United States Department of the Interior

GEOLOGICAL SURVEY
October 9, 1973

Form 9-1780
(Rev. Aug. 1973)

REPORT OF CALIBRATION

of Aerial Mapping Camera

Camera Type Wild Heerburg RC10   Camera Serial No. 1384
Lens Type   Wild Universal Aviogon   Lens Serial No. UAg II 3026
Nominal Focal Length 6 inches   Maximum Aperture f/4
                                             Test Aperture f/8

Submitted by
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Moffett Field, California 94035

Reference: Telephone conversation of October 1, 1973 with Mr. E. G. Frey
            Airborn Science, Ames Research Center

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: 153.05 mm

This measurement is considered accurate within 0.0 2 mm.

II. Radial Distortion:

D_c for azimuth angle

Field Angle	D_c	0° A-C	90° A-D	180° B-D	270° B-C
Degrees	µm	µm	µm	µm	µm
7.5	0	1	0	1	-1
15	1	2	1	0	0
22.5	2	5	1	3	-1
30	4	7	2	5	-1
35	1	5	3	0	-2
40	-3	1	-2	-5	-7
45	*	*	*	*	*

*Fiducial marks in the corners prevented measurements at 45°

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 maxi-
mum 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°
Displacement in μm	1	2	2	2

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 65.1.

Field Angle:	0°	7.5°	15°	22.5°	30°	35°	40°
Tangential lines	113	113	67	57	67	67	48
Radial lines	113	113	95	67	95	80	14

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

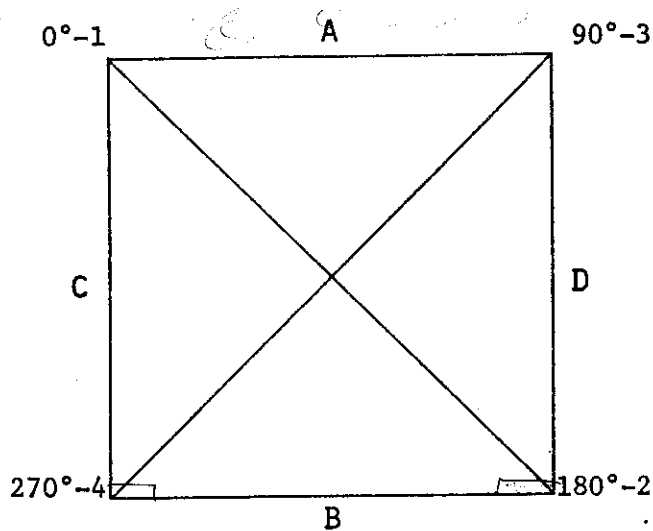|				
A-B	219.981 mm		1-3	212.004 mm
C-D	220.004 mm		3-2	212.011 mm
1-2	299.816 mm		2-4	212.001 mm
3-4	299.830 mm		4-1	212.010 mm

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 Wild 500 Pan No. 3863 filter accompanying this camera are within ten seconds of being parallel. This filter was used for the calibration.

VIII. Magazine Platen

The platen mounted in   Wild RC10   film magazine, No. 1384-64 does not depart from a true plane by more than 13 micrometers (0.0005 inch).

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        0°-1              A              90°-3


        C                               D


        270°-4                          180°-2
                          B
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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

Indicated Shutter Speed	Effective Shutter Speed	Efficiency
1/200	5.3 ms = 1/190 s	89%
1/400	2.7 ms = 1/375 s	86%
1/600	1.8 ms = 1/565 s	84%
1/800	1.3 ms = 1/750 s	80%
1/1000	1.1 ms = 1/940 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 a modification of the method described in American Standard PH3.4-1959.

STEREOMODEL FLATNESS TEST

Camera No. ___1384___ Lens No. ___UAg II 3026___ Magazine No. ___1384-64___

Focal Length ___153.05 mm___ Maximum Angle of Field Tested ___40°___

Base-height Ratio ___0.6___ Accuracy of Determination ___5 μm___
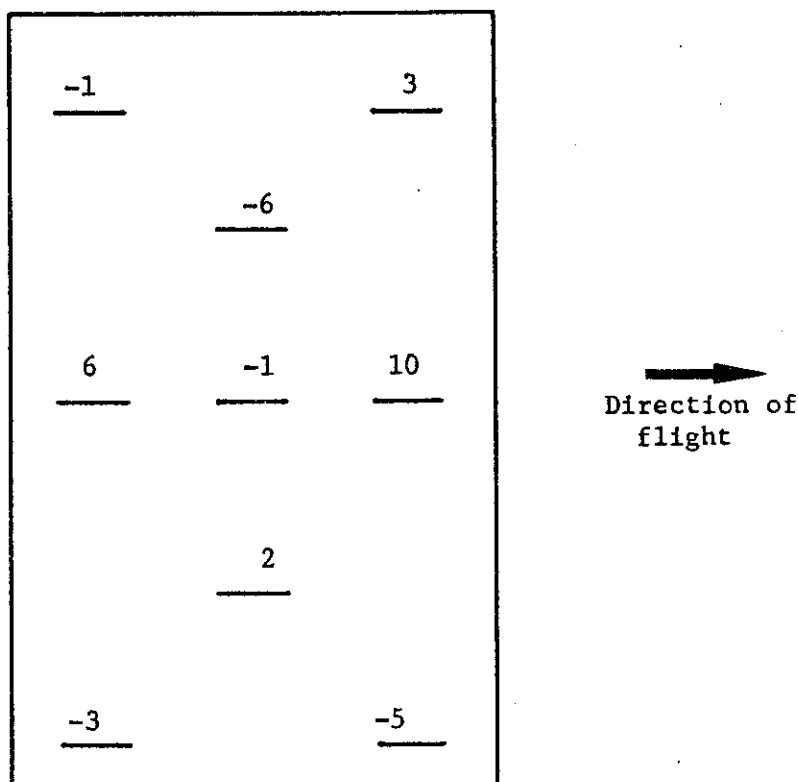
Stereomodel
Test point array
(values in micrometers)

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 diapositives made from film exposures.

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