

Instructions for Sending Camera Systems to the USGS EROS Data Center:

If your camera system has been approved for calibration, please follow the steps below to ship your camera system to the USGS EROS for characterization.

To schedule your camera system or if there are any questions on the instructions or inventory checklist, please contact:

Greg Stensaas at (605) 594-2569 (stensaas@usgs.gov) or
Jon Christopherson at (605) 594-2563 (jonchris@usgs.gov).

Items to Send:

Please see the list in **Attachment A** describing what items are required to be delivered to the USGS EROS to successfully test your camera system.

Inventory Checklist:

Please complete the attached Digital Camera Shipping/Receiving Inventory Checklist in **Attachment B**, entering complete descriptions of all delivered items, serial numbers, and conditions. Once filled out, the inventory checklist must be sent to the USGS EROS along with your camera system. This sheet will be used to inventory the parts received and ensure that everything intended to be delivered was received and in proper condition. The system will then be tested using the Verification of Operational Camera System in **Attachment C**. The checklist will then be used by USGS EROS staff to verify that all components are being returned to the owner upon completion of testing. The owner may then use the list as a receiving checklist to verify a successful return of the camera system.

Packaging:

The camera system must be delivered to the USGS in reusable container(s) and packaging. It is the USGS intent to use the same shipping container and material to return the camera in which it is delivered.

Delivery:

The USGS EDC delivery address is:

**USGS EROS Data Center
Attn: Digital Camera Lab (Stensaas)
47914 252nd St.
Sioux Falls, SD 57198-0001
(605) 594-2569**

Please insure all systems for their full value, as the USGS cannot be responsible for any items received damaged.

Return Delivery:

The USGS will return the camera system to the owner via ground delivery courier (UPS, FedEx, etc.). To ensure that the camera system is successfully returned, **the Camera Owner must furnish:**

1. A return authorization prepaid shipping label (including the cost of replacement insurance).
2. A contact telephone number.

An informal calibration report will also be sent. A sample report is shown in **Attachment D**.

Attachment (A):

Items Required to be Delivered to the USGS Camera Lab

The USGS EROS Digital Camera Characterization/Calibration Lab must have the following items to test you camera/lens combination:

1. Camera Body, and
(see next)
2. Camera Lens
The camera body and lens should be delivered as a mated pair. Additional lenses can be sent if prior approval is received from the USGS. Your camera/lens system will be returned in the same configuration from the USGS.
3. Digital back (if applicable)
As above, cameras equipped with a digital “back” should be delivered with it already affixed. It is recommended that the back be stabilized since a valid calibration cannot be attained if there is any movement. Removal or replacement of any item in the optical chain between the front lens element and the final detector array can significantly impact the camera characterization and the ability to properly calibrate the data generated by it.
4. Camera software supplied with camera.
Please send any software required to control the camera or download images from the camera system you are delivering. Additionally, if the images from the camera are in any non-standard or proprietary format, please provide the software or tools required to convert them to standard TIFF files.
5. Cables to transfer data from camera to Computer.
This includes any required USB, Firewire, proprietary, etc. cables and/or connectors necessary to retrieve images from the camera.
6. Flash attachment for camera
If the camera you are delivering does not have a flash assembly, please include instructions and any needed hardware for attaching a flash to the system (if possible). If instructions for doing this are in the provided owners/users manual that is sufficient.
7. Camera battery and charger
This is very important. The characterization process requires several hours of operation time for the camera system.
8. Flash attachment batteries and charger
Again, applicable only if the camera is being delivered with a flash unit.
9. Owner’s Manual/User’s Manual/Instructions:
Please include with the camera system the instructions on how to operate the system. For commercial, off-the-shelf systems this can be the owner’s/user’s manual. For custom or other special camera systems please provide detailed written instructions on the operation of the camera system and retrieval of images from it, and any other special handling required by the system. This includes any special notes on the configuration of the delivered system and special system handling or operating instructions.
10. Shipping List with Detailed Inventory:
Please fill out the attached form with detailed descriptions and serial numbers of all equipment included in the camera system being delivered to the USGS/EDC. All supporting equipment should also be listed. This list will serve as a shipping inventory and receipt checklist for both the Vendor-EROS shipping and the EROS-Vendor shipping.

Attachment (B):

**Digital Camera System
Shipping / Receiving Inventory Checklist**

Aerial Camera Firm: _____

Ref. Agreement: _____

USGS Shipping Address:

Vendor Return Address:

**USGS Center for EROS
47914 252nd St.
Sioux Falls, SD 57198-0001**

Tele: (605)594-2569

Equipment Delivery Checklist: (attach additional sheets as necessary)

Item	Description, Serial No. (if any), and Condition	Ship to EROS	EROS Rec'g	Ship to Vendor	Vendor Rec'g
Camera body					
Lens					
Digital Back					
Filters					
Camera Battery(ies)					
Power Supply/Charger					
Storage Media/Devices					
Owner's/Operator's Manuals					
Software					
Other Removable Devices					
Cables					
Other/Misc					

Attachment (C):

Below is a copy of the tests USGS staff will perform upon receipt of the camera to ensure that the camera works properly upon shipment. This is NOT the full characterization testing that will be performed in the camera, simply quick tests intended to verify that the camera is in working order and not damaged during shipment. If there are any special handling requirements or testing needs upon receipt please annotate them on this sheet or provide a written description of the tests needed and attach it to the Inventory Checklist that is delivered with the camera. USGS EROS Verification of Operational Camera System

**USGS Center for EROS
Verification of Operational Camera System**

DATE: _____

TECHNICIAN: _____

SOFTWARE INSTALLATION: Y/N_____

COMMENTS

DATA TRANSFER METHOD: (Y/N) _____

METHOD TYPE (cable/ memory card) _____

COMMENTS

CAMERA OPERATION: (Y/N) _____

COMMENTS

IMAGE TRANSFER TO MAIN COMPUTER: (Y/N) _____

COMMENTS

Attachment D

USGS/EROS REPORT OF CAMERA CALIBRATION 23 May 2005

Camera Description: Hasselblad w/Color back Zeiss Planar
Kodak DCSPROBackPlus 80mm lens
SN: DCSPB-1028 SN: 7277655

Sensor Size	Pixel Size (mm)
H 4072	0.009
V 4072	0.009

The calibration parameters for the above described camera system were derived from the parameters generated by the Australis software system with some modified by the USGS SMAC software system (Visit <http://calval.cr.usgs.gov/osl/smaccompen.pdf> for SMAC math model). Nine exposures were taken of a calibration cage, 203 points on the cage were measured, and Australis computed a set of calibration parameters. The SMAC package was then used to compute an alternate set of symmetric radial distortion parameters such that the distortions were balanced about zero. This was accomplished by adjusting the Australis derived focal length. If the balanced focal length is used, then the balanced coefficients must also be used (these parameters are designated with a prime symbol).

Description of Parameters

- C : Equivalent Focal Length
- (Xp,Yp) : Principal Point Offset
- (K1,K2,K3) : Symmetric Radial Distortion Coefficients
- (P1,P2) : Decentering Distortion Coefficients
- C' : Calibrated (Balanced) Focal Length
- (K'0,...,K'4) : Balanced Symmetric Radial Distortion Coefficients

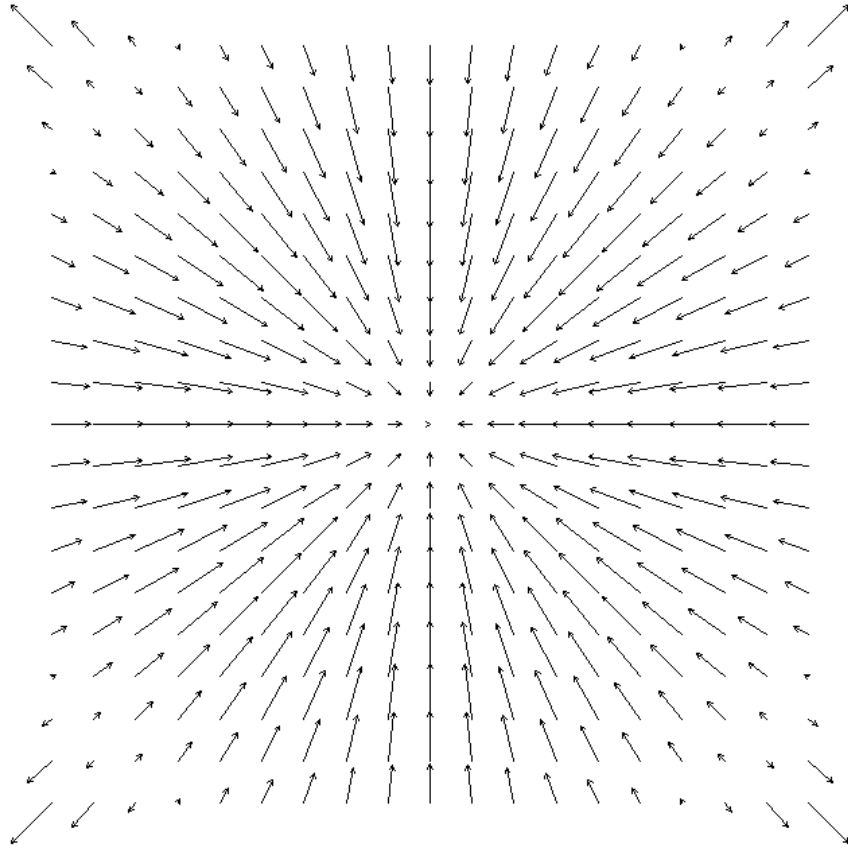
Parameter	Final Value	Std. Error	Source
C	80.6074 (mm)	2.350E-004	Australis
XP	-0.2695 (mm)	4.453E-003	Australis
YP	0.1478 (mm)	4.593E-003	Australis
K1	1.08515E-005	1.540E-007	Australis
K2	-1.71576E-009	5.741E-010	Australis
K3	8.12154E-013	6.496E-013	Australis
P1	-1.38387E-006	2.524E-007	Australis
P2	5.50028E-007	2.679E-007	Australis
C'	80.2255 (mm)		SMAC
K'0	-4.73717600E-003		SMAC
K'1	1.08000950E-005		SMAC
K'2	-1.70763215E-009		SMAC
K'3	8.08306709E-013		SMAC
K'4	0.00000000E+000		SMAC

Maximum Observational Radial Distance Encountered: 25.1 mm

This calibration is valid only to this radial limit. Any information extracted beyond this limit may not be accurately portrayed. A radial distance is defined as the length of a line from the optical center of the sensor (XP, YP) to the point of interest.

Hasselblad_80mm_7277655

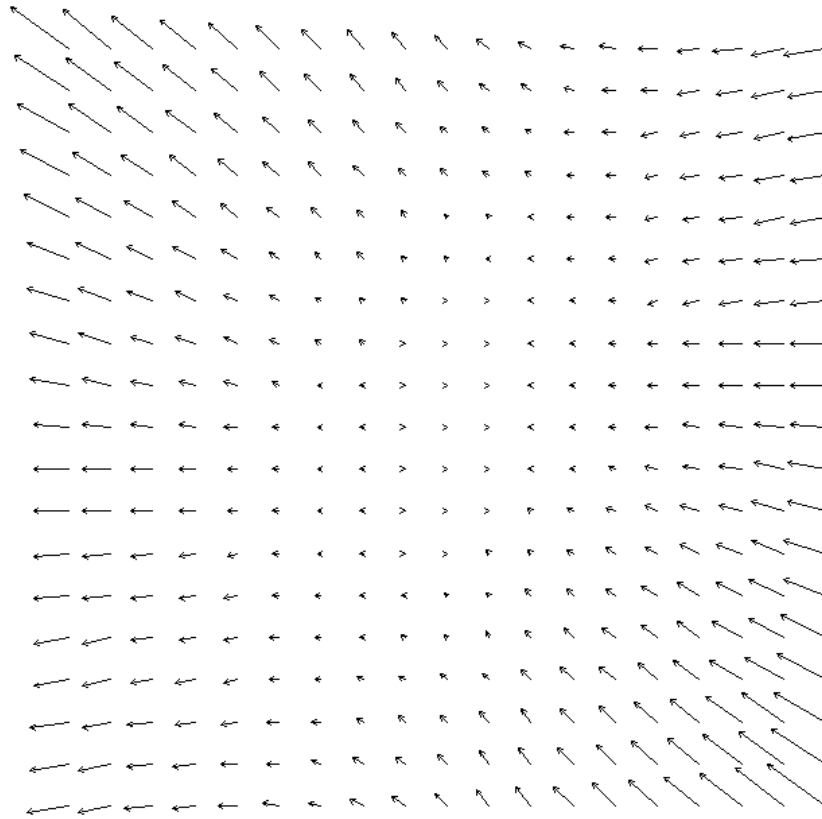
→ (45 Microns)



Radial Distortion

Hasselblad_80mm_7277655

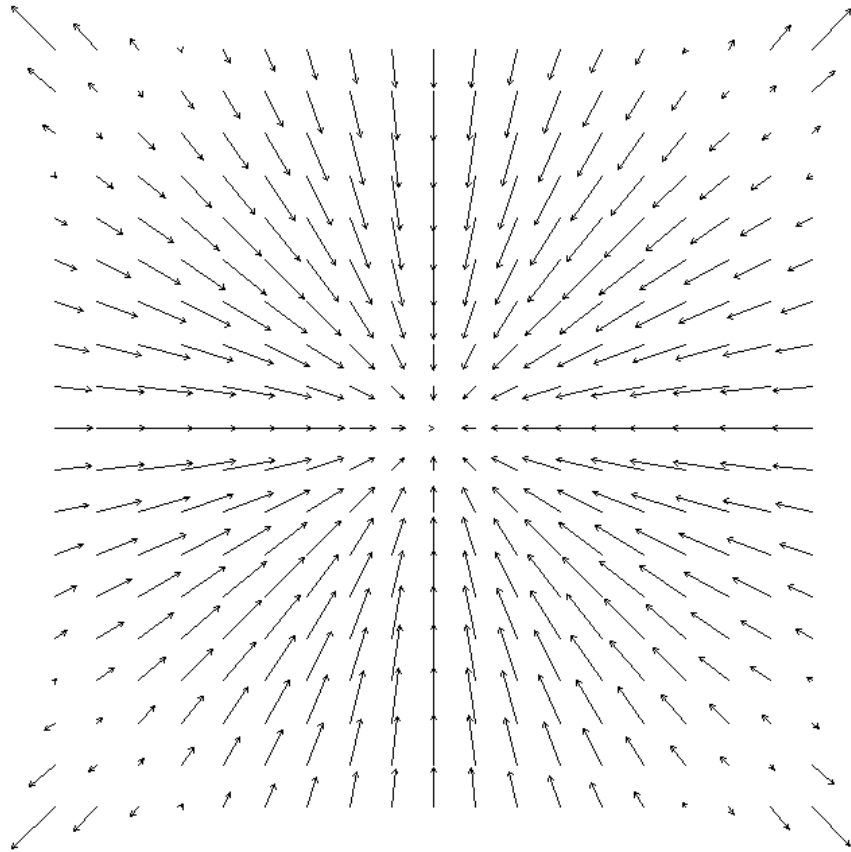
→ (2 Microns)



Alternate Scale Decentering Distortion

Hasselblad_80mm_7277655

→ (45 Microns)



Total Distortion