



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

REPORT OF CALIBRATION

January 29, 1979

of Aerial Mapping Camera

Camera type	<u>Wild Heerbrugg RC10</u>	Camera serial no.	<u>1321</u>
Lens type	<u>Wild Universal Avilogon</u>	Lens serial no.	<u>UAg 1027</u>
Nominal focal length	<u>153 mm</u>	Maximum aperture	<u>f/5.6</u>
		Test aperture	<u>f/5.6</u>

Submitted by
Robinson Aerial Surveys, Inc.
Newton, New Jersey 07860

Reference: Letter dated January 23, 1979 from Mr. H. David Hall

These measurements were made on Kodak micro flat glass plates, 0.25 inch thick with spectroscopic emulsion type V-F 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 3500K.

I. Calibrated Focal Length: 151.609 mm

This measurement is considered accurate within 0.005 mm

II. Radial Distortion:

Field angle (degrees)	D_c	D_c for azimuth angle			
		0° A-C	90° A-D	180° B-D	270° E-F
7.5	5	6	4	5	5
15	6	8	3	5	8
22.5	5	3	4	5	6
30	0	1	0	-2	1
35	-4	-4	-3	-5	-3
40	-2	-1	-2	0	-4

The radial distortion is measured for each of 4 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. 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 micrometres and indicates the radial displacement of the image from its ideal position for the calibrated focal length. A positive value indicates a displacement away from the center of the field. These measurements are considered accurate within 5 μ m.

III. Resolving power in cycles/mm Area-weighted average resolution 60.2

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Radial lines	95	95	95	67	80	67	14
Tangential lines	95	67	57	48	57	67	48

The resolving power is obtained by photographing a series of test bars and examining the resulting 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. 3702 and clear No. 3634 filters accompanying this camera are within ten seconds of being parallel. The 500 filter was used for the calibration.

V. Shutter Calibration

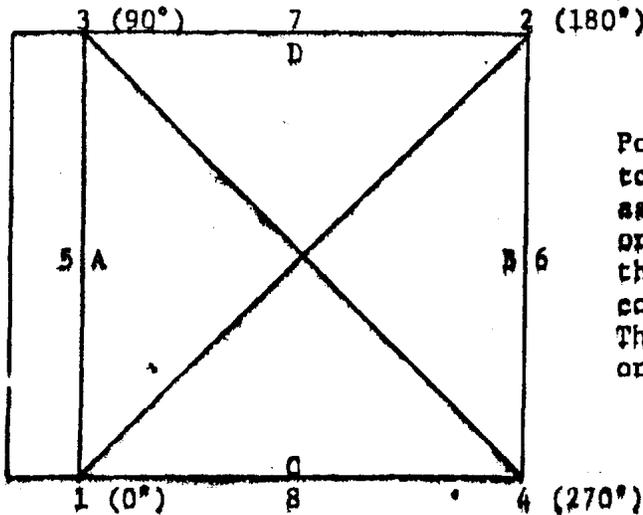
<u>Indicated shutter speed</u>	<u>Effective shutter speed</u>	<u>Efficiency</u>
1/200	4.75 ms = 1/210 s	76%
1/400	2.38 ms = 1/420 s	76%
1/600	1.58 ms = 1/630 s	76%
1/800	1.19 ms = 1/840 s	76%
1/1000	0.95 ms = 1/1050 s	76%

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

VI. Magazine Platen

The platen mounted in Wild RC10 film magazine No. 1321-41 does not depart from a true plane by more than 13 μm (0.0005 in). This camera is equipped with a platen identification marker that will register No. 41 in the data strip area for each exposure.

VII. Principal Point and Fiducial Coordinates



Positions of all points are referred to the principal point of autocollimation as origin. The diagram indicates the orientation of the reference points the camera is viewed from the back, contact positive with the emulsion. The direction-of-flight fiducial mark or data strip is to the left.

	<u>X coordinate</u>	<u>Y coordinate</u>
Indicated principal point, corner fiducials	0.000 mm	0.017 mm
Indicated principal point, midside fiducials	-0.001	0.015
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	0.005	0.000

Fiducial Marks

1
2
3
4
5
6
7
8

-106.001 mm	-105.984 mm
106.006	106.022
-105.995	106.013
105.999	-105.984
-110.003	0.002
109.992	0.028
0.001	110.013
-0.003	-109.981

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2 299.822 mm 3-4 299.806 mm

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

Midside fiducials

5-6 219.995 mm 7-8 219.994 mm

Lines joining these markers intersect at an angle of 89° 59' 32"

Corner fiducials (perimeter)

1-3 211.996 mm 2-3 212.001 mm

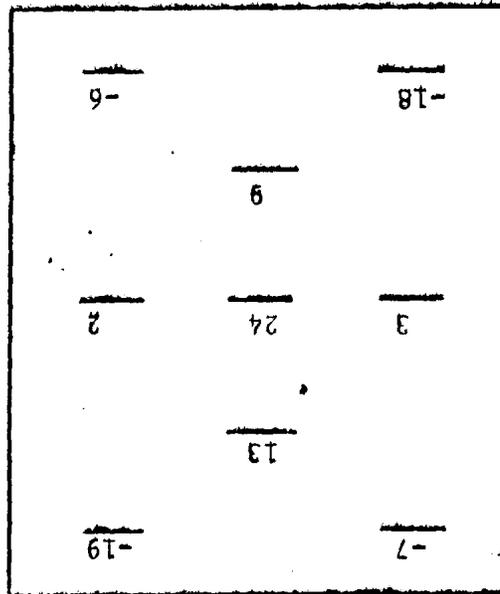
1-4 211.999 mm 2-4 212.006 mm

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

STEREOMODEL FLATNESS TEST AND FILM RESOLUTION

Camera No. 1321 Lens No. UAG 1027 Magazine No. 1321-41
 Focal length 151.609 mm Maximum angle of field tested 40°
 Base-height ratio 0.6 Accuracy of determination 5 μm
 Platen ID No. 41

Direction of flight

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.

Resolving Power, in cycles/mm
 Area-weighted average resolution 35.7
 Film: Type 2405

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Radial lines	48	48	48	40	48	40	14
Tangential lines	48	40	28	34	34	34	34

This report supersedes the previous calibration of this camera contained in USGS Report of Calibration No. RT-R/325, dated June 9, 1977.

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