



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092REPORT OF CALIBRATION
of Aerial Mapping Camera

November 9, 1993

Camera type:	Wild RC20*	Camera serial no.:	5046
Lens type:	Wild Normal Aviotor NAT/4-S	Lens serial no.:	17109
Nominal focal length:	305 mm	Maximum aperture:	f/4
		Test aperture:	f/6.6**

Submitted by: Leica, Inc.
Rockleigh, New Jersey

Reference: Leica, Inc., purchase order No.
01017, dated November 9, 1993.

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 5200K.

I. Calibrated Focal Length: 303.830 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	um	um	um	um	um
7.5	-3	-4	-3	-2	-2
15	-1	0	-2	0	-3
22.7	2	4	-1	4	0

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 away from the center of the field. These measurements are considered accurate within 5 um.

* Equipped with Forward Motion Compensation

** Limitation imposed by collimator aperture

III. Resolving Power in cycles/mm

Area-weighted average resolution: 78

Field angle:	0°	7.5°	15°	22.7°
Radial Lines	96	96	81	68
Tangential lines	96	96	81	57

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 2.5 to 135 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 420 No. 7396 and the 525 No. 7401 filters accompanying this camera are within 10 seconds of being parallel. The 525 filter was used for the calibration.

V. Shutter Calibration

<u>Indicated exposure time</u>	<u>Effective exposure time</u>	<u>Efficiency</u>
1/125	7.25 ms = 1/140 s	76%
1/250	3.75 ms = 1/265 s	76%
1/500	2.00 ms = 1/500 s	76%
1/1000	1.00 ms = 1/1000 s	76%

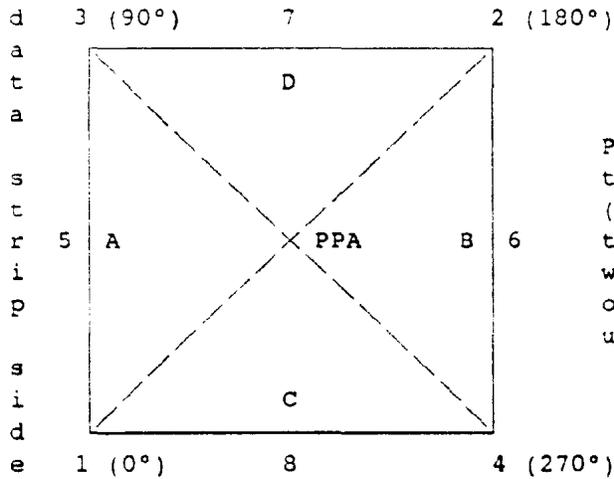
The effective exposure times were determined with the lens at aperture $f/4$. The method is considered accurate within 3 percent. The technique used is Method I described in American National Standard PH3.48-1972(R1978).

VI. Film Platen

The film platen mounted in Wild RC20 drive unit No. 5046-460 does not depart from a true plane by more than 13 μ m (0.0005 in).

This camera is equipped with a platen identification marker that will register "460" in the data strip area for each exposure.

VII. Principal Points 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 data strip is to the left.

	<u>X coordinate</u>	<u>Y coordinate</u>
Indicated principal point, corner fiducials	0.006 mm	-0.004 mm
Indicated principal point, midside fiducials	0.006	-0.003
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	-0.002	-0.012

Fiducial Marks

1	-105.987 mm	-105.999 mm
2	106.003	105.995
3	-105.995	105.991
4	106.007	-105.999
5	-111.989	-0.002
6	112.006	-0.004
7	0.001	111.993
8	0.010	-111.997

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2: 299.802 mm 3-4: 299.807 mm

Lines joining these markers intersect at an angle of 90° 00' 03"

Midside fiducials

5-6: 223.995 mm 7-8: 223.990 mm

Lines joining these markers intersect at an angle of 90° 00' 10"

Corner fiducials (perimeter)

1-3: 211.990 mm 2-3: 211.997 mm

1-4: 211.994 mm 2-4: 211.995 mm

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

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