



United States Department of the Interior



GEOLOGICAL SURVEY
RESTON, VA 22092

REPORT OF CALIBRATION
of Aerial Mapping Camera

August 20, 1992

Camera type: Wild RC8
Lens type: Universal Aviogon
Nominal focal length: 153 mm

Camera serial No.: 905
Lens serial No.: UAg 362
Maximum aperture: f/5.6
Test aperture: f/5.6

Submitted by: G.R.W. Aerial Surveys
Lexington, Kentucky

Reference: G.R.W. Aerial Surveys purchase order
No. 10539, dated August 12, 1992.

These measurements were made on Kodak Micro-flat glass plates, 0.25 inch thick, with spectroscopic emulsion type 157-01 Panchromatic, developed in D-19 at 68° F for 3 minutes with continuous agitation. These photographic plates were exposed on a multicollimator camera calibrator using a white light source rated at approximately 5200K.

I. Calibrated Focal Length: 152.557 mm

This measurement is considered accurate within 0.005 mm

II. Radial Distortion

Field angle	\bar{D}_c	D_c for azimuth angle			
		0° A-C	90° A-D	180° B-D	270° B-C
degrees	um	um	um	um	um
7.5	5	6	5	5	6
15	7	8	6	8	8
22.7	4	5	4	4	4
30	0	-1	0	-1	0
35	-4	-4	-3	-5	-3
40	-1	-4	1	-3	1

The radial distortion is measured for each of four radii of the focal plane separated by 90° in azimuth. To minimize plotting error due to distortion, a full least-squares solution is used to determine the calibrated focal length. \bar{D}_c is the average distortion for a given field angle. Values of distortion D_c based on the calibrated focal length referred to the calibrated principal point (point of symmetry) are listed for azimuths 0°, 90°, 180° and 270°. The radial distortion is given in micrometers and indicates the radial displacement away from the center of the field. These measurements are considered accurate within 5 um.

III. Resolving Power in cycles/mm

Area-weighted average resolution: 60

Field angle:	0°	7.5°	15°	22.7°	30°	35°	40°
Radial lines	67	67	113	67	95	67	14
Tangential lines	67	57	48	48	57	67	34

The resolving power is obtained by photographing a series of test bars and examining the resultant image with appropriate magnification to find the spatial frequency of the finest pattern in which the bars can be counted with reasonable confidence. The series of patterns has spatial frequencies from 5 to 268 cycles/mm in a geometric series having a ratio of the 4th root of 2. Radial lines are parallel to a radius from the center of the field, and tangential lines are perpendicular to a radius.

IV. Filter Parallelism

The two surfaces of the Wild 500 Pan No. 3606 and the Clear No. 3351 filters accompanying this camera are within 10 seconds of being parallel. The 500 filter was used for the calibration.

V. Shutter Calibration

<u>Indicated shutter speed</u>	<u>Effective shutter speed</u>	<u>Efficiency</u>
1/200	4.50 ms = 1/220 s	82%
1/400	2.38 ms = 1/420 s	82%
1/600	1.58 ms = 1/635 s	82%
1/700	1.33 ms = 1/750 s	82%

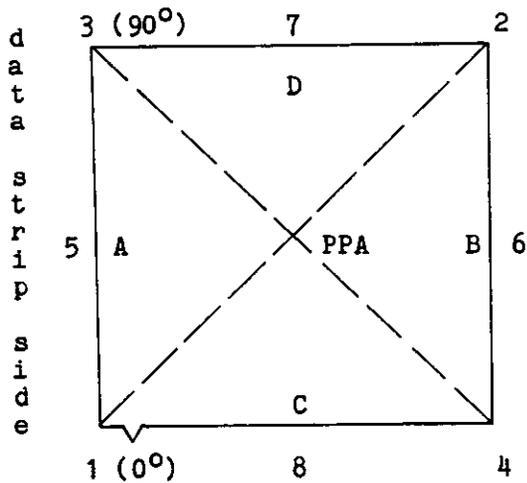
The effective shutter speeds were determined with the lens at aperture f/5.6. The method is considered accurate within 3 percent. The technique used is Method I described in American National Standard PH3.48-1972(R1978).

VI. Magazine Platen

The platen mounted in Wild RC8 film magazine No. 978 does not depart from a true plane by more than 13 um (0.0005 in).

The platen for this film magazine is equipped with an identification marker that will register "P25" in the data strip area for each exposure.

VII. Principal Points and Fiducial Coordinates



Positions of all points are referenced to the principal point of autocollimation (PPA) as origin. The diagram indicates the orientation of the reference points when the camera is viewed from the back, or a contact positive with the emulsion up. The data strip is to the left. To provide positive identification, a "V" notch orientation marker is located in the focal plane frame as shown.

	<u>X coordinate</u>	<u>Y coordinate</u>
Indicated principal point, corner fiducials	0.005 mm	-0.004 mm
Indicated principal point, midside fiducials	0.000	-0.009
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	-0.004	-0.001

Fiducial Marks

1	-105.988 mm	-105.999 mm
2	106.005	105.997
3	-105.995	105.989
4	106.006	-105.999
5	-109.999	-0.016
6	109.999	-0.002
7	0.000	109.983
8	0.000	-110.002

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2: 299.806 mm 3-4: 299.806 mm

Lines joining these markers intersect at an angle of 90° 00' 05"

Midside fiducials

5-6: 219.998 mm 7-8: 219.985 mm

Lines joining these markers intersect at an angle of 89° 59' 47"

Corner fiducials (perimeter)

1-3: 211.988 mm 2-3: 212.000 mm

1-4: 211.994 mm 2-4: 211.996 mm

The method of measuring these distances is considered accurate within 0.005 mm.

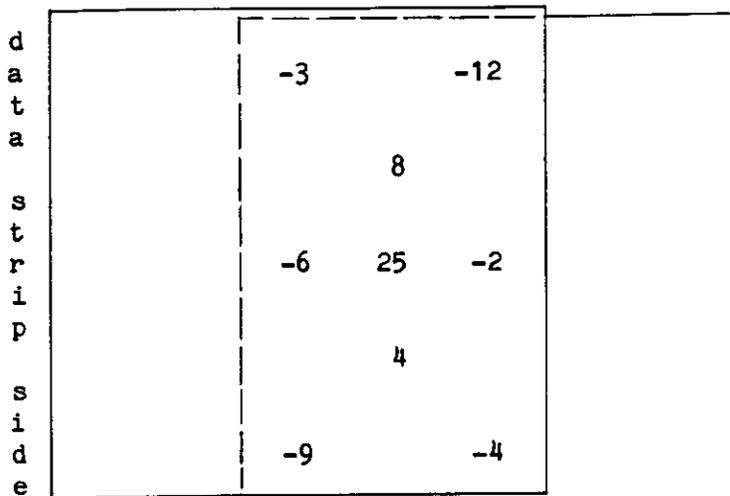
IX. Stereomodel Flatness

Magazine No.: 978

Base/Height ratio: 0.6

Platen ID: P25

Maximum angle of field tested: 40°



Stereomodel
Test point array
(values in micrometers)

The values shown on the diagram are the average departures from flatness (at negative scale) for two computer-simulated stereomodels based on comparator measurements on contact glass (Kodak Micro-flat) diapositives made from Kodak 2405 film exposures. These measurements are considered accurate within 5 μ m.

X. Resolving Power in cycles/mm

Area-weighted average resolution: 33

Film: Type 2405

Field angle:	0°	7.5°	15°	22.7°	30°	35°	40°
Radial lines	40	48	48	40	48	40	12
Tangential lines	40	40	28	28	28	34	24

This aerial mapping camera calibration report supersedes the previously issued USGS Report No. OSL/1457, dated June 19, 1989.

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