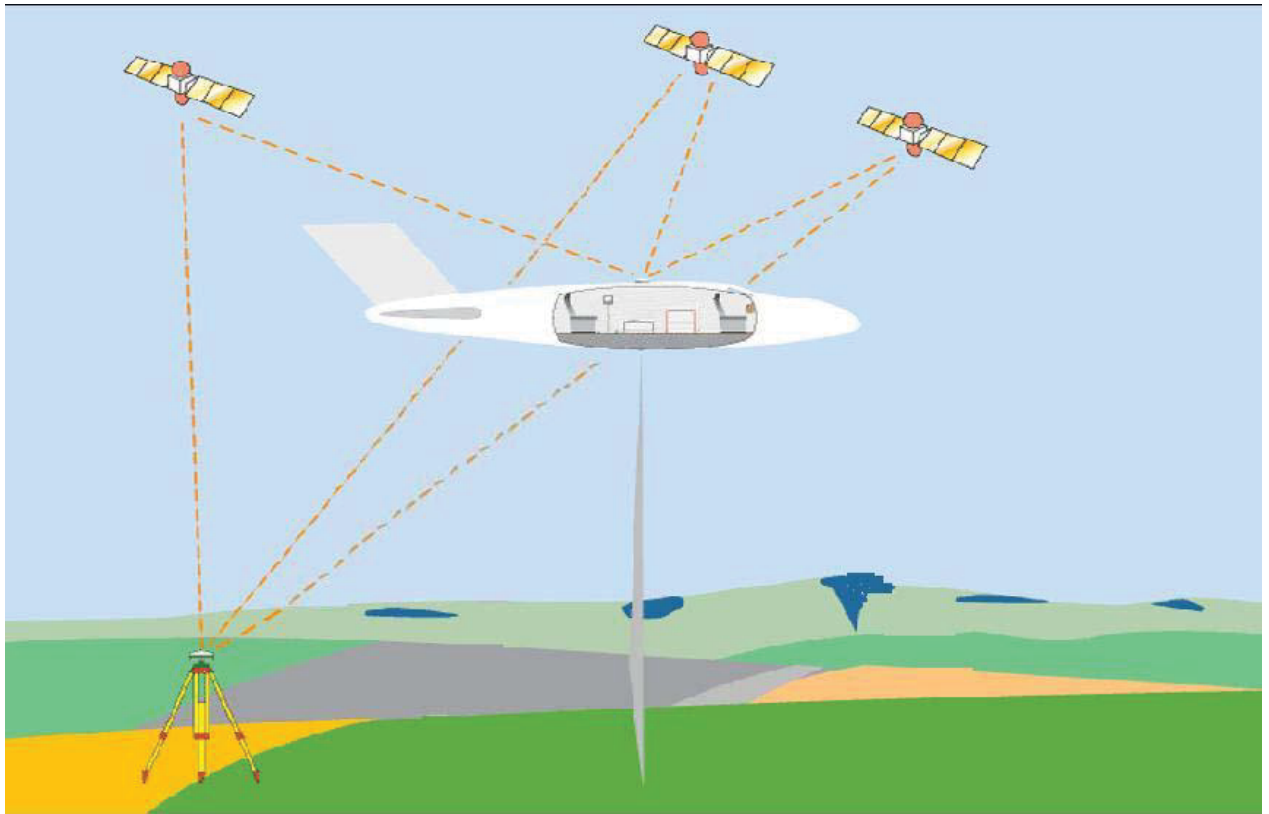


# ***ALS80-HP Calibration Certificate***



*This certificate is valid for*

*Model*  
**ALS80-HP**

*Serial Number*  
**SN8192**

*Calibration certificate issued on*

**06 March 2020**

**Spasa Calibration Flight  
and Calibration Computation**

*Certificate and calibration data ID*

**20200220- Calibracion\_Talavera.xml**

**Components of ALS80-HP**

Component	Device	Type	Serial Number
LS80	Laser Scanner		8192
SC80	System Controller		8192
DL80	Data Logger	XP embedded	8192
GC80	Galvo Controller	"ALS_80" performance	X12022216Y Rev.L
IMU	Inertial Measurement Unit	CUS6-"uIRS"	56076513
GPS	Firmware	SPAN	OMP060603RN0000
	Hardware	SPAN	BMAW13470029H
Receivers	Optical Paths	1	15.07.14 005 -
		2	15.07.14 006 -

**Nominal Laser Characteristics**

	Value
Beam diameter ( $1/e^2$ , mm)	6.2
Beam divergence ( $1/e$ and $1/e^2$ , mr)	0.23
Pulse width (maximum, Full Width Half Max, ns)	3
Maximum single-pulse energy (mJ)	0.5
Emitted center wavelength (nm)	1064

**Key parameters - Threshold Discriminator (from factory calibration flight on April 2016)**

Threshold discriminator channel	Threshold setting	
	General Operation	Power line or other low altitude ( $\leq 400$ m AGL) applications
Discriminator AG	<b>225 mv</b>	<b>185 mv</b>
Discriminator AN	45 mv	45 mv
Discriminator BG	<b>225 mv</b>	<b>185 mv</b>
Discriminator BN	45 mv	45 mv

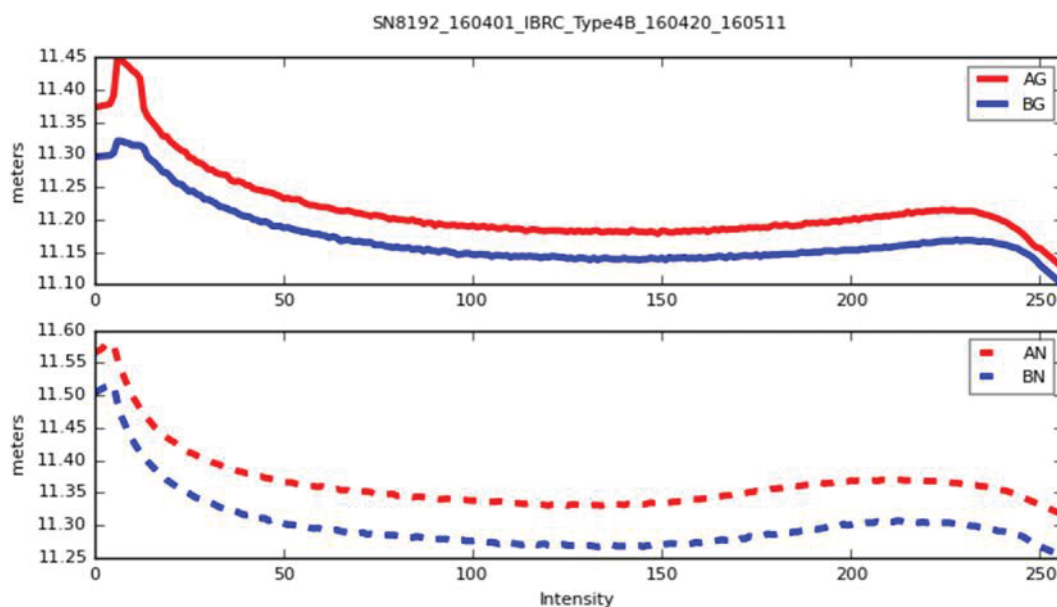
## Calibrated Parameters

### Intensity based range correction (IBRC)

File **SN8192\_160401\_IBRC\_Type4B\_160420\_160511.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 derived from test data are for intensity values of 0 (low intensity) to 255 (high intensity).



Intensity based range correction (IBRC) – curve

***Gain based intensity correction (GBIC) and Intensity Scale Factors***

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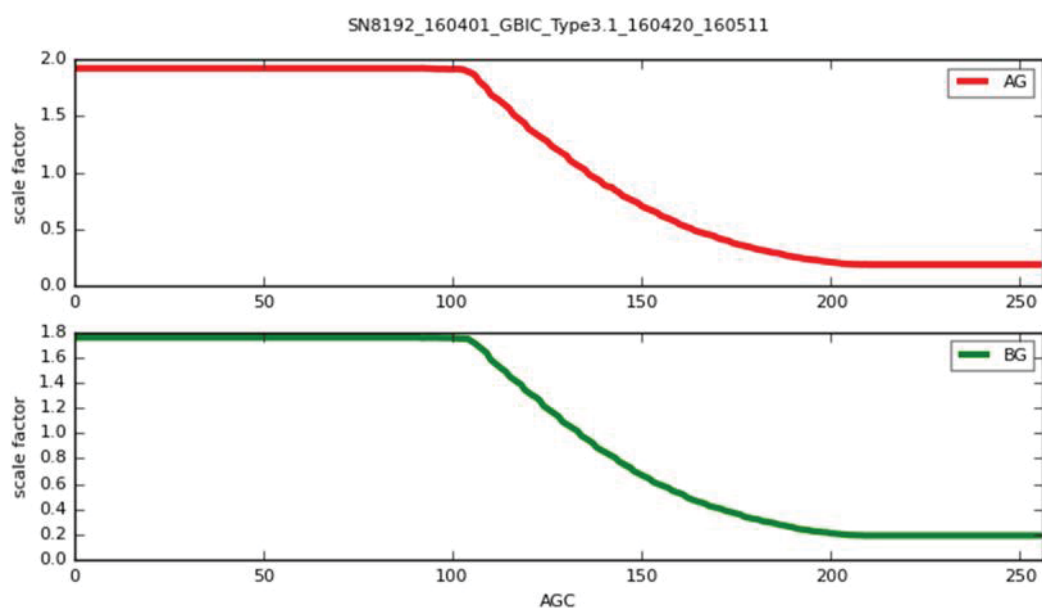
Files ***SN8192\_160401\_GBIC\_Type31\_160420\_160511.csv***

***SN8192\_IntensityCorrectionTable\_160420\_160426.xlsx***

Objective GBIC – To correct for the effect of varying AGC value on intensity.

ISF – To adjust intensity values throughout a flight

Note Correction factor values are unit less and are derived from test data through the range of AGC values.



*Gain based intensity correction (GBIC) curve*

**Flight and data processing**

	Passed	Date	Inspector
<i>Test flight – Talavera (Spain)</i>	OK	05-Mar-20	Jose M <sup>a</sup> Lara
<i>Calibration</i>	OK	05-Mar-20	Jose M <sup>a</sup> Lara

File **20200305-Calibracion-CloudPro-ALS80\_Talavera.xml**

Objective To correct for systematic effects of this ALS System.

Validation An 'on-site' calibration has to be performed after a new system installation to adjust calibration parameters for this particular installation.

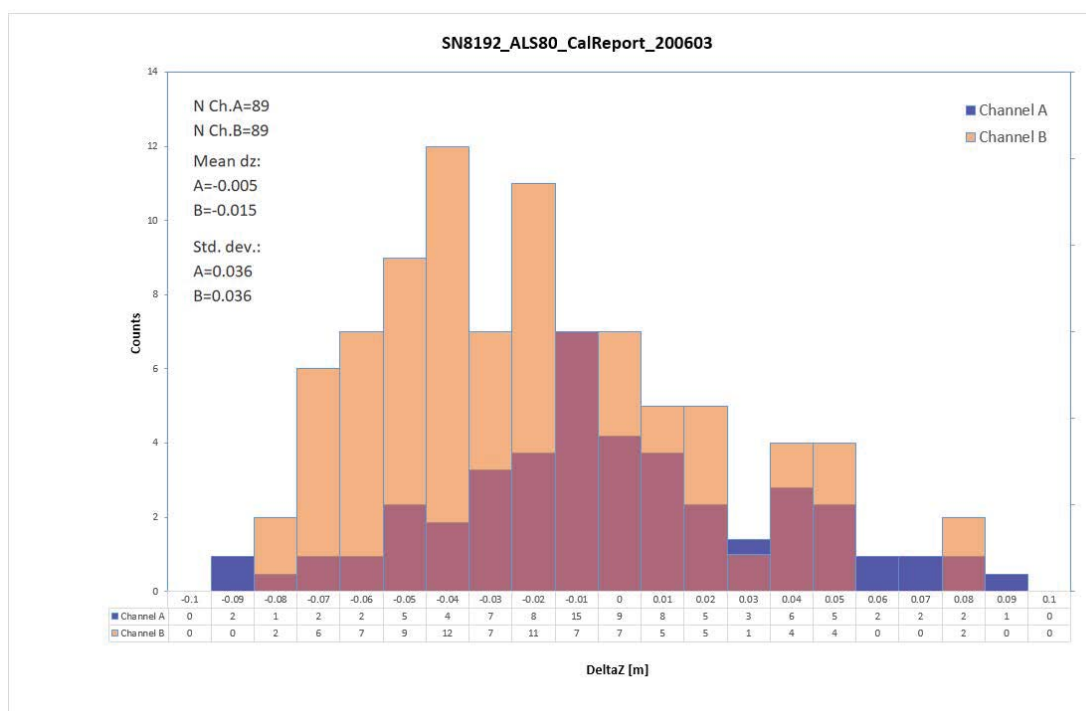
ALS Calibration Parameter Summary		
Parameter (units)	Receiver A	Receiver B
Scanner Correction		
Encoder Offset (number of ticks/counts)	-7300	
Encoder Latency (microseconds)	0.500	
Torsion Constant (Nm/rad)	0	
Encoder Scale Factor (Ticks/counts per Rev)	8388230	
POS Errors Entry		
Roll Boresight (radians)	0.0006380589	0.0005840639
Pitch Boresight (radians)	-0.003787654	-0.003937099
Heading Boresight (radians)	-0.0008778479	-0.0009185629
Pitch Error Slope (radians/degree)	0	0
PPS Correction (uSec)	0	
IMU Latency (uSec) [Maintain in ALSPP]	0	
Forward Laser Angle (Degrees)	0.06883	-0.01503
Down Laser Angle (Degrees)	8.87579	11.12421
Forward Mirror Normal Angle (Degrees)	0.00000	0.00000
Range Correction		
Intensity Based Range Correction [IBRC]	(text file specified above)	
Transition Pulse Rate (Hz)	35000	
Elevation Offset	0	
Intensity Correction		
See Intensity Scale Factors below		
Waveform Processing		
Trigger Delay - (pico seconds)	-59329	
GBIC Inputs		
Optional Gain Based Intensity Correction [GBIC]	(text file specified above)	
ALS70 Multi Channel Processing Options		
Gain/NonGain Intensity Threshold	Receiver A	Receiver B
	220	220

**Accuracy Check**

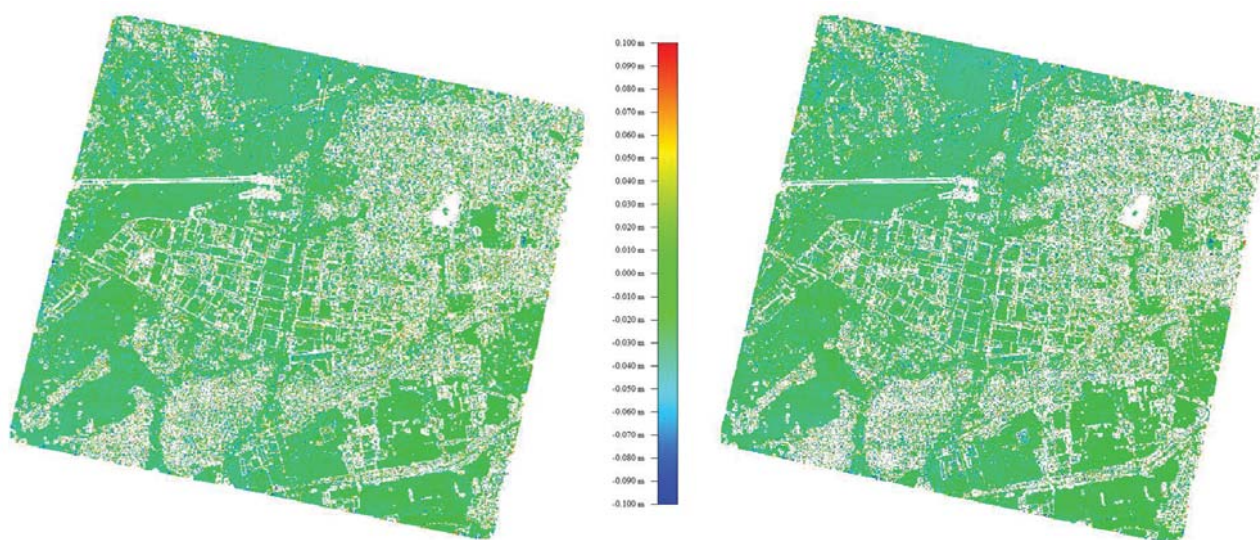
	Passed	Date	Inspector
<i>Two perpendicular lines to GCP</i>	OK	05-Mar-20	Jose M <sup>a</sup> Lara
<i>Two perpendicular lines – Ch. comparison</i>	OK	05-Mar-20	Jose M <sup>a</sup> Lara
<i>One line difference of Ch.A and Ch.B</i>	OK	05-Mar-20	Jose M <sup>a</sup> Lara

**Objective** To verify the calibration quality. Checks are based on measured Ground Control Points (GCP) on two perpendicular lines of the calibration pattern.

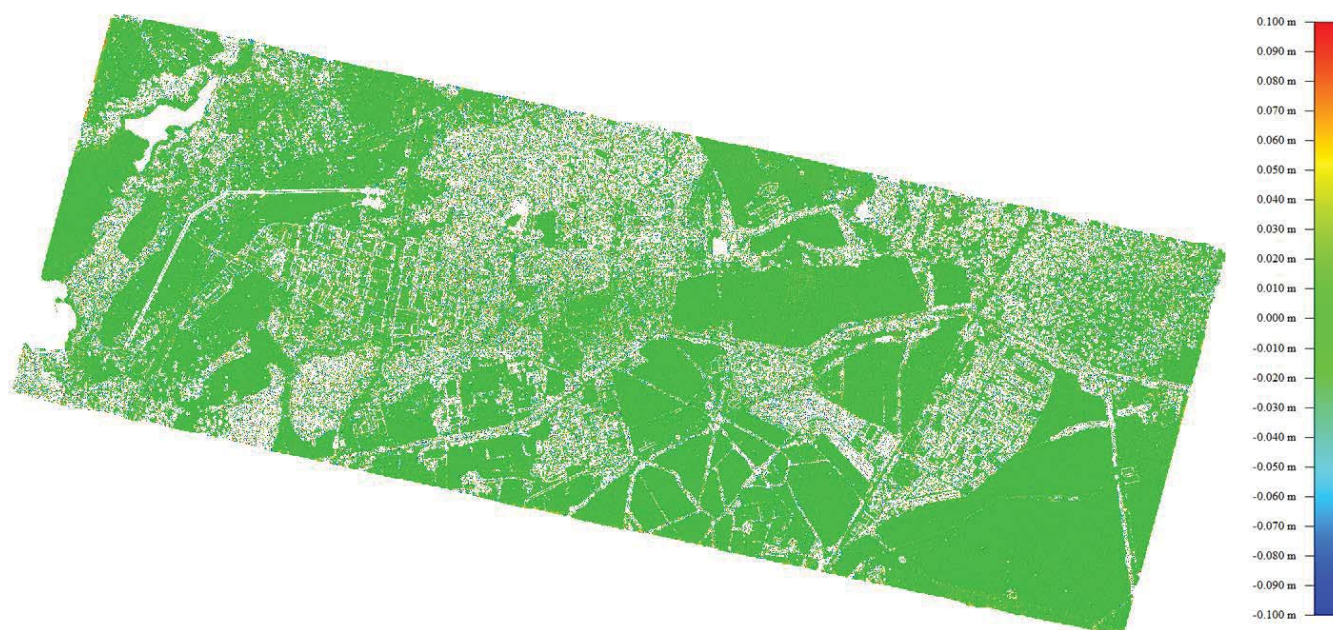
**Used GCP's** 200305-calculo\_apoyo\_Canal\_A\_v0.txt  
200305-calculo\_apoyo\_Canal\_B\_v0.txt







**Multi-line accuracy between perpendicular lines of ChA (AG&AN) and ChB**



**Subtraction of the two channels for a single line**