



United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Reston, Virginia 20192

REPORT OF CALIBRATION of Aerial Mapping Camera

April 05, 2017

Camera type: Wild RC30*
Lens type: Wild Universal Aviogon /4-S
Nominal focal Length: 153 mm

Camera serial no.:
Lens serial no.: 13360
Maximum aperture: f/4
Test aperture: f/4

Submitted by: Krawietz Aerial Photography
Belverde, TX

Reference:

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: 154.095 mm

II. Lens Distortion

Field angle:	7.5°	15°	22.7°	30°	35°	40°
Symmetric radial (μm)	0	0	1	2	2	-2
Decentering tangential (μm)	0	0	0	0	1	1

Symmetric radial distortion	Decentering distortion	Calibrated principal point
$K_0 = -0.5147\text{E-}06$	$P_1 = -0.5206\text{E-}07$	$x_p = 0.008 \text{ mm}$
$K_1 = -0.7170\text{E-}08$	$P_2 = -0.3519\text{E-}07$	$y_p = 0.015 \text{ mm}$
$K_2 = 0.4883\text{E-}12$	$P_3 = 0.0000$	
$K_3 = 0.0000$	$P_4 = 0.0000$	
$K_4 = 0.0000$		

The values and parameters for Calibrated Focal Length (CFL), Symmetric Radial Distortion (K_0, K_1, K_2, K_3, K_4), Decentering Distortion (P_1, P_2, P_3, P_4), and Calibrated Principal Point [point of symmetry] (x_p, y_p) were determined through a least-squares Simultaneous Multiframe Analytical Calibration (SMAC) adjustment. The x and y-coordinate measurements utilized in the adjustment of the above parameters have a standard deviation (σ) of ± 3 microns.

* Equipped with Forward Motion Compensation

III. Lens Resolving Power in cycles/mm

Area-weighted average resolution: 112

Field angle:	0°	7.5°	15°	22.7°	30°	35°	40°
Radial Lines	134	159	134	134	113	95	95
Tangential Lines	134	134	134	113	113	95	95

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 5 to 268 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

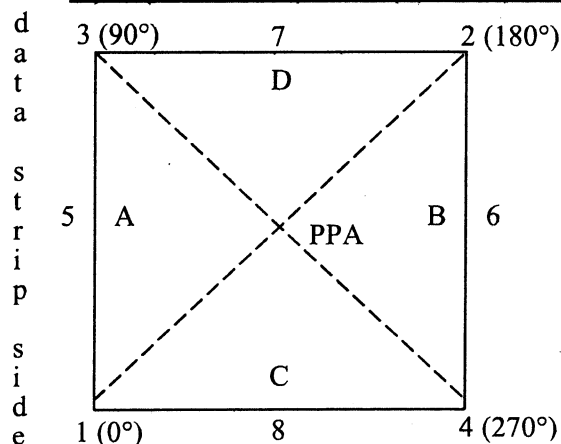
The two surfaces of the Wild 525 filter No. 7499 accompanying this camera are within 10 seconds of being parallel. This filter was used for the calibration.

V. Shutter Calibration

N/A

VI. Film Platen

N/A

VII. Principal Point and Fiducial Mark 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.

Indicated principal point, corner fiducials
Indicated principal point, midside fiducials
Principal point of autocollimation (PPA)
Calibrated principal point (point of symmetry)

<u>X coordinate (mm)</u>	<u>Y coordinate (mm)</u>
0.007	0.000
0.007	0.002
0.000	0.000
0.008	0.015

Fiducial Marks

1	-105.988	-105.994
2	106.007	106.000
3	-105.985	105.995
4	106.000	-105.994
5	-111.988	0.000
6	112.007	0.003
7	0.011	112.004
8	0.003	-111.995

VIII. Distances Between Fiducial marks

Corner fiducials (diagonals)	1-2: 299.806 mm	3-4: 299.795 mm
Lines joining these markers intersect at an angle of 89° 59' 59"		
Midside fiducials	5-6: 223.995 mm	7-8: 224.000 mm
Lines joining these markers intersect at an angle of 89° 59' 50"		
Corner fiducials (perimeter)	1-3: 211.989 mm	2-3: 211.993 mm
	1-4: 211.989 mm	2-4: 211.994 mm

The Method of measuring these distances is considered accurate within 0.003 mm

Note: For GPS applications, the nominal entrance pupil distance from the focal plane is 277mm.

This aerial mapping camera calibration report supersedes the previously issued USGS Report No. OSL/3598, dated April 20, 2012.


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Climate and Land Use Change