



# United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Reston, Virginia 20192

REPORT OF CALIBRATION  
of Aerial Mapping Camera

April 27, 2005

Camera type:	Wild RC20/30	Camera serial no.:	N/A
Lens type:	Wild Normal Aviotor /4-S	Lens serial no.:	17113
Nominal focal length:	305 mm	Maximum aperture:	f/4
		Test aperture:	f/6.6*

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

Reference: Keystone Aerial Surveys, Inc. purchase order  
No. 1212 dated April 25, 2005.

These measurements were made on Agfa glass plates, 0.19 inch thick, with spectroscopic emulsion type APX 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: 303.446 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	0	2	-3	4	-2
15	-2	-3	0	-3	-3
22.7	1	1	2	0	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, 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.

\* Limitation imposed by collimator aperture

III. Lens Resolving Power in cycles/mm

Area-weighted average resolution: 61

Field angle:	0°	7.5°	15°	22.7°
Radial Lines	81	68	48	68
Tangential lines	81	81	57	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 filter No. 7365 and the 525 filter No. 7245 accompanying this camera are within 10 seconds of being parallel. The 525 filter was used for the calibration.

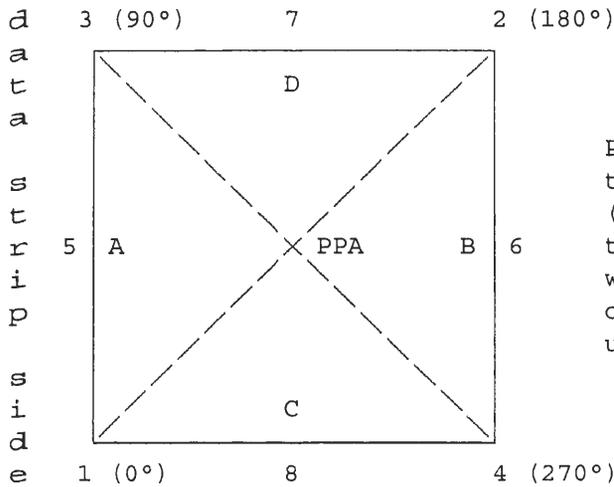
V. Shutter Calibration

( Not Applicable )

VI. Film Platen

( Not Applicable )

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	0.011 mm	0.008 mm
Indicated principal point, midside fiducials	0.010	0.010
Principal point of autocollimation	0.0	0.0
Calibrated principal point (point of symmetry)	-0.006	0.008

Fiducial Marks

1	-105.996 mm	-105.992 mm
2	106.012	106.003
3	-105.982	106.010
4	106.001	-105.992
5	-111.984	0.014
6	112.007	0.007
7	0.017	112.000
8	0.004	-111.990

VIII. Distances Between Fiducial Marks

Corner fiducials (diagonals)

1-2: 299.815 mm                      3-4: 299.802 mm

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

Midside fiducials

5-6: 223.992 mm                      7-8: 223.991 mm

Lines joining these markers intersect at an angle of 89° 59' 54"

Corner fiducials (perimeter)

1-3: 212.001 mm                      2-3: 211.994 mm

1-4: 211.998 mm                      2-4: 211.994 mm

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

This aerial mapping camera calibration report supersedes the previously issued USGS Report No. OSL/2103, dated April 23, 1995.

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