LiDAR Project Report

140G0219F0014-
TX_Pecos_Dallas_2018
QL2 LiDAR

Prepared For:

United States Geological Survey

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TASK ORDER: # TX Pecos_Dallas_2018

Project Report
LiDAR Collection, Processing, and QA/QC

140G0219F0014-
TX_Pecos_Dallas_2018 QL2 LiDAR

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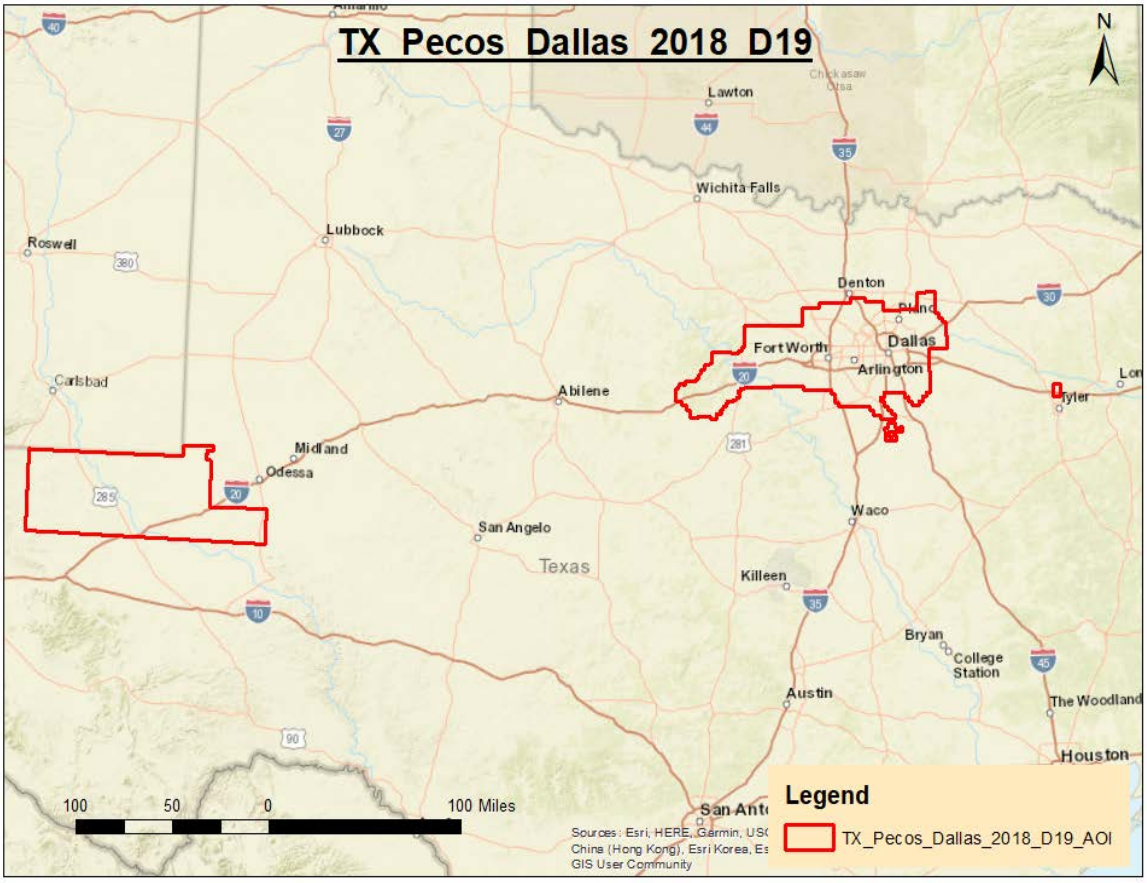

Image 1: Texas Pecos Dallas 2018 D19 AOI

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1 Introduction and Specifications

Digital Aerial Solutions, LLC (DAS) was tasked to collect and process a Light Detection and Ranging (LiDAR) derived elevation dataset for the 140G0219F0014-TX_Pecos_Dallas_2018. The area encompasses approximately 9,557 square miles Aerial LiDAR data was collected utilizing a Leica ALS80. The ALS80 is a discrete return topographic LiDAR mapping system manufactured by Leica Geosystems. LiDAR data collected for the 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR survey has an Aggregate Nominal Pulse (ANPS) spacing of (QL2 0.71 meters), and includes up to 2 discrete returns per pulse, along with intensity values for each return.

LiDAR datasets were post processed to generate elevation point cloud swaths for each flight line. Deliverables include the point cloud swaths, tiled point clouds classified by land cover type, breaklines to support hydro-flattening of digital elevation models (DEM), intensity tiles, and bare-earth DEM tiles. The point cloud deliverables are stored in the LAS version 1.4, point data record format 6. The tiling scheme for tiled deliverables is a 1,500-meter x 1,500-meter grid. Tile number is the appropriate cell number values found in the USNG index. All deliverables were generated in conformance with the U.S. Geological Survey National Geospatial Program Guidelines and Base Specifications, Version 1.3.

2 Spatial Reference System

The project is divided by the boarder of the UTM 13, UTM 14N and UTM 15N based on which side the project lies. The spatial reference of the data is as follows:

Horizontal Spatial Reference

- Coordinates: UTM Zone 13 N, UTM Zone 14 N and UTM Zone 15 N, Meters (to 2 decimal places)
- Datum: North American Datum 1983 (2011), Meters (to 2 decimal places)

Vertical Spatial Reference

All datasets are available with orthometric elevation; point cloud datasets are also available with ellipsoid heights.

- Datum: North American Vertical Datum of 1988 (GEOID12B)

3 LiDAR Acquisition

3.1 Survey Area

The 140G0219F0014-TX_Pecos_Dallas_2018QL2 LiDAR survey covers approximately 9,557 square miles for the QL2 area of interest covering all of Culberson, Reeves, Crane, Ward, Loving, Winkler, Palo Pinto, Stephens, Erath, Eastland, Wise, Denton, Collin, Rockwall, Dallas, Tarrant, Ellis, Johnson, Kaufman, Smith and Parker counties in TX. The flight plan consisted of 559 survey lines and 9 control lines.

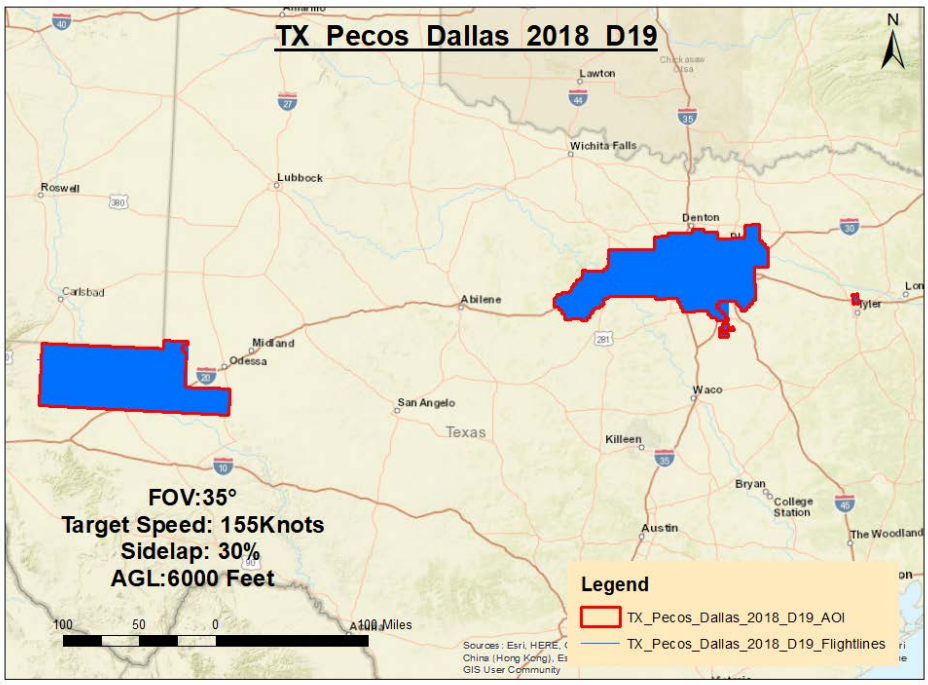


Image 2: TX Pecos Dallas 2018 D19 Flightlines

3.2 Acquisition Parameters

Acquisition parameters include the sensor configuration and the flight plan characteristics, and are selected based on a number of project specific criteria. Criteria reviewed include the required accuracies for the final dataset, the land cover types within the project survey area, and the required nominal pulse spacing. Aggregate Nominal Pulse Density (ANPD) for QL2 AOIs is no less than 2ppsm. The project parameters are summarized below.

Parameter	QL2
Flying Height Above Ground Level:	6,000 feet
Nominal Sidelap:	30%
Nominal Speed Over Ground:	155 Knots
Field of View:	35°
Laser Rate:	274.2 kHz
Scan Rate:	57.1 Hz
Maximum Across Track Spacing:	1.39 meters
Maximum Along Track Spacing:	0.71 meters
Average point Spacing:	0.58 meters

Table 1: Flight Parameters

3.3 Acquisition Mission

The acquisition mission for 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR survey was coordinated for optimal collection conditions and was acquired within 2 weeks. Collection began on January 26, 2019 and was completed on July 12, 2019.

3.4 Airborne GPS/IMU

Airborne global positioning system (GPS) and inertial measurement unit (IMU) data was collected on the aircraft during the acquisition mission, providing sensor position and orientation information for geo- referencing the LiDAR data. Airborne GPS observations were collected at a frequency of 0.5Hz, and IMU observations are collected at a frequency of 200Hz.

Aircraft	Sensor	GPS Lever Arm (m)	IMU Lever Arm (m)
C421-N112MJ	ALS80 SN# 8137	X: -0.192, Y: -0.034, Z: -1.382	X: -0.198, Y: 0.258, Z: 1.213
C441-N207SS	ALS80 SN# 8235	X: -0.117, Y: .200, Z: -1.350	X: 0.036, Y: 0.333, Z: 1.181
C421-N811NA	ALS80 SN# 8235	X: -0.184, Y: -0.041, Z: -1.375	X: -0.205, Y: 0.266, Z: 1.206

Table 2: Aircraft and Lever Arms

GPS data was collected with ground base stations during the acquisition missions, providing corrections to support differential post-processing of the airborne GPS. Base stations were setup at the following Airports: Pecos Municipal Airport, Odessa-Schlemeyer Field, Cleburne Regional Airport, Mineral Wells Airport and Lancaster Regional Airport. Ground GPS observations were collected at a frequency of 0.5Hz.

Name	Latitude	Longitude	Ellipsoid (m)
Pecos Municipal Airport-PEQ1	31° 23' 28.24061"	-103° 30' 43.65896"	769.327
Pecos Municipal Airport-PEQ2	31° 23' 27.95550"	-103° 30' 43.65896"	769.322
Pecos Municipal Airport-PEQ3	31° 23'29.62453 "	-103° 30' 43.43676"	769.237
Pecos Municipal Airport-PEQ4	31° 23' 29.24214"	-103° 30' 42.05740"	769.363
Odessa_Schlemeyer Airport-OD01	31° 55' 21.10895"	-102° 23' 30.67908"	880.630
Odessa_Schlemeyer Airport-OD02	31° 55' 21.18657"	-102° 23' 30.33225"	880.673
Cleburne Airport- CPT01	32° 21' 10.22825"	-97° 25' 52.07574"	230.642
Cleburne Airport- CPT02	32° 21' 10.68179"	-97° 25' 52.26561"	230.679
Mineral Wells Airport- MWL01	32° 47' 02.32545"	-98° 03' 32.67814"	255.892
Mineral Wells Airport- MWL02	32° 47' 02.18343"	-98° 03' 32.93783"	255.873
Lancaster Airport- LNC01	32° 34' 46.30209"	-96° 43' 12.84522"	122.841
Lancaster Airport- CS3200	32° 34' 46.80015"	-96° 43' 12.86469"	122.768

Table 3: Base Stations locations

4 LiDAR Processing

4.1 Acquisition Post-Processing

For each mission, airborne GPS was differentially corrected using the ground base station GPS for the corresponding day in Leica's IPAS software. The resulting solution is check to assure an accuracy of +/- 3 cm combined separation for north, east and height position difference between the forward and reverse processing solutions.

Differentially corrected airborne GPS data was merged with the airborne IMU dataset in Leica's IPAS software through Kalman filtering techniques. IPAS applies the reference lever arms for the GPS and IMU measurement systems during processing to determine the trajectory (position and orientation) of the LiDAR sensor during the acquisition mission. Estimated lever arm values reported posteriori validate the measurements made during sensor installation in the aircraft.

Raw LiDAR sensor ranging data and the final sensor trajectory from IPAS were processed in Leica's ALSPP software to produce the LiDAR elevation point cloud swaths for each flight line, stored in LAS version 1.4 file format. Quality control of the swath point clouds was performed to validate proper function of the sensor systems, full coverage of the project AOI, and point density consistent with the planned nominal pulse spacing.

Swath point clouds were assigned a unique File Source ID within the LAS file format before further processing. Swath files for the 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR project were numbered in chronological order of acquisition.

4.2 Geometric Calibration

Geometric and positional accuracy of the LiDAR swath point clouds is highly dependent on accurate calibration of the various subsystems within the LiDAR sensor system. Sensor calibration parameters fall into two categories, one being those parameters proprietary to the manufacturer's sensor design, and the other being parameters common to most commercial airborne LiDAR sensors, the IMU to laser reference system alignment angles (bore-site), and mirror deformation constants (scaling).

The manufacturer specific calibration parameters are applied in Leica's ALSPP software for the Leica ALS80 sensor system. Terrasolid's Terramatch software was used to calculate the IMU bore-site and mirror scale parameters for the 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR. Within the TerraMatch software, the Tie- line workflow was used to solve for the parameters. The Tie-line workflow involves automated selection of numerous 'tie-lines', which represent a linear segment fit to the data that should have the same slope, azimuth, position and elevation, within the overlap sections of the survey lines and control lines. The tie- lines provide observations for algorithms within TerraMatch to solve for the bore-site and mirror scale parameters for the lift.

The Tie-line workflow is dependent upon well distributed tie-lines throughout the swath point clouds to effectively solve for bore-site and mirror scale parameters with the automated algorithms.

Manual estimation of the bore-site and mirror scale parameters was performed using the observed tie-lines in overlap areas.

The final step of geometric calibration is to determine elevation (z) offset corrections to be applied to the swath point clouds. The Z values calculated during the course of the acquisition mission can vary at the centimeter level as the GPS satellite constellation observed in the survey area changes with satellites moving through their orbits over the course of the mission. Baseline length from the ground base station GPS to the airborne GPS can also impact the z values calculated for the swath point clouds. The Z offset corrections are calculated in two steps; a relative step, where individual lines are corrected one to another using the adjusted tie-lines from the bore-site and mirror scale calculation step; and an absolute step, where groups of lines are leveled to project ground control.

For 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR project, the control lines were used to determine relative z offset corrections in areas of discernible ground. The ground control points listed below were used to adjust the LiDAR by an average of -0.200m.

Point Id	Easting	Northing	Orth. Height	Type	UTM Zone
5_45	650681.573	3516519.465	900.04	GCP	13
5_104	624582.9	3484580.184	866.335	GCP	13
5_110	608040.537	3483898.036	970.879	GCP	13
5_116	595631.15	3485018.756	968.201	GCP	13
5_122	572483.115	3492784.726	1148.192	GCP	13
5_128	603817.123	3520792.73	874.779	GCP	13
5_1	709535.491	3500907.336	835.259	GCP	13
5_10	678018.541	3490027.322	799.002	GCP	13
5_16	652676.593	3481489.293	781.459	GCP	13
5_22	640460.321	3477220.608	792.268	GCP	13
5_28	628591.548	3501228.523	843.769	GCP	13
5_34	612989.87	3508659.707	865.533	GCP	13
5_44	625021.442	3529894.4	923.351	GCP	13
5_51	670043.176	3521441.422	861.005	GCP	13
5_57	677871.404	3537486.451	898.562	GCP	13
5_67	696867.458	3528888.418	918.463	GCP	13
5_73	676579.041	3503196.638	819.137	GCP	13
5_79	702133.749	3478215.005	770.803	GCP	13
5_85	738706.922	3490602.212	810.042	GCP	13
5_91	751248.254	3478965.911	775.101	GCP	13
5_97	753393.37	3502843.692	888.457	GCP	13
4_1	587413.749	3650866.968	332.367	GCP	14
4_4	587419.536	3630594.265	269.335	GCP	14
4_11	552371.833	3619589.463	369.686	GCP	14
4_15	547184.814	3603120.192	303.539	GCP	14

Point Id	Easting	Northing	Orth. Height	Type	UTM Zone
4_30	562470.861	3582070.791	377.843	GCP	14
4_35	545378.128	3595795.175	333.054	GCP	14
4_43	554720.968	3596813.100	314.450	GCP	14
4_54	564036.527	3599738.159	301.859	GCP	14
4_65	565739.847	3611472.963	265.944	GCP	14
3_108	620574.066	3611696.978	360.492	GCP	14
3_114	602088.775	3613852.570	241.889	GCP	14
3_120	612628.135	3623835.033	322.614	GCP	14
3_126	604976.582	3633414.444	390.883	GCP	14
3_132	617752.842	3638236.465	311.041	GCP	14
2_14	710944.197	3567303.314	142.446	GCP	14
2_2	703722.013	3563052.257	152.458	GCP	14
2_26	706028.429	3571983.030	158.947	GCP	14
2_8	711183.644	3560629.148	127.382	GCP	14
3_2	665690.804	3587809.894	218.663	GCP	14
3_8	658808.320	3600586.019	227.272	GCP	14
3_14	638416.905	3610484.625	223.787	GCP	14
3_20	638309.898	3636820.619	224.007	GCP	14
3_26	642186.244	3658355.624	277.942	GCP	14
3_32	660818.209	3655130.379	190.428	GCP	14
3_38	666654.453	3634223.428	175.213	GCP	14
3_44	671123.543	3614825.228	199.985	GCP	14
3_50	682200.650	3598361.141	170.010	GCP	14
3_58	697893.251	3613863.176	209.678	GCP	14
3_64	692895.013	3635281.712	158.504	GCP	14

Point Id	Easting	Northing	Orth. Height	Type	UTM Zone
3_70	688732.489	3652380.442	138.110	GCP	14
3_76	711104.356	3646604.702	184.400	GCP	14
3_82	717841.845	3663884.664	194.326	GCP	14
3_88	738453.524	3672411.737	164.678	GCP	14
3_94	753012.227	3652719.502	166.582	GCP	14
3_100	738864.455	3645571.520	177.543	GCP	14
3_140	701870.588	3579811.942	178.273	GCP	14
3_146	706392.768	3599833.214	184.149	GCP	14
3_152	704949.101	3625347.013	145.175	GCP	14
3_158	723235.664	3624179.396	156.319	GCP	14
3_164	738776.257	3625557.689	141.088	GCP	14
3_170	737485.044	3613952.972	121.661	GCP	14
3_176	719570.600	3601624.191	140.597	GCP	14
3_182	727497.150	3587134.421	143.739	GCP	14
3_58	697893.251	3613863.176	209.678	GCP	14
3_64	692895.013	3635281.712	158.504	GCP	14
3_70	688732.489	3652380.442	138.110	GCP	14
3_76	711104.356	3646604.702	184.400	GCP	14
3_82	717841.845	3663884.664	194.326	GCP	14
3_88	738453.524	3672411.737	164.678	GCP	14
3_94	753012.227	3652719.502	166.582	GCP	14
3_100	738864.455	3645571.520	177.543	GCP	14
3_140	701870.588	3579811.942	178.273	GCP	14
1_1	281211.927	3592430.961	166.072	GCP	15
1_4	285379.738	3591856.462	151.723	GCP	15

Point Id	Easting	Northing	Orth. Height	Type	UTM Zone
1_7	282869.14	3596547.712	149.183	GCP	15
1_10	284794.044	3601147.156	131.917	GCP	15
1_13	279890.971	3601548.492	131.89	GCP	15

Table 5: Ground Control Points

The final geometrically calibrated swath point clouds were compared to the bare-earth profile survey data. The data fit the profile surveys within the vertical accuracy tolerance specified for the project. Full documentation of the vertical accuracy checks maybe found in section 5.1.

4.3 Point Cloud Classification

Georeferenced information was applied to the swath point cloud LAS files. Geometrically calibrated swath point clouds were cut into USNG index, 1,500-meter x 1,500-meter LAS 1.2 format tiles for point cloud classification and derived in LAS 1.4 format for product creation.

Tiled point cloud data was processed in Terrasolid's Terrascan software to assign initial classification values. The Terrascan software provides a number of routines to algorithmically detect and assign points to their appropriate class. Points left unclassified by the algorithmic routine remain as Class 1

– Processed, but unclassified. Automated classification routines assigned points to one of the following classes:

```
Class 1 – Processed, but unclassified
Class 2 – Bare-earth ground
Class 7 – Low Noise (low, manually identified, if necessary)
Class 9 – Water
Class 17 – Bridge Decks
Class 18 – High Noise (high, manually identified, if necessary)
Class 20 – Ignored Ground (Breakline Proximity)
```

Automated classification results were reviewed for each tiled point cloud, and manual edits made where necessary to correct for misclassified points. Points remaining in Class 1 after the automated classification routines were run were left in Class 1. Points falling outside of a 100-meter buffer of the project AOI polygon were excluded from the tiled point clouds.

4.4 Breakline Collection

Manual breakline collection was performed to support the hydro-flattening requirements of the project's DEM deliverables. Breaklines were collected directly from the classified point clouds and from triangulated irregular network (TIN) surface models built from the classified point clouds, in Terrasolid's Terrascan and Terramodeler software. Breakline features were collected as design file elements in Bentley's Microstation software. Breaklines were converted to ESRI 3D shapefile format for the breakline deliverable, and tiled to USNG index.

The data collected for the 140G0219F0014-TX_Pecos_Dallas_2018 survey maintained significant point density in the water, marsh, and swamp, limiting the usefulness of point density as guiding factor in breakline placement.

Points classified as Class 2 – Bare-earth ground, falling within a tenth of a meter buffer of the collected breaklines, were reassigned to Class 20 – Ignored Ground. These points are excluded from the surface model during DEM generation to preserve the hydro-flattening characteristics of the breaklines.

4.5 DEM Generation

The final classified point clouds and collected breaklines were reviewed for conformance to the task order (scope of work). Within the LP360 software, points in Class 2 – Bare- earth ground and breaklines were combined to generate TIN elevation models for each tile, from which the bare-earth DEM tiles were interpolated and exported as GeoTIFF 32-bit floating point raster format ".tif" format.

5 Quality Control

5.1 Point Clouds

Accuracy and completeness of the LiDAR point clouds directly impacts the quality of all other derived LiDAR derived products. Ensuring a quality LiDAR dataset begins with proper mission planning and execution. Ground GPS base stations are located such that GPS baselines between the ground and airborne receivers do not exceed 30km. For the 140G0219F0014-TX_Pecos_Dallas_2018 project, two base stations were run to meet this requirement, one at the field operations airport and one within the survey area. Static alignment is performed both before take-off and after landing to allow for GPS integer ambiguity resolution. Sensor operators carefully monitor the LiDAR unit and its various subsystems during the acquisition mission to ensure proper function. Airborne GPS positional dilution of precision (PDOP) estimates are monitored to ensure they remain less than 3. The optical system is monitored to ensure there are no ranging errors encountered during the flight lines.

During acquisition post-processing estimates of the trajectory data accuracy are reviewed to ensure they will support the required accuracies of the point cloud data. The trajectory accuracy is a function of the differentially corrected GPS data and the IMU data.

The raw swath points cloud generated from CloudPro are reviewed as another check for proper sensor function. The point clouds are reviewed for full coverage of the AOI, required point density and nominal pulse spacing, clustering, proper intensity values, full swath coverage within the planned field of view, and planned survey line overlap.

Geometric calibration quality control validates that the positional accuracy requirements of the project are met, and includes relative accuracy assessments for intra-swath (within) and inter-swath (between) accuracy, along with absolute accuracy assessments against project ground control.

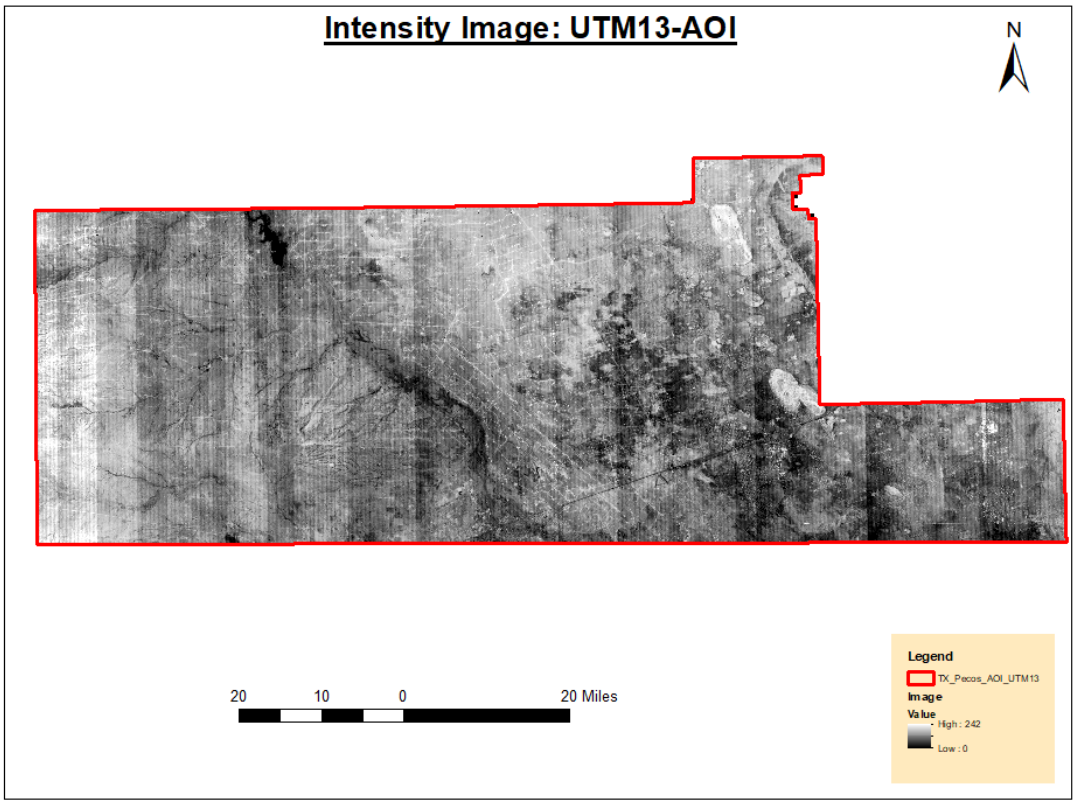


Image 3A UTM 13: EASTERN TX QL2 LiDAR Intensity Image

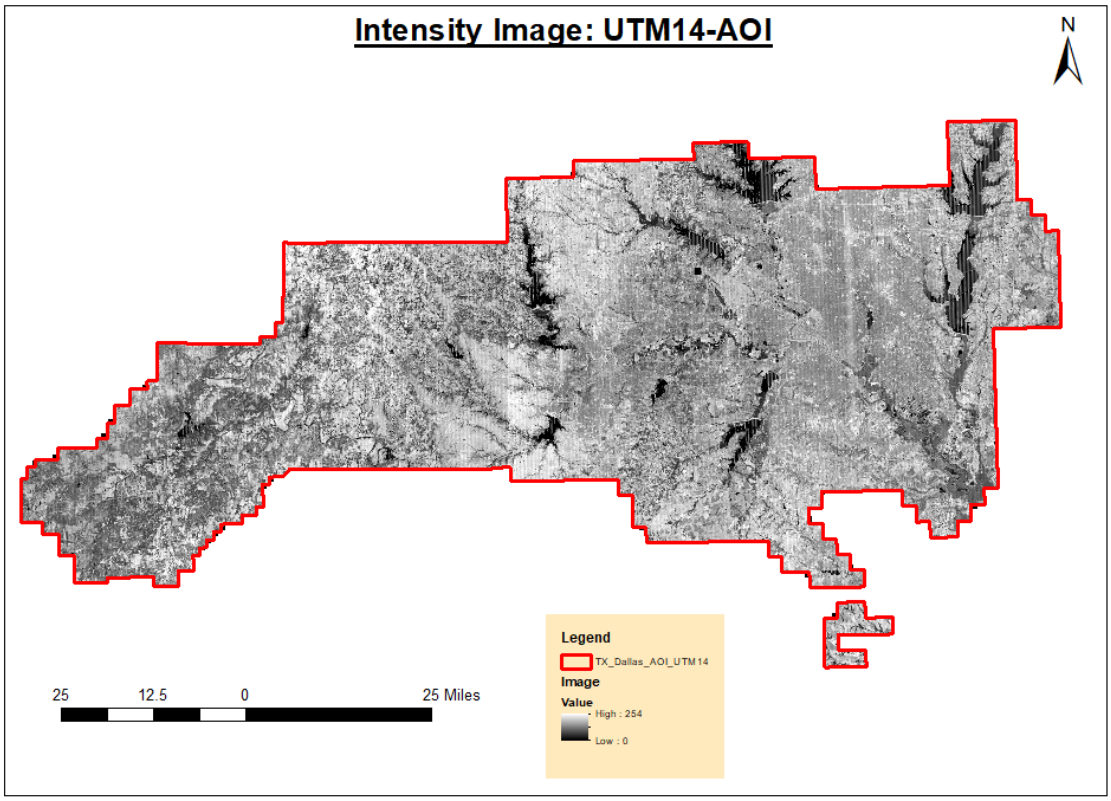


Image 3B UTM 14: EASTERN TX QL2 LiDAR Intensity Image

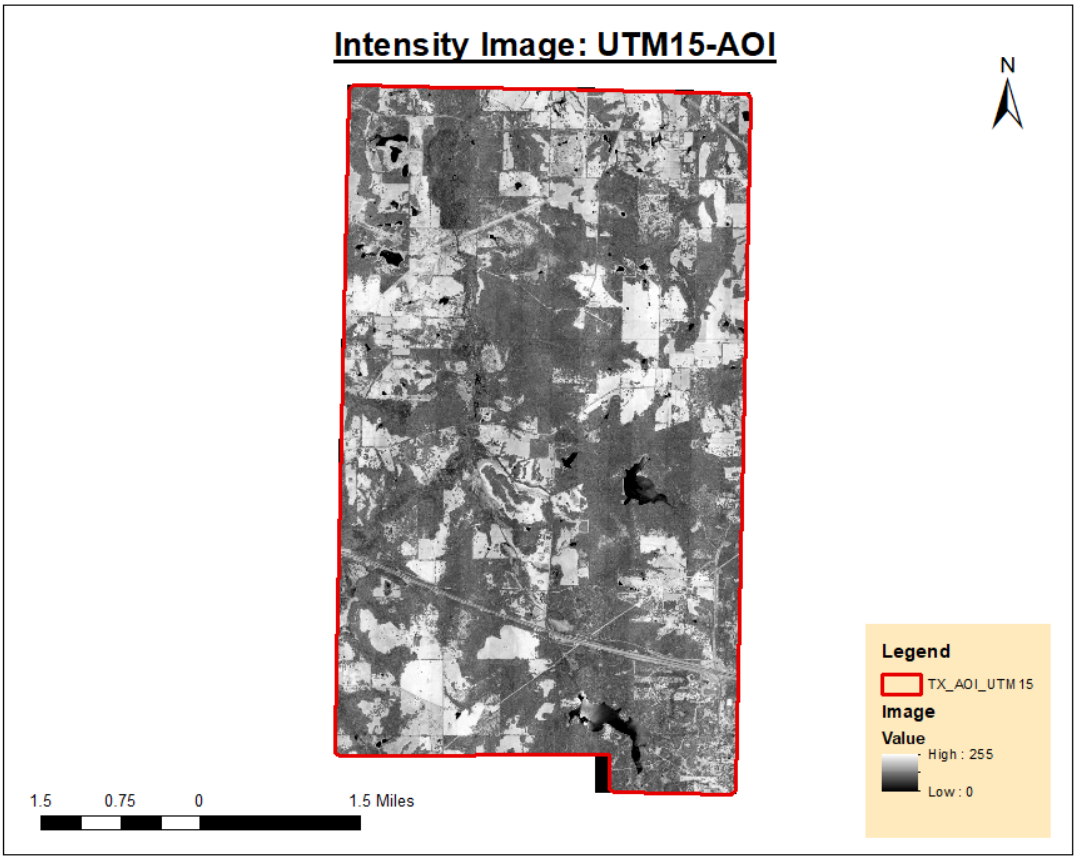


Image 3B UTM 15: EASTERN TX QL2 LiDAR Intensity Image

Relative vertical accuracy assessments are normally made using the tie-lines generated in the Terramatch software, as these lines provide positional observations throughout the extent of individual swaths, and between neighboring swaths.

This data set was produced to meet ASPRS "Positional Accuracy Standards for Digital Geospatial Data" (2014) for a 22.6 (cm) RMSEx / RMSEy Horizontal Accuracy Class which equates to Positional Horizontal Accuracy =+/- 78.3 cm at a 95% confidence level.

Estimated LiDAR Horizontal:	(cm)
Error Per Point ($RMSE_R$)	32.0
Error Per Point ($RMSE_X$/$RMSE_Y$)	22.6
Per Point at 95% confidence level	78.3

Table 6: Estimated LiDAR Horizontal Accuracy

Absolute vertical accuracy assessments for the point cloud data are made against ground check point data. For the 140G0219F0014-TX_Pecos_Dallas_2018 QL2 LiDAR, ground check point data consisted of the ground GPS base station and real-time kinematic (RTK) GPS techniques.

Check point locations were collected at 1 – second intervals during the RTK survey. Points collected during the static pre-initialization and post-initialization was removed from the assessment so as not to bias the assessment.

Local TIN models of the elevation points are built around each ground check points. The tin model elevation is sampled at the horizontal position of the ground check point. The TIN model elevation and ground check point survey elevation values were used to calculate the Non-vegetated Vertical Accuracy (NVA) of the swath point clouds. Table 7 below shows the tested accuracy values for TIN and DEM data at 95% confidence level. The full calculations for all check points can be found in Appendix B.

Tested Accuracy	$RMSE_Z$	NVA	VVA
Classified LiDAR UTM13	0.072	60	45
Digital Elevation Model UTM 13	0.073	60	45
Classified LiDAR UTM 14	0.053	124	97
Digital Elevation Model UTM 14	0.057	124	97
Classified LiDAR UTM 15	0.044	6	4
Digital Elevation Model UTM 15	0.035	6	4

Table 7: Tested $RMSE_Z$ of NVA, NVA and VVA of LiDAR Point Cloud and Digital Elevation Model.

Total #	# NVA	# VVA
336	190	146

Table 8: Number of Survey Points used to calculate accuracy of data.

The tiled point cloud products were reviewed for full coverage of the AOI and proper classification. As part of the QC process, TINs are built in the Terramodeler software for each tile using the ground class and the hydro-flattening breaklines. The TINs are reviewed for non-ground features, and edited where necessary to remove any remaining non-ground features. Points were also reviewed for absolute elevation, and points falling below the selected orthometric elevation for water were removed from the ground class.

5.2 Breaklines

The final breaklines in ESRI 3D shapefile format were reviewed for topological consistency and correct elevation. Breaklines features are continuous and do not have overlaps or dangles.

5.3 Digital Elevation Models

Digital elevation models (DEMs) were reviewed for conformance with the SOW and the Base Mapping Specification version 1.3 guidelines. DEM files were loaded in the Global Mapper software and inspected visually for edge matching between tiles, void areas within the project AOI, and proper coding of the NODATA values. DEM file naming was verified for consistency with the USNG index.

Appendix A. Flight Logs

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/26/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1842.4			2		Pecos_Tx			Wes Ashmore	
Hobbs ST	1839.3		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.1		A	8,145		165	TEMP	1.500	C421-N112MJ	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		8	190126_172637	17:26	17:47	8186	264°	149	1064	21	1.1	0.6	Cloud cover 1st 14 miles
		251	190126_175630	17:56	18:09	8958	174°	167	1054	22	1.0	0.6	
		252	190126_181411	18:14	18:27	8990	352°	161	1048	20	1.1	0.6	ALS: Range Gate
		253	190126_183209	18:31	18:45	8972	172°	164	1043	19	1.3	0.7	
		254	190126_185006	18:50	19:03	8988	354°	164	1037	19	1.2	0.7	"
		255	190126_190854	19:09	19:22	8888	172°	164	1031	18	1.3	0.7	"
		256	190126_192650	19:26	19:39	8919	353°	164	1025	18	1.2	0.7	"
		257	190126_194456	19:44	19:58	8900	172°	164	1019	19	1.1	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Tx							Sensor Operator/s	
								Geoffrey McCall	
Date/Julian:	1/27/2019	ALS80 SN # 8137- HP		Disk Drive MM70	Flight Plan(s):			Pilot/s	
Hobbs End	1846.1			2	Pecos_Tx			David Carlson	
Hobbs ST	1842.4		LIFT	Target Altitude (MSL)	TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.7		A	8,866	165	TEMP	1.500	C421-N112MJ	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		258	190127_160322	16:03	16:16	8900	352°	157	1012	24	1.1	0.6	ALS: Range Gate
		259	190127_162208	16:22	16:35	8869	172°	166	1006	21	1.1	0.6	"
		260	190127_164156	16:42	16:55	8837	352°	159	1000	23	1.1	0.6	"
		261	190127_170102	17:00	17:14	8840	172°	163	994	24	1.1	0.6	"
		262	190127_171910	17:19	17:32	8785	353°	154	988	23	1.2	0.6	"
		263	190127_173729	17:37	17:50	8785	172°	164	982	25	1.1	0.6	"
		264	190127_175500	17:55	18:08	8800	352°	153	976	24	1.1	0.6	"
		265	190127_181340	18:13	18:26	8800	172°	163	970	19	1.4	0.7	"
		266	190127_183245	18:32	18:46	8800	352°	157	964	18	1.4	0.7	"
		267	190127_185135	18:51	19:04	8765	173°	160	958	18	1.1	0.7	"

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/31/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1847.9			2		Pecos_Tx			David Carlson	
Hobbs ST	1847.1		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	0.8		A	7,941		165	TEMP	1.500	C421-N112MJ	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		378	190131_221811	22:18	22:31	7967	352°	160	303	23	1.2	0.6	ALS Range Gate. Turbulence.
													Pitch + Roll too much.

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	3/7/2019		Disk Drive MM70		Flight Plan(s):				Pilot/s	
Hobbs End	1868.9		1		TX_Pecos_Dallas_2019				Mike Wasielewski	
Hobbs ST	1865.6	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.3	A	6,872		165		TEMP	1.500	C421-N112MJ	MWL (Mineral Wells)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		5	190307_005905	:59	1:07	6344	364°	142	1078	20	1.1	0.6	
		179	190307_011414	1:14	1:16	6827	174°	150	1074	20	1	0.6	
		180	190307_012054	1:20	1:23	6822	356°	160	1073	19	1.1	0.7	Range Gate Warning
		181	190307_012829	1:28	1:31	6743	177°	147	1072	16	1.3	0.8	
		182	190307_013553	1:35	1:38	6761	355°	161	1071	16	1.3	0.8	Range Gate Warning
		183	190307_014332	1:43	1:47	6709	176°	150	1069	17	1.2	0.7	Low Return Warning
		184	190307_015117	1:51	1:54	6653	357°	162	1068	15	1.4	0.8	Range Gate Warning
		185	190307_015956	1:59	2:03	6533	174°	147	1066	16	1.2	0.7	
		186	190307_020732	2:07	2:10	6532	357°	164	1064	18	1.1	0.7	
		187	190307_021543	2:15	2:19	6529	177°	145	1063	18	1.1	0.7	
		188	190307_022432	2:24	2:29	6546	356°	161	1061	17	1.2	0.7	Range Gate Warning
		189	190307_023432	2:34	2:39	6539	175°	144	1059	16	1.3	0.7	Range Gate Warning
		190	190307_024353	2:43	2:48	6529	357°	163	1056	18	1.4	0.7	Range Gate Warning
		191	190307_025343	2:53	3:00	6482	176°	147	1054	18	1.5	0.7	
		192	190307_030433	3:04	3:10	6514	355°	165	1051	18	1.3	0.7	Range Gate and Low Return Warning
		193	190307_031536	3:15	3:22	6492	175°	150	1048	19	1.2	0.6	Range Gate Warning
		194	190307_032600	3:26	3:32	6399	357°	165	1045	19	1.2	0.6	Low Return Warning
		195	190307_033634	3:36	3:43	6389	175°	149	1042	18	1.4	0.6	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	3/7/2019		Disk Drive MM70		Flight Plan(s):				Pilot/s	
Hobbs End	1872.3		1		TX_Pecos_Dallas_2019				Mike Wasielewski	
Hobbs ST	1868.9	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.4	A	6,438		165		TEMP	1.500	C421-N112MJ	MWL (Mineral Wells)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available MM Space	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:						PDOP	HDOP	
		196	190307_152532	15:25	15:31	6400	175°	158	1039	20	1.1	0.6	Range Gate Warning
		197	190307_153608	15:36	15:42	6414	357°	152	1036	18	1.2	0.7	Range Gate Warning
		198	190307_154657	15:46	15:53	6412	176°	157	1033	18	1.3	0.7	Range Gate Warning
		199	190307_155819	15:58	16:05	6414	356°	153	1030	17	1.3	0.7	Range Gate Warning
		200	190307_160940	16:09	16:16	6425	176°	163	1026	17	1.2	0.7	Range Gate and Low Return Warning
		201	190307_162138	16:21	16:29	6398	355°	152	1023	16	1.4	0.8	Range Gate Warning
		202	190307_163344	16:33	16:41	6386	176°	162	1019	16	1.3	0.8	Range Gate Warning
		203	190307_164652	16:46	16:54	6321	356°	157	1016	17	1.1	0.7	
		204	190307_165940	16:59	17:07	6324	177°	159	1012	18	1.1	0.7	Range Gate Warning
		205	190307_171222	17:12	17:20	6343	355°	160	1008	18	1.2	0.7	Range Gate Warning
		206	190307_172518	17:25	17:33	6335	176°	150	1005	18	1.2	0.7	Range Gate Warning
		207	190307_173753	17:37	17:46	6316	355°	163	1001	19	1.2	0.6	
		208	190307_175104	17:51	17:59	6293	177°	158	997	19	1.2	0.6	Range Gate Warning
		209	190307_180427	18:04	18:12	6318	355°	161	993	19	1.2	0.6	Range Gate Warning
		6	190307_181728	18:17	18:24	6321	85°	157	989	21	1.1	0.6	Low Return Warning

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	3/7/2019		Disk Drive MM70		Flight Plan(s):				Pilot/s	
Hobbs End	1875.8		1		TX_Pecos_Dallas_2019				Mike Wasielewski	
Hobbs ST	1872.3	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5	B	6,341		165		TEMP	1.500	C421-N112MJ	MWL (Mineral Wells)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available MM Space	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:						PDOP	HDOP	
		210	190307_203944	20:39	20:48	6245	176°	153	1117	19	1.2	0.6	Low Return Warning
		211	190307_205315	20:53	21:02	6265	357°	155	1113	22	1.1	0.6	
		212	190307_210654	21:06	21:16	6258	177°	152	1109	22	1.2	0.6	Low Return Warning
		213	190307_212135	21:21	21:30	6283	357°	161	1104	22	1.2	0.6	Low Return Warning
		214	190307_213719	21:37	21:48	6249	177°	154	1100	22	1.1	0.6	Range Gate Warning
		215	190307_215253	21:52	22:03	6198	356°	162	1095	20	1.4	0.6	
		235	190307_220841	22:08	22:17	6125	176°	153	1090	21	1.2	0.6	
		250	190307_222211	22:22	22:32	6132	355°	164	1086	22	1.1	0.6	Range Gate Warning
		251	190307_223729	22:37	22:48	6087	177°	159	1081	21	1	0.6	Range Gate Warning
		252	190307_225249	22:52	23:03	6117	356°	162	1076	18	1.2	0.7	Range Gate Warning
		253	190307_230754	23:07	23:18	6104	177°	149	1071	19	1.1	0.7	Range Gate Warning
		254	190307_232304	23:23	23:33	6106	355°	161	1067	18	1.4	0.8	Range Gate and Low Return Warning
		255	190307_233712	23:37	23:48	6098	174°	146	1062	19	1.2	0.7	Range Gate and Low Return Warning

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Lidar_FY19								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/7/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1879.2			708		Pecos_Parker_Dallas			Wes Ashmore	
Hobbs ST	1875.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.4		A	6,500		165	TEMP	1.500	C421-N112MJ	MWL (Minneral Wells, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		216	190308_005302	:53	1:03	6223	175°	147	699	18	1.1	0.6	
		217	190308_010835	1:08	1:19	2338	358°	170	694	19	1.1	0.7	
		218	190308_012419	1:24	1:35	6219	176°	148	688	16	1.2	0.7	ALS Range GATE MAX
		219	190308_014031	1:40	1:51	6267	356°	155	683	17	1.2	0.8	ALS BG
		220	190308_015623	1:56	2:07	6223	176°	148	678	17	1.3	0.7	ALS Range GATE MAX
		221	190308_021241	2:12	2:24	6257	357°	159	673	18	1.2	0.7	ALS BG
		222	190308_022842	2:28	2:40	6249	177°	147	667	18	1.2	0.6	ALS BG
		223	190308_024301	2:43	2:53	6274	352°	158	662	22	1.1	0.7	ALS BG
		224	190308_025837	2:58	3:08	6230	176°	146	658	20	1.3	0.6	
		225	190308_031341	3:13	3:26	6263	356°	159	653	22	1.2	0.6	
		226	190308_032850	3:28	3:38	6233	175°	149	648	21	1.4	0.6	
		227	190308_034338	3:43	3:52	6245	356°	157	643	22	1.4	0.6	ALS AG, RANGE GATE MAX

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Lidar_FY19								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/8/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1881.9			3		Pecos_Parker_Dallas			Wes Ashmore	
Hobbs ST	1879.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	2.7		A	6,500		165	TEMP	1.500	C421-N112MJ	MWL (Minneral Wells, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		228	190308_162036	16:20	16:29	6089	138°	147	986	17	1.2	0.7	
		229	190308_163353	16:33	16:42	6105	360°	154	981	16	1.3	0.8	
		230	190308_164720	16:47	16:56	6078	177°	163	977	16	1.2	0.8	
		231	190308_170026	17:00	17:09	6114	357°	162	972	18	1.1	0.8	
		232	190308_171340	17:13	17:22	6091	177°	161	968	18	1.2	0.7	
		233	190308_172628	17:26	17:34	6123	356°	164	964	18	1.2	0.7	
		234	190308_173924	17:39	17:47	6104	174°	158	960	20	1.2	0.7	
		236	190308_175126	17:51	17:59	6131	356°	167	656	20	1.2	0.7	
		237	190308_180432	18:04	18:12	6109	177°	150	953	20	1.2	0.7	
		238	190308_181635	18:16	18:26	6149	356°	173	949	21	1.2	0.6	
		239	190308_182917	18:29	18:37	6120	177°	185	945	20	1.2	0.6	
		240	190308_184110	18:41	18:48	6116	355°	171	941	22	1.1	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Lidar_FY19								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/8/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1885.4			3		Pecos_Parker_Dallas			Wes Ashmore	
Hobbs ST	1881.9		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		B	6,500		165	TEMP	1.500	C421-N112MJ	MWL (Minneral Wells, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		241	190308_210959	21:09	21:18	6091	176°	145	938	23	1.3	0.6	
		242	190308_212215	21:22	21:30	6102	357°	166	934	25	1.1	0.6	ALS Range GATE MAX
		243	190308_213505	21:35	21:43	6105	176°	145	930	23	1.1	0.6	
		244	190308_214730	21:47	21:55	6126	351°	164	926	20	1.4	0.6	ALS Range GATE MAX
		245	190308_215958	21:59	22:07	6076	175°	144	922	21	1.3	0.6	
		246	190308_221124	22:11	22:18	6093	356°	167	919	24	1.1	0.6	
		247	190308_222350	22:23	22:31	6081	177°	145	916	23	1.1	0.6	ALS Range GATE MIN
		248	190308_223544	22:35	22:48	6088	356°	163	912	21	1.2	0.7	HIGH SPIKE AGL
		249	190308_225007	22:50	23:02	6042	177°	141	908	19	1.3	0.7	
		256	190308_230458	23:04	23:15	6127	355°	156	902	20	1.2	0.7	ALS Range GATE MAX
		257	190308_232033	23:20	23:32	6055	175°	142	895	20	1.4	0.8	
		258	190308_233524	23:35	23:45	6100	349°	174	892	21	1.1	0.7	ALS RANGE GATE MAX
		259	190308_235019	23:50	:1	6049	177°	137	887	20	1.1	0.6	
		260	190309_000508	:5	:15	6084	358°	178	882	23	0.9	0.6	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	3/9/2019		Disk Drive MM70		Flight Plan(s):				Pilot/s	
Hobbs End	1889		1		TX_Pecos_Dallas_2019				Mike Wasielewski	
Hobbs ST	1885.4	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.6	A	6,137		165		TEMP	1.500	C421-N112MJ	MWL (Mineral Wells)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		261	190309_012431	1:24	1:34	6115	356°	164	1056	14	1.3	0.7	
		262	190309_014128	1:41	1:52	6068	176°	145	1052	14	1.4	0.8	Low Return Warning
		263	190309_015640	1:56	2:03	6087	357°	159	1047	16	1.2	0.7	Range Gate Warning
		264	190309_021111	2:11	2:22	6060	175°	144	1042	16	1.1	0.7	Low Return Warning
		265	190309_022633	2:26	2:36	6102	355°	159	1037	16	1.2	0.7	Range Gate Warning
		266	190309_024145	2:41	2:53	6063	177°	141	1031	19	1.1	0.6	Range Gate Warning
		267	190309_025729	2:57	3:07	6101	356°	162	1027	17	1.3	0.7	Range Gate Warning
		268	190309_031224	3:12	3:23	6055	177°	148	1022	18	1.2	0.6	Range Gate Warning
		269	190309_032827	3:28	3:38	6083	357°	163	1017	17	1.4	0.6	
		270	190309_034318	3:43	3:54	6047	176°	147	1012	19	1.4	0.6	Range Gate Warning
		271	190309_035813	3:58	4:08	6079	359°	165	1007	21	1.2	0.6	
		272	190309_041248	4:12	4:24	6020	176°	146	1002	21	1.2	0.6	
		273	190309_042743	4:27	4:37	6037	356°	160	996	21	1.2	0.8	Low Return Warning

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/16/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1903.6			1		Pecos_Parker_Dallas_Addon			Dave Carlson	
Hobbs ST	1900.5		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.1		A	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		274	190316_012651	1:26	1:38	5957	356°	154	992	15	1.3	0.7	Low Return Warning
		275	190316_014304	1:43	1:52	5964	136°	171	987	16	1.2	0.7	Low Return Warning
		276	190316_015837	1:58	2:09	5974	356°	153	983	15	1.2	0.7	Low Return Warning
		277	190316_021449	2:14	2:25	6000	175°	172	977	17	1.2	0.6	
		278	190316_022942	2:29	2:40	5979	356°	155	973	15	1.4	0.7	
		279	190316_024529	2:45	2:55	5979	356°	175	968	17	1.3	0.6	Low Return Warning
		280	190316_030032	3:00	3:09	6044	356°	152	963	16	1.5	0.7	Low Return Warning
		281	190316_031629	3:16	3:26	6067	172°	162	958	16	1.4	0.6	
		282	190316_033128	3:31	3:47	6048	355°	155	953	17	1.2	0.6	
		283	190316_034715	3:47	3:57	6073	172°	162	948	17	1.2	0.6	Range Gate Warning

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/16/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1907			1		DFW			Mike Wasielewski	
Hobbs ST	1903.6		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.4		B	6,006		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		130	190316_051607	5:16	5:35	6017	355°	152	943	18	1.2	0.7	
		131	190316_053912	5:39	5:57	6037	175°	162	938	19	1.2	0.7	Low Return Warning
		132	190316_060228	6:02	6:21	6016	357°	150	921	16	1.4	0.7	
		133	190316_062549	6:25	6:44	6037	176°	163	919	17	1.6	0.7	
		134	190316_064812	6:48	7:07	6020	153°	187	911	18	1.3	0.7	
		135	190316_071121	7:11	7:29	6038	174°	157	907	16	1.3	0.7	
		136	190316_073350	7:33	7:58	6020	655°	162	893	17	1.1	0.7	
		137	190316_075627	7:56	8:15	6035	178°	165	886	17	1.1	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/16/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1909.2			1		Pecos_Parker_Dallas_Addon			Wes Ashmore	
Hobbs ST	1907		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	2.2		A	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		284	190316_162748	16:27	16:38	6112	357°	154	878	18	1.1	0.8	
		285	190316_164217	16:42	16:52	6118	176°	171	873	19	1.2	0.7	Range Gate Warning
		286	190316_165638	16:56	17:07	6116	357°	152	868	19	1.2	0.7	
		287	190316_171147	17:11	17:22	6168	176°	162	863	18	1.1	0.6	
		288	190316_172601	17:26	17:36	6150	357°	154	859	21	1.2	0.7	Low Return Warning
		289	190316_174059	17:40	17:51	6174	174°	161	854	21	1.1	0.6	
		290	190316_175532	17:55	18:06	6199	4°	149	849	19	1.2	0.6	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/16/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1912.5			1		Pecos_Parker_Dallas_Addon			Wes Ashmore	
Hobbs ST	1909.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.3		B	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		291	190317_013112	1:31	1:40	6247	357°	160	844	15	1.4	0.8	Range Gate Warning
		292	190317_014544	1:45	1:55	6219	177°	159	839	16	1.2	0.7	Low Return Warning
		293	190317_020026	2:00	2:11	6230	356°	131	835	18	1.2	0.8	Range Gate Warning
		294	190317_021509	2:15	2:24	6261	176°	163	830	18	1.2	0.6	Low Return Warning
		295	190317_022944	2:29	2:39	6218	357°	162	825	18	1.4	0.7	Low Return Warning
		296	190317_024353	2:43	2:53	6237	176°	174	821	18	1.2	0.6	Low Return Warning
		296	190317_030837	3:08	3:18	6244	357°	161	817	18	1.5	0.7	
		297	190317_032321	3:23	3:33	6251	176°	165	812	19	1.3	0.6	Range Gate Warning
		298	190317_033718	3:37	3:47	6154	357°	164	807	20	1.3	0.6	
		299	190317_035142	3:51	4:01	6199	175°	163	803	19	1.2	0.7	
		300	190317_040545	4:05	4:18	6150	356°	165	798	17	1.4	0.8	
		301	190317_042022	4:20	4:24	6164	177°	167	794	18	1.2	0.7	Range Gate Warning
		302	190317_043430	4:34	4:41	6156	358°	166	789	19	1.4	0.7	
		303	190317_044834	4:48	5:00	6156	177°	166	785	19	1.4	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019										Sensor Operator/s	
											Stephen Overcast	
Date/Julian:	3/17/2019		Disk Drive MM70		Flight Plan(s):						Pilot/s	
Hobbs End	1916.4		1		TX_DFW_6000FT_LIDAR						Dave Carlson/Mike Wasielewski	
Hobbs ST	1912.9		LIFT	Target Altitude (MSL)	TARGET AIRSPD (KNTS)		BASE PID:		Base Height		Aircraft	Airport Idnt:
Flight Time	3.5		A	6,056	160		TEMP		1.500		C421-N112MJ	KCPT (Cleburne)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		138	190317_062126	6:21	6:39	5990	356°	156	780	18	1.4	0.8	Low Return Warning
		139	190317_064518	6:45	7:03	6069	176°	154	772	19	1.4	0.7	Low Return Warning
		140	190317_070907	7:09	7:27	6025	357°	156	764	18	1.3	0.7	Low Return Warning
		141	190317_073407	7:34	7:52	5960	176°	159	756	19	1.2	0.7	Low Return Warning
		142	190317_075724	7:57	8:14	5934	356°	160	748	18	1.2	0.7	
		143	190317_082107	8:21	8:39	6036	176°	157	741	16	1.6	0.8	
		144	190317_084432	8:44	9:02	6008	356°	160	733	16	1.4	0.8	
		145	190317_090816	9:08	9:26	6013	177°	157	725	18	1.2	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	3/17/2019		Disk Drive MM70		Flight Plan(s):				Pilot/s	
Hobbs End	1918.9		1		TX_Pecos_Dallas				Mike Wasielewski	
Hobbs ST	1916.4	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	2.5	B	5,852		165		TEMP	1.500	C421-N112MJ	KCPT (Cleburne)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		7	190317_163019	16:30	16:32	5802	355°	161	717	20	1	0.6	Range Gate Warning
		8	190317_163648	16:36	16:39	5817	176°	165	716	18	1.1	0.7	
		9	190317_164325	16:43	16:46	5808	357°	159	715	18	1.2	0.7	Range Gate Warning
		10	190317_165051	16:50	16:53	5802	175°	160	713	19	1.2	0.7	
		11	190317_165801	16:58	17:01	5806	358°	155	712	19	1.1	0.6	Range Gate Warning
		12	190317_170459	17:04	17:07	5804	177°	163	711	20	1.1	0.6	
		13	190317_171202	17:12	17:15	5800	357°	157	709	19	1.1	0.6	
		14	190317_171852	17:18	17:21	5786	177°	164	708	19	1.2	0.6	
		15	190317_172523	17:25	17:28	5782	358°	159	707	19	1.2	0.6	
		16	190317_173157	17:31	17:34	5783	178°	163	705	19	1.2	0.6	
		17	190317_173817	17:38	17:41	5792	359°	152	704	20	1.1	0.6	
		18	190317_174505	17:45	17:46	5839	178°	164	702	18	1.2	0.6	
		19	190317_174932	17:49	17:50	5789	357°	152	702	18	1.2	0.6	
		20	190317_175353	17:53	17:54	5782	177°	162	701	20	1.2	0.6	
		21	190317_175823	17:58	17:59	5788	357°	152	701	20	1.2	0.6	
		22	190317_180241	18:02	18:03	5780	178°	162	701	20	1.2	0.6	
		23	190317_180700	18:07	18:07	5797	356°	152	700	20	1.2	0.6	Range Gate Warning
		24	190317_181059	18:10	18:11	5787	178°	161	700	20	1.2	0.6	
		2	190317_181633	18:16	18:21	5780	267°	166	699	19	1.3	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/17/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1922.4			1		Pecos_Parker_Dallas_Addon			Wes Ashmore	
Hobbs ST	1918.9		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		A	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		304	190318_012908	1:29	1:41	6050	357°	163	698	17	1.3	0.7	Range Gate Warning
		305	190318_014333	1:43	1:53	6090	176°	159	693	18	1.2	0.7	
		306	190318_015730	1:57	2:07	6109	356°	158	688	22	1.2	0.7	Range Gate Warning
		307	190318_021146	2:11	2:21	6088	177°	158	684	22	1.3	0.7	Range Gate Warning
		308	190318_022608	2:26	2:35	6038	356°	162	679	22	1.6	0.8	
		309	190318_024215	2:42	2:52	6081	258°	163	674	22	1.3	0.7	
		81	190318_031120	3:11	3:24	6091	175°	157	670	22	1.5	0.7	
		82	190318_032907	3:29	3:42	6085	357°	160	663	22	1.2	0.6	
		83	190318_034700	3:47	4:00	6091	174°	158	657	24	1.2	0.6	Low Return Warning
		84	190318_040450	4:04	4:18	6087	356°	160	650	21	1.4	0.8	
		85	190318_042228	4:22	4:36	6018	175°	160	644	20	1.3	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019									Sensor Operator/s	
										Stephen Overcast	
Date/Julian:	3/18/2019		Disk Drive MM70		Flight Plan(s):					Pilot/s	
Hobbs End	1925.7		1		TX_DFW_6000FT_LIDAR					Dave Carlson/Mike Wasielewski	
Hobbs ST	1922.4	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:		Base Height	Aircraft	Airport Idnt:
Flight Time	3.6	A	6,063		160		TEMP		1.500	C421-N112MJ	KCPT (Cleburne)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		146	190318_055032	5:50	6:08	6016	357°	156	638	19	1.4	0.7	
		147	190318_061347	6:13	6:31	6018	177°	154	630	17	1.4	0.7	
		148	190318_063655	6:36	6:54	6007	358°	159	622	18	1.3	0.7	
		43	190318_065926	6:59	7:18	6033	176°	152	615	116	1.3	0.7	
		129	190318_072314	7:23	7:40	6044	356°	160	607	17	1.1	0.7	
		128	190318_074523	7:45	8:03	6060	176°	157	599	18	1.1	0.7	
		127	190318_080827	8:08	8:25	6049	355°	160	592	16	1.3	0.8	
		126	190318_083042	8:30	8:48	6059	176°	155	584	16	1.2	0.7	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/18/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1929			1		Pecos_Parker_Dallas_Addon			Dave Carlson	
Hobbs ST	1925.7		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.3		A	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		86	190319_011016	1:10	1:23	6063	358°	162	576	16	1.3	0.8	Low Return Warning
		87	190319_012849	1:28	1:42	6067	175°	154	570	15	1.4	0.8	Low Return Warning
		88	190319_014657	1:46	2:00	6083	356°	153	564	15	1.4	0.8	Low Return Warning
		89	190319_020525	2:05	2:19	6064	176°	153	558	18	1.2	0.6	Low Return Warning
		90	190319_022326	2:23	2:37	6033	357°	160	552	18	1.2	0.6	Low Return Warning
		91	190319_024141	2:41	2:55	6048	176°	153	546	18	1.3	0.7	
		92	190319_025956	2:59	3:13	6057	356°	162	540	19	1.5	0.7	Low Return Warning
		93	190319_031747	3:17	3:31	6037	173°	157	534	20	1.3	0.6	Low Return Warning
		94	190319_033543	3:35	3:50	6037	355°	162	528	21	1.2	0.7	
		95	190319_035310	3:53	4:07	6037	177°	151	522	20	1.3	0.8	Low Return Warning

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019										Sensor Operator/s	
											Stephen Overcast	
Date/Julian:	3/19/2019		Disk Drive MM70		Flight Plan(s):						Pilot/s	
Hobbs End	1932.6		3		TX_DFW_6000FT_LIDAR						Mike Wasielewski	
Hobbs ST	1929	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:		Base Height		Aircraft	Airport Idnt:
Flight Time	3.6	A	6,112		160		TEMP		1.500		C421-N112MJ	KCPT (Cleburne)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available MM Space	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:						PDOP	HDOP	
		125	190319_052010	5:20	5:37	6048	352°	166	877	18	1.1	0.6	Low Return Warning
		124	190319_054120	5:41	5:59	6023	175°	148	869	17	1.2	0.7	Low Return Warning
		123	190319_060310	6:03	6:20	6019	357°	157	861	18	1.4	0.7	Low Return Warning
		122	190319_062444	6:24	6:42	6017	176°	153	853	19	1.1	0.6	Low Return Warning
		121	190319_064630	6:46	7:03	6014	356°	160	845	15	1.4	0.7	Low Return Warning
		120	190319_070738	7:07	7:25	6020	177°	154	837	16	1.2	0.7	Low Return Warning
		119	190319_072932	7:29	7:46	6028	357°	160	830	17	1.1	0.6	Low Return Warning
		118	190319_075020	7:50	8:08	6011	175°	154	822	16	1.1	0.7	Low Return Warning
		80	190319_082149	8:21	8:33	6199	267°	160	814	15	1.2	0.7	Low Return Warning

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	3/19/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	1936			1		Pecos_Parker_Dallas_Addon			Dave Carlson	
Hobbs ST	1932.6		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		A	6,100		165	TEMP	1.500	C421-N112MJ	CPT (Cleburne, TX)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		1004	190320_005609	:56	:57	6197	355°	163	712	16	1.4	0.8	
		1003	190320_005858	:58	1:00	6199	356°	155	712	16	1.5	0.8	
		1002	190320_010136	1:01	1:02	6206	354°	154	711	16	1.5	0.8	
		1001	190320_010830	1:08	1:08	6199	176°	147	711	16	1.5	0.8	
		96	190320_012941	1:29	1:48	6060	357°	156	711	17	1.3	0.7	Range Gate Warning
		97	190320_014713	1:47	2:00	6047	177°	147	704	18	1.3	0.7	Range Gate Warning
		98	190320_020458	2:04	2:18	6034	356°	156	697	18	1.5	0.7	
		99	190320_022255	2:22	2:37	6032	174°	146	692	18	1.2	0.7	
		100	190320_024112	2:41	2:55	6042	354°	162	685	18	1.4	0.6	Low Return Warning
		101	190320_030002	3:00	3:13	60080	175°	155	679	18	1.5	0.7	
		102	190320_031833	3:18	3:30	6038	353°	163	672	18	1.3	0.7	
		103	190320_033703	3:37	3:51	6006	176°	146	665	20	1.1	0.6	

Leica ALS80 Flight Log

Project:	TX_Pecos_Dallas_2019									Sensor Operator/s	
										Stephen Overcast	
Date/Julian:	3/20/2019		Disk Drive MM70		Flight Plan(s):					Pilot/s	
Hobbs End	1939.6		706		TX_DFW_6000FT_LIDAR					Mike Wasielewski	
Hobbs ST	1936	LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)		BASE PID:		Base Height	Aircraft	Airport Idnt:
Flight Time	3.6	A	6,112		160		TEMP		1.500	C421-N112MJ	KCPT (Cleburne)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
		117	190320_050012	5:00	5:18	6130	355°	160	658	20	1.2	0.6	Range Gate Warning
		116	190320_052151	5:21	5:39	6032	176°	157	650	20	1.1	0.6	
		115	190320_054313	5:43	6:01	6051	356°	156	643	19	1.2	0.6	Low Return Warning
		114	190320_060359	6:03	6:20	6032	175°	158	635	19	1.3	0.7	
		113	190320_062402	6:24	6:41	6054	355°	154	628	21	1.1	0.6	
		112	190320_064458	6:44	7:01	6036	176°	159	620	18	1.3	0.7	Low Return Warning
		111	190320_070606	7:06	7:21	6049	356°	152	613	19	1.1	0.7	
		110	190320_072535	7:25	7:40	6021	176°	158	606	18	1.2	0.7	
		109	190320_074525	7:45	8:00	6039	355°	160	599	18	1.1	0.7	Range Gate Warning
		108	190320_080331	8:03	8:18	5948	175°	160	592	14	1.6	0.8	Low Return Warning

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	4/19/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	66.2			705		TX_DFW_6000ft_Lidar			Wes Ashmore	
Hobbs ST	62.9		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.3		A	6,000		160	TEMP	1.500	C421-N112MJ	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		42	190420_005340	:53	:58	6072	358°	132	680	19	1.5	0.7	ALS BG
		41	190420_010225	1:02	1:06	6116	176°	168	677	20	1.5	0.7	"
		40	190420_011143	1:11	1:16	6102	355°	135	675	21	1.3	0.6	ALS AG
		39	190420_012046	1:20	1:26	6106	175°	171	673	23	1.1	0.6	"
		38	190420_013022	1:30	1:36	6097	357°	139	671	22	1.2	0.7	
		37	190420_014012	1:40	1:45	6113	176°	176	668	22	1.3	0.8	
		36	190420_015001	1:50	1:56	6113	356°	137	666	23	1.1	0.7	"
		107	190420_022523	2:25	2:42	5912	355°	133	663	20	1.2	0.7	
		106	190420_024618	2:46	3:00	5956	176°	166	656	19	1.1	0.6	
		105	190420_030358	3:03	3:21	5945	355°	132	649	20	1.1	0.6	
		104	190420_032456	3:24	3:39	5981	175°	173	641	19	1.3	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	4/19/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	69.8			705		TX_DFW_6000ft_Lidar			Dave Carlson	
Hobbs ST	66.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.6		B	6,000		160	TEMP	1.500	C421-N112MJ	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		44	190420_045855	4:58	5:19	5967	357°	144	635	18	1.2	0.7	ALS BG AG
		45	190420_052401	5:24	5:42	6011	177°	160	626	19	1	0.6	"
		46	190420_054720	5:47	6:07	6031	356°	137	619	18	1.1	0.7	"
		47	190420_061217	6:12	6:30	5992	175°	159	610	17	1.2	0.7	"
		48	190420_063524	6:35	6:56	5943	355°	134	602	17	1.2	0.7	"
		49	190420_070047	7:00	7:19	5934	174°	163	593	19	1.2	0.7	"
		50	190420_072431	7:24	7:45	6025	356°	141	585	17	1.3	0.7	"
		51	190420_074940	7:49	8:08	6042	175°	167	576	20	1.1	0.6	"

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	4/20/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	72.8			705		Tx_Blk1_Tyler/Tx_Parker North_Addon			Wes Ashmore	
Hobbs ST	69.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3		A	5,800		165	TEMP	1.500	C421-N112MJ	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		2	190420_182200	18:22	18:24	5737	358°	145	567	22	1.2	0.6	ALS Range Gate
		3	190420_182824	18:28	18:30	5751	175°	166	566	22	1.2	0.6	"
		4	190420_183420	18:34	18:36	5735	359°	140	565	23	1.1	0.6	"
		5	190420_184032	18:40	18:42	5750	178°	172	564	21	1.2	0.6	"
		6	190420_184706	18:47	18:49	5767	358°	136	563	22	1.2	0.6	"
		7	190420_185344	18:53	18:56	5764	178°	161	561	20	1.3	0.6	" BG AG
		8	190420_190042	19:00	19:03	5750	357°	142	560	20	1.3	0.6	
		9	190420_190712	19:07	19:09	5772	178°	165	559	20	1.3	0.6	
		1	190420_191310	19:13	19:15	5758	283°	147	558	22	1.2	0.6	ALS Range Gate
		501	190420_201807	20:18	20:28	6588	86°	159	557	19	1.2	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	4/20/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	76.3			1		TX_DFW_6000ft_Lidar			Dave Carlson	
Hobbs ST	72.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		B	6,000		160	TEMP	1.500	C421-N112MJ	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		52	190421_023016	2:30	2:48	6035	535°	152	515	20	1.2	0.6	ALS AG BG
		53	190421_025319	2:53	3:12	6012	176°	143	507	18	1.2	0.7	"
		54	190421_031708	3:17	3:35	6024	355°	161	498	18	1.3	0.7	" + Range Gate
		55	190421_034027	3:40	4:00	6031	177°	140	490	17	1.5	0.7	"
		56	190421_040439	4:04	4:23	6016	356°	162	481	19	1.2	0.6	" + Range Gate
		57	190421_042758	4:27	4:47	6016	176°	139	473	17	1.1	0.6	"
		58	190421_045148	4:51	5:10	6027	357°	163	464	15	1.2	0.7	" + Range Gate
		59	190421_051607	5:16	5:34	6021	176°	150	456	15	1.2	0.7	"

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	4/21/2019	ALS80 SN # 8137- HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	79.7			705		TX_DFW_6000ft_Lidar			Wes Ashmore	
Hobbs ST	76.3		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.4		A	6,000		160	TEMP	1.500	C421-N112MJ	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		603	190422_023700	2:37	2:54	6002	355°	180	552	19	1.1	0.6	
		61	190422_025902	2:59	3:19	5976	177°	137	544	19	1.1	0.6	ALS AG
		62	190422_032306	3:23	3:40	6039	354°	172	535	17	1.5	0.7	
		63	190422_034501	3:45	4:05	5975	177°	142	527	17	1.4	0.8	
		64	190422_040925	4:09	4:27	6018	358°	171	518	19	1.1	0.6	
		65	190422_043109	4:31	4:51	6010	176°	141	510	17	1.3	0.7	
		66	190422_045445	4:54	5:11	6068	358°	170	501	18	1.1	0.7	*ALS Range Gate ALS BG
		67	190422_051628	5:16	5:36	5953	177°	143	493	19	1	0.6	*17 miles from end till 2 miles, pulsating
													vibration in sensor timed with aircraft
													panel light flicker.

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/27/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6569.9			2		Pecos_Tx			Mike Wasielewski	
Hobbs ST	6566.4		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		B	8,736		165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		268	190127_230256	23:03	23:16	8680	357°	162	952	21	1.3	0.7	
		269	190127_232134	23:21	23:35	8646	179°	165	946	21	1.3	0.6	
		270	190127_233957	23:39	23:53	8700	359°	155	940	22	1.5	0.7	
		271	190127_235740	23:57	:10	8652	180°	168	934	22	1.4	0.7	
		272	190128_001605	:16	:29	8670	358°	162	928	25	1.1	0.6	
		273	190128_003413	:34	:47	8652	180°	168	922	20	1.4	0.7	
		274	190128_005151	:51	1:05	8657	357°	158	916	22	1.2	0.6	
		275	190128_010948	1:09	1:22	8625	181°	169	910	22	1.1	0.6	
		276	190128_012735	1:27	1:40	8631	0°	165	904	21	1.1	0.6	
		277	190128_014524	1:45	1:58	8633	176°	165	898	21	1.4	0.8	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/28/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6575.5			2		Pecos_Tx			Wes Ashmore	
Hobbs ST	6569.9		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.6		A	8,598		165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		278	190128_154440	15:44	15:58	8618	359°	157	892	26	1.1	0.6	
		279	190128_160228	16:02	16:15	8620	178°	166	886	24	1.1	0.6	
		280	190128_162024	16:20	16:33	8608	0°	162	881	23	1.3	0.6	
		281	190128_163833	16:38	16:51	8630	179°	164	875	25	1.1	0.6	
		282	190128_165641	16:56	17:09	8640	359°	162	869	26	1	0.5	ALS Warning: AG%
		283	190128_171453	17:14	17:28	8539	179°	163	863	22	1.2	0.6	
		284	190128_173222	17:32	17:45	8506	0°	168	857	23	1.1	0.6	"
		285	190128_174953	17:50	18:03	8614	181°	165	851	23	1.1	0.6	
		286	190128_180712	18:07	18:20	8493	359°	167	845	20	1.3	0.7	
		287	190128_182430	18:24	18:37	8474	180°	164	839	18	1.5	0.7	
		288	190128_184159	1842	18:55	8482	1°	168	833	18	1.3	0.7	"
		289	190128_185911	1859	19:12	8483	178°	163	827	18	1.3	0.7	
		290	190128_191644	1916	19:30	8480	359°	168	821	19	1.1	0.7	"
		291	190128_193413	1934	19:47	8464	177°	163	815	19	1	0.6	"
		292	190128_195109	1951	20:04	8440	1°	166	809	18	1.1	0.7	
		293	190128_200817	2008	20:21	8440	179°	160	803	18	1.2	0.7	
		294	190128_202514	2025	20:38	8444	1°	162	798	19	1.2	0.7	
		295	190128_204201	2042	20:55	8424	180°	160	792	19	1.3	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/28/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6580.6			2		Pecos_Tx			Mike Wasielewski	
Hobbs ST	6575.5		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.1		B	8,372		165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		296	190129_003005	:30	:43	8312	0°	161	786	21	1.4	0.7	
		297	190129_004825	:48	1:01	8304	179°	165	780	22	1.2	0.6	
		298	190129_010546	1:05	1:18	8258	359°	163	774	23	1.1	0.6	
		299	190129_012413	1:24	1:37	8233	180°	165	768	22	1.1	0.6	
		300	190129_014133	1:41	1:54	8236	359°	162	762	20	1.3	0.7	
		301	190129_015858	1:59	2:12	8240	181°	159	757	18	1.4	0.8	
		302	190129_021549	2:15	2:28	8202	1°	165	751	19	1.2	0.7	
		303	190129_023309	2:33	2:46	8196	181°	163	745	20	1	0.7	
		304	190129_025034	2:50	3:03	8221	1°	167	739	18	1.1	0.7	ALS Warning: AG%
		305	190129_030737	3:07	3:20	8196	178°	164	733	20	1.2	0.7	"
		306	190129_032537	3:25	3:38	8174	0°	164	727	20	1.2	0.7	"
		307	190129_034323	3:43	3:56	8167	180°	165	722	19	1.1	0.7	"
		308	190129_040039	4:00	4:13	8192	359°	166	716	18	1.2	0.7	"
		309	190129_041845	4:18	4:31	8177	179°	164	710	18	1.2	0.7	"
		310	190129_043534	4:35	4:48	8180	358°	162	704	16	1.3	0.8	"
		311	190129_045243	4:52	5:05	8177	181°	167	699	17	1.2	0.7	"

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	1/29/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6586			2		Pecos_Tx			David Carlson	
Hobbs ST	6580.6		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.4		A	8,168		165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		312	190129_163021	16:30	16:43	8130	0°	169	693	22	1.2	0.6	ALS Warning: AG%
		312	190129_164920	16:49	17:02	8114	181°	169	687	24	1.1	0.6	"
		314	190129_170814	17:08	17:21	8138	0°	168	681	21	1.1	0.6	"
		315	190129_172719	17:28	17:40	8106	181°	159	675	25	1.0	0.5	
		316	190129_174617	17:46	17:59	8119	359°	164	670	25	1.1	0.6	
		317	190129_180550	18:05	18:19	8085	182°	166	664	21	1.3	0.7	
		318	190129_182514	18:25	18:38	8088	0°	164	658	19	1.3	0.7	
		319	190129_184414	18:44	18:57	8081	182°	165	652	19	1.2	0.7	
		320	190129_190314	19:03	19:16	8086	0°	163	646	19	1.3	0.8	
		321	190129_192313	19:23	19:36	8074	180°	162	640	17	1.2	0.8	
		322	190129_194210	19:42	19:55	8092	359°	162	634	17	1.2	0.8	
		323	190129_200100	20:01	20:14	8052	181°	165	628	17	1.3	0.8	
		324	190129_202000	20:20	20:33	8101	0°	162	623	18	1.3	0.7	
		325	190129_203853	20:39	20:52	8080	178°	165	617	18	1.3	0.8	
		326	190129_205832	20:58	21:11	8109	358°	166	611	17	1.4	0.7	
		327	190129_211712	21:17	21:30	8073	181°	164	605	19	1.1	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Tx							Sensor Operator/s	
								Geoffrey McCall	
Date/Julian:	1/29/2019	ALS80 SN# 8235_HP		Disk Drive MM70	Flight Plan(s):			Pilot/s	
Hobbs End	6590.8			2	Pecos_Tx			Wes Ashmore	
Hobbs ST	6586		LIFT	Target Altitude (MSL)	TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	4.8		B	8,119	165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		328	190129_233748	23:37	23:51	8050	359°	164	599	21	1.3	0.6	
		329	190129_235516	23:55	:8	8111	181°	155	593	24	1.1	0.6	
		330	190130_001235	:12	:26	8124	0°	168	587	21	1.2	0.6	
		331	190130_002935	:29	:43	8095	180°	166	581	20	1.3	0.6	
		332	190130_004748	:47	1:01	8107	0°	167	575	21	1.1	0.6	100% R1 Not Going Away
		333	190130_010446	1:04	1:17	8099	181°	163	569	21	1.1	0.6	"
		334	190130_012149	1:21	1:35	8112	0°	159	563	19	1.2	0.7	"
		335	190130_013914	1:39	1:52	8106	180°	167	557	20	1.3	0.7	"
		336	190130_015620	1:56	2:09	8097	359°	156	551	19	1.1	0.7	"
		337	190130_021355	2:14	2:27	8076	178°	154	546	19	1.1	0.7	"
		338	190130_023136	2:31	2:44	8088	356°	156	540	17	1.2	0.7	"
		339	190130_024904	2:49	3:02	8079	180°	155	534	19	1.1	0.6	"
		340	190130_030641	3:06	3:20	8105	359°	155	528	19	1.1	0.6	"
		341	190130_032419	3:24	3:37	8071	180°	165	522	20	1.1	0.6	"
		342	190130_034150	3:41	3:55	8085	357°	160	516	19	1.1	0.7	"
		343	190130_035916	3:59	4:12	8070	181°	166	510	21	1.3	0.8	"

Leica ALS80 Flight Log

Project:	Pecos_Tx						Sensor Operator/s	
							Geoffrey McCall	
Date/Julian:	1/30/2019	ALS80 SN# 8235_HP	Disk Drive MM70	Flight Plan(s):			Pilot/s	
Hobbs End	6596.5		2	Pecos_Tx			David Carlson	
Hobbs ST	6590.8	LIFT	Target Altitude (MSL)	TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.7	A	8,050	165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		344	190130_162336	16:23	16:36	7968	0°	165	504	23	1.1	0.6	
		345	190130_164208	16:42	16:55	7951	180°	166	498	24	1.0	0.6	
		346	190130_170045	17:00	17:13	7974	0°	163	492	20	1.2	0.6	
		347	190130_171919	17:19	17:32	8007	179°	164	486	21	1.1	0.6	
		348	190130_173750	17:37	17:51	8028	359°	160	481	23	1.1	0.6	
		349	190130_175624	17:56	18:09	7996	180°	167	475	21	1.2	0.6	
		350	190130_181428	18:14	18:27	8013	360°	164	469	18	1.3	0.8	
		351	190130_183242	18:32	18:45	7993	180°	165	463	16	1.3	0.8	
		352	190130_185049	18:50	19:04	8003	2°	163	457	16	1.4	0.8	
		353	190130_190859	19:09	19:22	7986	180°	165	451	15	1.2	0.7	
		354	190130_192704	19:27	19:40	8000	0°	165	445	20	1.0	0.6	
		355	190130_194516	19:45	19:58	7975	180°	162	439	18	1.2	0.7	
		356	190130_200328	20:03	20:16	7994	359°	160	433	20	1.2	0.6	
		357	190130_202128	20:21	20:34	7970	179°	164	427	18	1.4	0.7	
		358	190130_203931	20:39	20:52	7980	359°	162	422	17	1.9	0.8	
		359	190130_205734	20:57	21:10	7971	181°	166	416	19	1.7	0.8	
		360	190130_211533	21:15	21:28	7988	359°	163	410	21	1.1	0.6	
		361	190130_213322	21:33	21:46	7963	180°	162	404	19	1.2	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Alex Perdomo	
Date/Julian:	1/30/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	101.5			2		Pecos_Tx			Mike Wasielewski	
Hobbs ST	96.5		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5		B	7,965		165	TEMP	1.500	C441-N207SS	PEQ

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		362	190130_234747	23:47	:1	7893	0°	164	398	24	1.2	0.6	
		363	190131_000601	:6	:18	7890	180°	164	392	25	1.1	0.6	
		364	190131_002346	:23	:36	7913	0°	165	386	21	1.3	0.6	
		365	190131_004139	:41	:54	7898	179°	164	380	23	1.2	0.6	
		366	190131_005938	:59	1:12	7913	359°	166	374	24	1.1	0.6	
		367	190131_011738	1:17	1:30	7903	180°	166	368	24	1.0	0.6	
		368	190131_013522	1:35	1:48	7926	359°	167	362	23	1.1	0.6	
		369	190131_015314	1:53	2:06	7919	180°	162	356	20	1.2	0.7	
		370	190131_021130	2:11	2:24	7931	0°	161	350	20	1.2	0.7	
		371	190131_022917	2:29	2:42	7917	180°	163	344	19	1.2	0.7	
		372	190131_024755	2:48	3:01	7930	0°	164	336	20	1.1	0.6	
		373	190131_030543	3:05	3:18	7923	180°	163	333	19	1.1	0.7	
		374	190131_032303	3:22	3:36	7940	0°	162	327	19	1.1	0.7	
		375	190131_034031	3:40	3:53	7925	180°	161	321	18	1.1	0.7	
		376	190131_035830	3:58	4:11	7951	0°	163	315	19	1.1	0.7	
		377	190131_041700	4:16	4:30	7934	180°	164	309	16	1.5	0.8	IMU error after finishing line

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/4/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6607.4			4		Pecos_Tx			David Carlson	
Hobbs ST	6602.1		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.3		A	8,290		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		499	190205_004943	:49	:54	8280	271°	166	1088	23	1.1	0.6	Refly #8
		379	190205_010444	1:04	1:18	8115	182°	152	1086	21	1.1	0.7	ALS: Max Range Gate
		380	190205_012349	1:23	1:37	7914	359°	159	1080	19	1.4	0.8	
		381	190205_014255	1:43	1:56	7910	179°	165	1074	20	1.1	0.7	
		382	190205_020153	2:02	2:15	7930	3°	166	1068	20	1.0	0.6	
		383	190205_022038	2:20	2:34	7930	179°	159	1062	20	1.1	0.6	
		384	190205_023928	2:39	2:52	7935	2°	165	1056	23	1.0	0.6	
		385	190205_025813	2:58	3:11	7921	179°	159	1050	21	1.1	0.6	
		386	190205_031640	3:16	3:30	7933	0°	165	1044	19	1.1	0.7	
		387	190205_033505	3:35	3:48	7927	179°	163	1038	20	1.2	0.7	ALS : No PPS Detected By TDC@03:40-AIRSTART
		388	190205_040437	4:05	4:18	7945	359°	160	1032	16	1.3	0.7	
		389	190205_042333	4:23	4:37	7932	180°	162	1026	18	1.2	0.7	
		390	190205_044215	4:42	4:55	7955	0°	167	1020	17	1.4	0.8	
		391	190205_050059	5:01	5:14	7924	181°	168	1014	20	1.2	0.7	
		392	190205_051945	5:19	5:33	7960	359°	160	1008	22	1.2	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/5/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6612.2			4		Pecos_Tx			Wes Ashmore	
Hobbs ST	6607.4		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	4.8		A	7,958		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		393	190205_164927	16:49	17:03	7910	184°	161	1001	19	1.2	0.6	
		394	190205_170717	17:07	17:20	7961	1°	162	995	22	1.1	0.6	
		395	190205_172527	17:25	17:38	7927	179°	157	989	22	1.1	0.6	
		396	190205_174339	17:43	17:57	7947	359°	160	983	19	1.4	0.7	
		397	190205_180155	18:02	18:15	7911	180°	160	977	17	1.4	0.7	
		398	190205_181945	18:19	18:33	7918	1°	167	971	18	1.3	0.7	
		399	190205_183807	18:38	18:51	7895	179°	165	965	17	1.1	0.7	
		400	190205_185557	18:56	19:09	7911	0°	168	959	18	1.1	0.7	
		401	190205_191448	19:14	19:28	7892	180°	161	953	18	1.1	0.7	
		401	190205_193227	19:32	19:45	7906	358°	165	947	17	1.2	0.7	
		403	190205_195058	19:51	20:04	7872	180°	161	941	17	1.2	0.7	
		404	190205_200854	20:09	20:22	7901	0°	168	935	18	1.1	0.6	
		405	190205_202704	20:27	20:40	7933	180°	158	929	18	1.2	0.7	
		406	190205_204508	20:45	20:58	7934	0°	169	923	20	1.1	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/5/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6617.4			4		Pecos_Tx			David Carlson	
Hobbs ST	6612.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	5.2		B	7,899		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		407	190205_230612	23:06	23:19	7977	180°	155	917	24	1.2	0.6	ALS:AG%
		408	190205_232500	23:25	23:38	7052	358°	162	911	25	1.2	0.6	"
		409	190205_234403	23:44	23:57	7943	180°	160	905	23	1.1	0.6	
		410	190206_000256	:3	:16	7903	1°	165	899	21	1.2	0.6	
		411	190206_002338	:23	:38	7885	181°	160	893	23	1.1	0.6	
		412	190206_004427	:44	:59	7924	0°	158	886	22	1.0	0.6	
		413	190206_010505	1:05	1:20	7893	181°	161	879	21	1.3	0.7	
		414	190206_012524	1:25	1:40	7919	358°	160	872	19	1.4	0.7	
		415	190206_014603	1:46	2:01	7893	180°	164	866	20	1.2	0.7	
		416	190206_020623	2:06	2:21	7938	359°	166	859	18	1.2	0.7	
		417	190206_022735	2:27	2:42	7888	180°	164	852	19	1.1	0.6	
		418	190206_024814	2:48	3:03	7936	1°	167	845	18	1.1	0.6	
		419	190206_030904	3:09	3:24	7882	180°	162	839	17	1.1	0.7	
		420	190206_032928	3:29	3:44	7939	359°	163	832	16	1.2	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/6/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6619.8			4		Pecos_Tx			Mike Wasielewski	
Hobbs ST	6617.4		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	2.4		A	7,935		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		421	190206_160924	16:09	16:24	7840	180°	165	825	25	1.1	0.6	
		422	190206_162915	16:29	16:44	7889	358°	166	818	23	1.1	0.6	
		423	190206_164844	16:48	17:03	7839	180°	159	812	23	1.1	0.6	
		424	190206_170815	17:08	17:23	7908	358°	166	805	26	1.0	0.6	
		425	190206_172752	17:27	17:43	7865	181°	156	798	24	1.1	0.6	
	*	426	190206_174731	17:47	18:02	7897	357°	165	791	19	1.3	0.7	*Turbulence-20 miles from north end.
													Pitch and Roll 6+. Speed 170+
													Possible Refly

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/7/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6623.5			4		Pecos_Tx			Wes Ashmore	
Hobbs ST	6619.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.7		A	7,926		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		426	190207_144700	14:47	15:02	7905	181°	162	784	24	1.1	0.6	Refly
		427	190207_150703	15:07	15:22	7952	359°	157	778	26	1.0	0.5	
		428	190207_152708	15:27	15:42	7922	180°	157	771	23	1.2	0.6	
	*	429	190207_154704	15:47	16:02	7951	1°	170	764	24	1.1	0.6	ALS: Range Gate
	*	430	190207_160705	16:07	16:22	7938	180°	155	757	24	1.1	0.6	ALS: BG%Return
	*	431	190207_162733	16:27	16:42	8048	0°	147	750	24	1.1	0.6	ALS: Range Gate
	*	432	190207_164735	16:47	17:03	7940	179°	158	743	26	1.0	0.6	"
	*	433	190207_170719	17:07	17:22	7907	0°	182	736	25	1.1	0.6	"
	*	434	190207_172710	17:27	17:42	7891	179°	163	729	22	1.2	0.7	
	*	435	190207_174745	17:48	18:03	7940	0°	166	723	18	1.4	0.7	"
													*South 10-15 miles=Turbulence

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/7/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6628.3			4		Pecos_Tx			Mike Wasielewski	
Hobbs ST	6623.5		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	4.8		B	7,870		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available MM Space	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:						PDOP	HDOP	
B		436	190208_003219	:32	:47	7839	179°	165	716	24	1.1	0.6	
		437	190208_005230	:52	1:07	7855	358°	163	709	23	1.1	0.6	
		438	190208_011245	1:12	1:28	7854	180°	154	702	19	1.4	0.8	
		439	190208_013347	1:33	1:49	7884	0°	157	695	21	1.2	0.7	
		440	190208_015337	1:53	2:09	7847	181°	163	688	21	1.2	0.7	
		441	190208_021345	2:13	2:29	7883	0°	166	681	20	1.1	0.6	
		442	190208_023353	2:33	2:49	7885	181°	158	674	20	1.1	0.7	
		443	190208_025336	2:53	3:08	7891	0°	168	667	22	1.0	0.6	
		444	190208_031307	3:13	3:28	7899	179°	167	661	18	1.2	0.7	
		445	190208_033305	3:33	3:38	7892	1°	161	654	17	1.2	0.7	
		446	190208_034258	3:43	3:48	7893	180°	159	651	15	1.5	0.8	
		447	190208_035251	3:52	3:58	7886	360°	164	649	15	1.5	0.8	
		448	190208_040248	4:02	4:08	7892	179°	163	646	15	1.4	0.8	
		449	190208_041245	4:12	4:18	7844	359°	165	644	16	1.3	0.7	IMU Data
		450	190208_042335	4:23	4:29	7876	180°	158	641	16	1.6	0.8	
		451	190208_043330	4:33	4:39	7896	356°	160	638	15	1.6	0.8	
		452	190208_044328	4:43	4:49	7873	180°	159	636	17	1.3	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/8/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6632.9			4		Pecos_Tx			Mike Wasielewski	
Hobbs ST	6628.3		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	4.6		A	7,870		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		453	190208_133919	13:39	13:45	7870	181°	164	633	22	1.1	0.6	
		454	190208_135019	13:50	13:55	7890	359°	160	631	23	1.2	0.6	
		455	190208_140028	14:00	14:06	7884	180°	162	628	24	1.2	0.6	
		456	190208_141356	14:14	14:19	7852	359°	164	626	23	1.1	0.6	
		457	190208_142403	14:24	14:29	7848	180°	168	623	23	1.0	0.5	
		458	190208_143359	14:34	14:39	7862	0°	162	621	24	1.0	0.5	
		459	190208_144343	14:43	14:49	7855	180°	160	618	27	1.1	0.6	
		460	190208_145312	14:53	14:58	7882	359°	165	616	27	1.0	0.5	
		461	190208_150244	15:02	15:08	7865	180°	157	613	26	1.1	0.6	
		462	190208_151214	15:12	15:17	7880	0°	164	611	25	1.1	0.6	
		463	190208_152201	15:22	15:27	7871	179°	159	608	24	1.2	0.6	
		464	190208_153125	15:31	15:36	7887	2°	163	606	23	1.2	0.6	
		465	190208_154105	15:41	15:46	7877	179°	159	603	25	1.2	0.6	
		466	190208_155056	15:51	15:56	7885	1°	164	600	24	1.1	0.6	
		467	190208_160058	16:01	16:06	7839	179°	154	598	24	1.1	0.6	
		468	190208_161015	16:10	16:15	7885	357°	160	595	24	1.1	0.6	
		469	190208_161957	16:20	16:25	7884	178°	162	593	24	1.1	0.6	
		470	190208_162931	16:29	16:35	7891	2°	167	590	23	1.1	0.6	
		471	190208_163930	16:39	16:45	7884	179°	157	588	24	1.1	0.6	
		472	190208_164857	16:49	16:54	7884	359°	163	585	25	1.0	0.6	
		473	190208_165903	16:59	17:04	7876	179°	161	583	27	1.0	0.5	
		474	190208_170824	17:08	17:14	7878	1°	162	580	24	1.1	0.6	
		475	190208_171822	17:18	17:23	7875	180°	159	578	24	1.1	0.6	
		476	190208_172740	17:27	17:33	7891	2°	158	575	22	1.3	0.7	
		477	190208_173734	17:37	17:43	7864	179°	161	573	20	1.4	0.7	
		478	190208_174702	17:47	17:52	7866	357°	167	570	20	1.3	0.7	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Geoffrey McCall	
Date/Julian:	2/10/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	6635.8			4		Pecos_Tx			Wes Ashmore	
Hobbs ST	6632.9		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	2.9		A	7,873		165	TEMP	1.500	C441-N207SS	ODO

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		479	190210_233840	23:38	23:44	7865	180°	158	567	21	1.4	0.6	
		480	190210_234827	23:48	23:54	7904	355°	167	565	22	1.2	0.6	ALS: Range Gate
		490	190211_000325	:3	:9	7834	180°	163	562	23	1.1	0.6	
		491	190211_001306	:13	:18	7860	359°	162	560	24	1.1	0.6	
		492	190211_002315	:23	:29	7852	179°	163	557	22	1.1	0.6	
		493	190211_003323	:33	:39	7848	359°	168	554	19	1.1	0.7	
		494	190211_004347	:43	:49	7846	180°	161	552	22	1.3	0.7	
		495	190211_005359	:54	:59	7859	4°	168	549	20	1.4	0.8	
		496	190211_010412	1:04	1:10	7840	179°	164	547	20	1.4	0.8	
		497	190211_011413	1:14	1:20	7908	359°	168	544	21	1.2	0.7	
		498	190211_012419	1:24	1:30	7870	181°	164	542	21	1.2	0.7	
		489	190211_013824	1:38	1:44	7905	0°	168	539	21	1.1	0.6	
		488	190211_014824	1:48	1:54	7870	180°	164	537	20	1.1	0.6	
		487	190211_015806	1:58	2:03	7900	1°	167	534	22	1.0	0.6	
		486	190211_020836	2:08		7855	180°	160	531	23	1.0	0.6	Rain 5 mile into. Refly

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	4/19/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4787.5			3		TX_DFW_6000FT_LiDAR_SN8235			Mike Wasielewski	
Hobbs ST	4790.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.3		A	6,053		160	TEMP	1.500	C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		25	190420_004944	:49	1:07	5983	359°	142	809	19	1.5	0.7	AG/BG (Low Return Warning)
		24	190420_011124	1:11	1:28	6059	181°	156	801	24	1.2	0.6	AG/BG (Low Return Warning)
		23	190420_013404	1:34	1:52	5989	359°	149	795	24	1.1	0.6	AG/BG (Low Return Warning)
		22	190420_015640	1:56	2:14	6011	180°	151	788	22	1.3	0.7	AG/BG (Low Return Warning)
		21	190420_022011	2:20	2:38	6013	1°	148	780	21	1.2	0.7	AG/BG (Low Return Warning)
		20	190420_024309	2:43	3:01	6060	179°	151	773	20	1.1	0.6	AG/BG (Low Return Warning)
		19	190420_030522	3:05	3:24	6051	359°	142	766	21	1.1	0.6	AG/BG (Low Return Warning) Range Gate
		18	190420_032758	3:27	3:46	6020	182°	151	759	19	1.3	0.7	AG/BG (Low Return Warning)

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	4/19/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4794.2			3		TX_DFW_6000FT_LiDAR_SN8235			Mike Wasielewski	
Hobbs ST	4790.8		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.4		B	6,027		160	TEMP	1.500	C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		17	190420_045933	4:59	5:19	5950	359°	142	752	20	1.2	0.7	AG/BG (Low Return Warning)
		16	190420_052249	5:22	5:41	6006	180°	147	745	21	1.1	0.6	AG/BG (Low Return Warning)
		15	190420_054625	5:46	6:06	5931	359°	140	737	17	1.3	0.7	AG/BG (Low Return Warning)
		14	190420_061041	6:10	6:30	5989	180°	150	730	19	1.2	0.7	AG/BG (Low Return Warning)
		13	190420_063507	6:35	6:51	5932	359°	146	722	19	1.2	0.7	AG/BG (Low Return Warning) Range Gate
		12	190420_065607	6:56	7:11	5956	180°	158	716	21	1.2	0.7	AG/BG (Low Return Warning)
		11	190420_071710	7:17	7:33	5950	359°	149	709	19	1.3	0.7	AG/BG (Low Return Warning)
		10	190420_073816	7:38	7:54	5991	181°	157	703	21	1.1	0.7	AG/BG (Low Return Warning)

Leica ALS80 Flight Log

Project:	Pecos_Tx							Sensor Operator/s	
								Stephen Overcast	
Date/Julian:	4/20/2019	ALS80 SN# 8235_HP	Disk Drive MM70	Flight Plan(s):				Pilot/s	
Hobbs End	4796.7		706	TX_DFW_6000FT_LiDAR_SN8235				Mike Wasielewski	
Hobbs ST	4794.2	LIFT	Target Altitude (MSL)	TARGET AIRSPD (KNTS)	BASE PID:	Base Height		Aircraft	Airport Idnt:
Flight Time	2.5	A	6,178	160	TEMP	1.500		C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		26	190420_181402	18:14	18:23	6133	359°	154	358	23	1.2	0.6	AG/BG (Low Return Warning)
		27	190420_182746	18:27	18:37	6134	178°	159	354	25	1.1	0.6	AG/BG (Low Return Warning)
		28	190420_184144	18:41	18:51	6130	359°	156	351	24	1.1	0.6	AG/BG (Low Return Warning)
		29	190420_185452	18:54	19:04	6139	180°	157	347	21	1.1	0.6	
		30	190420_190804	19:08	19:17	6131	358°	156	343	23	1.2	0.6	
		31	190420_192137	19:21	19:31	6138	180°	157	339	21	1.3	0.7	
		32	190420_193447	19:34	19:44	6134	359°	159	335	22	1.2	0.6	
		33	190420_195132	19:51	19:57	6137	179°	155	331	22	1.3	0.7	
		34	190420_200123	20:01	20:07	6114	359°	156	329	22	1.3	0.7	
		35	190420_201042	20:10	20:16	6129	180°	155	324	21	1.2	0.6	

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	4/20/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4800.2			3		TX_DFW_6000FT_LiDAR_SN8235			Mike Wasielewski	
Hobbs ST	4796.7		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		B	6,050		160	TEMP	1.500	C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		9	190421_024455	2:44	3:01	6025	359°	155	696	18	1.2	0.6	AG/BG (Low Return Warning)
		8	190421_030440	3:04	3:21	6022	180°	155	690	19	1.2	0.6	AG/BG (Low Return Warning)
		7	190421_032428	3:24	3:40	6037	359°	158	683	18	1.3	0.7	AG/BG (Low Return Warning)
		6	190421_034357	3:43	3:59	6029	181°	150	677	17	1.5	0.7	AG/BG (Low Return Warning)
		5	190421_040300	4:03	4:18	6030	359°	155	670	20	1.2	0.6	AG/BG (Low Return Warning)
		4	190421_042110	4:21	4:36	6022	181°	150	664	18	1.2	0.6	AG/BG (Low Return Warning)
		3	190421_043952	4:39	4:54	6028	358°	157	658	17	1.3	0.7	AG/BG (Low Return Warning)
		2	190421_045802	4:58	5:12	6008	180°	152	652	17	1.1	0.7	AG/BG (Low Return Warning)
		1	190421_051559	5:15	5:30	6023	359°	157	646	17	1.1	0.7	AG/BG (Low Return Warning)
		78	190421_053451	5:34	5:48	6004	181°	153	640	17	1.1	0.7	AG/BG (Low Return Warning)

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	4/21/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4803.7			3		TX_DFW_6000FT_LiDAR_SN8235			Mike Wasielewski	
Hobbs ST	1800.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	3.5		A	6,053		160	TEMP	1.500	C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		68	190422_023354	2:33	2:52	6054	359°	152	634	19	1.1	0.6	AG/BG (Low Return Warning)
		69	190422_025645	2:56	3:12	6018	179°	141	626	19	1.1	0.6	AG/BG (Low Return Warning)
		70	190422_031523	3:15	3:29	6069	359°	155	620	18	1.2	0.7	AG/BG (Low Return Warning)
		71	190422_033436	3:34	3:49	6025	180°	142	615	16	1.2	0.7	AG/BG (Low Return Warning)
		72	190422_035343	3:53	4:07	6070	359°	151	609	19	1.2	0.6	AG/BG (Low Return Warning)
		73	190422_041159	4:11	4:27	6027	181°	142	603	19	1.1	0.6	AG/BG (Low Return Warning)
		74	190422_043054	4:30	4:44	6055	159°	156	597	17	1.3	0.7	AG/BG (Low Return Warning)
		75	190422_044932	4:49	5:04	6029	180°	146	591	17	1.2	0.7	AG/BG (Low Return Warning)
		76	190422_050758	5:07	5:22	6063	359°	150	585	18	1.1	0.7	AG/BG (Low Return Warning)
		77	190422_052653	5:26	5:41	6021	180°	147	579	18	1.1	0.7	AG/BG (Low Return Warning)

Leica ALS80 Flight Log

Project:	Pecos_Tx								Sensor Operator/s	
									Stephen Overcast	
Date/Julian:	4/21/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4804.8			706		TX_DFW_6000FT_LiDAR_SN8235			Mike Wasielewski	
Hobbs ST	4803.7		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	1.1		B	6,083		160	TEMP	1.500	C421-N811NA	LNC

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
B		54	190422_064339	6:43	7:03	6088	359°	150	324	18	1.3	0.7	Refly
		56	190422_070732	7:07	7:21	6033	180°	153	316	19	1.3	0.7	Refly (2/3 Line collected/CANX due to weather)
		58											Refly (Not Collected)
		66											Refly (Not Collected)

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	7/11/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4836.2			1		TX_DFW_6000ft_Lidar			Wes Ashmore	
Hobbs ST	4834.6		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	1.6		A	6,000		160	TEMP	1.500	C421-N811A	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		2	190712_013146	1:31	1:51	5959	359°	159	1116	19	1.2	0.7	ALS AG Return
		3	190712_015939	1:59	2:14	6148	41°	162	1107	21	1.1	0.6	ALS Range Gate Max
		1	190712_022843	2:28	2:47	6097	179°	157	1101	20	1.3	0.7	Max Range Gate

Leica ALS80 Flight Log

Project:	Pecos_Dallas_Tx								Sensor Operator/s	
									Cynthia Williams	
Date/Julian:	7/12/2019	ALS80 SN# 8235_HP		Disk Drive MM70		Flight Plan(s):			Pilot/s	
Hobbs End	4836.9			1		TX_DFW_6000ft_Lidar			Wes Ashmore	
Hobbs ST	4836.2		LIFT	Target Altitude (MSL)		TARGET AIRSPD (KNTS)	BASE PID:	Base Height	Aircraft	Airport Idnt:
Flight Time	0.7		A	6,000		160	TEMP	1.500	C421-N811A	LNC (Lancaster, Tx)

Lift	#	Flight Line	Mission Line	UTC time:		GPS Altitude: ASL:	Direction	Speed: kts:	Available	S/Vs:	Position Acc.		Comments and Conditions:
				Begin:	End:				MM Space		PDOP	HDOP	
A		1	190712_164727	16:46	16:58	3660	360°	151	1093	18	1.2	0.7	BG Return
		2	190712_170148	17:01	17:12	3675	179°	147	1086	18	1.3	0.8	AG Return

Appendix B. Vertical Accuracy Calculations

Project Information

Prepared By: DAS
Project Name: TX Pecos Dallas 2018 QL2
Sensor Info: ALS80
Required Nominal Pulse Spacing: 0.71
Vendor Name: Digital Aerial Solutions. LLC
Units: Meters
Percent of Extent Tolerance: Extents Not Checked
Date of Aquisition: Start: 1/26/2019 Finish: 4/22/2019

Metadata Information

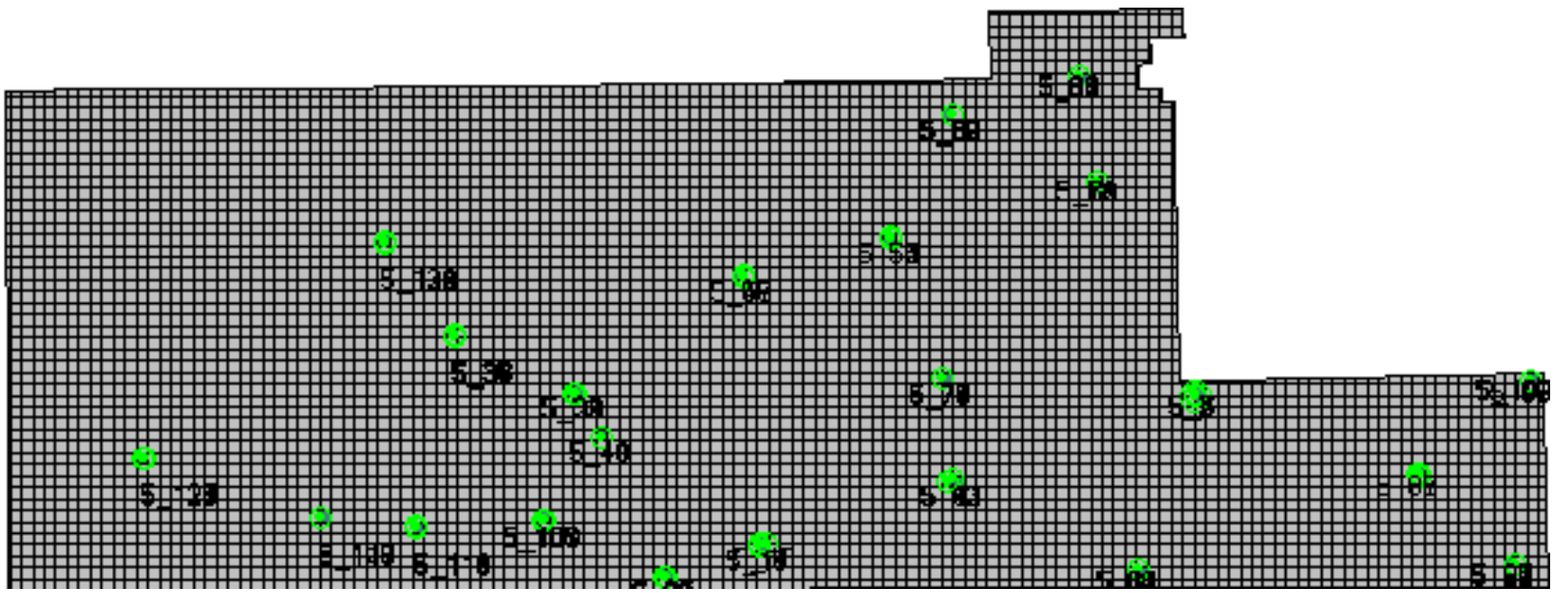
Tile Index:
- Filename: Clip_TX_Pecos_Tiles_UTM13.shp
- Number of Polys: 0

Intensity:
- Tile Index Attribute: Not Specified
- Data Filename: Not Specified

DEM:
- Tile Index Attribute: Name
- Data Filename: UTM13

LAS:
- Tile Index Attribute: Name
- Data Filename: UTM13_LAS

Tiled-Data Area



LiDAR Accuracy Assessment Summary

LC Type	# Points	NVA	VVA	RMSE Z
LAS		95% Confidence	95 Percentile	
Bare Earth	39	0.134		0.068
High Vegetation	1		0.050	0.050
Low Vegetation	35		0.103	0.069
Medium Vegetation	9		0.157	0.096
Urban Terrain	1	0.629		0.321
Urban Terrian	20	0.073		0.037
NVA Total:	60	0.142		0.072
VVA Total:	45		0.157	0.075
Total:	105			0.073
DEM		95% Confidence	95 Percentile	
Bare Earth	39	0.129		0.066
High Vegetation	1		0.053	0.053
Low Vegetation	35		0.106	0.069
Medium Vegetation	9		0.157	0.096
Urban Terrain	1	0.684		0.349
Urban Terrian	20	0.077		0.039
NVA Total:	60	0.143		0.073
VVA Total:	45		0.157	0.075
Total:	105			0.073

LiDAR Accuracy Assessment Summary (continued)

LC Type	# Points	NVA	VVA	RMSE Z
			Units:	Meters

Coordinates and Offsets of Analyzed Locations

		ID					
			Survey X	**Survey Y**	**Z1**	**Z DEM**	**Z LAS**
					LC Type	**ΔZ DEM**	**ΔZ LAS**
1)	☑	**5_3**					
			709573.154	3500950.373	834.381	834.503	834.497
					Bare Earth	0.122	0.115
2)	☑	**5_13**					
			678046.064	3489983.858	798.492	798.465	798.464
					Bare Earth	-0.027	-0.028
3)	☑	**5_23**					
			640518.624	3477266.96	791.473	791.46	791.471
					Bare Earth	-0.013	-0.002
4)	☑	**5_29**					
			628664.352	3501218.171	842.426	842.392	842.394
					Bare Earth	-0.034	-0.032
5)	☑	**5_31**					
			628692.594	3501329.137	841.902	841.916	841.909
					Bare Earth	0.014	0.007
6)	☑	**5_33**					
			628606.857	3501337.873	842.5	842.416	842.4
					Bare Earth	-0.084	-0.1
7)	☑	**5_36**					
			613023.077	3508580.416	865.817	865.649	865.652
					Bare Earth	-0.168	-0.165

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
8)	☑	5_37					
			613064.646	3508548.826	865.209	865.089	865.11
					Bare Earth	-0.12	-0.099
9)	☑	5_39					
			612911.274	3508748.173	863.696	863.721	863.704
					Bare Earth	0.025	0.008
10)	☑	5_40					
			632045.269	3495497.653	833.51	833.509	833.511
					Bare Earth	-0.001	0.001
11)	☑	5_47					
			650699.045	3516470.592	899.534	899.522	899.525
					Bare Earth	-0.012	-0.009
12)	☑	5_49					
			650735.585	3516372.961	898.843	898.871	898.88
					Bare Earth	0.028	0.037
13)	☑	5_50					
			650728.803	3516553.497	899.135	899.2	899.215
					Bare Earth	0.065	0.08
14)	☑	5_61					
			677998.203	3537534.972	898.296	898.336	898.325
					Bare Earth	0.04	0.029

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
15)	☑	5_62					
			677857.207	3537533.429	897.88	898.023	898.022
					Bare Earth	0.143	0.142
16)	☑	5_69					
			696938.532	3528917.644	918.499	918.579	918.58
					Bare Earth	0.08	0.081
17)	☑	5_71					
			696778.608	3528868.932	917.801	917.958	917.954
					Bare Earth	0.157	0.153
18)	☑	5_80					
			702115.307	3478245.907	770.867	770.857	770.864
					Bare Earth	-0.01	-0.004
19)	☑	5_86					
			738719.159	3490561.755	809.039	809.056	809.04
					Bare Earth	0.017	0.001
20)	☑	5_88					
			738764.091	3490616.245	809.374	809.345	809.339
					Bare Earth	-0.029	-0.035
21)	☑	5_94					
			751294.668	3478984.696	774.744	774.705	774.698
					Bare Earth	-0.039	-0.046

Coordinates and Offsets of Analyzed Locations (Continued)

	ID	Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
22)	**5_95**					
		751251.489	3479034.082	774.738	774.728	774.733
				Bare Earth	-0.01	-0.005
23)	**5_101**					
		753410.182	3502903.894	887.979	887.881	887.907
				Bare Earth	-0.098	-0.072
24)	**5_105**					
		624545.392	3484577.611	866.715	866.709	866.705
				Bare Earth	-0.006	-0.01
25)	**5_108**					
		624613.628	3484545.485	865.569	865.573	865.575
				Bare Earth	0.004	0.005
26)	**5_109**					
		624655.33	3484527.117	864.946	864.926	864.928
				Bare Earth	-0.02	-0.018
27)	**5_114**					
		608053.244	3483795.337	970.635	970.608	970.603
				Bare Earth	-0.027	-0.032
28)	**5_115**					
		608070.281	3483668.796	967.063	967.027	967.027
				Bare Earth	-0.036	-0.036

Coordinates and Offsets of Analyzed Locations (Continued)

	ID	Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
29)	**5_119**					
		595645.273	3484903.58	966.302	966.327	966.324
				Bare Earth	0.025	0.022
30)	**5_120**					
		595582.663	3485024.021	967.62	967.621	967.613
				Bare Earth	0.001	-0.007
31)	**5_121**					
		595672.212	3485019.186	967.962	967.954	967.95
				Bare Earth	-0.008	-0.012
32)	**5_123**					
		572476.849	3492746.361	1147.773	1147.849	1147.826
				Bare Earth	0.076	0.053
33)	**5_126**					
		572407.036	3492771.996	1148.045	1148.085	1148.092
				Bare Earth	0.04	0.047
34)	**5_129**					
		603856.489	3520816.006	874.22	874.219	874.207
				Bare Earth	-0.001	-0.013
35)	**5_131**					
		603876.601	3520793.895	874.28	874.261	874.261
				Bare Earth	-0.019	-0.019

Coordinates and Offsets of Analyzed Locations (Continued)

	ID	Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
36)	**5_133**					
		603802.108	3520754.397	874.813	874.812	874.809
				Bare Earth	-0.001	-0.004
37)	**5_64**					
		694532.151	3542563.041	951.082	951.144	951.17
				Bare Earth	0.062	0.087
38)	**5_65**					
		694514.221	3542525.879	950.693	950.812	950.883
				Bare Earth	0.119	0.19
39)	**5_66**					
		694574.744	3542647.293	951.115	951.143	951.114
				Bare Earth	0.028	-0.001
40)	**5_63**					
		694555.424	3542598.15	950.932	950.583	950.611
				Urban Terrain	-0.349	-0.321
41)	**5_4**					
		709618.371	3500975.156	834.509	834.511	834.517
				Urban Terrian	0.002	0.008
42)	**5_6**					
		709701.751	3501025.979	833.835	833.837	833.836
				Urban Terrian	0.002	0.001

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
43)	☑	5_9					
			677439.063	3489779.118	799.274	799.254	799.246
					Urban Terrian	-0.02	-0.028
44)	☑	5_12					
			677921.69	3489984.837	798.631	798.637	798.623
					Urban Terrian	0.006	-0.008
45)	☑	5_18					
			652794.448	3481537.151	781.618	781.587	781.584
					Urban Terrian	-0.031	-0.034
46)	☑	5_19					
			652579.906	3481464.144	781.769	781.766	781.769
					Urban Terrian	-0.003	0
47)	☑	5_25					
			640589.304	3477300.278	791.647	791.611	791.615
					Urban Terrian	-0.036	-0.033
48)	☑	5_27					
			640332.138	3477133.954	792.468	792.461	792.442
					Urban Terrian	-0.007	-0.026
49)	☑	5_53					
			670021.316	3521490.241	861.153	861.132	861.125
					Urban Terrian	-0.021	-0.028

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
50)	☑	5_55					
			669962.39	3521621.193	861.563	861.548	861.554
					Urban Terrian	-0.015	-0.009
51)	☑	5_60					
			677958.826	3537511.834	898.89	898.849	898.867
					Urban Terrian	-0.041	-0.023
52)	☑	5_70					
			696821.113	3528882.757	918.187	918.144	918.146
					Urban Terrian	-0.043	-0.041
53)	☑	5_72					
			696864.703	3528826.319	918.576	918.552	918.561
					Urban Terrian	-0.024	-0.015
54)	☑	5_77					
			676547.832	3503283.354	819.284	819.278	819.268
					Urban Terrian	-0.006	-0.016
55)	☑	5_78					
			676523.21	3503187.359	819.696	819.714	819.716
					Urban Terrian	0.018	0.02
56)	☑	5_84					
			702161.476	3478119.884	771.184	771.175	771.16
					Urban Terrian	-0.009	-0.024

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
57)	☑	5_93					
			751272.643	3478880.793	775.121	775.077	775.071
					Urban Terrian	-0.044	-0.05
58)	☑	5_99					
			753397.806	3502739.677	888.465	888.377	888.381
					Urban Terrian	-0.088	-0.084
59)	☑	5_100					
			753431.85	3502858.247	887.643	887.528	887.544
					Urban Terrian	-0.115	-0.099
60)	☑	5_113					
			608038.707	3483978.224	971.71	971.692	971.696
					Urban Terrian	-0.018	-0.014
61)	☑	5_83					
			702144.876	3478154.488	770.354	770.407	770.404
					High Vegetation	0.053	0.05
62)	☑	5_5					
			709650.974	3501005.629	833.423	833.472	833.472
					Low Vegetation	0.049	0.049
63)	☑	5_8					
			677419.623	3489741.479	799.371	799.323	799.323
					Low Vegetation	-0.048	-0.048

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
64)	☑	5_15					
			653609.371	3481816.702	781.442	781.403	781.409
					Low Vegetation	-0.039	-0.033
65)	☑	5_17					
			652731.134	3481491.305	781.573	781.668	781.673
					Low Vegetation	0.095	0.1
66)	☑	5_26					
			640374.279	3477165.786	792.102	792.138	792.094
					Low Vegetation	0.036	-0.008
67)	☑	5_32					
			628643.835	3501327.33	842.588	842.625	842.619
					Low Vegetation	0.037	0.031
68)	☑	5_35					
			613002.065	3508616.309	864.965	864.898	864.906
					Low Vegetation	-0.067	-0.059
69)	☑	5_38					
			612946.788	3508695.642	863.281	863.206	863.236
					Low Vegetation	-0.075	-0.045
70)	☑	5_46					
			650615.795	3516513.049	899.483	899.456	899.517
					Low Vegetation	-0.027	0.034

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
71)	5_48					
		650724.132	3516418.893	899.334	899.336	899.347
				Low Vegetation	0.002	0.013
72)	5_52					
		670001.215	3521430.194	860.545	860.608	860.604
				Low Vegetation	0.063	0.059
73)	5_56					
		670053.901	3521384.058	860.644	860.683	860.689
				Low Vegetation	0.039	0.044
74)	5_58					
		677890.86	3537439.927	897.952	897.966	898.02
				Low Vegetation	0.014	0.068
75)	5_59					
		677920.279	3537487.792	898.077	898.256	898.263
				Low Vegetation	0.179	0.186
76)	5_68					
		696902.784	3528901.127	919.114	919.155	919.185
				Low Vegetation	0.041	0.071
77)	5_75					
		676605.203	3503115.464	818.821	818.911	818.904
				Low Vegetation	0.09	0.083

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
78)	5_76					
		676564.266	3503238.334	818.819	818.891	818.889
				Low Vegetation	0.072	0.07
79)	5_81					
		702103.106	3478203.313	770.673	770.701	770.706
				Low Vegetation	0.028	0.033
80)	5_82					
		702110.045	3478148.88	770.463	770.518	770.51
				Low Vegetation	0.055	0.047
81)	5_87					
		738732.117	3490502.595	809.267	809.356	809.37
				Low Vegetation	0.089	0.103
82)	5_90					
		738676.082	3490713.21	810.223	810.329	810.28
				Low Vegetation	0.106	0.057
83)	5_92					
		751252.11	3478924.473	774.923	774.942	774.949
				Low Vegetation	0.019	0.026
84)	5_96					
		751212.031	3479061.786	774.779	774.82	774.801
				Low Vegetation	0.041	0.022

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
85)	☑	5_98					
			753388.929	3502800.171	887.884	887.879	887.883
					Low Vegetation	-0.005	-0.001
86)	☑	5_102					
			753385.86	3502940.781	888.086	888.097	888.114
					Low Vegetation	0.011	0.028
87)	☑	5_106					
			624496.321	3484606.854	867.249	867.284	867.293
					Low Vegetation	0.035	0.044
88)	☑	5_107					
			624582.295	3484632.305	865.985	866.052	866.059
					Low Vegetation	0.067	0.074
89)	☑	5_111					
			607997.35	3483905.527	971.572	971.568	971.588
					Low Vegetation	-0.004	0.016
90)	☑	5_112					
			608024.387	3483937.228	971.807	971.839	971.839
					Low Vegetation	0.032	0.032
91)	☑	5_117					
			595641.447	3484981.04	967.73	967.806	967.759
					Low Vegetation	0.076	0.029

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
92)	☑	5_118					
			595662.16	3484943.964	967.697	967.494	967.48
					Low Vegetation	-0.203	-0.217
93)	☑	5_124					
			572458.702	3492706.048	1147.144	1147.18	1147.145
					Low Vegetation	0.036	0.001
94)	☑	5_127					
			572428.407	3492809.377	1148.848	1148.863	1148.866
					Low Vegetation	0.015	0.018
95)	☑	5_130					
			603886.967	3520861.803	874.327	874.366	874.365
					Low Vegetation	0.039	0.038
96)	☑	5_132					
			603899.07	3520751.402	873.785	873.857	873.859
					Low Vegetation	0.072	0.074
97)	☑	5_2					
			709525.593	3500931.235	834.334	834.491	834.491
					Medium Vegetation	0.157	0.157
98)	☑	5_11					
			677971.595	3490013.555	798.596	798.634	798.674
					Medium Vegetation	0.038	0.078

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
99)	5_24					
		640538.881	3477306.552	791.682	791.668	791.67
				Medium Vegetation	-0.014	-0.012
100)	5_30					
		628672.764	3501274.3	842.505	842.56	842.541
				Medium Vegetation	0.055	0.036
101)	5_41					
		632099.38	3495497.65	833.394	833.452	833.443
				Medium Vegetation	0.058	0.049
102)	5_54					
		669990.721	3521583.718	860.94	861.076	861.078
				Medium Vegetation	0.136	0.138
103)	5_74					
		676585.066	3503152.648	819.226	819.332	819.336
				Medium Vegetation	0.106	0.11
104)	5_89					
		738714.726	3490676.73	810.352	810.401	810.422
				Medium Vegetation	0.049	0.07
105)	5_125					
		572414.844	3492729.042	1147.308	1147.441	1147.419
				Medium Vegetation	0.133	0.111

LAS

Nonvegetated Vertical Accuracy

LandCover Type: Bare Earth, Urban Terrain, Urban Terrian

Minimum DZ: -0.321

Maximum DZ: 0.19

Mean DZ: -0.009

Mean Magnitude DZ: 0.212

Number Observations: 60

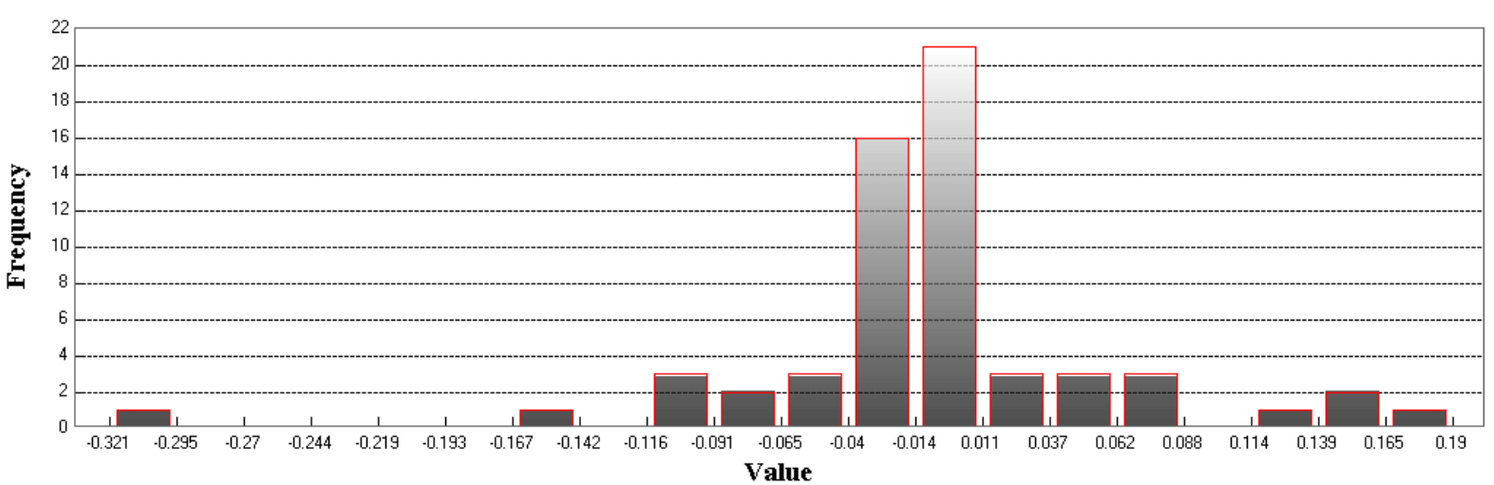
Standard Deviation DZ: 0.072

RMSE Z: 0.072

95% Confidence Level Z: 0.142

Units: Meters

Histogram



Min: -0.321

Max: 0.19

Number Of Bins: 20

Bin Interval: 0.026

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: High Vegetation

Minimum DZ: 0.05

Maximum DZ: 0.05

Mean DZ: 0.05

Mean Magnitude DZ: 0.223

Number Observations: 1

Standard Deviation DZ: NaN

RMSE Z: 0.05

95th Percentile: 0.05

Units: Meters

Histogram

Min: -0.321

Max: 0.19

Number Of Bins: 20

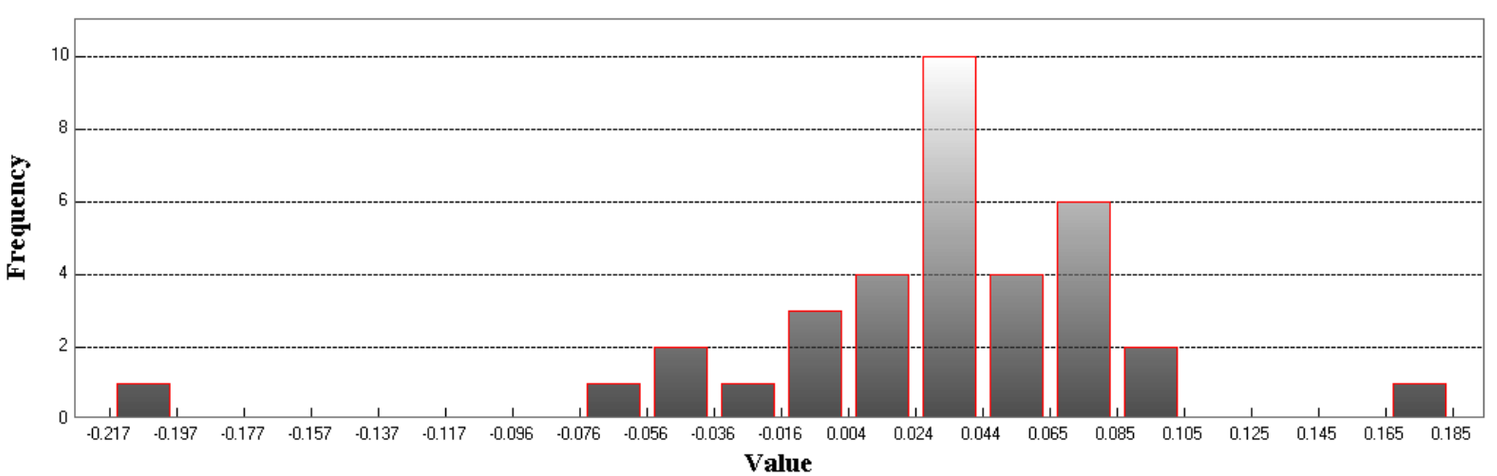
Bin Interval: 0.026

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation
Minimum DZ: -0.217
Maximum DZ: 0.186
Mean DZ: 0.03
Mean Magnitude DZ: 0.231
Number Observations: 35
Standard Deviation DZ: 0.064
RMSE Z: 0.069
95th Percentile: 0.103
Units: Meters

Histogram



Min: -0.217
Max: 0.186
Number Of Bins: 20
Bin Interval: 0.02

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: Medium Vegetation

Minimum DZ: -0.012

Maximum DZ: 0.157

Mean DZ: 0.082

Mean Magnitude DZ: 0.291

Number Observations: 9

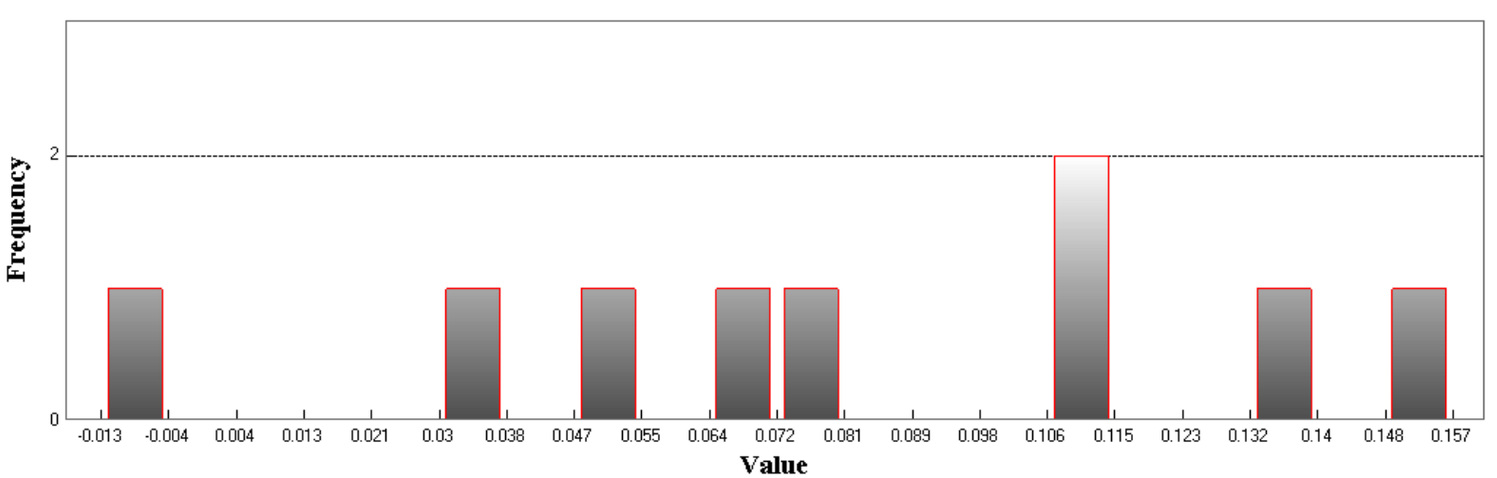
Standard Deviation DZ: 0.053

RMSE Z: 0.096

95th Percentile: 0.157

Units: Meters

Histogram



Min: -0.012

Max: 0.157

Number Of Bins: 20

Bin Interval: 0.008

DEM

Nonvegetated Vertical Accuracy

LandCover Type: Bare Earth, Urban Terrain, Urban Terrian

Minimum DZ: -0.349

Maximum DZ: 0.157

Mean DZ: -0.009

Mean Magnitude DZ: 0.212

Number Observations: 60

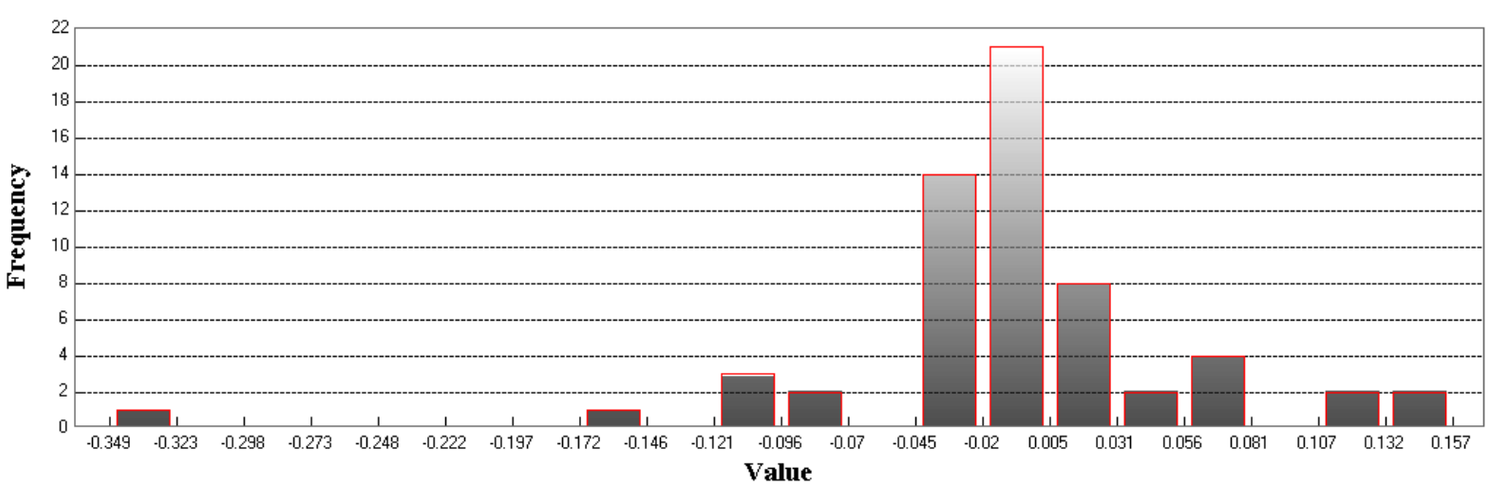
Standard Deviation DZ: 0.073

RMSE Z: 0.073

95% Confidence Level Z: 0.143

Units: Meters

Histogram



Min: -0.349

Max: 0.157

Number Of Bins: 20

Bin Interval: 0.025

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: High Vegetation

Minimum DZ: 0.053

Maximum DZ: 0.053

Mean DZ: 0.053

Mean Magnitude DZ: 0.231

Number Observations: 1

Standard Deviation DZ: NaN

RMSE Z: 0.053

95th Percentile: 0.053

Units: Meters

Histogram

Min: -0.349

Max: 0.157

Number Of Bins: 20

Bin Interval: 0.025

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation

Minimum DZ: -0.203

Maximum DZ: 0.179

Mean DZ: 0.028

Mean Magnitude DZ: 0.233

Number Observations: 35

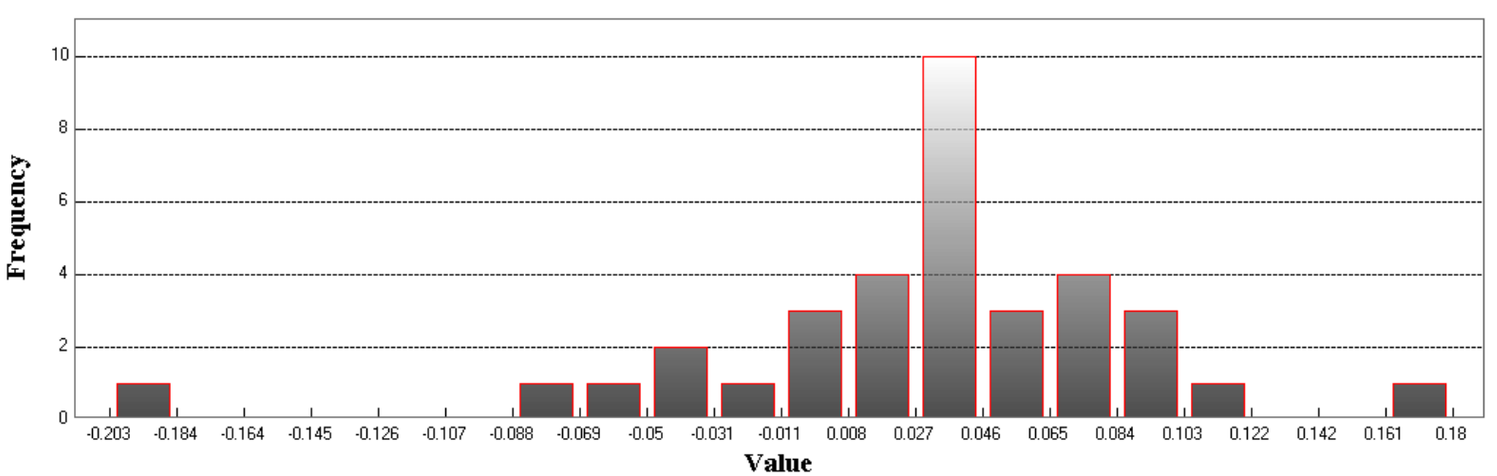
Standard Deviation DZ: 0.065

RMSE Z: 0.069

95th Percentile: 0.106

Units: Meters

Histogram



Min: -0.203

Max: 0.179

Number Of Bins: 20

Bin Interval: 0.019

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: Medium Vegetation

Minimum DZ: -0.014

Maximum DZ: 0.157

Mean DZ: 0.08

Mean Magnitude DZ: 0.288

Number Observations: 9

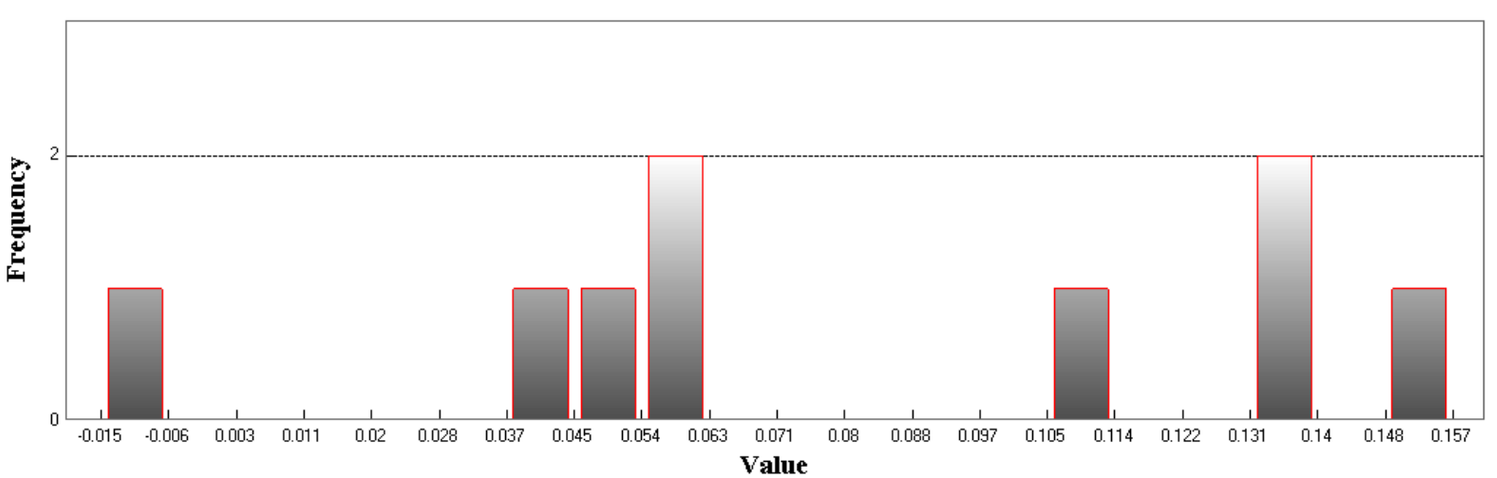
Standard Deviation DZ: 0.056

RMSE Z: 0.096

95th Percentile: 0.157

Units: Meters

Histogram



Min: -0.014

Max: 0.157

Number Of Bins: 20

Bin Interval: 0.009

Project Information

Prepared By: DAS
Project Name: TX Pecos Dallas 2018 QL2
Sensor Info: ALS80
Required Nominal Pulse Spacing: 0.71
Vendor Name: Digital Aerial Solutions. LLC
Units: Meters
Percent of Extent Tolerance: Extents Not Checked
Date of Aquisition: Start: 1/26/2019 Finish: 4/22/2019

Metadata Information

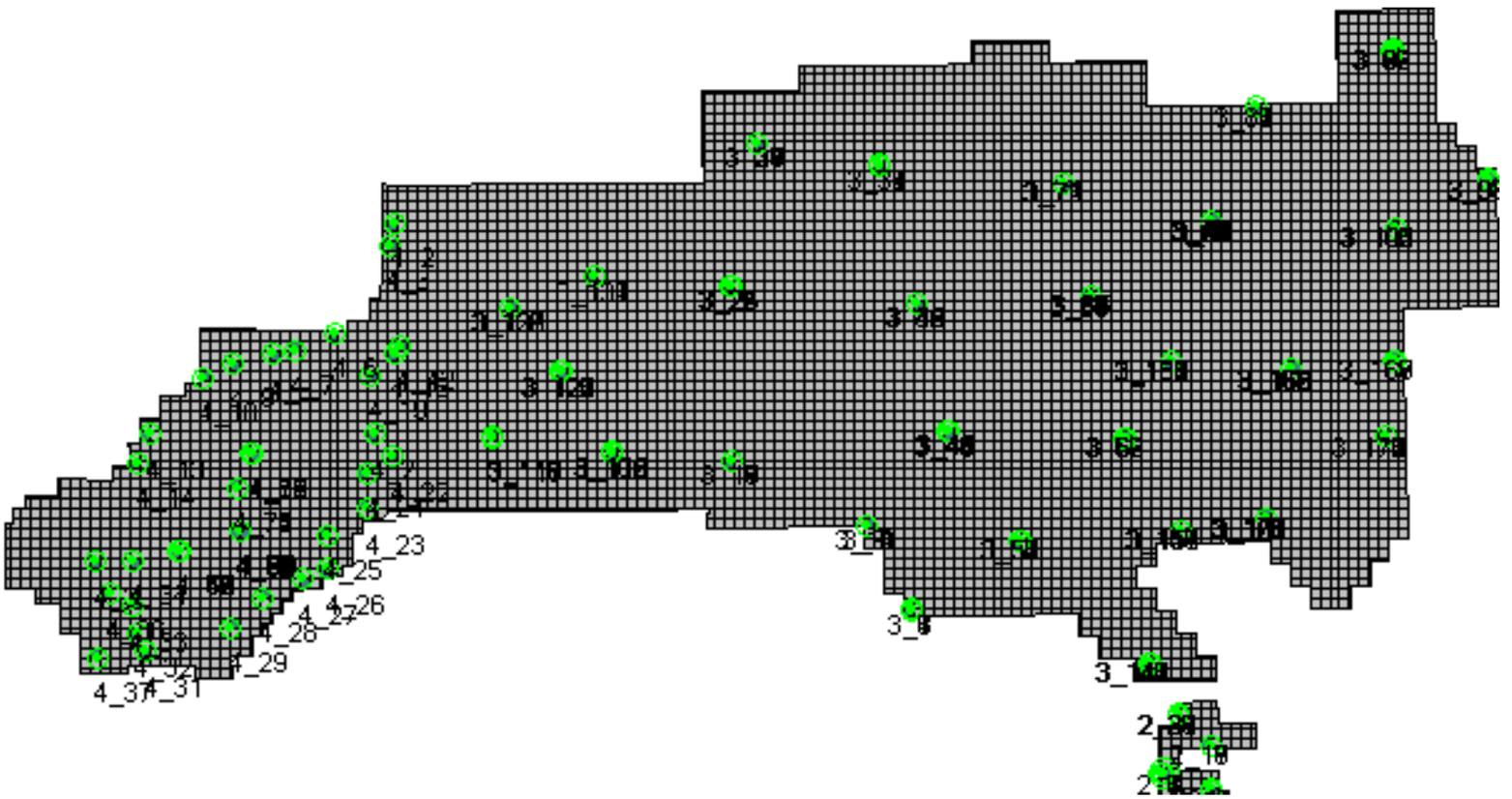
Tile Index:
- Filename: Clip_TX_Dallas_Tiles_UTM14.shp
- Number of Polys: 0

Intensity:
- Tile Index Attribute: Not Specified
- Data Filename: Not Specified

DEM:
- Tile Index Attribute: Name
- Data Filename: UTM14

LAS:
- Tile Index Attribute: Name
- Data Filename: UTM14_LAS

Tiled-Data Area



LiDAR Accuracy Assessment Summary

LC Type	# Points	NVA	VVA	RMSE Z
LAS		95% Confidence	95 Percentile	
Bare Earth	28	0.090		0.046
High Vegetation	10		0.219	0.106
Low Vegetation	79		0.158	0.085
Medium Vegetation	8			0.124
Urban Terrain	96	0.108		0.055
NVA Total:	124	0.104		0.053
VVA Total:	89		0.162	0.088
Total:	221			0.072
DEM		95% Confidence	95 Percentile	
Bare Earth	28	0.101		0.052
High Vegetation	10		0.213	0.101
Low Vegetation	79		0.153	0.086
Medium Vegetation	8		0.251	0.122
Urban Terrain	96	0.116		0.059
NVA Total:	124	0.113		0.057
VVA Total:	97		0.162	0.091
Total:	221			0.072
			Units:	Meters

Coordinates and Offsets of Analyzed Locations

		ID					
			Survey X	**Survey Y**	**Z1**	**Z DEM**	**Z LAS**
					LC Type	**ΔZ DEM**	**ΔZ LAS**
1)	☑	**2_6**					
			703734.952	3563015.098	149.768	149.799	149.77
					Bare Earth	0.031	0.002
2)	☑	**2_29**					
			706043.988	3572016.203	158.21	158.131	158.15
					Bare Earth	-0.079	-0.06
3)	☑	**3_6**					
			665636.968	3587858.108	219.834	219.78	219.779
					Bare Earth	-0.054	-0.055
4)	☑	**3_18**					
			638537.033	3610452.813	223.225	223.178	223.191
					Bare Earth	-0.047	-0.035
5)	☑	**3_24**					
			638326.724	3636866.168	225.059	225.147	225.141
					Bare Earth	0.088	0.082
6)	☑	**3_35**					
			660777.779	3655163.463	191.183	191.263	191.253
					Bare Earth	0.08	0.07
7)	☑	**3_90**					
			738461.539	3672456.533	161.463	161.449	161.416
					Bare Earth	-0.014	-0.047

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
8)	☑	**3_110**					
			620524.176	3611635.512	358.705	358.737	358.717
					Bare Earth	0.032	0.012
9)	☑	**3_128**					
			604893.601	3633421.032	391.341	391.3	391.297
					Bare Earth	-0.041	-0.044
10)	☑	**3_129**					
			604917.395	3633456.754	391.756	391.687	391.705
					Bare Earth	-0.069	-0.051
11)	☑	**3_131**					
			604902.595	3633501.034	392.789	392.776	392.755
					Bare Earth	-0.013	-0.034
12)	☑	**3_143**					
			701754.8	3579801.974	176.206	176.131	176.166
					Bare Earth	-0.075	-0.04
13)	☑	**3_145**					
			701897.42	3579882.943	176.007	175.958	175.957
					Bare Earth	-0.049	-0.05
14)	☑	**3_147**					
			706382.632	3599871.575	184.724	184.706	184.706
					Bare Earth	-0.018	-0.018

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
15)	☑	3_148					
			706415.178	3599891.723	184.942	184.941	184.933
					Bare Earth	-0.001	-0.009
16)	☑	3_160					
			723175.925	3624178.74	155.009	155.011	155.017
					Bare Earth	0.002	0.008
17)	☑	3_180					
			719492.106	3601627.533	141.156	141.026	141.036
					Bare Earth	-0.13	-0.12
18)	☑	4_10					
			558382.993	3622916.487	348.525	348.511	348.488
					Bare Earth	-0.014	-0.037
19)	☑	4_25					
			577223.544	3598999.248	295.385	295.315	295.322
					Bare Earth	-0.07	-0.063
20)	☑	4_27					
			573470.799	3592390.427	331.742	331.764	331.755
					Bare Earth	0.022	0.012
21)	☑	4_31					
			549780.475	3581594.881	413.006	413.052	413.024
					Bare Earth	0.046	0.018

Coordinates and Offsets of Analyzed Locations (Continued)

	ID					
		Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
22)	4_49					
		554840.988	3596837.647	314.095	314.145	314.139
				Bare Earth	0.05	0.044
23)	4_51					
		554822.024	3596878.21	313.946	313.97	313.977
				Bare Earth	0.024	0.031
24)	4_67					
		565752.867	3611374.808	266.507	266.471	266.479
				Bare Earth	-0.036	-0.028
25)	4_69					
		565778.547	3611419.906	266.413	266.433	266.435
				Bare Earth	0.02	0.022
26)	4_71					
		563671.647	3606262.832	268.465	268.439	268.445
				Bare Earth	-0.026	-0.02
27)	3_16					
		638445.872	3610462.75	222.055	222.056	222.06
				Bare Earth	0.001	0.005
28)	4_42					
		588113.084	3627760.821	284.748	284.797	284.79
				Bare Earth	0.049	0.042

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS
		Survey X	Survey Y	LC Type	ΔZ DEM	ΔZ LAS
29)	2_5					
		703598.193	3563044.032	154.73	154.767	154.757
				Urban Terrain	0.037	0.027
30)	2_11					
		711145.29	3560607.205	127.494	127.507	127.501
				Urban Terrain	0.013	0.007
31)	2_12					
		711111.066	3560586.498	127.644	127.685	127.689
				Urban Terrain	0.041	0.045
32)	2_13					
		711077.353	3560566.546	127.707	127.702	127.702
				Urban Terrain	-0.005	-0.005
33)	2_19					
		710896.056	3567356.568	145.249	145.221	145.232
				Urban Terrain	-0.028	-0.017
34)	2_30					
		706078.268	3572028.839	158.364	158.315	158.287
				Urban Terrain	-0.049	-0.077
35)	2_31					
		706113.943	3572050.563	158.328	158.258	158.26
				Urban Terrain	-0.07	-0.068

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
36)	☑	3_5					
			665678.491	3587851.602	219.142	219.1	219.1
					Urban Terrain	-0.042	-0.042
37)	☑	3_7					
			665648.48	3587818.841	219.167	219.129	219.129
					Urban Terrain	-0.038	-0.038
38)	☑	3_11					
			658756.126	3600653.899	224.392	224.319	224.304
					Urban Terrain	-0.073	-0.088
39)	☑	3_12					
			658777.742	3600621.639	224.927	224.851	224.853
					Urban Terrain	-0.076	-0.074
40)	☑	3_13					
			658782.156	3600552.373	227.542	227.511	227.513
					Urban Terrain	-0.031	-0.029
41)	☑	3_17					
			638486.599	3610464.762	222.961	222.902	222.916
					Urban Terrain	-0.059	-0.045
42)	☑	3_19					
			638581.372	3610453.762	223.906	223.917	223.922
					Urban Terrain	0.011	0.016

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
43)	☑	3_23					
			638210.083	3636901.474	226.451	226.456	226.456
					Urban Terrain	0.005	0.005
44)	☑	3_25					
			638364.507	3636821.638	223.617	223.645	223.642
					Urban Terrain	0.028	0.025
45)	☑	3_27					
			642177.911	3658396.966	276.694	276.778	276.761
					Urban Terrain	0.084	0.067
46)	☑	3_31					
			642223.277	3658347.501	278.586	278.648	278.652
					Urban Terrain	0.062	0.066
47)	☑	3_33					
			660842.693	3655169.973	190.93	190.917	190.927
					Urban Terrain	-0.013	-0.003
48)	☑	3_34					
			660802.629	3655196.494	191.716	191.687	191.681
					Urban Terrain	-0.029	-0.035
49)	☑	3_37					
			660809.99	3655092.693	190.53	190.558	190.543
					Urban Terrain	0.028	0.013

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
50)	☑	3_41					
			666575.171	3634230.434	175.76	175.807	175.81
					Urban Terrain	0.047	0.05
51)	☑	3_42					
			666599.463	3634201.833	175.669	175.704	175.701
					Urban Terrain	0.035	0.032
52)	☑	3_43					
			666643.304	3634168.874	175.404	175.424	175.423
					Urban Terrain	0.02	0.019
53)	☑	3_46					
			671189.422	3614835.41	199.039	199.03	199.048
					Urban Terrain	-0.009	0.009
54)	☑	3_48					
			671155.363	3614885.978	198.396	198.43	198.455
					Urban Terrain	0.034	0.059
55)	☑	3_49					
			671111.764	3614862.129	199.792	199.79	199.805
					Urban Terrain	-0.002	0.013
56)	☑	3_52					
			682160.782	3598336.828	169.663	169.458	169.492
					Urban Terrain	-0.205	-0.171

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
57)	☑	3_55					
			682135.813	3598277.288	170.269	170.253	170.248
					Urban Terrain	-0.016	-0.021
58)	☑	3_60					
			697935.937	3613847.213	210.869	210.838	210.844
					Urban Terrain	-0.031	-0.025
59)	☑	3_61					
			697968.917	3613828.783	211.746	211.716	211.723
					Urban Terrain	-0.03	-0.023
60)	☑	3_63					
			697943.2	3613908.526	211.145	211.152	211.145
					Urban Terrain	0.007	0
61)	☑	3_66					
			692886.561	3635326.159	158.168	158.251	158.253
					Urban Terrain	0.083	0.085
62)	☑	3_67					
			692852.018	3635304.087	158.746	158.794	158.808
					Urban Terrain	0.048	0.062
63)	☑	3_69					
			692879.196	3635203.337	159.203	159.271	159.27
					Urban Terrain	0.068	0.067

Coordinates and Offsets of Analyzed Locations (Continued)

	ID					
		Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
64)	3_71					
		688730.673	3652341.573	137.959	137.988	137.991
				Urban Terrain	0.029	0.032
65)	3_75					
		688790.171	3652404.677	136.956	136.96	136.966
				Urban Terrain	0.004	0.01
66)	3_78					
		711100.492	3646657.459	185.076	185.028	185.028
				Urban Terrain	-0.048	-0.048
67)	3_79					
		711050.824	3646661.615	184.838	184.788	184.784
				Urban Terrain	-0.05	-0.054
68)	3_81					
		711081.12	3646527.007	183.613	183.563	183.56
				Urban Terrain	-0.05	-0.053
69)	3_83					
		717851.977	3663842.398	194.68	194.578	194.573
				Urban Terrain	-0.102	-0.107
70)	3_86					
		717800.638	3663873.019	195.185	195.047	195.109
				Urban Terrain	-0.138	-0.076

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
71)	3_87					
		717840.088	3663921.31	194.175	194.052	194.054
				Urban Terrain	-0.123	-0.121
72)	3_92					
		738527.053	3672495.939	159.249	159.228	159.215
				Urban Terrain	-0.021	-0.034
73)	3_97					
		753028.166	3652832.775	166.472	166.46	166.495
				Urban Terrain	-0.012	0.023
74)	3_98					
		752964.045	3652700.822	166.17	166.258	166.238
				Urban Terrain	0.088	0.068
75)	3_99					
		752995.868	3652685.967	166.506	166.549	166.546
				Urban Terrain	0.043	0.04
76)	3_101					
		738863.675	3645609.944	176.907	176.922	176.908
				Urban Terrain	0.015	0.001
77)	3_105					
		738865.505	3645523.685	176.681	176.659	176.664
				Urban Terrain	-0.022	-0.017

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
78)	☑	3_111					
			620495.186	3611612.131	356.539	356.605	356.58
					Urban Terrain	0.066	0.041
79)	☑	3_112					
			620468.913	3611583.096	354.21	354.228	354.216
					Urban Terrain	0.018	0.006
80)	☑	3_117					
			602099.781	3614227.966	244.773	244.693	244.663
					Urban Terrain	-0.08	-0.11
81)	☑	3_118					
			602156.28	3614141.133	240.96	240.884	240.869
					Urban Terrain	-0.076	-0.091
82)	☑	3_121					
			612630.561	3623795.04	321.696	321.696	321.691
					Urban Terrain	0	-0.005
83)	☑	3_123					
			612571.498	3623830.781	322.92	322.882	322.896
					Urban Terrain	-0.038	-0.024
84)	☑	3_125					
			612605.674	3623874.693	323.082	323.099	323.102
					Urban Terrain	0.017	0.02

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
85)	☑	3_133					
			617789.584	3638232.334	311.859	311.854	311.846
					Urban Terrain	-0.005	-0.013
86)	☑	3_137					
			617699.614	3638239.775	309.262	309.249	309.23
					Urban Terrain	-0.013	-0.032
87)	☑	3_142					
			701792.413	3579811.597	176.541	176.435	176.434
					Urban Terrain	-0.106	-0.107
88)	☑	3_149					
			706420.9	3599852.205	184.53	184.347	184.373
					Urban Terrain	-0.183	-0.157
89)	☑	3_153					
			704939.251	3625384.711	144.973	145.002	144.991
					Urban Terrain	0.029	0.018
90)	☑	3_156					
			704990.965	3625411.456	143.064	143.102	143.07
					Urban Terrain	0.038	0.006
91)	☑	3_157					
			704985.748	3625376.592	143.763	143.761	143.763
					Urban Terrain	-0.002	0

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
92)	☑	3_161					
			723195.511	3624210.897	155.666	155.719	155.693
					Urban Terrain	0.053	0.026
93)	☑	3_163					
			723261.064	3624212.147	156.95	156.906	156.901
					Urban Terrain	-0.044	-0.049
94)	☑	3_166					
			738838.505	3625518.395	141.642	141.659	141.658
					Urban Terrain	0.017	0.016
95)	☑	3_167					
			738796.947	3625519.516	141.437	141.443	141.443
					Urban Terrain	0.006	0.006
96)	☑	3_169					
			738734.715	3625546.133	141.041	141.029	141.031
					Urban Terrain	-0.012	-0.01
97)	☑	3_173					
			737569.041	3613970.141	122.606	122.546	122.552
					Urban Terrain	-0.06	-0.054
98)	☑	3_174					
			737605.466	3613961.607	124.216	124.129	124.125
					Urban Terrain	-0.087	-0.091

Coordinates and Offsets of Analyzed Locations (Continued)

	ID	Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
99)	**3_175**					
		737616.948	3613929.589	126.711	126.611	126.643
				Urban Terrain	-0.1	-0.068
100)	**3_177**					
		719547.768	3601654.955	141.375	141.254	141.264
				Urban Terrain	-0.121	-0.111
101)	**3_181**					
		719532.335	3601611.69	141.102	140.993	140.992
				Urban Terrain	-0.109	-0.111
102)	**4_3**					
		586648.673	3642823.928	314.707	314.714	314.696
				Urban Terrain	0.007	-0.011
103)	**4_7**					
		572291.161	3627058.018	298.931	298.925	298.94
				Urban Terrain	-0.006	0.009
104)	**4_8**					
		568985.882	3626526.724	348.568	348.54	348.535
				Urban Terrain	-0.028	-0.033
105)	**4_9**					
		563051.943	3625167.482	325.763	325.768	325.748
				Urban Terrain	0.005	-0.015

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
106)	☑	4_13					
			550398.361	3614387.336	351.634	351.714	351.719
					Urban Terrain	0.08	0.085
107)	☑	4_18					
			587488.778	3626695.171	292.544	292.565	292.559
					Urban Terrain	0.021	0.015
108)	☑	4_20					
			584327.466	3614336.68	244.875	244.845	244.842
					Urban Terrain	-0.03	-0.033
109)	☑	4_22					
			587235.462	3610947.388	256.768	256.806	256.807
					Urban Terrain	0.038	0.039
110)	☑	4_36					
			544365.913	3590262.015	347.495	347.6	347.583
					Urban Terrain	0.105	0.088
111)	☑	4_39					
			542185.649	3595036.156	433.507	433.481	433.484
					Urban Terrain	-0.026	-0.023
112)	☑	4_45					
			554761.281	3596771.414	314.756	314.815	314.816
					Urban Terrain	0.059	0.06

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
113)	☑	4_46					
			554788.113	3596761.565	314.74	314.823	314.823
					Urban Terrain	0.083	0.083
114)	☑	4_52					
			554790.635	3596903.617	313.874	313.888	313.874
					Urban Terrain	0.014	0
115)	☑	4_53					
			554773.809	3596873.772	313.996	314.019	314.02
					Urban Terrain	0.023	0.024
116)	☑	4_56					
			563985.886	3599716.108	301.025	301.004	300.984
					Urban Terrain	-0.021	-0.041
117)	☑	4_58					
			564012.456	3599766.986	301.302	301.309	301.286
					Urban Terrain	0.007	-0.016
118)	☑	4_59					
			564054.025	3599762.955	302.405	302.377	302.377
					Urban Terrain	-0.028	-0.028
119)	☑	4_62					
			564065.594	3599684.239	302.918	302.838	302.868
					Urban Terrain	-0.08	-0.05

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
120)	☑	**4_63**					
			564070.928	3599637.772	303.765	303.755	303.746
					Urban Terrain	-0.01	-0.019
121)	☑	**4_64**					
			564071.083	3599581	303.823	303.77	303.789
					Urban Terrain	-0.053	-0.034
122)	☑	**4_70**					
			565691.938	3611483.166	266.166	266.13	266.145
					Urban Terrain	-0.036	-0.021
123)	☑	**4_73**					
			563691.958	3606347.187	268.248	268.257	268.217
					Urban Terrain	0.009	-0.031
124)	☑	**4_74**					
			563650.362	3606223.604	268.793	268.767	268.757
					Urban Terrain	-0.026	-0.036
125)	☑	**3_21**					
			638276.779	3636839.688	224.384	224.487	224.503
					High Vegetation	0.103	0.119
126)	☑	**3_62**					
			698017.697	3613824.871	212.963	212.965	213.051
					High Vegetation	0.002	0.088

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
127)	☑	**3_116**					
			602105.756	3613926.797	240.046	240.095	240.084
					High Vegetation	0.049	0.038
128)	☑	**3_124**					
			612560.674	3623872.635	323.532	323.595	323.598
					High Vegetation	0.063	0.066
129)	☑	**3_155**					
			704972.438	3625466.166	143.059	143.272	143.278
					High Vegetation	0.213	0.219
130)	☑	**3_159**					
			723198.277	3624148.812	155.105	155.159	155.159
					High Vegetation	0.054	0.054
131)	☑	**4_19**					
			583778.347	3623168.361	307.186	307.173	307.183
					High Vegetation	-0.013	-0.003
132)	☑	**4_21**					
			583409.337	3608483.047	250.344	250.49	250.488
					High Vegetation	0.146	0.144
133)	☑	**4_28**					
			567462.506	3589727.418	350.776	350.883	350.865
					High Vegetation	0.107	0.089

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
134)	☑	4_37					
			542505.864	3580633.089	383.42	383.478	383.489
					High Vegetation	0.058	0.069
135)	☑	2_3					
			703680.479	3563041.879	152.63	152.657	152.706
					Low Vegetation	0.027	0.076
136)	☑	2_4					
			703640.353	3563038.439	153.271	153.366	153.398
					Low Vegetation	0.095	0.127
137)	☑	2_7					
			703767.664	3563047.066	150.542	150.658	150.642
					Low Vegetation	0.116	0.1
138)	☑	2_9					
			711166.204	3560664.44	126.575	126.717	126.692
					Low Vegetation	0.142	0.117
139)	☑	2_10					
			711143.933	3560700.388	126.976	127.054	127.05
					Low Vegetation	0.078	0.074
140)	☑	2_15					
			710971.818	3567330.644	140.862	141.015	141.006
					Low Vegetation	0.153	0.144

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
141)	☑	2_16					
			710967.592	3567369.096	142.185	142.266	142.229
					Low Vegetation	0.081	0.044
142)	☑	2_17					
			710926.242	3567364.891	143.755	143.8	143.784
					Low Vegetation	0.045	0.029
143)	☑	2_27					
			706005.753	3571953.814	158.252	158.279	158.276
					Low Vegetation	0.027	0.024
144)	☑	2_28					
			706032.101	3571937.287	158.425	158.478	158.449
					Low Vegetation	0.053	0.024
145)	☑	3_3					
			665731.571	3587826.021	218.256	218.307	218.303
					Low Vegetation	0.051	0.047
146)	☑	3_4					
			665720.189	3587865.045	219.407	219.434	219.433
					Low Vegetation	0.027	0.026
147)	☑	3_10					
			658797.229	3600655.928	224.126	224.078	224.083
					Low Vegetation	-0.048	-0.043

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
148)	☑	3_15					
			638391.816	3610451.936	221.352	221.409	221.42
					Low Vegetation	0.057	0.068
149)	☑	3_22					
			638250.663	3636870.069	225.65	225.747	225.714
					Low Vegetation	0.097	0.064
150)	☑	3_28					
			642140.066	3658403.548	275.171	275.31	275.325
					Low Vegetation	0.139	0.154
151)	☑	3_29					
			642130.39	3658371.268	277.641	277.761	277.774
					Low Vegetation	0.12	0.133
152)	☑	3_30					
			642145.728	3658337.891	280.033	280.186	280.159
					Low Vegetation	0.153	0.126
153)	☑	3_36					
			660783.642	3655123.454	190.719	190.783	190.777
					Low Vegetation	0.064	0.058
154)	☑	3_39					
			666621.661	3634249.52	175.66	175.75	175.761
					Low Vegetation	0.09	0.101

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
155)	☑	3_40					
			666589.167	3634266.734	175.992	176.047	176.043
					Low Vegetation	0.055	0.051
156)	☑	3_45					
			671168.262	3614801.024	199.709	199.786	199.796
					Low Vegetation	0.077	0.087
157)	☑	3_47					
			671196.345	3614876.993	197.439	197.549	197.484
					Low Vegetation	0.11	0.045
158)	☑	3_51					
			682168.076	3598381.715	169.644	169.689	169.67
					Low Vegetation	0.045	0.026
159)	☑	3_53					
			682128.924	3598305.01	170.025	170.142	170.089
					Low Vegetation	0.117	0.064
160)	☑	3_54					
			682103.104	3598255.35	171.13	171.155	171.168
					Low Vegetation	0.025	0.038
161)	☑	3_59					
			697874.258	3613829.433	209.334	209.362	209.368
					Low Vegetation	0.028	0.034

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
162)	☑	3_65					
			692926.945	3635307.92	158.371	158.538	158.539
					Low Vegetation	0.167	0.168
163)	☑	3_68					
			692875.154	3635243.05	158.81	158.958	158.962
					Low Vegetation	0.148	0.152
164)	☑	3_72					
			688748.011	3652306.335	137.514	137.565	137.578
					Low Vegetation	0.051	0.063
165)	☑	3_73					
			688775.288	3652328.056	137.063	137.161	137.16
					Low Vegetation	0.098	0.097
166)	☑	3_74					
			688782.057	3652356.017	137.094	137.12	137.109
					Low Vegetation	0.026	0.015
167)	☑	3_77					
			711134.12	3646628.964	184.816	184.764	184.768
					Low Vegetation	-0.052	-0.048
168)	☑	3_80					
			711099.331	3646562.73	183.974	183.989	183.992
					Low Vegetation	0.015	0.018

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
169)	☑	3_84					
			717812.325	3663843.95	195.449	195.365	195.37
					Low Vegetation	-0.084	-0.079
170)	☑	3_85					
			717772.514	3663847.851	196.099	196.043	196.034
					Low Vegetation	-0.056	-0.065
171)	☑	3_89					
			738417.572	3672431.41	162.888	162.909	162.913
					Low Vegetation	0.021	0.025
172)	☑	3_91					
			738490.797	3672512.609	157.212	157.26	157.255
					Low Vegetation	0.048	0.043
173)	☑	3_93					
			738546.721	3672527.738	155.884	155.947	155.918
					Low Vegetation	0.063	0.034
174)	☑	3_96					
			753023.284	3652792.015	165.921	166.083	166.083
					Low Vegetation	0.162	0.162
175)	☑	3_102					
			738881.135	3645646.578	175.419	175.528	175.51
					Low Vegetation	0.109	0.091

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
176)	☑	3_103					
			738910.123	3645623.141	177.242	177.316	177.324
					Low Vegetation	0.074	0.082
177)	☑	3_104					
			738905.327	3645581.442	177.57	177.701	177.695
					Low Vegetation	0.131	0.125
178)	☑	3_109					
			620540.954	3611673.998	359.18	359.299	359.325
					Low Vegetation	0.119	0.145
179)	☑	3_113					
			620436.558	3611559.737	351.639	351.809	351.846
					Low Vegetation	0.17	0.207
180)	☑	3_115					
			602097.986	3613891.735	241.275	241.27	241.251
					Low Vegetation	-0.005	-0.024
181)	☑	3_119					
			602173.937	3614105.114	239.507	239.471	239.476
					Low Vegetation	-0.036	-0.031
182)	☑	3_122					
			612588.73	3623796.355	321.763	321.795	321.78
					Low Vegetation	0.032	0.017

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
183)	☑	3_127					
			604935.566	3633422.026	390.603	390.62	390.617
					Low Vegetation	0.017	0.014
184)	☑	3_130					
			604940.625	3633449.772	391.039	391.071	391.08
					Low Vegetation	0.032	0.041
185)	☑	3_134					
			617836.525	3638228.909	311.168	311.18	311.201
					Low Vegetation	0.012	0.033
186)	☑	3_135					
			617913.153	3638228.146	310.268	310.291	310.302
					Low Vegetation	0.023	0.034
187)	☑	3_136					
			617736.248	3638202.606	309.168	309.303	309.309
					Low Vegetation	0.135	0.141
188)	☑	3_141					
			701831.626	3579815.689	176.898	176.843	176.853
					Low Vegetation	-0.055	-0.045
189)	☑	3_144					
			701887.008	3579846.131	177.067	177.03	177.046
					Low Vegetation	-0.037	-0.021

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
190)	☑	3_151					
			706409.556	3599771.043	183.563	183.679	183.666
					Low Vegetation	0.116	0.103
191)	☑	3_154					
			704943.601	3625423.759	144.929	144.982	144.988
					Low Vegetation	0.053	0.059
192)	☑	3_162					
			723219.395	3624240.243	156.386	156.483	156.492
					Low Vegetation	0.097	0.106
193)	☑	3_165					
			738809.755	3625542.089	141.249	141.294	141.303
					Low Vegetation	0.045	0.054
194)	☑	3_168					
			738757.912	3625517.372	141.525	141.57	141.575
					Low Vegetation	0.045	0.05
195)	☑	3_171					
			737498.606	3613991.653	121.818	121.8	121.802
					Low Vegetation	-0.018	-0.016
196)	☑	3_172					
			737531.885	3613970.025	122.473	122.476	122.459
					Low Vegetation	0.003	-0.014

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
197)	☑	**3_178**					
			719511.796	3601669.007	141.195	141.169	141.155
					Low Vegetation	-0.026	-0.04
198)	☑	**3_179**					
			719468.268	3601661.63	141.021	140.981	140.992
					Low Vegetation	-0.04	-0.029
199)	☑	**4_2**					
			587351.805	3646257.047	346.44	346.578	346.546
					Low Vegetation	0.138	0.106
200)	☑	**4_14**					
			548635.03	3610073.356	351.687	351.795	351.78
					Low Vegetation	0.108	0.093
201)	☑	**4_23**					
			583353.811	3603031.825	303.385	303.373	303.364
					Low Vegetation	-0.012	-0.021
202)	☑	**4_26**					
			577439.924	3593981.376	334.904	334.973	334.972
					Low Vegetation	0.069	0.068
203)	☑	**4_32**					
			548490.165	3584255.098	368.776	368.862	368.889
					Low Vegetation	0.086	0.113

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
204)	☑	4_33					
			547816.128	3588403.588	331.708	331.686	331.73
					Low Vegetation	-0.022	0.022
205)	☑	4_48					
			554839.488	3596800.092	314.064	314.213	314.222
					Low Vegetation	0.149	0.158
206)	☑	4_50					
			554830.219	3596852.341	313.904	314.109	314.127
					Low Vegetation	0.205	0.223
207)	☑	4_55					
			564010.693	3599719.696	301.042	301.053	301.045
					Low Vegetation	0.011	0.003
208)	☑	4_57					
			563996.044	3599754.564	300.431	300.482	300.455
					Low Vegetation	0.051	0.024
209)	☑	4_61					
			564086.417	3599763.03	302.765	302.782	302.787
					Low Vegetation	0.017	0.022
210)	☑	4_66					
			565744.835	3611433.363	266.018	266.056	266.051
					Low Vegetation	0.038	0.033

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	Survey Y	Z1	Z DEM	Z LAS
					LC Type	ΔZ DEM	ΔZ LAS
211)	☑	**4_68**					
			565750.992	3611519.222	265.357	265.416	265.434
					Low Vegetation	0.059	0.077
212)	☑	**4_72**					
			563685.33	3606305.147	267.778	267.862	267.856
					Low Vegetation	0.084	0.078
213)	☑	**4_75**					
			563627.296	3606165.76	268.016	268.064	268.048
					Low Vegetation	0.048	0.032
214)	☑	**3_9**					
			658823.142	3600630.769	224.601	224.665	224.645
					Medium Vegetation	0.064	0.044
215)	☑	**3_95**					
			753027.467	3652757.428	165.929	166.18	166.177
					Medium Vegetation	0.251	0.248
216)	☑	**3_150**					
			706447.189	3599800.451	183.589	183.684	183.697
					Medium Vegetation	0.095	0.108
217)	☑	**4_6**					
			578562.03	3629779.247	284.651	284.692	284.704
					Medium Vegetation	0.041	0.053

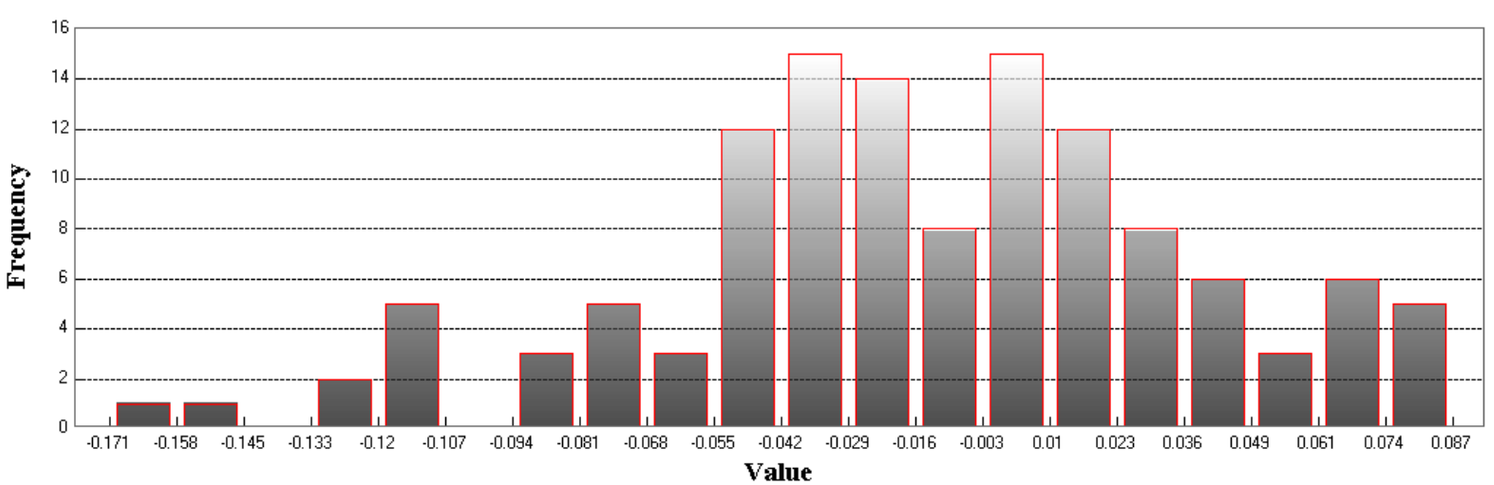
Coordinates and Offsets of Analyzed Locations (Continued)

	ID					
		Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
218) ☑	4_29					
		562683.112	3585182.901	388.989	389.048	389.039
				Medium Vegetation	0.059	0.05
219) ☑	4_34					
		547763.58	3595391.426	306.97	307.069	307.08
				Medium Vegetation	0.099	0.11
220) ☑	4_44					
		554745.034	3596787.11	314.952	315.087	315.09
				Medium Vegetation	0.135	0.138
221) ☑	4_60					
		564125.897	3599774.72	303.588	303.683	303.695
				Medium Vegetation	0.095	0.106

LAS

Nonvegetated Vertical Accuracy
LandCover Type: Bare Earth, Urban Terrain
Minimum DZ: -0.171
Maximum DZ: 0.088
Mean DZ: -0.014
Mean Magnitude DZ: 0.204
Number Observations: 124
Standard Deviation DZ: 0.052
RMSE Z: 0.053
95% Confidence Level Z: 0.104
Units: Meters

Histogram



Min: -0.171
Max: 0.088
Number Of Bins: 20
Bin Interval: 0.013

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: High Vegetation

Minimum DZ: -0.003

Maximum DZ: 0.219

Mean DZ: 0.088

Mean Magnitude DZ: 0.298

Number Observations: 10

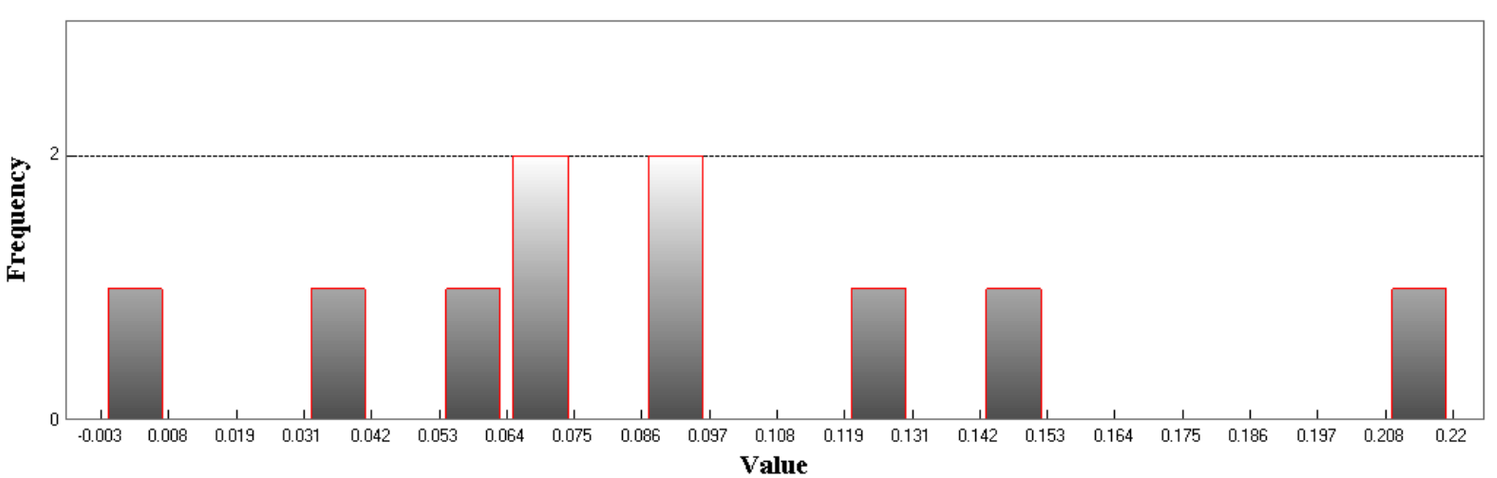
Standard Deviation DZ: 0.062

RMSE Z: 0.106

95th Percentile: 0.219

Units: Meters

Histogram



Min: -0.003

Max: 0.219

Number Of Bins: 20

Bin Interval: 0.011

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation

Minimum DZ: -0.079

Maximum DZ: 0.223

Mean DZ: 0.057

Mean Magnitude DZ: 0.264

Number Observations: 79

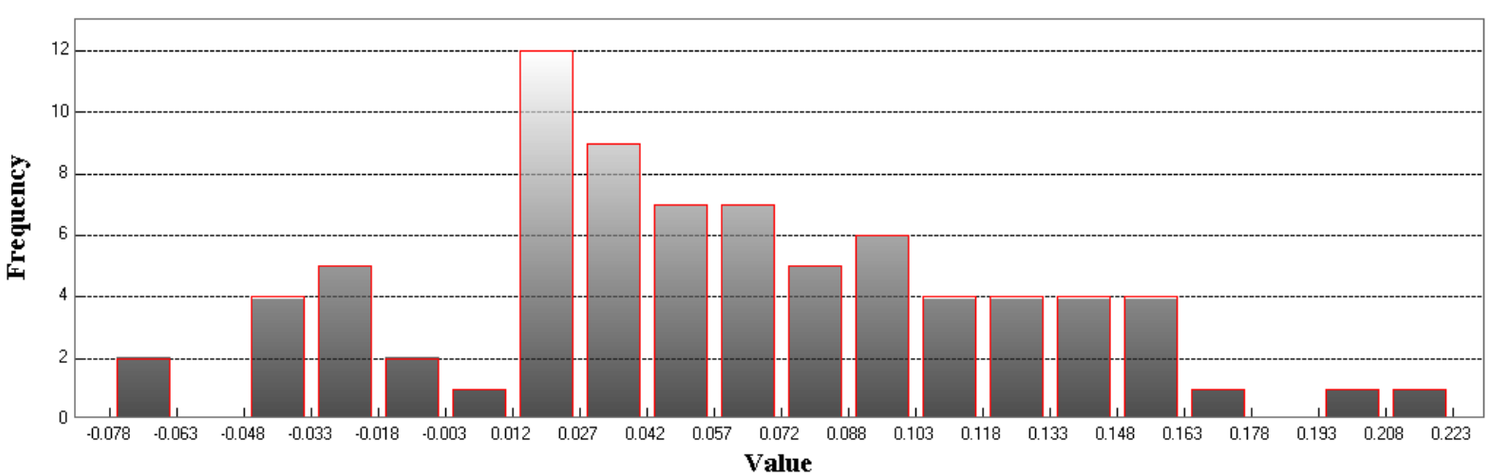
Standard Deviation DZ: 0.063

RMSE Z: 0.085

95th Percentile: 0.158

Units: Meters

Histogram



Min: -0.079

Max: 0.223

Number Of Bins: 20

Bin Interval: 0.015

DEM

Nonvegetated Vertical Accuracy

LandCover Type: Bare Earth, Urban Terrain

Minimum DZ: -0.205

Maximum DZ: 0.105

Mean DZ: -0.012

Mean Magnitude DZ: 0.21

Number Observations: 124

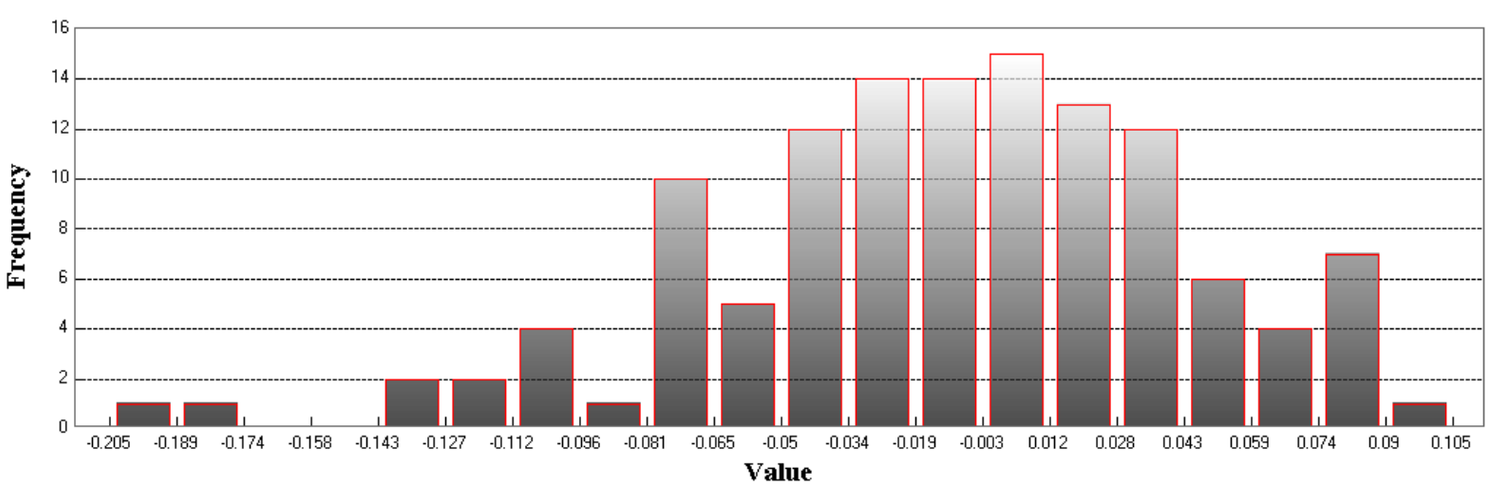
Standard Deviation DZ: 0.056

RMSE Z: 0.057

95% Confidence Level Z: 0.113

Units: Meters

Histogram



Min: -0.205

Max: 0.105

Number Of Bins: 20

Bin Interval: 0.016

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: High Vegetation

Minimum DZ: -0.013

Maximum DZ: 0.213

Mean DZ: 0.078

Mean Magnitude DZ: 0.284

Number Observations: 10

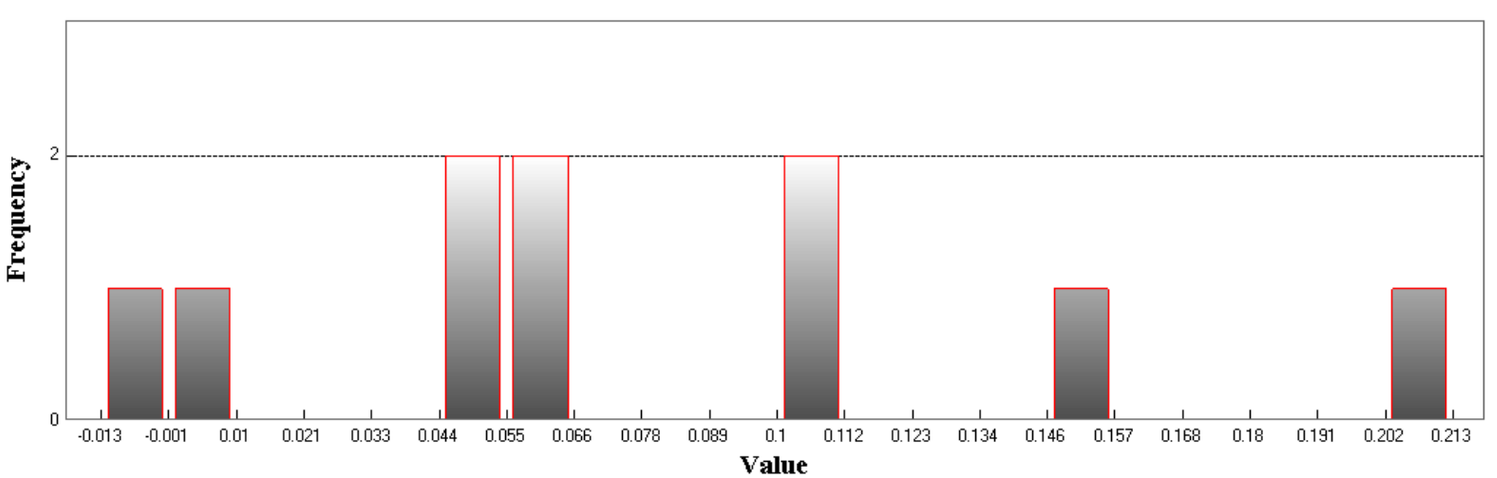
Standard Deviation DZ: 0.067

RMSE Z: 0.101

95th Percentile: 0.213

Units: Meters

Histogram



Min: -0.013

Max: 0.213

Number Of Bins: 20

Bin Interval: 0.011

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation

Minimum DZ: -0.084

Maximum DZ: 0.205

Mean DZ: 0.059

Mean Magnitude DZ: 0.267

Number Observations: 79

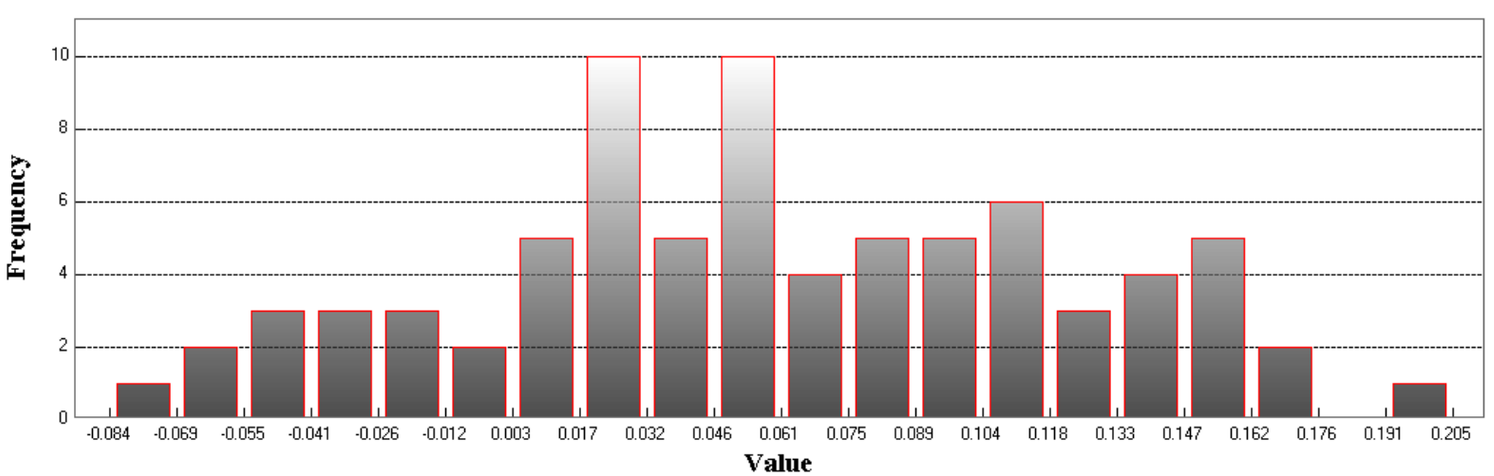
Standard Deviation DZ: 0.063

RMSE Z: 0.086

95th Percentile: 0.153

Units: Meters

Histogram



Min: -0.084

Max: 0.205

Number Of Bins: 20

Bin Interval: 0.014

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: Medium Vegetation

Minimum DZ: 0.041

Maximum DZ: 0.251

Mean DZ: 0.105

Mean Magnitude DZ: 0.324

Number Observations: 8

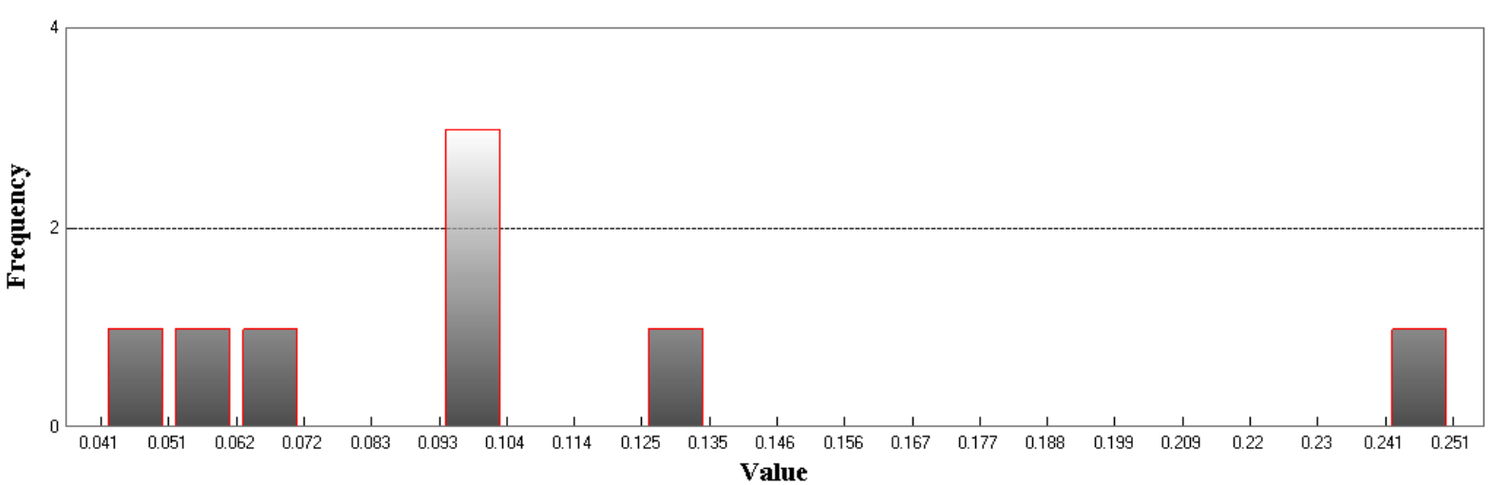
Standard Deviation DZ: 0.066

RMSE Z: 0.122

95th Percentile: 0.251

Units: Meters

Histogram



Min: 0.041

Max: 0.251

Number Of Bins: 20

Bin Interval: 0.011

Project Information

Prepared By: DAS
Project Name: TX Pecos Dallas 2018 QL2
Sensor Info: ALS80
Required Nominal Pulse Spacing: 0.71
Vendor Name: Digital Aerial Solutions. LLC
Units: Meters
Percent of Extent Tolerance: Extents Not Checked
Date of Aquisition: Start: 1/26/2019 Finish: 4/22/2019

Metadata Information

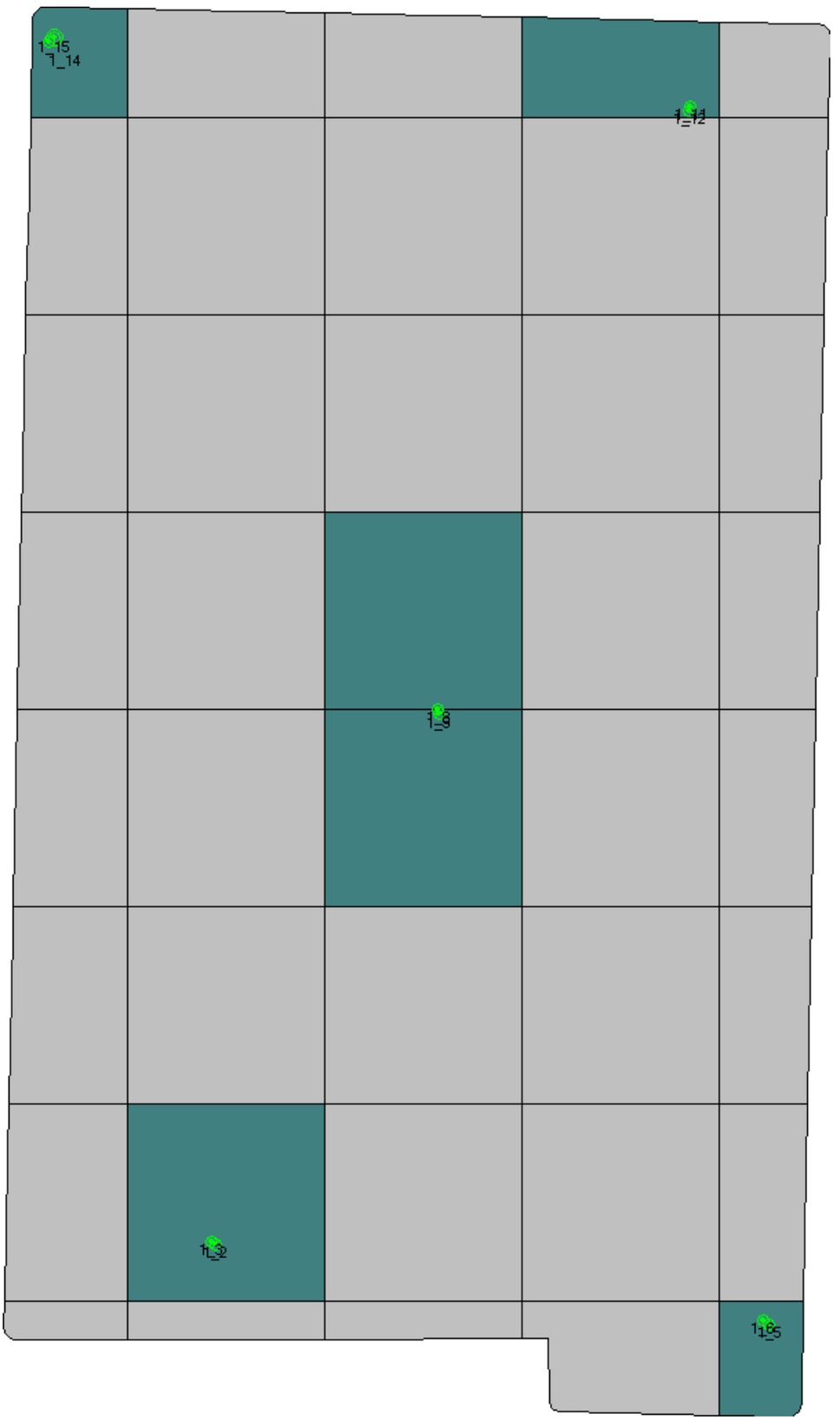
Tile Index:
- Filename: Clip_TX_Tiles_UTM15.shp
- Number of Polys: 0

Intensity:
- Tile Index Attribute: Not Specified
- Data Filename: Not Specified

DEM:
- Tile Index Attribute: Name
- Data Filename: UTM15

LAS:
- Tile Index Attribute: Name
- Data Filename: UTM15_LAS

Tiled-Data Area



LiDAR Accuracy Assessment Summary

LC Type	# Points	NVA	VVA	RMSE Z
LAS		95% Confidence	95 Percentile	
Bare Earth	2	0.098		0.050
Low Vegetation	4		0.129	0.075
Urban Terrian	4	0.079		0.040
NVA Total:	6	0.086		0.044
VVA Total:	4		0.129	0.075
Total:	10			0.058
DEM		95% Confidence	95 Percentile	
Bare Earth	2	0.020		0.010
Low Vegetation	4		0.108	0.068
Urban Terrian	4	0.082		0.042
NVA Total:	6	0.068		0.035
VVA Total:	4		0.108	0.068
Total:	10			0.058
			Units:	Meters

Coordinates and Offsets of Analyzed Locations

		ID					
			Survey X	**Survey Y**	**Z1**	**Z DEM**	**Z LAS**
					LC Type	**ΔZ DEM**	**ΔZ LAS**
1)	☑	**1_15**					
			279946.598	3601609.982	136.564	136.578	136.627
					Bare Earth	0.014	0.063
2)	☑	**1_8**					
			282868.429	3596508.219	146.748	146.743	146.716
					Bare Earth	-0.005	-0.032
3)	☑	**1_2**					
			281174.296	3592436.889	166.421	166.434	166.428
					Urban Terrian	0.013	0.007
4)	☑	**1_6**					
			285337.994	3591857.32	152.165	152.19	152.153
					Urban Terrian	0.025	-0.012
5)	☑	**1_12**					
			284777.409	3601057.878	131.108	131.137	131.163
					Urban Terrian	0.029	0.055
6)	☑	**1_14**					
			279908.495	3601584.212	133.112	133.186	133.169
					Urban Terrian	0.074	0.057
7)	☑	**1_3**					
			281139.015	3592454.86	166.478	166.586	166.607
					Low Vegetation	0.108	0.129

Coordinates and Offsets of Analyzed Locations (Continued)

		ID					
			Survey X	**Survey Y**	**Z1**	**Z DEM**	**Z LAS**
					LC Type	**ΔZ DEM**	**ΔZ LAS**
8)	☑	**1_5**					
			285382.47	3591828.39	151.253	151.312	151.323
					Low Vegetation	0.059	0.07
9)	☑	**1_9**					
			282872.29	3596468.079	144.192	144.239	144.195
					Low Vegetation	0.047	0.003
10)	☑	**1_11**					
			284785.409	3601092.305	132.234	132.271	132.268
					Low Vegetation	0.037	0.034

LAS

Nonvegetated Vertical Accuracy

LandCover Type: Bare Earth, Urban Terrian

Minimum DZ: -0.032

Maximum DZ: 0.063

Mean DZ: 0.023

Mean Magnitude DZ: 0.194

Number Observations: 6

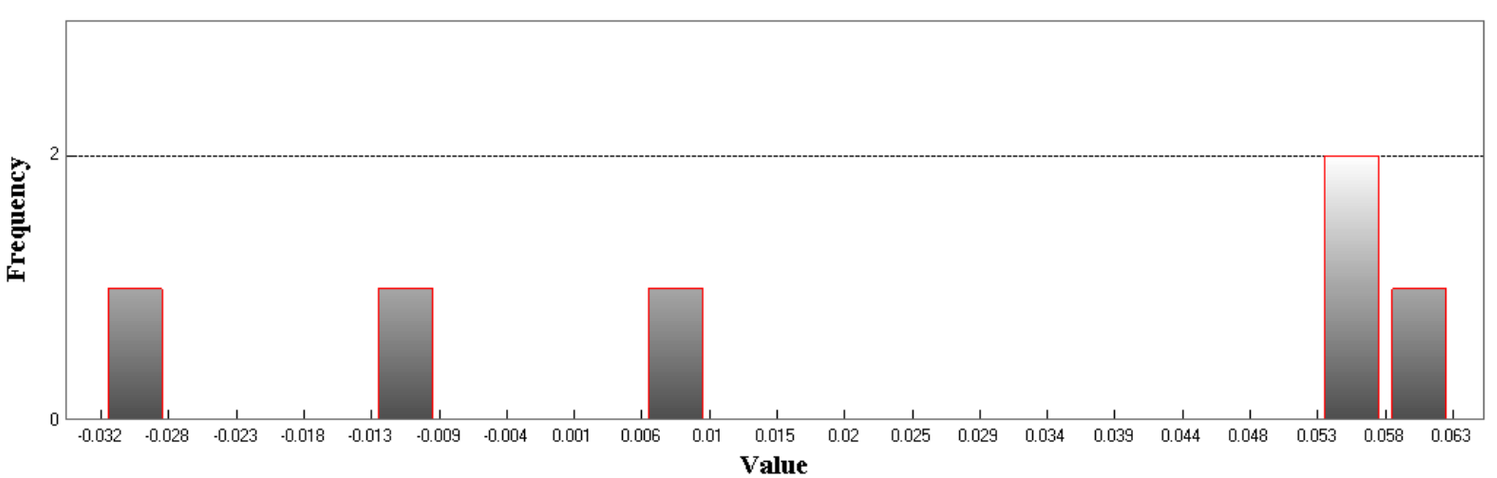
Standard Deviation DZ: 0.041

RMSE Z: 0.044

95% Confidence Level Z: 0.086

Units: Meters

Histogram



Min: -0.032

Max: 0.063

Number Of Bins: 20

Bin Interval: 0.005

LAS (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation

Minimum DZ: 0.003

Maximum DZ: 0.129

Mean DZ: 0.059

Mean Magnitude DZ: 0.243

Number Observations: 4

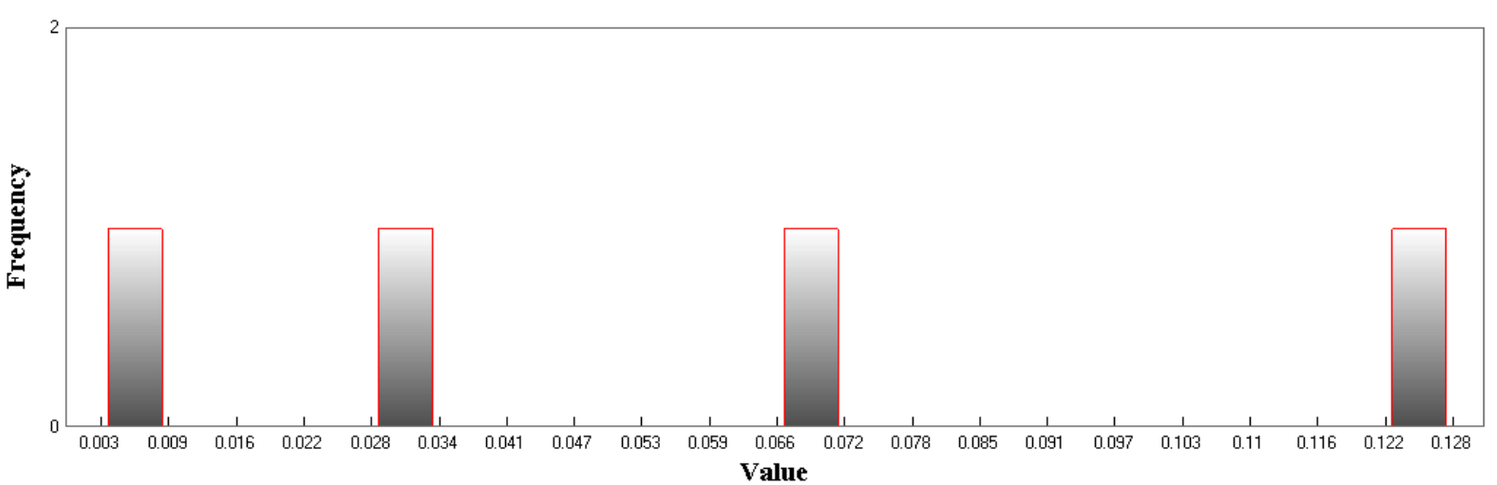
Standard Deviation DZ: 0.054

RMSE Z: 0.075

95th Percentile: 0.129

Units: Meters

Histogram



Min: 0.003

Max: 0.129

Number Of Bins: 20

Bin Interval: 0.006

DEM

Nonvegetated Vertical Accuracy

LandCover Type: Bare Earth, Urban Terrian

Minimum DZ: -0.005

Maximum DZ: 0.074

Mean DZ: 0.025

Mean Magnitude DZ: 0.163

Number Observations: 6

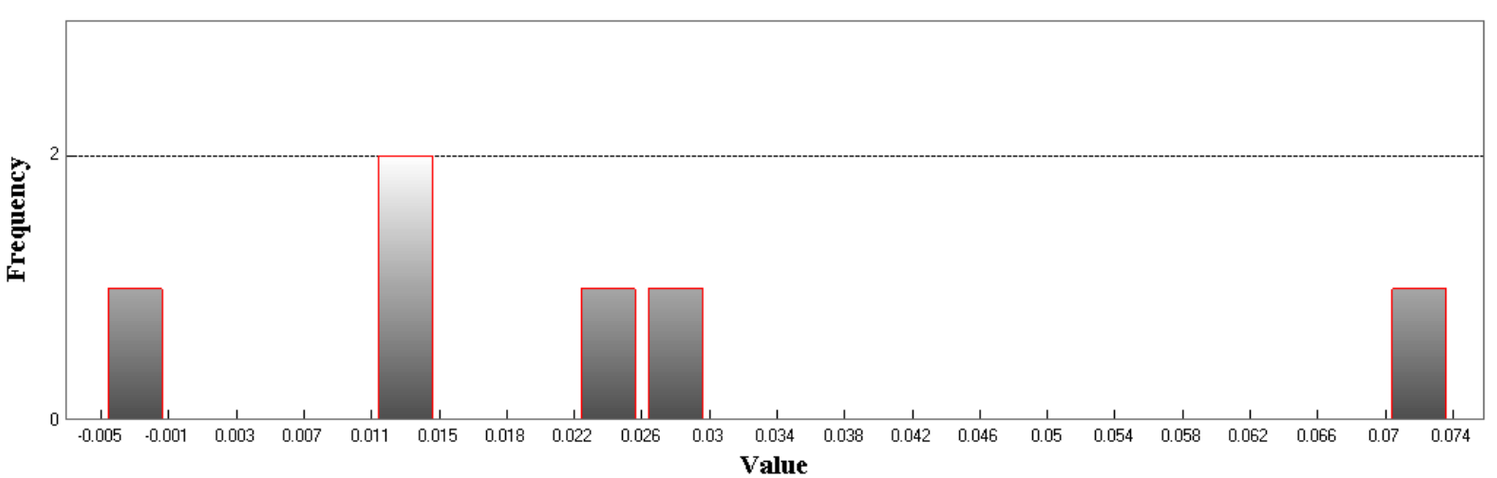
Standard Deviation DZ: 0.027

RMSE Z: 0.035

95% Confidence Level Z: 0.068

Units: Meters

Histogram



Min: -0.005

Max: 0.074

Number Of Bins: 20

Bin Interval: 0.004

DEM (Continued)

Vegetated Vertical Accuracy

LandCover Type: Low Vegetation

Minimum DZ: 0.037

Maximum DZ: 0.108

Mean DZ: 0.063

Mean Magnitude DZ: 0.251

Number Observations: 4

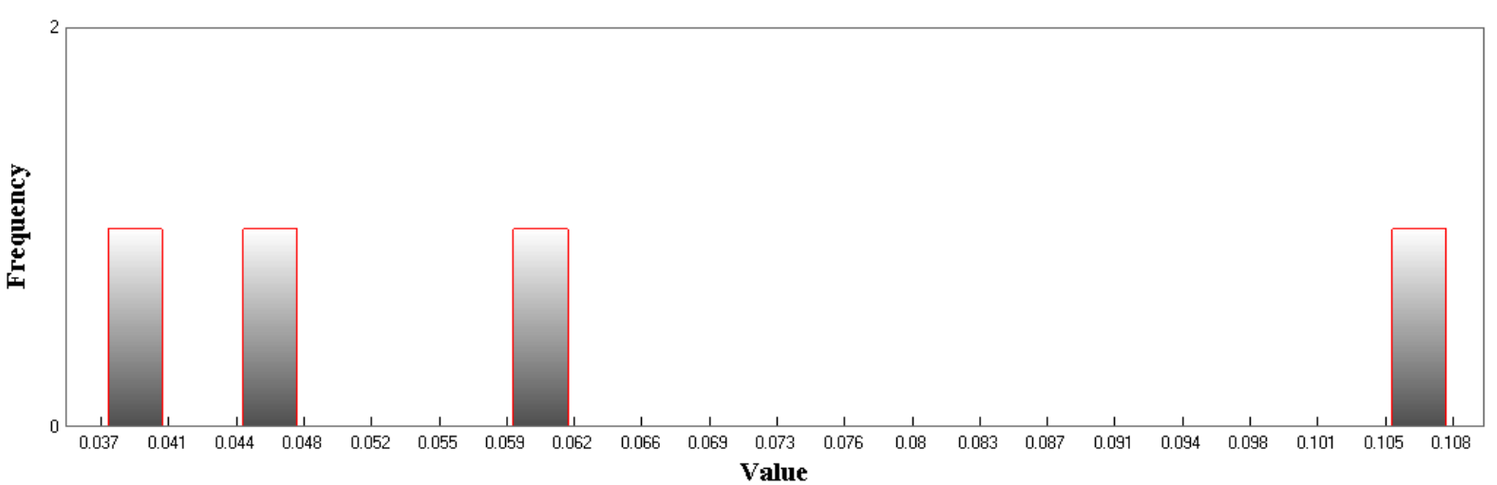
Standard Deviation DZ: 0.032

RMSE Z: 0.068

95th Percentile: 0.108

Units: Meters

Histogram



Min: 0.037

Max: 0.108

Number Of Bins: 20

Bin Interval: 0.004