QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES

TITLE	**COLLECTION AND HANDLING OF DIGITAL IMAGES**
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1.0   PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection and handling procedures for digital images and data files collected with a digital camera. This TI is referenced in standard operating procedure (SOP) 4305, *Collection of Scene Monitoring Photographic Film, Videotape, and Digital Images* specifically describes:

- Tracking and documenting memory cards containing digital images and camera scripting settings files

- Identifying and labeling digital image files

- Validating digital image quantity and quality

2.0   RESPONSIBILITIES

2.1   PROJECT MANAGER

The project manager shall oversee all collection and handling procedures.

2.2   DATA COORDINATOR

The data coordinator shall:

- Supply the site operator with memory cards and all necessary monitoring supplies.

- Verify that scheduled site visits are performed and notify the site operator if he/she fails to make a scheduled visit.

- Review all camera documentation completed by the site operator for completeness and accuracy, and file all documentation and correspondence in the site-specific quality assurance database.

- Oversee memory card tracking.

- Review all memory cards for quantity and quality.

- Resolve problems reported by the site operator and data technician.

- Verify that all Master Log documentation is complete and accurate.

- Determine collection and recovery statistics.

2.3   DATA TECHNICIAN

The data technician shall:

- Log all memory cards mailed to Air Resource Specialists, Inc. (ARS) from site operators.

- Complete Master Log documentation for each memory card.

- Identify and chronologically label all image files by site.

- Report any noted documentation or data inconsistencies to the data coordinator.

- File all supporting documentation.

2.4 SITE OPERATOR

The site operator shall:

- Report any noted inconsistencies upon site servicing and memory card exchanges to the data coordinator.

- Complete a Visibility Monitoring Status/Assessment Sheet and memory card pouch label for each memory card.

- Mail filled memory cards and accompanying documentation to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The following equipment and materials are used to collect, document, and validate digital images collected from memory cards:

- Memory cards

- Memory card pouches

- Memory card pouch labels

- Mailing envelopes

- Visibility Monitoring Status/Assessment Sheets

- Master Logs

- Personal computer (PC) with CD-ROM writer

- Memory card reader or adapter (PCMCIA Compact Flash reader, adapter, or USB Flash Card reader)

- ARS' Air Quality Database

- Blank CDs

- Manila folders

- Hanging folders

- File cabinet

- 3-ring binders

4.0   METHODS

This section includes the following two (2) major subsections:

4.1   Digital Image Collection Procedures
4.2   Digital Image Handling Procedures

4.1   DIGITAL IMAGE COLLECTION PROCEDURES

4.1.1 Memory Card Preparation and Exchange

The camera script programs (Startup.csm and PalmCam.csm) handle all data collection and image identification processing as each image is taken. Image files (in JPEG format) and a data file record (in text format), containing all pertinent time, date, and image file name information are written routinely to the camera's exchangeable memory card. Memory cards prepared for installation should be void of past image files, but must contain all Kodak script program files in the System folder, as shown in Figure 4-1. The data coordinator formats memory cards as follows:

|	
DELETE IMAGE FILES	Delete all JPG image files located in the memory card image folder (e.g., DC290_01).
DELETE IMAGE FOLDER	Delete the memory card image folder (e.g., DC290_01).
DELETE TEXT FILE	Delete the *Images.dat* text file located in the root directory of the memory card (see example in Figure 4-2).
VERIFY PROGRAM AND FOLDERS ARE MAINTAINED	Verify that the System folder and the Kodak script programs (Startup.csm and PalmCam.csm) are properly maintained on the memory card as shown in Figure 4-1.
RETURN CARD	Return the memory card to the site operator for future use.
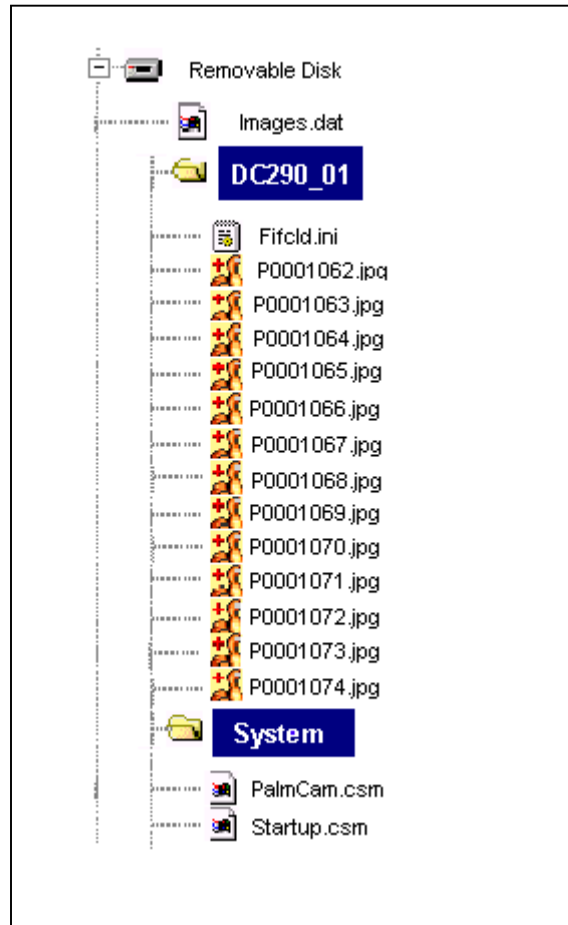
Figure 4-1. File Format and Contents of the Camera Memory Card.

```
DC290_01/P0000752.JPG  Date:0x082900  Time: 0x121039  Temp:752  Batt:148  Counters:000  Script:1.0/6-16-2000
DC290_01/P0000753.JPG  Date:0x082900  Time: 0x121834  Temp:770  Batt:148  Counters:002  Script:1.0/6-16-2000
DC290_01/P0000754.JPG  Date:0x082900  Time: 0x122709  Temp:788  Batt:148  Counters:003  Script:1.0/6-16-2000
DC290_01/P0000755.JPG  Date:0x083000  Time: 0x121039  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000756.JPG  Date:0x083000  Time: 0x121833  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000757.JPG  Date:0x083000  Time: 0x122709  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000758.JPG  Date:0x083100  Time: 0x121038  Temp:770  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000759.JPG  Date:0x083100  Time: 0x121834  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000760.JPG  Date:0x083100  Time: 0x122709  Temp:770  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000761.JPG  Date:0x090100  Time: 0x121039  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000762.JPG  Date:0x090100  Time: 0x121834  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000763.JPG  Date:0x090100  Time: 0x122709  Temp:842  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000764.JPG  Date:0x090200  Time: 0x121039  Temp:824  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090200  Time: 0x121835  Temp:806  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090200  Time: 0x122705  Temp:770  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090300  Time: 0x121038  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090300  Time: 0x121835  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090300  Time: 0x122705  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090400  Time: 0x121040  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090400  Time: 0x121842  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090400  Time: 0x122705  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090500  Time: 0x121040  Temp:770  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090500  Time: 0x121842  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090500  Time: 0x122705  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090600  Time: 0x104614  Temp:770  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090600  Time: 0x104614  Temp:806  Batt:148  Counters:004  Script:1.0/6-16-2000
DC290_01/P0000765.JPG  Date:0x090600  Time: 0x104614  Temp:788  Batt:148  Counters:004  Script:1.0/6-16-2000
```

Figure 4-2. Example Image.dat File.

4.1.2   **Memory Card Capacity**

The RDCS-100 can store over 250 high-resolution images on its internal 128 MB memory card. The size of each collected image will vary depending on the lighting conditions and detail of the vista being photographed. At the 1792 x 1200 resolution with "best" JPEG compression, a typical image size for a daylight mountain vista is 450 KB. Night-time images are typically smaller than 100 KB. Approximate calculations for the maximum number of images that can be stored on a 128 MB memory card given available collection schedules are provided in Table 4-1.

Table 4-1
Image Collection and Memory Card Exchange Schedule

Collection Schedule	Number of Images for 128 MB Memory Card	Maximum Number of Days Between Memory Card Exchange
3 times per day	284 daylight images	90 days (3 months)
once per day	284 daylight images	284 days (9 months)
twice per day	284 daylight images	140 days (approximately 5 months)
Hourly	238 daylight images	17 days
(24 times per day)	170 night-time images	
Hourly	273 daylight images	21 days
(daylight: 13 times per day)		
5-minute intervals	235 daylight images	approximately 1.5 days
(288 times per day)	168 night-time images	
10-minute intervals	252 daylight images	3 days
(144 times per day)	180 night-time images	

Site operators are encouraged to monitor system operations at a minimum of two-week intervals. Regular maintenance actions include verifying equipment status, the proper number of exposures taken, adequate battery voltage, and alignment checks. Memory card exchanges can be made any time the equipment is serviced, with the maximum number of days between exchanges noted above.

4.1.3   **Field Documentation**

Collection procedures for digital images include site servicing visits to perform memory card exchanges at the required interval, and the mailing of filled memory cards and accompanying documentation by the site operator to ARS. When servicing a site, the operator loads a formatted memory card into the camera. Camera scripting programs record the date and time that the images are taken.

The operator also completes a memory card pouch label and attaches it to the memory card pouch. An example memory card pouch label is provided as Figure 4-3. The labeled pouch is shipped to ARS via FedEx, along with a completed Visibility Monitoring Status/Assessment Sheet.

```
Site Code: PASA1 Data Seq. # :  003
Date/Time ON:   11/06/2000
Date/Time OFF:  11/20/2000
Memory Card ID # : FS-128-004
```

Figure 4-3. Example Memory Card Pouch Label.

An example completed Visibility Monitoring Status/Assessment Sheet is provided as Figure 4-4. Memory cards should be sent immediately to:

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

Further details on site servicing procedures and site operator-related image collection procedures can be found in TI 4120-3800, *Routine Site Operator Maintenance Procedures for the Remote High-Resolution Digital Camera System (HRDC-100).*

4.2   DIGITAL IMAGE HANDLING PROCEDURES

Image handling begins when the full memory cards are received at ARS. A detailed flowchart of handling procedures is shown in Figure 4-5.

4.2.1   Memory Card Check-In

Receipt of the memory cards is recorded on a site Master Log and in the ARS Air Quality Database (AQDB). Once the cards are received at ARS, they are put into a PCMCIA Compact Flash reader, adapter, or USB Flash Card reader and downloaded to a PC. To download, the data coordinator accesses the AQDB:

- From the Load Data menu, select **Receive Memory Cards.**

- Select the **Log Memory Card Received** tab.

- In this window, enter the *site* and *vista*.

- Press the **Copy** button to copy all files to the local c:\drive.

An example Log Memory Card Received window in the AQDB is provided as Figure 4-6.

The completed Visibility Monitoring Status/Assessment Sheet, which accompanies each mailed memory card is also reviewed by the data coordinator (see Section 4.2.2). Receipt of memory cards and status/assessment sheets are documented on the Master Log (see Section 4.2.3).

Site ID: _F7CO2_ Data Sequence # : _OO3_
Initials: _KKF_   Memory Card ID # : _FS-128-OO9_
Shipment Tracking # : _8279 4190 3143_

REMOTE DIGITAL CAMERA SYSTEM
VISIBILITY MONITORING STATUS/ASSESSMENT SHEET

MEMORY CARD LOADED

Today's Date: _7/3/01_ Time: _17:10_

Yes	No	
☒	☐	PalmCam Remote program properly activated
☒	☐	Viewed Controller status:
☒	☐	PDA date/time matches controller date/time
☒	☐	Site status verified
		Enclosure temp (°F): _86.5_
		System battery voltage: _13.8_
☒	☐	Loaded memory card
☒	☐	Camera & solenoid bracket secured on tripod plate
☒	☐	Power cable jacks secure
☒	☐	Controller cable jacks secure
☒	☐	Camera cable jacks secure
☒	☐	TEST picture taken as expected
		camera image count = _1_
☒	☐	Camera alignment verified
☒	☐	PDA power turned off
☒	☐	Enclosure door locked and
		door seal clamps tightened

MEMORY CARD REMOVED

Today's Date: _7/17/01_ Time: _16:08_

Yes	No	
☒	☐	System found in proper condition
☒	☐	PalmCam Remote program properly activated
☒	☐	Viewed Controller status:
☒	☐	PDA date/time matches controller date/time
☒	☐	Site status verified
		Enclosure temp (°F): _88_
		System Battery Voltage: _14.1_
☒	☐	Images collected as expected,
		controller exposure count = _40_
☒	☐	Power, controller, camera jacks secure
☒	☐	Camera & solenoid bracket removed from tripod plate
☒	☐	Exchanged memory card
☒	☐	Memory card pouch properly labeled
☒	☐	Memory card and assessment sheet shipped
		(denote shipment tracking # above)

13 days X 3 = 39
1 test shot

DESCRIBE WEATHER AND VISIBILITY CONDITIONS for the duration of the monitoring period:

Daily afternoon thunderstorms. Hot

Current % Cloud Cover _10%_   Ambient Temperature °F _86_ _94_ _50_
                                                      Now Max Min

COMMENTS/ACTION TAKEN

Exchanged PDA batteries on 7/17/01
Checked all other batteries - they are fine.
Took test photo on 7/3/01 @ 17:15.

SUPPLIES NEEDED

None at this time.

Ship white copy and memory card to:

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

Figure 4-4. Example Remote Digital Camera System Visibility Monitoring Status/Assessment
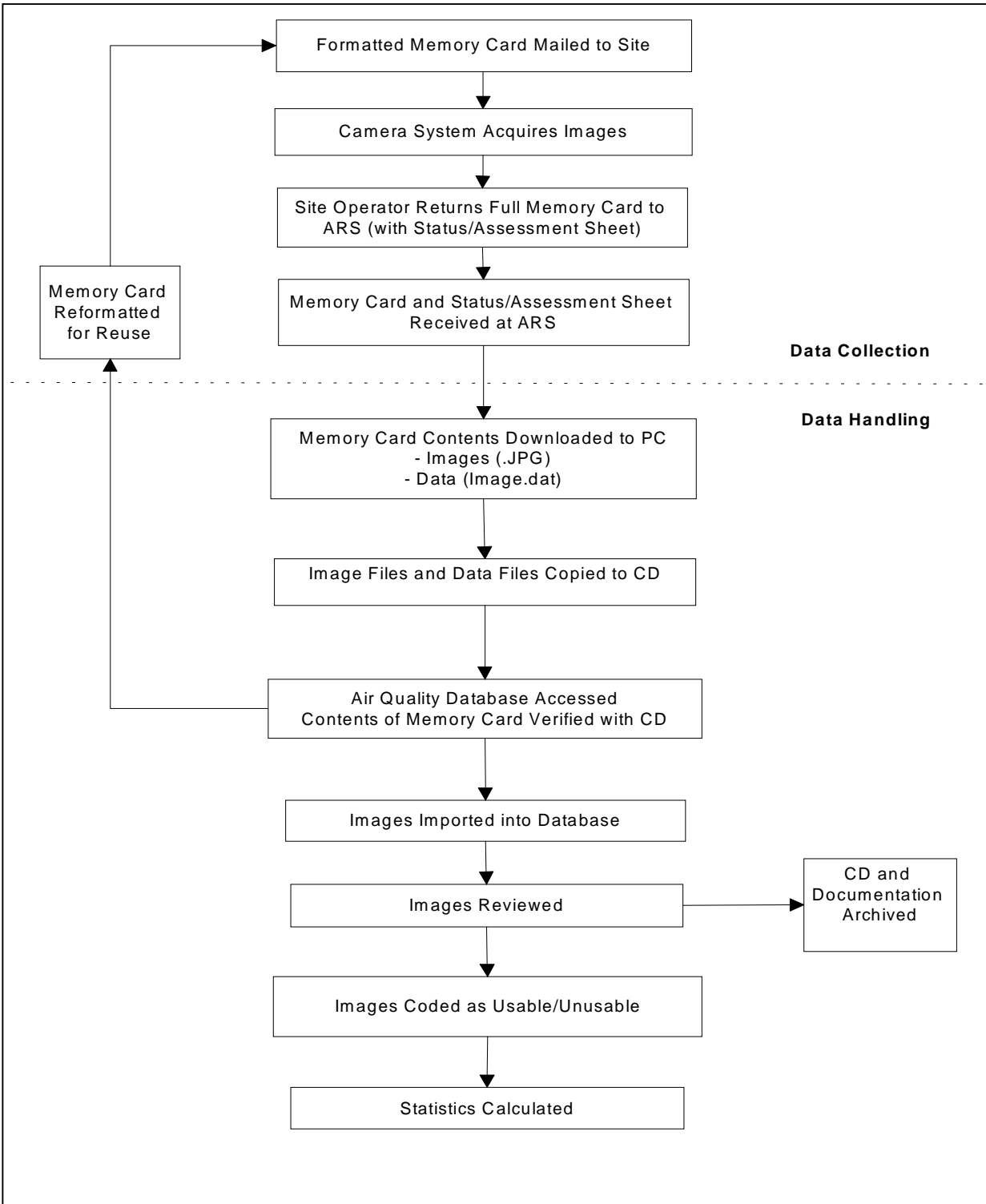Sheet for the Remote High-Resolution Digital Camera System (RDCS-100).

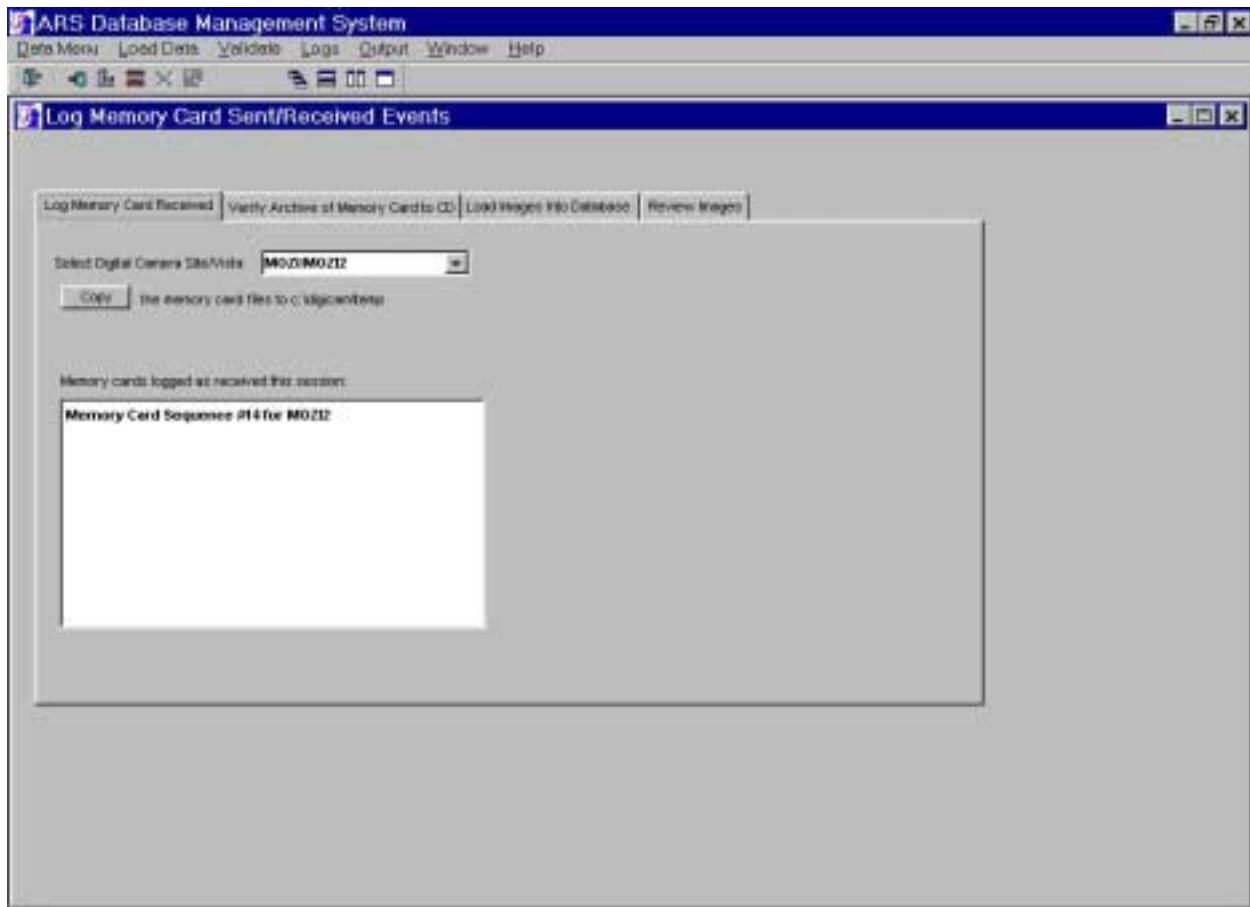Figure 4-5. Flowchart of the Image Collection and Handling Procedures.

Figure 4-6. Log Memory Card Received Screen in the AQDB.

4.2.2   Visibility Monitoring Status/Assessment Sheet Review

The Visibility Monitoring Status/Assessment Sheet is thoroughly reviewed by the ARS data coordinator to verify proper camera operations and note any weather anomalies or requested operational supplies. Any discrepancies are documented by site and memory card number on the Master Log and corrective action is initiated. Any requested monitoring supplies or photographic components are shipped within 24 hours, provided sufficient backup equipment/supplies are available.

4.2.3   Master Log Completion

Completion of the Master Log is essential to ensure quality image documentation. Information recorded on the Master Log is partially derived from site operator documentation; the remainder of the information is recorded for tracking purposes during image handling. An example Master Log is provided as Figure 4-7. The following information is entered on the Master Log:

DIGITAL MASTER LOG

WINTER _____

SPRING _____

SUMMER _____

FALL _____

CONTACTS

_____

Location _____

Year _____

_____

CARD	LOG	Date Log	Time Log	# Pos.	# Rec.	# Good	Correspondence / Equipment Change	Problems/Events	Card Rec.	Data Arv.	Sup. Mail

N:\Project\ARS\FORMS\CAMERA\DIGITAL MASTER LOG.doc

Figure 4-7. Example Master Log.

- Season

- Site name and abbreviation

- Year

- Contact persons (site operators)

- CARD - Consecutive, chronological memory card number by site

- LOG - *Yes* if a status/assessment sheet was completed and accompanies the memory card, *no* if a status/assessment sheet was not sent with the memory card

- DATE LOG - The beginning and ending dates of the images contained on the memory card, as noted by the site operator on the status/assessment sheet and verified by review of the images

- TIME LOG - The beginning and ending times of the images contained on the memory card, as noted by the site operator on the status/assessment sheet and verified by the review of the images

- # POS - Number of images possible on the memory card, noted by the on/off dates and times the site operator recorded on the status/assessment sheet

- # REC - The actual number of images taken, recorded after review and validation of the memory card

- # GOOD - The actual number of images that are usable for qualitative analysis

- CORRESPONDENCE/EQUIPMENT CHANGE - Notation and description of correspondence or communication pertaining to each specific memory card, the type and date of replacement equipment changes or modifications

- PROBLEMS/EVENTS - Notation and description of problems or events pertaining to each specific memory card

- CARD REC – The date the memory card was received at ARS

- DATA ARV – The date the image data were archived

- SUP MAIL - A notation of the type, volume, and date monitoring supplies were sent to the site, if applicable

The data coordinator verifies that all Master Log documentation is complete and accurate. Master Logs and any accompanying documentation are chronologically stored in 3-ring notebooks by site.

4.2.4   Image and Data Verification

After the image and data files are extracted from the memory card and placed on a PC, they are also written to a CD for archive. Refer to TI 4610-5040, *Digital Image Archives,* for archive procedures. The data coordinator accesses the AQDB and verifies the contents of the memory card with the contents of the CD archive, as follows:

- From the Load Data menu, select **Receive Memory Cards.**

- Select the **Verify Archive of Memory Card to CD** tab.

- In this window, click the **Read Card** button.

- Click the **Read CD** button to view contents of each medium in the windows provided.

- Click the **Verify Archive** button to verify that both collections of files are the same.

Figure 4-8 shows an example Verify Archive of Memory Card to CD screen.
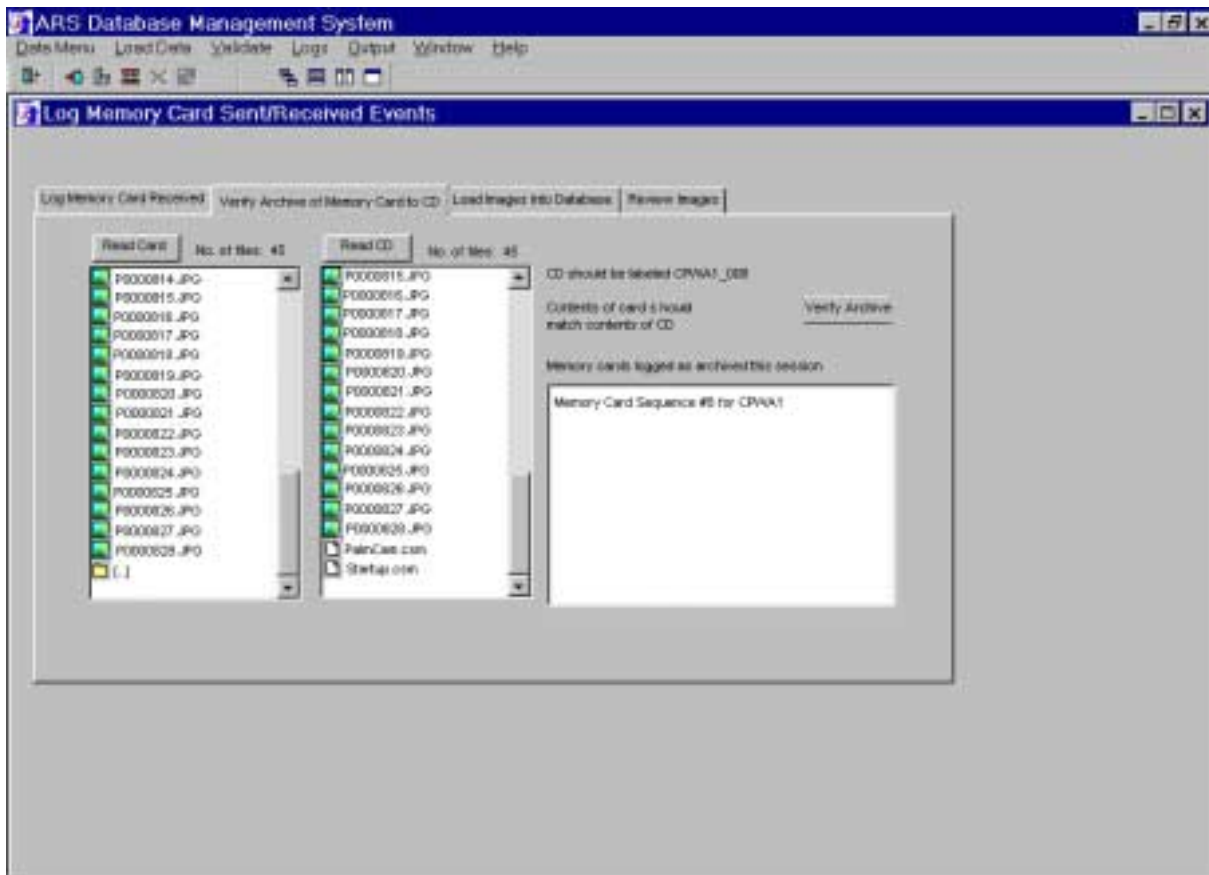

Figure 4-8.   Verify Archive of Memory Card to CD Screen in the AQDB.

4.2.5   Loading Files Into Database

After the archive has been verified, all images and data from the memory card are loaded into the AQDB as follows:

- From the Load Data menu, select **Receive Memory Cards.**

- Select the **Load Images Into Database** tab.
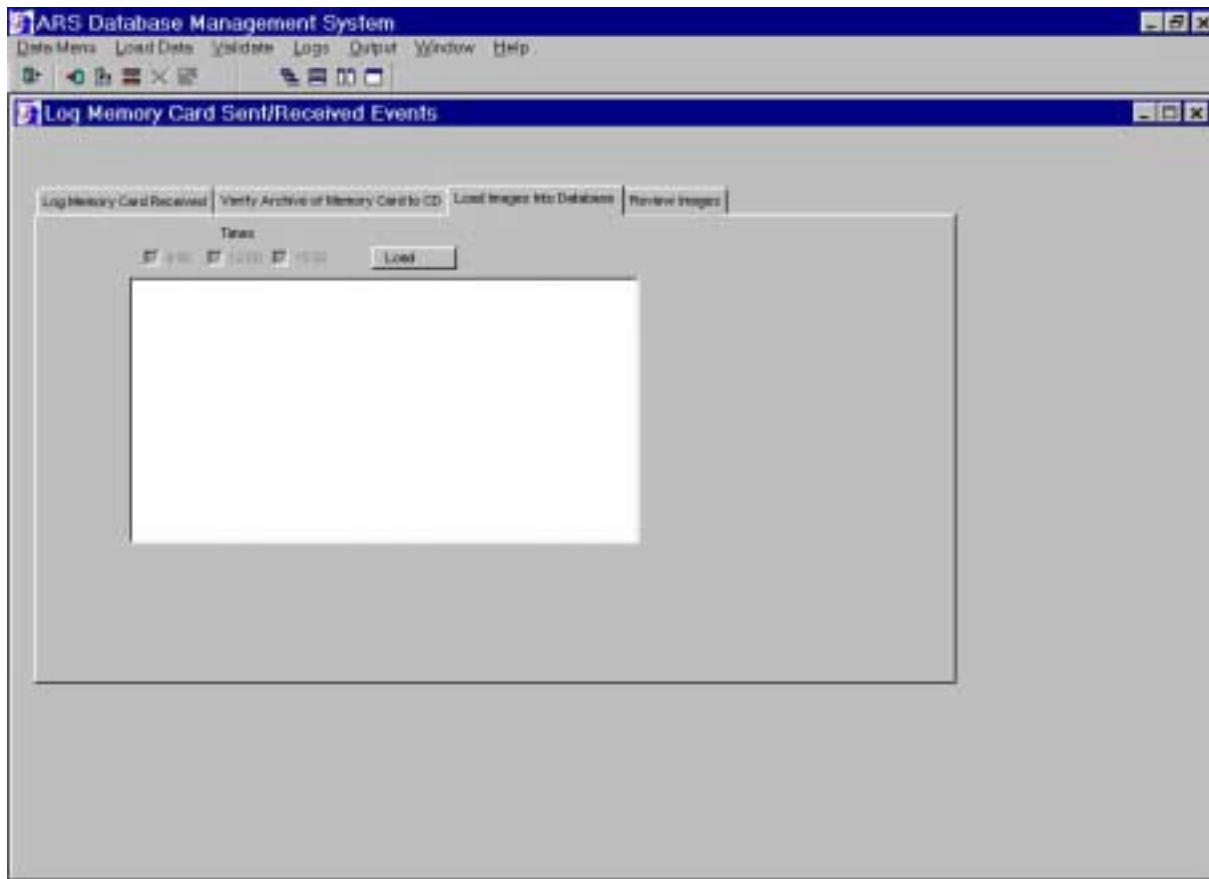
Figure 4-9 shows an example screen.

Figure 4-9. Load Images into Database Screen in the AQDB.

4.2.6   Image and Data Review

All operator documentation are thoroughly reviewed with the images. Specific procedures include:

- Reviewing operator comments and logged memory card loading and exchange dates.

- Reviewing logged memory card sequence number with AQDB sequence reference.

- Reviewing the *Image.dat* file (refer to Figure 4-2) to ensure the proper sequence of images was collected.

- Checking for the proper site abbreviation and zoom parameters.

- Reviewing all images for proper exposure, alignment, and zoom angle using image browsing software such as Kodak Shoebox, Thumbs Plus, or a customized image review database application.

- Databasing all associated image acquisition parameters with each image.

- Blank-filling data records that were skipped or missing.

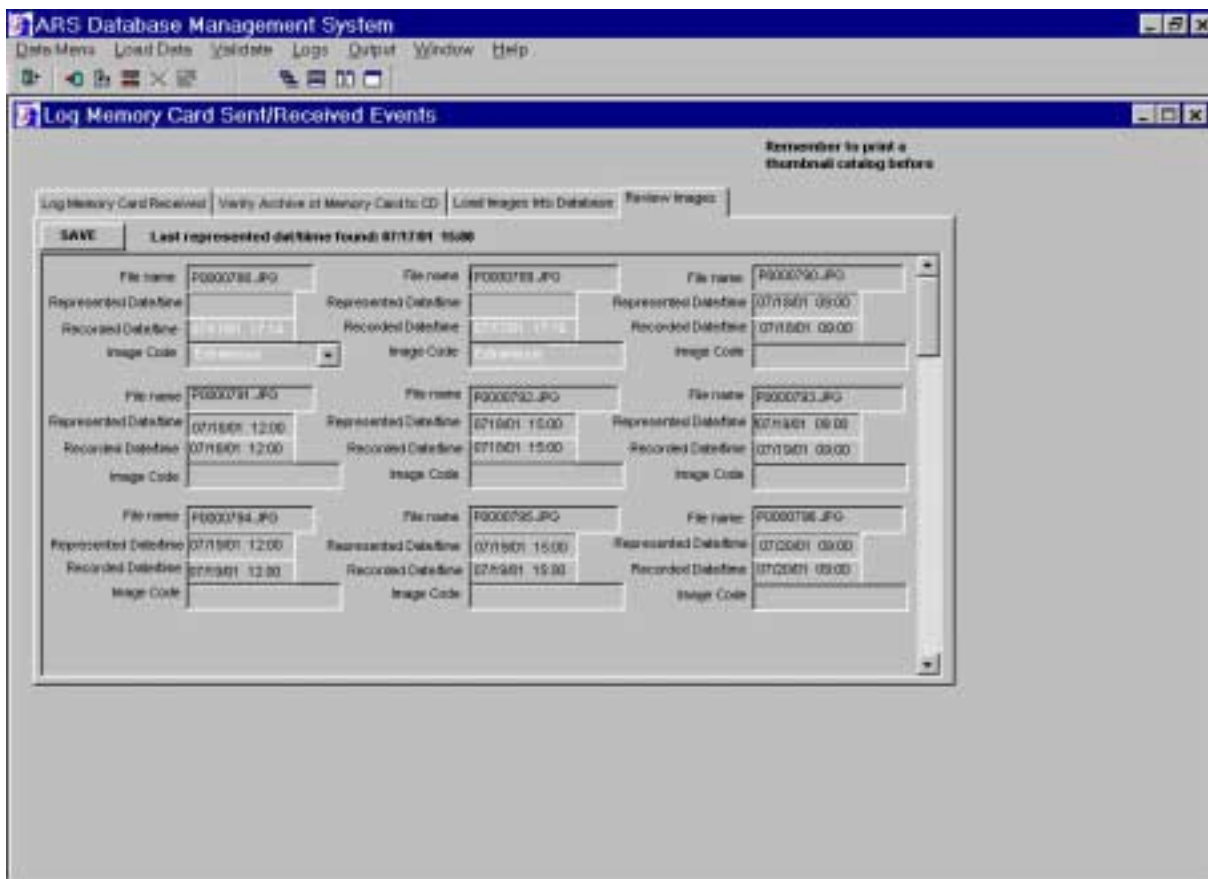Refer to Figure 4-10 for an example Review Images tab in the AQDB.

Figure 4-10. Review Images Screen in the AQDB.

Images are further reviewed by the data coordinator to verify that:

- The number of images corresponds to the data collection period noted on the memory card pouch label.

- Date and time are correct.

- The vista alignment is correct.

- The vista focus is correct.

- No exposure inconsistencies exist.

- The temperature and battery voltage is adequate.

After verification that all information has been correctly documented, the data coordinator then creates a catalog of the memory card's contents (see Figure 4-11). The thumbnail catalog is printed out on a laserjet printer for archive with the CD. A copy of the Image.dat file, and the status/assessment sheet are also included for archive.
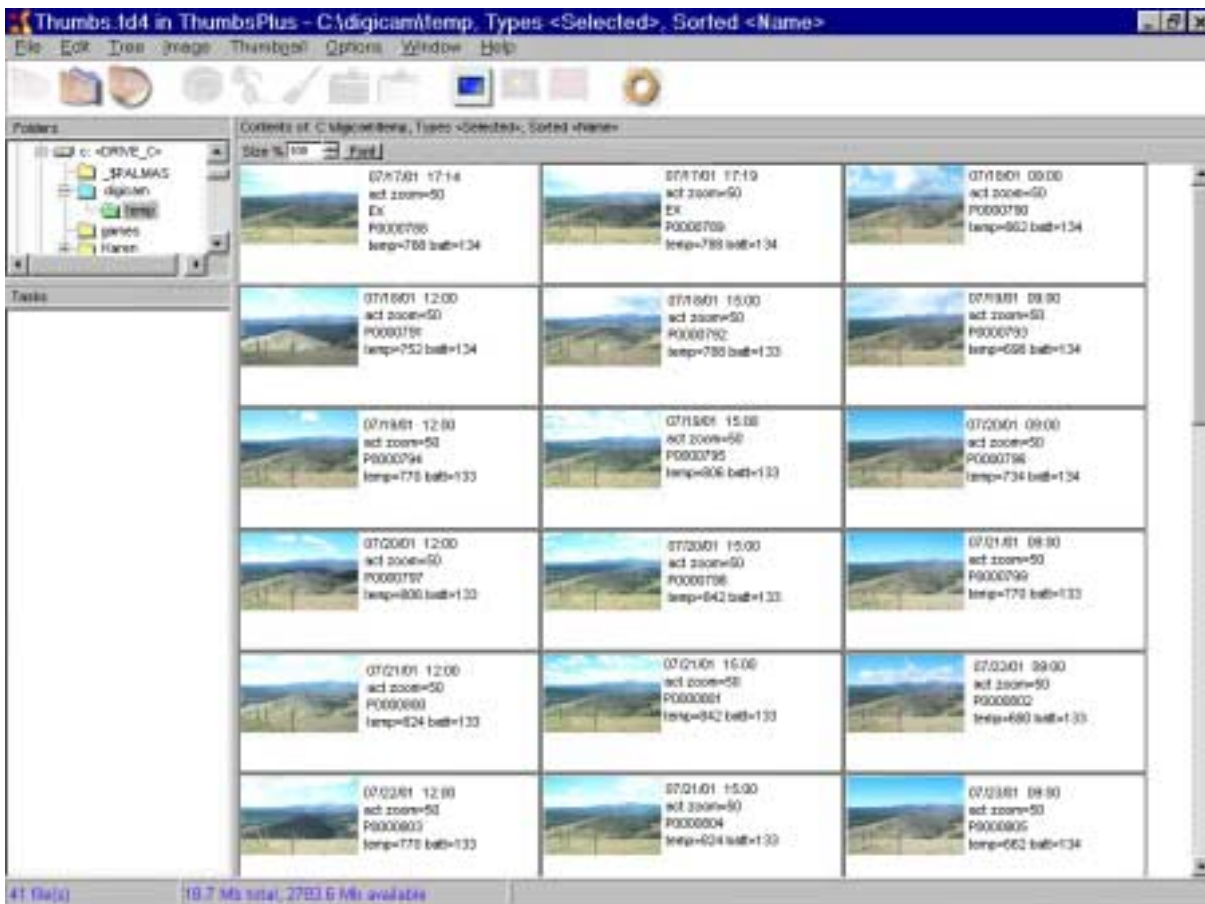

Figure 4-11. Example Catalog Printout of Memory Card Contents.

All images are visually reviewed on the PC and are considered usable (good) for further qualitative analyses, except for:

- Supplemental visibility images.

- Out-of-alignment images (e.g., the target is not in the view).

- Extremely under- or overexposed images.

- Out-of-focus images; distinct features cannot be identified.

- Images taken through a fogged or icy enclosure window.

Any discrepancies found are documented by memory card number on the Master Log and corrective action is initiated by the data coordinator. (Refer to TI 4120-3900, *Emergency Maintenance and Troubleshooting Procedures for the Remote High-Resolution Digital Camera System (RDCS-100)*). Any problems or interesting events observed on the images are reviewed with the project manager.

4.2.5   Final Collection and Data Recovery Statistics

Master Logs are completed and verified by the data coordinator at the end of each season to summarize the data collected at each site and to thoroughly document data recovery and observed equipment operation discrepancies, as well as actions taken to resolve such discrepancies. The completed Master Logs reflect final collection statistics for the period.

Data recovery statistics are compiled seasonally by the data coordinator. The primary data collection statistic calculated is:

% Overall Data Recovery = (# REC / # POS)

Completed Master Logs are stored chronologically by site in 3-ring notebooks.