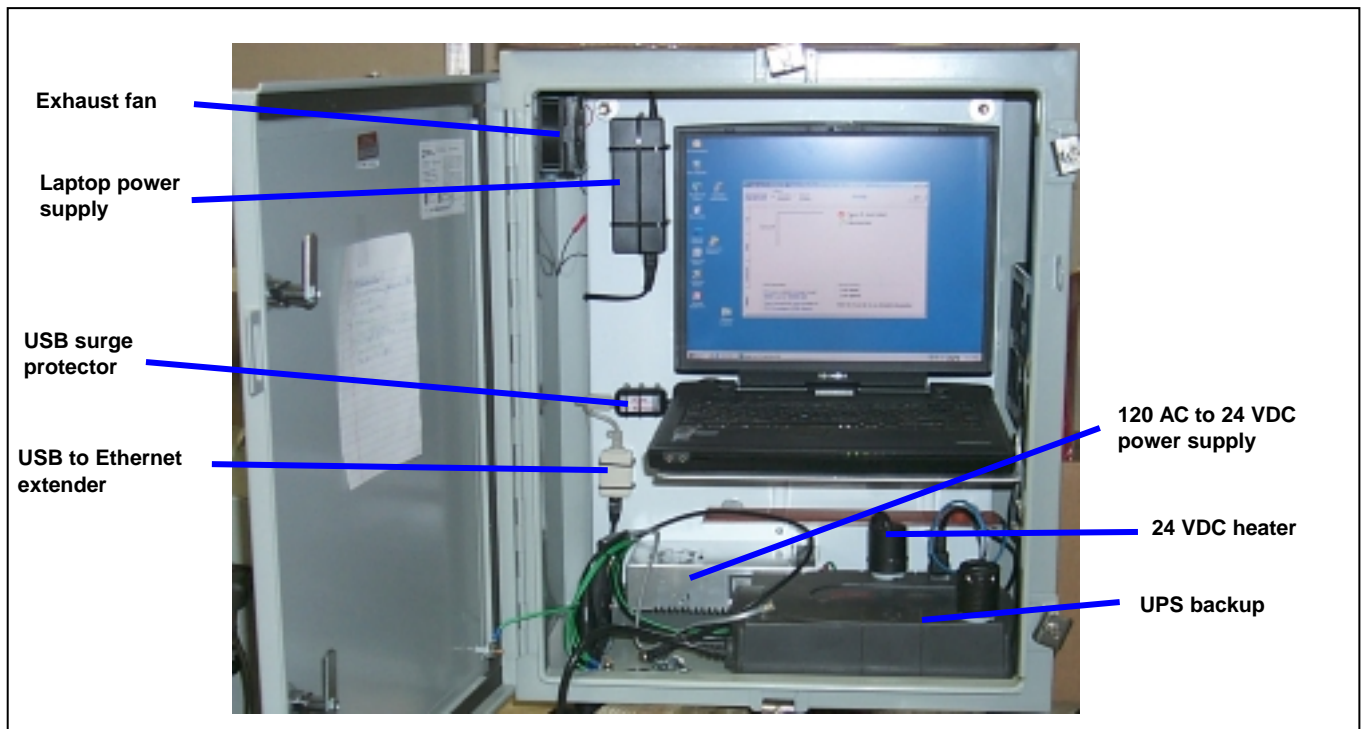


Figure 4-3. Power Supply Subsystem and Camera Control Computer Subsystem.

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

4.1 GENERAL INFORMATION

Maintaining a 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 image postings on the Internet.
- 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.

- When the site operator cannot identify or resolve a camera system-related problem or if the site operator is not available to address the malfunction, the data coordinator may ship replacement components (power supply, cables, etc.) to the site. Site operators exchange the equipment and ship the malfunctioning components to ARS for evaluation and repair.
- All troubleshooting and emergency maintenance communication documentation will be retained in the site-specific Quality Assurance Database for future reference. The data coordinator will continue to monitor images for reoccurrence or resolution of the problem.

Site operators can often diagnose and solve equipment problems in the field, reducing 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 component.

A camera manufacturer's instruction booklet provides additional reference and is located in the *Site Operator's Manual for High-Resolution Digital Camera Systems*.

4.2 TROUBLESHOOTING AND EMERGENCY MAINTENANCE PROCEDURES

Before reporting problems or calling for assistance to diagnose an equipment problem, follow this troubleshooting sequence:

- 1) Check the problem areas listed 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 can review the problem accurately.
- 4) Refer to the *Site Operator's Manual for High-Resolution Digital Camera Systems* when necessary.

The high-resolution digital camera system is comprised of two systems: 1) the camera and data collection system and 2) the Web server system. In general, it is necessary to determine which of the systems is inoperable or is operating incorrectly. For example, failure of the Web page to update may indicate a problem with either the camera system or the Web server. The Web page is a good place to check operation of the camera system because the system depends on a reliable Internet connection. There will be times when the image and data cannot be transferred due to Internet or Internet Service Provider (ISP) problems.

Table 4-1

Troubleshooting Procedure for the
High-Resolution Digital Camera System (HRDC)

Problem	Problem Cause	Solution
Camera system loses power in power failure	Power misconfigured	Check to make sure essential systems are plugged into the battery back-up side of the UPS. (Monitor is not essential).
Current image is not displayed on computer monitor	Camera failure	Power cycle the camera (turn power off, remove power input and batteries for 30 seconds, replace power and batteries). Turn power back on and reset. (Also called a camera hard reset).
	HRDC software failure	Restart HRDC system or reboot computer and restart HRDC software.
	Automatic Operation not enabled	Make sure the <i>Automatic Operation</i> and <i>Upload Enabled</i> checkboxes are selected in the ARS_DIGICAM software.
Image displayed is not correct view or zoom	Camera moved	Check camera alignment.
	Incorrect zoom setting in configuration file	First try power cycle the camera and reset (see below under image is blurry). If that doesn't correct the problem, next check the zoom setting in the .INI file. Lower the zoom setting in the .INI file, take a preview picture, then increase the zoom to correct the setting and take another preview picture.
Image is blurry	Obstruction on camera enclosure window	Clean window.
	Camera is out of focus	<p>Power cycle and reset the camera. For Olympus 2100, do the following:</p> <ol style="list-style-type: none"> 1) The PC can stay ON but exit the ARS_DIGICAM software. 2) Unplug the serial cable from the camera. 3) Manually turn the camera off by pushing the lever to OFF. 4) Push the camera lever all the way forward to the "reset" position (hold for several seconds). 5) Hold the lever in the reset position until you hear a "beep". 6) Let the lever drop back to the ON position. The camera will remain powered on. 7) Plug the serial cable back into the camera. 8) Go back to the PC and start the ARS_DIGICAM software. 9) Repeat if you get the error message again or if the Web image is blurry. <p>Power cycle and reset the camera. For Kodak DC265 or Olympus C730, do the following:</p> <ol style="list-style-type: none"> 1) The PC can stay ON but exit the ARS_DIGICAM software. 2) Unplug the serial cable from the camera. 3) Manually turn the camera off by holding down the power button. 4) Pause and leave the camera off for a couple of minutes. 5) Hold the power button down and turn the camera back on. 6) Plug the serial cable back into the camera. 7) Go back to the PC and start the ARS_DIGICAM software. 8) Repeat if you get the error message again or if the image is blurry.

Table 4-1 (continued)

Troubleshooting Procedure for the
High-Resolution Digital Camera System (HRDC)

<p>Black image is posting on Web page</p>	<p>Hard drive on computer too full</p> <p>Camera failure</p>	<p>Archive to CD all zipped files in the data folder under C:\ARS_DIGICAM. Then delete the archived files and restart the PC.</p> <p>Power cycle the camera (turn power off, remove power input and batteries for 30 seconds, replace power and batteries). Turn power back on and reset.</p>
<p>Data on computer monitor does not match the data on external instrumentation (datalogger), i.e., incorrect date stamp</p>	<p>Wiring problem</p> <p>HRDC software failure</p> <p>Communication failure, modem locked up or phone line issue</p>	<p>Check wiring.</p> <p>Restart the HRDC system or reboot the computer and restart the ARS_DIGICAM software. If using PC208 to connect to Campbell datalogger, restart PC208 and then connect via its Connection tab. To update data, manually collect data by selecting 'data collection' in the Manual Operation menu after taking ARS_DIGICAM out of automatic operation (uncheck the Automatic Operation box on main screen). Note any errors in the Log tab screen in ARS_DIGICAM.</p> <p>Power cycle the external modem (turn power off, remove power input for 30 seconds, replace power, then turn power back on). The computer to reset the internal modem. Check the telephone line for dial tone and where it is plugged in to modem. The telephone line should be plugged into 'line in' or phone jack outlet port on the modem.</p>
<p>Internet upload failure</p>	<p>Telephone line or ISP problem</p> <p>Modem locked up</p>	<p>Dial the telephone number manually to see if the modem on other end picks up. Check for dial tone on telephone line. Listen to the modem trying to connect to ISP via speaker. Attempt to manually connect to the Internet through "network and dial-up connection" under Control Panel. Then check browser functionality.</p> <p>Power cycle the external modem. Restart the computer to reset the internal modem. Check modem operation by going to 'phone and modem options' under Control Panel. Then select the Modems tab and view the properties of selected modems. View the Diagnostic tab and click the 'query modem' button. A string of commands fills in the 'command response window' that indicates the modem is ok. However, if an error window pops up that indicates a problem, it might be necessary to remove the modem from the hardware list and re-install it. Please call ARS before attempting this.</p>

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 using the following methods:

Telephone: 970/484-7941
Fax: 970/484-3423
E-mail: info@air-resource.com

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, locating, and a brief description of the problem(s) or need(s). You may also leave an e-mail message, especially after business hours or for a step-by-step follow-up.

Data collection errors or discrepancies observed by the data coordinator during image review can also initiate required corrective action. All requested maintenance or troubleshooting procedures performed must be thoroughly documented by the site operator on and by the data coordinator in the site-specific Quality assurance Database.

4.2.1 Remedial Procedures for Specific Instruments

Remedial procedures include those necessary when servicing the camera system directly, or when servicing the instrumentation whose data are used by the system. Remedial procedures for the camera are generally necessary when the camera is exhibiting problems or needs adjustment. The digital camera can be used outside of its enclosure as described in the camera manual. This is the best way to determine if the camera is working properly. Items to check on the camera are:

VERIFY CAMERA IS TURNED ON	Verify that the camera is on, by pressing the power button. The software keeps the camera turned on; if the HRDC software fails, the camera will turn off after approximately 2 days.
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VERIFY PICTURES ARE DELETED	Verify that no pictures are currently in the camera (camera is empty). If the camera is not empty, delete all pictures in the camera. Refer to the manufacturer's camera manual for details.
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REPLACE CAMERA	Replace the camera in the enclosure and attach all cables.
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If the camera is working correctly independent of the enclosure, yet fails under computer control, the problem likely exists in the communication link between the camera and computer. To bypass the communication link:

REMOVE CAMERA AND CABLE	Remove the camera and interface cable from the enclosure. Leave the power cable in the enclosure. Carry the camera down to the camera computer.
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ATTACH CAMERA	Attach the camera to the PC serial port.
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TURN CAMERA ON	Turn the camera on and run the ARS_DIGICAM software.
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If the camera works properly when connected directly to the computer, there is a problem with the communication link. If the camera fails to work under computer control, but works manually, the problem is either the computer serial port or camera serial port. In this case:

- CHECK CAMERA Check camera operation using another PC running the Kodak or Olympus software that accompanied the camera.
- CHECK SERIAL PORT Check the computer serial port using a breakout box or similar diagnostic tool.

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 (i.e., when the camera is scheduled to take an image).

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 may ship replacement components (power supply, cables, etc.) to the site as quickly as possible. Site operators exchange the equipment and ship the malfunctioning components to ARS for evaluation and repair.