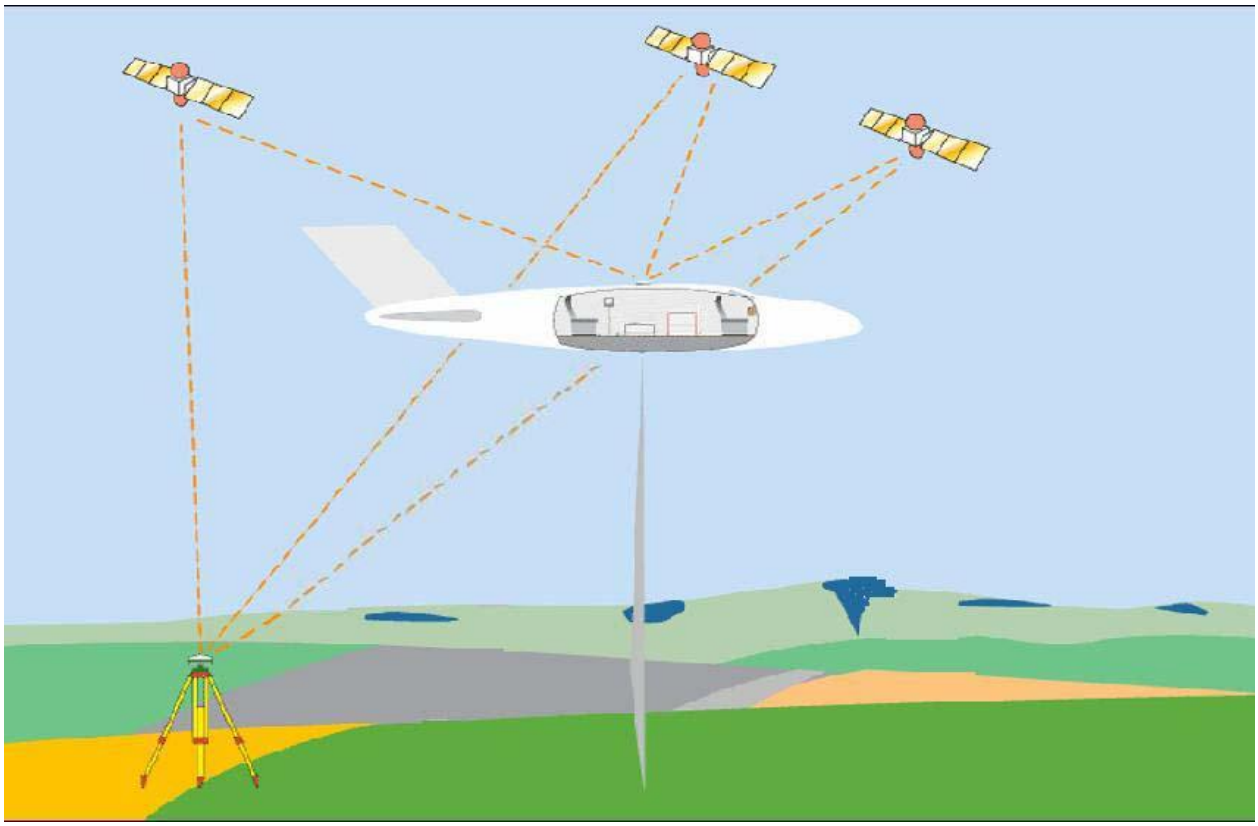
ALS Calibration Certificate



	Model	*Serial Number*
This certificate is valid for	**ALS50-II**	**SN089**

Calibration certificate issued on	**06 February 2013**
by	**Roberto Clerigo**
Certificate and calibration data ID	***SN089 ALS Cal Report 130131***

Leica Geosystems AG
Heinrich-Wild-Strasse
9435 Heerbrugg
Switzerland

Leica Geosystems

Components of ALS

Component	Device	Type	Serial Number
LS50	Laser Scanner		080
	IPAS 10		6553
	Inertial Measurement unit	CUS6 “uIRS”	56015342
DLM50	Data Logger	XP embedded	080
	Galvo Controller	"ALS_P2" performance	080
SC50	System Controller		080

Calibration process

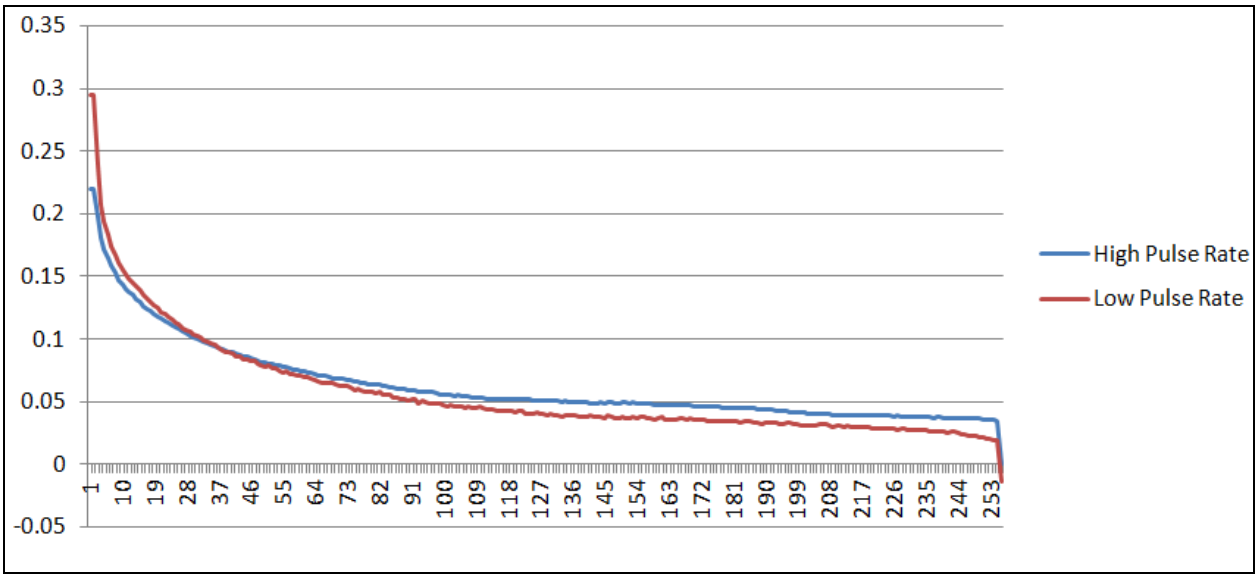
Intensity based range correction (IBRC)

	Passed	Date	Inspector
RIVIT (raw IBRC) measurements	*ok*	*18 Dec 12*	Phung Nguyen
IBRC table	*ok*	*18 Dec 12*	Phung Nguyen

File ***SN89_IBRC_Dualtable_20121218.csv***

Objective To correct for the effect of varying range based on return signal strength.

Note The range biases are in meters. The bias values are for intensity values of 0 (low intensity) to 255 (high intensity) in that order. Use above file in ALSPP for IBRC correction.



Intensity based range correction (IBRC) - curve

Flight and data processing

	Passed	Date	Inspector
Test flight	*ok*	*31 Jan 13*	Phung Nguyen
Data Quality Check	*ok*	*05 Feb 13*	Mal Hentschel
(Boresight) Calibration	*ok*	*06 Feb 13*	Roberto Clerigo

File ***ALS_SN080_calibrated_130123.reg***
Objective To correct for systematic effects of this ALS System.
Note It is recommended that a complete calibration be performed after system delivery to verify and establish a final set of parameters.

IPAS Processing

Parameter [Units]	**Value**
IMU Type	CUS6 “uIRS”
IMU Lever Arm X [m]	-0.411
IMU Lever Arm Y [m]	0.206
IMU Lever Arm Z [m]	-0.192m
Omega Rotation Angle	0.00000
Phi Rotation Angle	0.00000
Kappa Rotation Angle	0.00000
User Frame Lever Arm X [m]	-0.142
User Frame Lever Arm Y [m]	-0.001
User Frame Lever Arm Z [m]	-0.188
Omega Rotation Angle	0.00000
Phi Rotation Angle	0.00000
Kappa Rotation Angle	0.00000
IPAS Pro IMU Latency [sec]	0.000
Test Airplane	
GPS Lever Arm X [m]	0.350
GPS Lever Arm Y [m]	0.030
GPS Lever Arm Z [m]	-1.220

ALS Calibration Summary – Key Parameters for use in the ALS Post Processor

Parameter [Units]	**Value**
Encoder Scale Factor [encoder counts per revolution]	8388608
Encoder Offset [encoder counts]	-13797
Roll [rad]	0.002621928
Pitch [rad]	-0.00309600
Heading [rad]	0.000242981
Pitch Error Slope [rad/deg]	-1.2e-005
Torsion Constant [Nm/rad]	250000
Nominal Range Offset [m]	3.22
R1 [m] BankA / BankB	3.220 / 3.25
R2 [m] BankA / BankB	3.233 / 3.244
R3 [m] BankA / BankB	3.265 / 3.266
R4 [m] BankA / BankB	3.229 / 3.278
TPR [Hz]	50000
TPR Offset [m]	0
Elevation Offset [m]	0
Encoder Latency [ms]	0.40
IMU Latency [ms]	0

Accuracy Check

	Value	**Std Dev**	**Inspector**
Avg Dz to Control. Bregenz 451 check points	*-0.001*	*0.036*	Roberto Clerigo
Summary Calibration check	*ok*		Roberto Clerigo

Nominal Laser Characteristics

	Value
Beam diameter (1/e and 1/e^2, mm)	*5.6, 8.0*
Beam divergence (1/e and 1/e^2, mr)	*0.15, 0.22*
Pulse width (maximum, Full Width Half Max, ns)	*9*
Maximum single-pulse energy (mJ)	*0.2*
Emitted wavelength (nm)	*1064*

Inspection

Inspector

Name	**Roberto Clerigo**
Position	Airborne Systems Support Engineer

Name	**Phung Nguyen**
Position	Airborne Systems Support Engineer