

Bemerk.: Samtlige optagelser fra SF-Divn.

USGS Report No. RSAS/722



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

REPORT OF CALIBRATION
of Aerial Mapping Camera

July 10, 1981

Camera type: Wild RC10
Lens type: Wild Super Aviogon II
Nominal focal length: 88 mm
Camera serial no.: 2035
Lens serial no.: SAg II 2035
Maximum aperture: f/5.6
Test aperture: f/11

Submitted by: Mark Hurd Aerial Surveys, Inc.
Goleta, California 93116

Reference: Mark Hurd purchase order No. W 6130, dated June 29, 1981.

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 three 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: 87.716 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	μm	μm	μm	μm	μm
7.5	-1	0	-1	0	-1
15	-3	-3	-2	-4	-4
22.5	-7	-7	-5	-8	-8
30	-9	-8	-8	-10	-9
35	-9	-11	-9	-10	-8
40	-6	-8	-5	-7	-5
45	1	-1	2	0	3
50	9	5	9	9	13
54.5	7	0	17	-4	13

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 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 .

samt Neuroaerogram. 1981
 on request m. den gamle Pæliden. app. (no JON/78)
 CP records, number: SF. 721K
 Den enkelte værdi = SF. 716.

III. Resolving Power in cycles/mm

Area-weighted average resolution: 47.4

Field angle:	0°	7.5°	15°	22.5°	30°	35°	40°	45°	50°	54.5°
Radial lines	99	99	70	59	70	83	99	42	21	21
Tangential lines	99	83	59	49	42	42	49	70	49	42

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 9 to 470 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 505 Pan No. 4149 filter accompanying this camera are within ten seconds of being parallel. This filter was used for the calibration.

V. Shutter Calibration

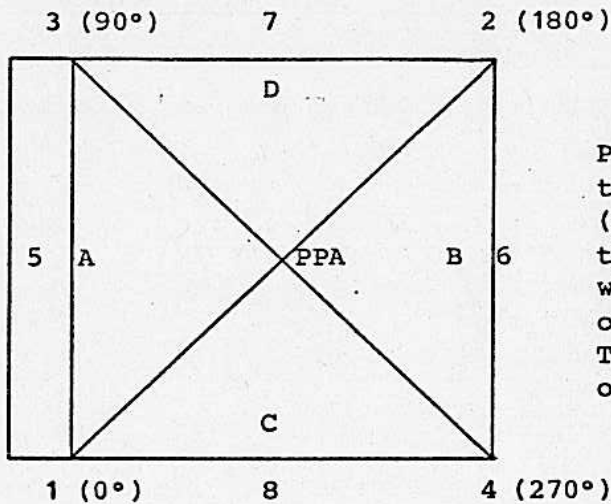
<u>Indicated shutter speed</u>	<u>Effective shutter speed</u>	<u>Efficiency</u>
1/200	5.25 ms = 1/190 s	87%
1/400	2.50 ms = 1/400 s	87%
1/600	1.67 ms = 1/600 s	87%
1/800	1.19 ms = 1/840 s	87%

The effective shutter speeds were determined with the lens at aperture $f/11$. The method is considered accurate within 3%. The technique used is Method I described in American National Standard PH3.48-1972(R1978).

VI. Magazine Platen

The platens mounted in Fairchild film magazines No. 52-468 and No. 52-577 do not depart from a true plane by more than 13 μ m (0.0005 in.).

VII. Principal Point 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 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	-0.019 mm	-0.008 mm
Indicated principal point, midside fiducials	-0.017	-0.007
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	0.006	0.000

Fiducial Marks

1	-106.010 mm	-106.001 mm
2	105.975	105.987
3	-106.012	105.986
4	105.974	-106.001
5	-110.007	-0.006
6	109.973	-0.007
7	-0.015	109.986
8	-0.019	-110.004

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2: 299.794 mm 3-4: 299.794 mm

Lines joining these markers intersect at an angle of 89° 59' 58"

Midside fiducials

5-6: 219.979 mm 7-8: 219.990 mm

Lines joining these markers intersect at an angle of 89° 59' 57"

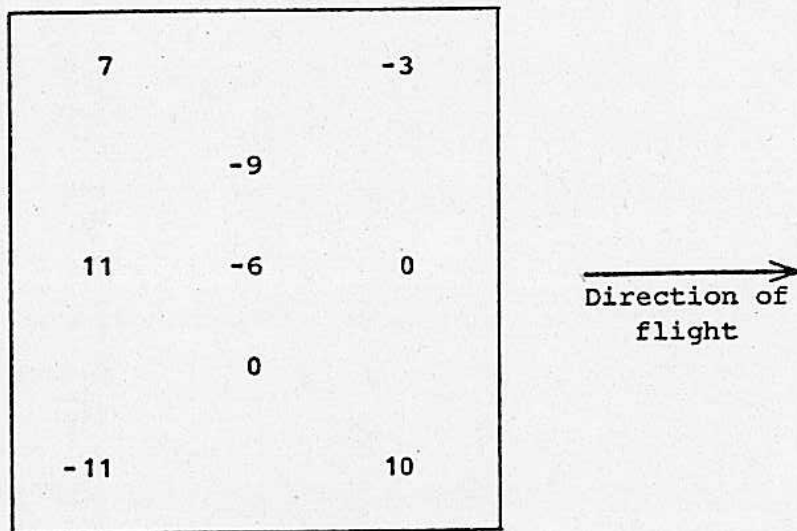
Corner fiducials (perimeter)

1-3: 211.987 mm 2-3: 211.987 mm
 1-4: 211.983 mm 2-4: 211.988 mm

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

IX. Stereomodel Flatness

Camera No.: 2035 Lens No.: SAg II 2035 Magazine No.: 52-468
 Focal Length: 87.716 mm Maximum angle of field tested: 54.5°
 Base/Height ratio: 1.0 Accuracy of determination: 5 um



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

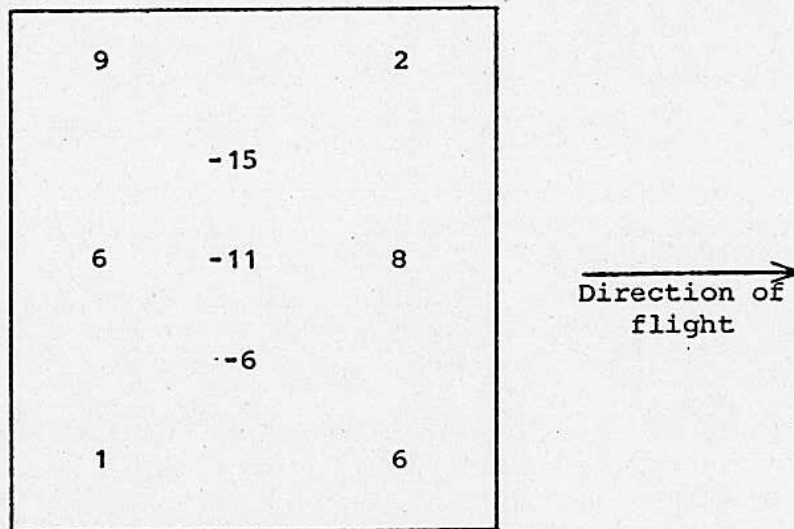
Film: Type 2405

Area-weighted average resolution: 33.5

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

IX. Stereomodel Flatness

Camera No.: 2035 Lens No.: SAg II 2035 Magazine No.: 52-577
 Focal Length: 87.716 mm Maximum angle of field tested: 54.5°
 Base/Height ratio: 1.0 Accuracy of determination: 5 um



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

Film: Type 2405

Area-weighted average resolution: 32.7

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

This report supersedes the previous calibration of this camera contained in USGS Report of Calibration No. RT-R/432, dated June 20, 1978.

William P. Tayman

William P. Tayman
 Chief, Optical Science Section
 National Mapping Division