



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

April 24, 1979

Form 9-1780
(Apr. 1973)

REPORT OF CALIBRATION

of Aerial Mapping Camera

Camera Type	<u>Wild Heerbrugg RC8</u>	Camera Serial No.	<u>341</u>
Lens Type	<u>Wild Aviogon</u>	Lens Serial No.	<u>Ag 83</u>
Nominal Focal Length	<u>153 mm</u>	Maximum Aperture	<u>f/5.6</u>
		Test Aperture	<u>f/5.6</u>

Submitted by
Keystone Aerial Surveys, Inc.
Philadelphia, Pennsylvania 19114

Reference: Keystone purchase order No. 0947, dated April 11, 1979

These measurements were made using Kodak Micro Flat Glass Plates, 0.25 inch thick with Spectroscopic emulsion type V-F Panchromatic, developed in D-19 at 68°F for three minutes, with continuous agitation. These photographic plates were exposed on a multicollimator camera calibrator using K-3 filters and an incandescent tungsten light source.

I. Calibrated Focal Length: 152.147 mm

This measurement is considered accurate within 0.005mm.

II. Radial Distortion:

Field Angle Degrees	\bar{D}_c μm	D_c for azimuth angle			
		0° A-C μm	90° A-D μm	180° B-D μm	270° B-C μm
7.5	5	6	3	4	5
15	5	7	4	4	7
22.5	4	4	3	5	5
30	0	1	0	-1	0
35	-4	-4	-4	-4	-3
40	-1	0	-1	1	-3

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, the calibrated focal length is derived to equalize the absolute values of the maximum positive and maximum negative distortions. \bar{D}_c is the average distortion for a given field angle. Values of distortion D_c based on the calibrated focal length are listed for azimuth angles 0, 90, 180, and 270 degrees. The radial distortion is given in micrometers 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 μm .

111. Resolving power in cycles/mm Area-weighted average resolution 69.0

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Radial lines	113	113	113	67	80	67	17
Tangential lines	113	95	80	67	80	67	40

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 450 Pan No. 341 Ag83 filter accompanying this camera are within ten seconds of being parallel. This filter was used for the calibration.

V. Shutter Calibration

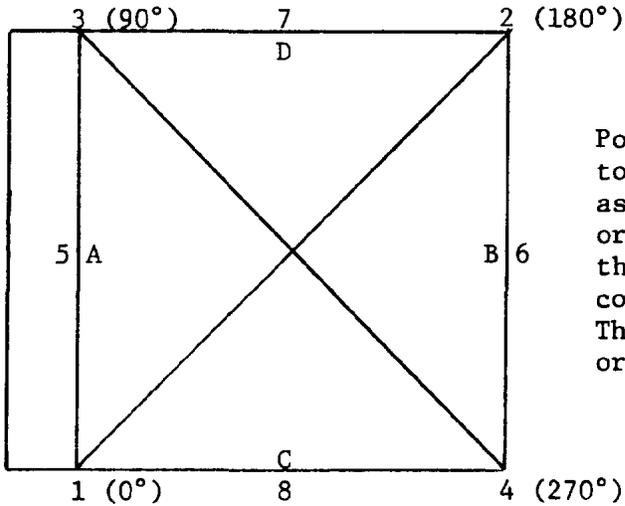
<u>Indicated shutter speed</u>	<u>Effective shutter speed</u>	<u>Efficiency</u>
Green	6.49 ms = 1/150 s	77%
Yellow	3.26 ms = 1/310 s	77%

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 RC5 film magazine No. 419 and 544 does not depart from a true plane by more than 13 μm (0.0005 in).

VII. Principal Point and Fiducial Coordinates



Positions of all points are referenced to the principal point of autocollimation 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 direction-of-flight fiducial marker or data strip is to the left.

	<u>X coordinate</u>	<u>Y coordinate</u>
Indicated principal point, corner fiducials	0.008 mm	-0.012 mm
Indicated principal point, midside fiducials	0.010	-0.006
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	0.002	0.000

Fiducial Marks

1	-105.983 mm	-106.002 mm
2	106.014	105.992
3	-105.990	105.986
4	105.998	-106.002
5	-109.994	-0.011
6	110.000	-0.001
7	0.014	109.980
8	0.007	-110.007

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2 299.808 mm 3-4 299.797 mm

Lines joining these markers intersect at an angle of 90° 00' 01"

Midside fiducials

5-6 219.995 mm 7-8 219.988 mm

Lines joining these markers intersect at an angle of 89° 59' 44"

Corner fiducials (perimeter)

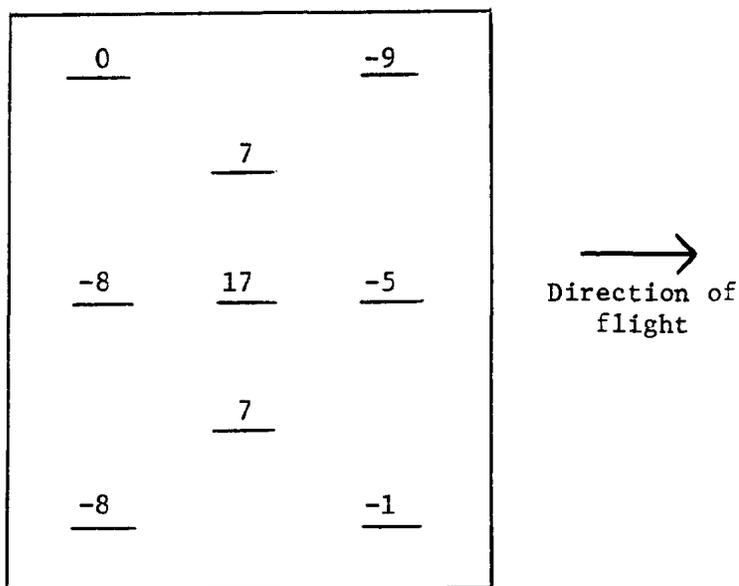
1-3 211.989 mm 2-3 212.004 mm

1-4 211.982 mm 2-4 211.995 mm

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

STEREOMODEL FLATNESS TEST AND FILM RESOLUTION

Camera No. 341 Lens No. Ag 83 Magazine No. 419
 Focal length 152.147 mm Maximum angle of field tested 40°
 Base-height ratio 0.6 Accuracy of determination 5 μm



Stereomodel
 Test point array
 (values in micrometres)

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.

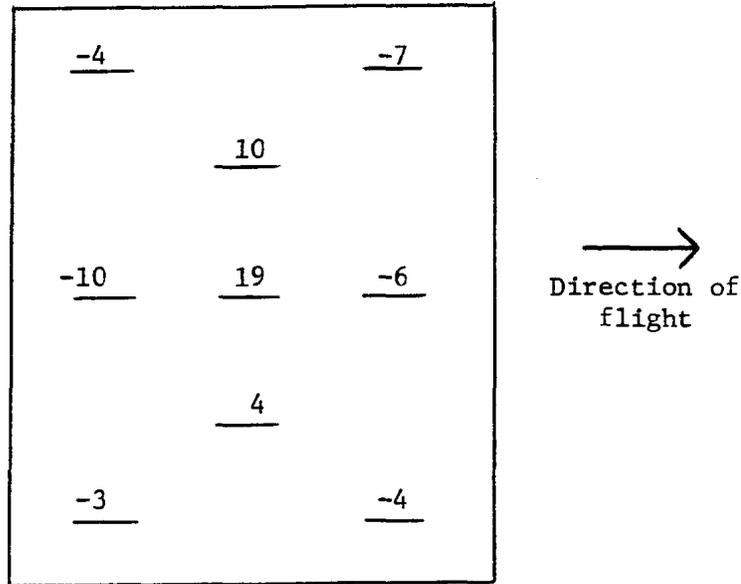
Resolving Power, in cycles/mm Area-weighted average resolution 40.8
 Film: Type 2405

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Radial lines	57	48	57	40	48	48	17
Tangential lines	57	48	48	40	40	40	28

William P. Tayman
 Branch of Research and Design
 Topographic Division

STEREOMODEL FLATNESS TEST AND FILM RESOLUTION

Camera No. 341 Lens No. Ag 83 Magazine No. 544
 Focal length 152.147 mm Maximum angle of field tested 40°
 Base-height ratio 0.6 Accuracy of determination 5 μm



Stereomodel
 Test point array
 (values in micrometres)

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 40.3
 Film: Type 2405

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Radial lines	57	48	57	40	48	48	17
Tangential lines	57	48	40	40	40	40	28

This report supersedes the previous calibration of this camera contained in USGS Report of Calibration No. RT-R/229, dated January 15, 1976.


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