United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Reston, Virginia 20192

REPORT OF CALIBRATION
of Aerial Mapping Camera

March 10, 2009

Camera type:	Wild RC30*	**Camera serial no.:**	5227
Lens type:	Wild Normal Aviotar/4-S	**Lens serial no.:**	17118
Nominal focal Length:	305 mm	**Maximum aperture:**	f/4
		Test aperture:	f/6.6**

Submitted by: Selkirk Remote Sensing Ltd.
Richmond, British Columbia, Canada

Reference: Selkirk Remote Sensing Ltd. purchase order No. 2867, dated February 27, 2009.

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: 302.945 mm

This measurement is considered accurate within 0.005 mm

II. Radial Distortion:

Field angle	$\overline{D}_C$	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	-2	0	-3	-2	-3
15	-1	2	-5	1	-1
22.7	1	1	2	1	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. $\overline{D}_C$ 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 5µm.

* Equipped with Forward Motion Compensation

** Limitation imposed by collimator aperture

III. Lens Resolving Power in cycles/mm

Area-weighted average resolution: 78

Field angle:	0º	7.5º	15º	22.7º
Radial Lines	81	96	81	68
Tangential Lines	81	96	81	58

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 525 filter No. 7443 accompanying this camera are within 10 seconds of being parallel. This filter was used for the calibration.

V. Shutter Calibration

Indicated Time (sec)	Rise Time (µ sec)	Fall Time (µ sec)	½ Width Time (ms)	Nom. Speed (sec)	Efficiency (%)
1/125	1235	1260	8.69	1/130	91
1/250	654	660	4.60	1/240	91
1/500	334	340	2.34	1/470	91
1/1000	171	172	1.19	1/920	91

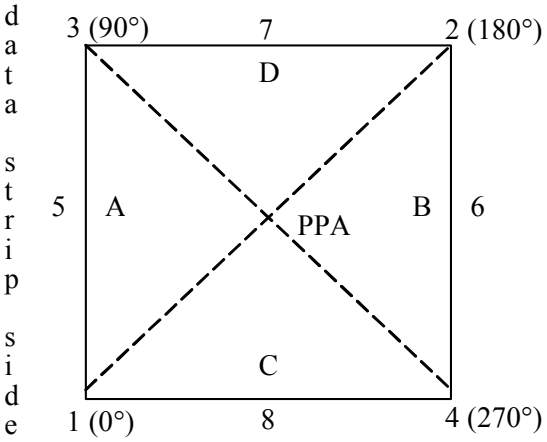
The effective exposure times were determined with the lens at aperature f/4. The method is considered accurate within 3 percent. The technique used is described in International Standard ISO 516:1999(E).

VI. Film Platen

The platen mounted in Wild drive unit No. 5227 does not depart from a true plane by more than 13 µm (0.0005 in).

This camera is equipped with a platen identification marker that will register "593" in the data strip area for each exposure.

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.

	X coordinate (mm)	Y coordinate (mm)
Indicated principal point, corner fiducials	0.026	-0.002
Indicated principal point, midside fiducials	0.024	-0.002
Principal point of autocollimation (PPA)	0.000	0.000
Calibrated principal point (point of symmetry)	-0.002	-0.004
Fiducial Marks		
1	-105.985	-106.002
2	106.036	105.997
3	-105.967	105.995
4	106.020	-106.002
5	-111.974	-0.002
6	112.024	-0.001
7	0.033	111.992
8	0.014	-112.002

VIII. Distances Between Fiducial marks

Corner fiducials (diagonals)	1-2:	299.827 mm	3-4:	299.801 mm
Lines joining these markers intersect at an angle of	90° 00' 07"			
Midside fiducials	5-6:	223.998 mm	7-8:	223.994 mm
Lines joining these markers intersect at an angle of	89° 59' 42"			
Corner fiducials (perimeter)	1-3:	211.996 mm	2-3:	212.003 mm
	1-4:	212.005 mm	2-4:	211.999 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 314mm.

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