



Geometric Verification
DMC lie_230 23522



Camera Geometric Verification Certificate
No: DMC lie_230 23522



For

Keystone Aerial Survey
467 Aviation Way
Frederick, MD 21701

United States

DMC Ile_230 23522
Geometric Verification

Camera: DMC Ile_230 23522
Manufacturer: Leica Geosystems Technologies, D-73430 Aalen, Germany
Reference: PAN
Serial Number: 00123118 (PAN Head)
Date of Calibration: 20 November 2014
Date of Report: 30 June 2023
Number of Pages: 5

This camera system is certified by Leica Geosystems Technologies and is fully functional within its specifications and tolerances.

Date of Calibration: November 2014

Date of Certification: June 2023



Dipl.Ing. Christian Müller, Product Manager



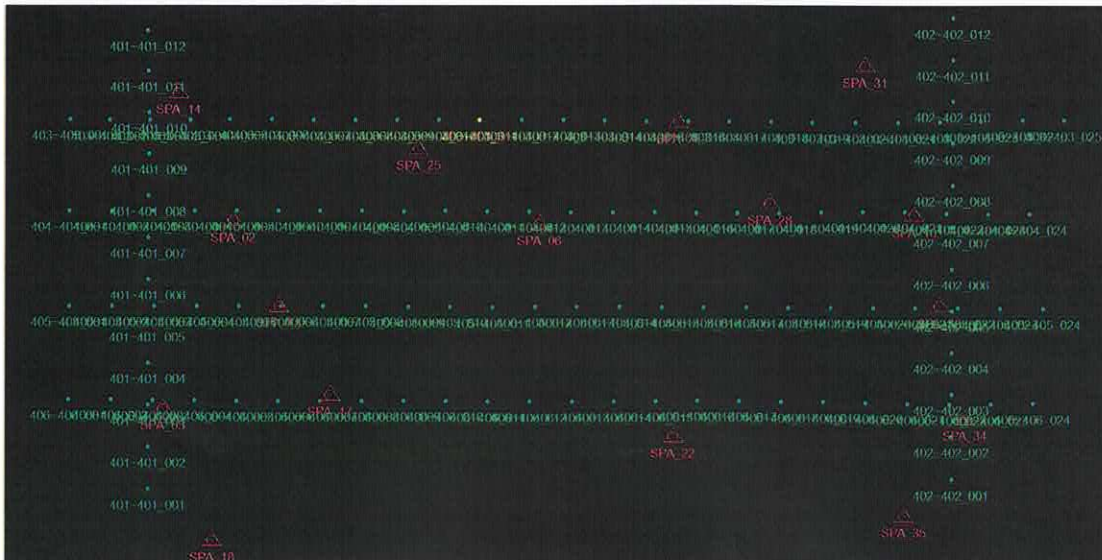
Michael Reading, Senior Support Analyst

Camera Serial Numbers and Burn-In flight

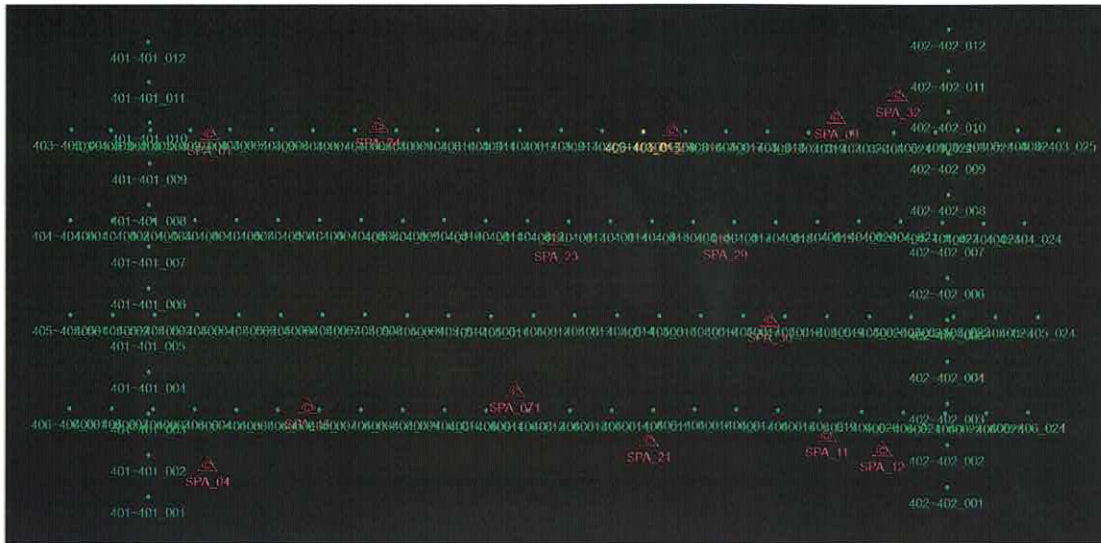
Camera Head	Serial Number	Calib. Date
PAN (reference)	00123118	20.11.2014
MS1 (NIR)	00118804	20.11.2014
MS2 (Blue)	00124736	20.11.2014
MS3 (Red)	00124693	20.11.2014
MS4 (Green)	00124739	20.11.2014

Verification flight performed: 16 June 2023

Flight parameters of 5 cm Verification Flight – Control Points



Flight parameters of 5 cm Verification Flight – Check Points



Parameter	Validation Flight
GSD (cm)	5
End-lap (%)	70
Side-Lap (%)	40
Number of Exposures	121
Number of Flight Lines	4
Number of Cross Flight Lines	2
Number of Control Points	16
Number of Check Points	14
GNSS / INS	Yes

Application

Parameter	Validation Flight
Weighting for manual measured image points (um)	3.0
Weighting for automatic measured image points (um)	3.0
Weighting for Control Points (m)	0.080 / 0.080 / 0.080
Weighting for GPS (m)	0.050 / 0.050 / 0.050
Weighting for INS (deg)	0.010 / 0.010 / 0.050
Modeling of GPS systematic residuals	YES
Bore Sight Alignment (YES/NO)	YES
Camera Self Calibration (YES/NO)	NO

Statistics –Bundle Block Adjustment

Parameter	Validation Flight
Sigma0 [µm]	0.76444
Mean Std Dev Photo Position [m]	0.01460 / 0.01960 / 0.01353
Mean Std Dev Photo Attitude [deg]	0.00117 / 0.01960 / 0.01353
Mean Std Dev Control Points [m]	0.00930 / 0.00956 / 0.01986
Mean Std Dev Check Points [m]	0.018155 / 0.032219 / 0.031532
RMS Photo Position [m]	0.00846 / 0.00815 / 0.01057
RMS Photo Attitude [deg]	0.00084 / 0.00087 / 0.00066

Statistics – Results From Independent Reference Measurements

Parameter	Validation Flight
RMS of Control Points - horizontal [m]	0.03543 / 0.02895
Max Ground Residual of Control Points - horizontal [m]	0.10507 / 0.07264
RMS of Control Points - vertical [m]	0.02381
Max Ground Residual of Control Points - vertical [m]	0.06139
RMS of Check Points - horizontal [m]	0.03126 / 0.03388
Max Ground Residual of Check Points - horizontal [m]	0.06914 / 0.06379
RMS of Check Points - vertical [m]	0.03128
Max Ground Residual of Check Points - vertical [m]	0.06989

The results of the aerial triangulation were generated with ImageStation Automatic Triangulation (ISAT), 2022, Version 16.7.0, Build 573 from Hexagon Geospatial.

Aerial Triangulation performed by


Michael Reading

06.30.2023
Date