



United States Department of the Interior

GEOLOGICAL SURVEY

April 18, 1975

Form 9-1780
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REPORT OF CALIBRATION

of Aerial Mapping Camera

Camera Type	<u>Wild Heerbrugg RC10</u>	Camera Serial No.	<u>1774</u>
Lens Type	<u>Wild Super-Aviogon</u>	Lens Serial No.	<u>SAG II 2004</u>
Nominal Focal Length	<u>88 mm</u>	Maximum Aperture	<u>f/5.6</u>
		Test Aperture	<u>f/8</u>

Submitted by
Aerial Photo & Survey Co.
Lake Forest, Illinois 60045

Reference: Letter dated March 29, 1975 from Mr. A. John Ortseifen

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 a white light source rated at approximately 3500°K.

I. Calibrated Focal Length: 88.13 mm

This measurement is considered accurate within 0.02 mm.

II. Radial Distortion:

Field Angle	D_c	D_c for azimuth angle			
		0° A-C	90° A-D	180° B-D	270° B-C
Degrees	μm	μm	μm	μm	μm
7.5	-2	-3	-1	0	-3
15	-6	-7	-4	-6	-7
22.5	-9	-8	-10	-8	-8
30	-11	-10	-11	-14	-10
35	-10	-11	-10	-12	-8
40	-5	-5	-3	-9	-3
45	2	0	5	0	3
50	12	14	11	10	11
54.5	6	1	10	8	4

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. 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 .

III. Tangential Distortion

Field Angle	22.5°	30°	35°	40°	45°	50°	54.5°
Displacement in μm	1	2	2	2	2	4	4

The values reported are displacements from the center image point of a straight line connecting corresponding image points at equal field angles along opposite radii of the focal plane. The method of measurement is considered accurate within 5 μm .

IV. Resolving Power, in cycles/mm Area Weighted Average Resolution 43.3

Field Angle:	0°	7.5°	15°	22.5°	30°	35°	40°	45°	50°	54.5°
Tangential lines	118	99	83	70	59	59	59	59	42	35
Radial lines	118	99	99	70	83	99	59	17	14	12

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 assurance. The series of patterns has spatial frequencies in a geometric series having a ratio of the fourth root of two. Tangential lines are those perpendicular to the radius from the center of the field. Radial lines are those lying parallel to the radius.

V. Principal Point of Autocollimation

The lines joining opposite pairs of collimation index markers intersect at an angle within 1 minute of 90° and their intersection indicates the location of the principal point of autocollimation within 0.03 mm. This condition is true for both the corner and mid-side fiducials.

VI. Collimation Marker Separation

A-B	220.006 mm	1-3	211.999 mm
C-D	220.009 mm	3-2	211.988 mm
1-2	299.819 mm	2-4	212.005 mm
3-4	299.808 mm	4-1	212.002 mm

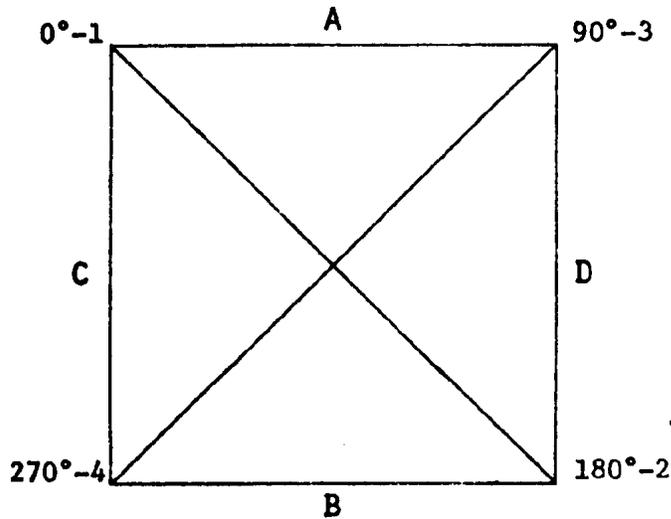
Markers A and B lie in the line of flight. The method of measuring these separations is considered accurate within 0.005 mm.

VII. Filter Parallelism

The two surfaces of the 500 Pan No. 3416 and 700 Infra No. 3535 filters accompanying this camera are within ten seconds of being parallel. The 500 filter was used for the calibration.

VIII. Magazine Platen

The platen mounted in Wild RC10 film magazine, No. 1774-136 does not depart from a true plane by more than 13 micrometers (0.0005 inch).



The diagram indicates the orientation of the reference points when the camera is viewed from the back. The direction of flight fiducial marker or data strip is at the top.

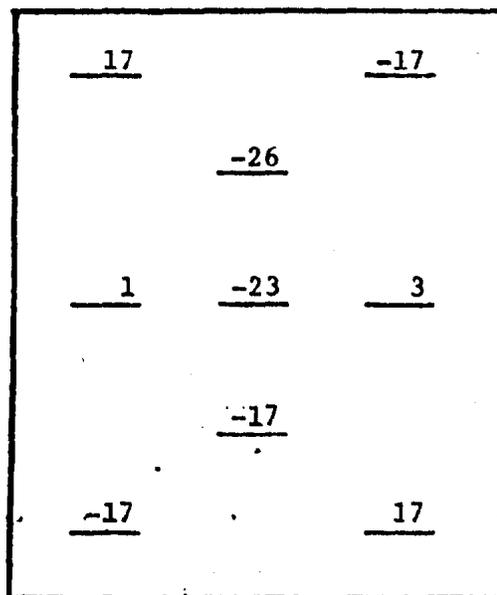
IX. Shutter Calibration

<u>Indicated Shutter Settings</u>	<u>Effective Shutter Speeds</u>	<u>Efficiency</u>
1/200	5.0 ms = 1/200 s	80%
1/400	2.5 ms = 1/400 s	80%
1/600	1.6 ms = 1/625 s	80%
1/800	1.2 ms = 1/835 s	80%
1/1000	1.0 ms = 1/1025 s	78%

The effective shutter speeds were determined with the lens at aperture f/8. The method is considered accurate within 3%. The technique used was Method I described in American National Standard PH3.48-1972.

STEREOMODEL FLATNESS TEST AND FILM RESOLUTION

Camera No. 1774 Lens No. SAG II 2004 Magazine No. 1774-136
 Focal Length 88.13 mm Maximum Angle of Field Tested 54°
 Base-height Ratio 1.0 Accuracy of Determination 5 μm



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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 29.3
 Film: Type 2405

Field Angle:	0°	7.5°	15°	22.5°	30°	35°	40°	45°	50°	54.5°
Tangential lines	70	59	49	42	35	35	35	42	30	24
Radial lines	70	59	59	49	59	49	35	17	12	12

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