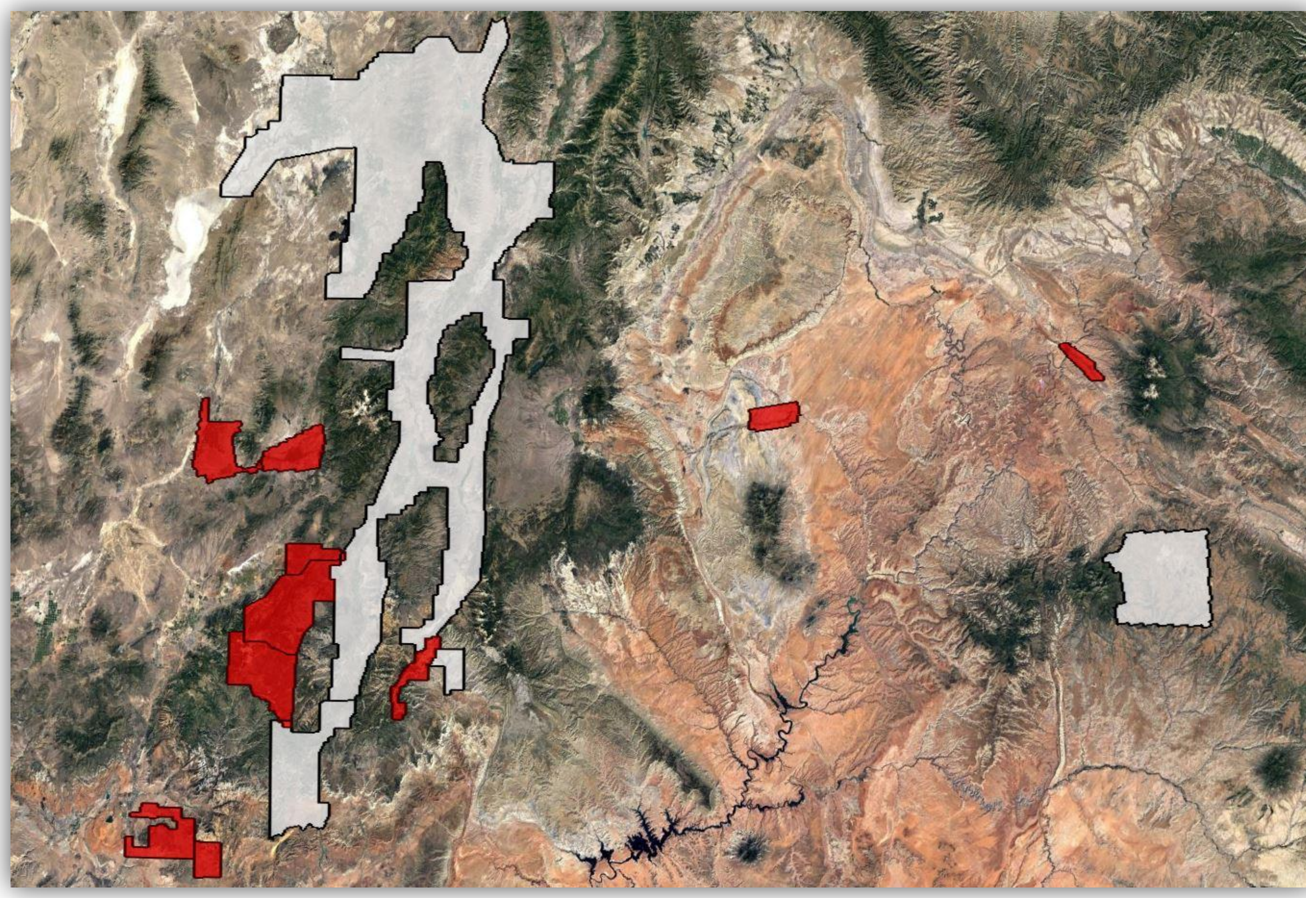
LiDAR PROJECT REPORT

Utah 2018 LiDAR - Southern Utah QL1 & QL2

Contract # AV2406

Submitted: December 11, 2018



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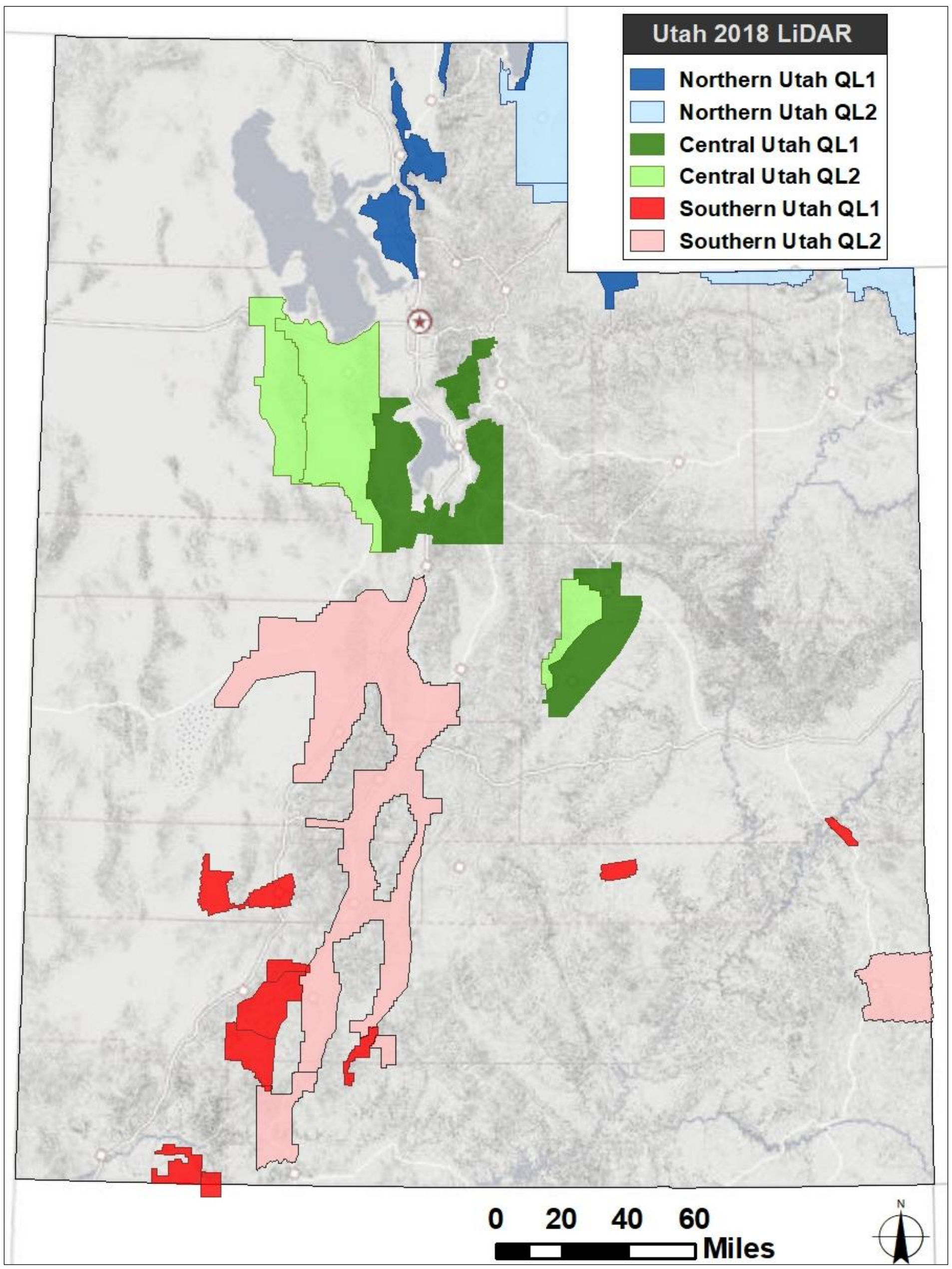
1. Introduction

1.1 Project Overview

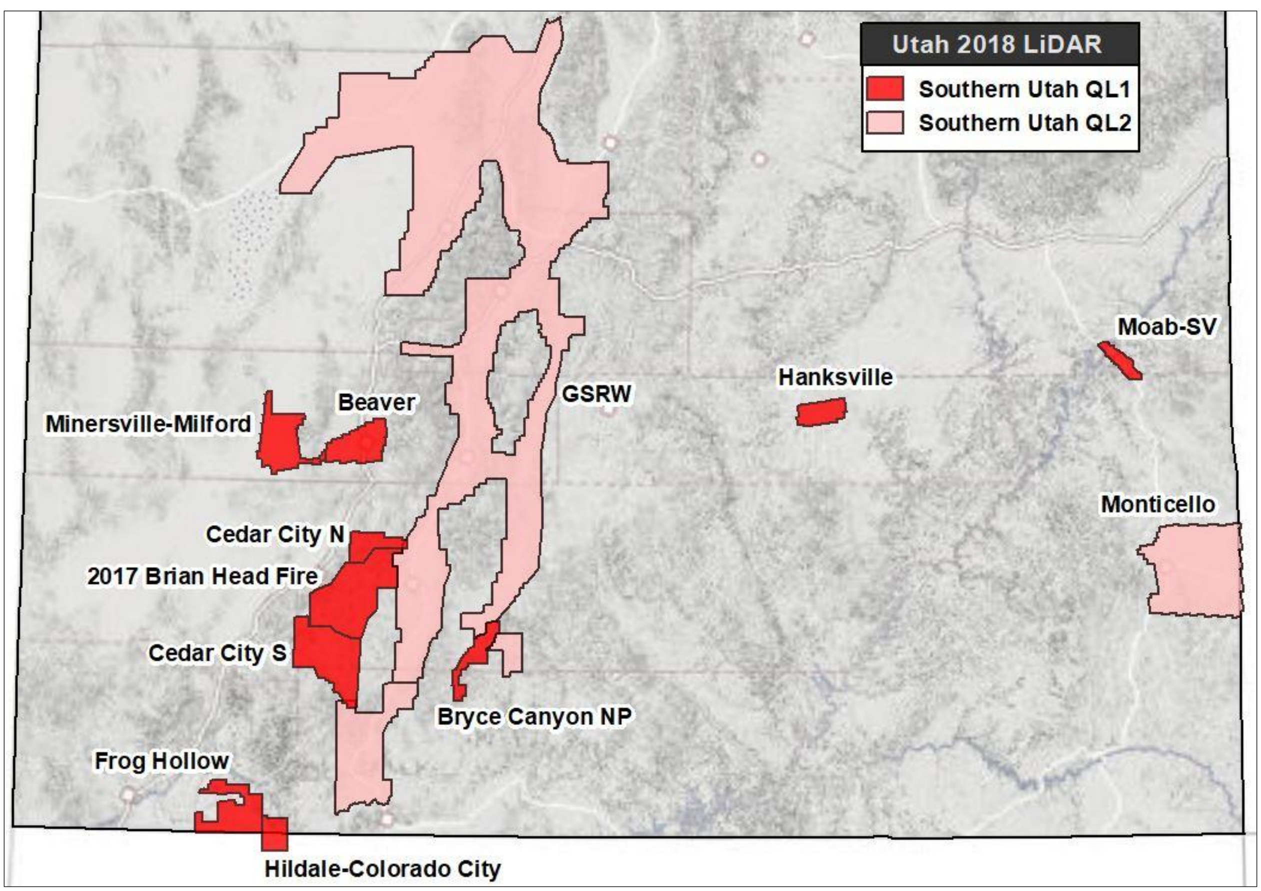
Aero-Graphics, Inc., a full-service geospatial firm located in Salt Lake City, Utah, was contracted by the State of Utah, Department of Technology Services, Division of Integrated Technology, Automated Geographic Reference Center (AGRC) and partners to acquire, process, and deliver aerial Lidar data and derivative products that adhere to U.S. Geological Survey (USGS) National Geospatial Program (NGP) Lidar Base Specification Version 1.2 (2014). The assigned project areas cover portions of Utah and one small area in Arizona, totaling approximately 10,450 mi^2.



1.2 Project Area Description

As described in the Scope of Work (SOW), the Utah 2018 LiDAR project was separated into three (3) delivery areas: Northern Utah, Central Utah, and Southern Utah. This report focuses on the Southern Utah area, which covers 977 mi^2 (QL1) and 4,175 mi^2 (QL2), for a combined total of 5,152 mi^2.

Southern Utah QL1 & QL2 Project Areas			
Sub-AOI Name	**Quality Level**	**Area (mi^2)**	**Acquisition Spec**
2017 Brian Head Fire Area	QL1	234	Leaf On
Beaver Area	QL1	94	Anytime
Bryce Canyon National Park Area	QL1	56	Anytime
Cedar City District North & South	QL1	233	Leaf On
Frog Hollow Area	QL1	114	Anytime
Hanksville	QL1	51	Anytime
Hildale-Colorado City	QL1	43	Leaf Off
Minersville-Milford	QL1	123	Anytime
Moab-Spanish Valley Area	QL1	29	Leaf On
Greater Sevier River Watershed Area	QL2	3,769	Leaf Off
Monticello	QL2	406	Anytime



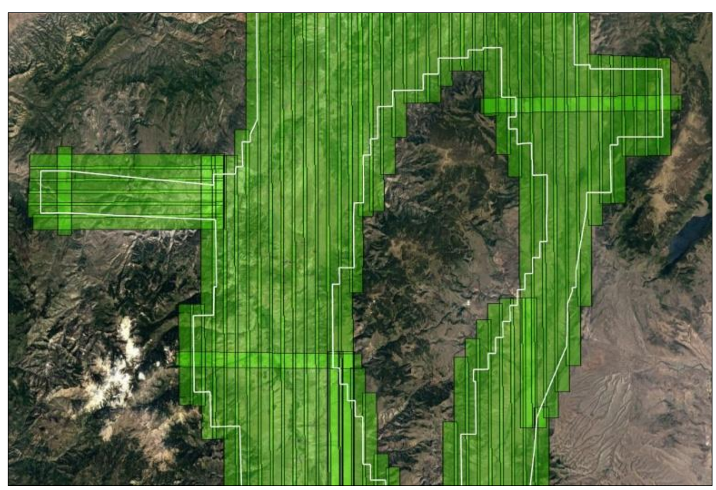
2. LiDAR Acquisition

2.1 Flight Planning

A specialized flight plan for each area was developed by Aero-Graphics' Aerial Department Manager to ensure complete coverage and that all contract specifications were met. Prior to mobilizing to the acquisition sites, Aero-Graphics' staff monitored all site conditions and potential weather hazards including wind, rain, snow, and blowing dust. In addition, Aero-Graphics ensured that all airspace clearances were secured by the proper officials before acquisition occurred.

The table below contains the planned settings for the Southern Utah QL1 and Southern Utah QL2 project areas. Additional flight information including area coverage and sensor settings can be found in the individual lift metadata files.

Planned Specs	Southern Utah QL1	Southern Utah QL2			
	Optech Galaxy PRIME	Optech Galaxy PRIME	Optech Galaxy T550	Optech Orion H300	Leica ALS70-HP
Altitude (m)	1450-1500	2500	1550	1800	2430
Speed (kts)	110-120	110	140	110	120
PRF (kHz)	450-650	200	250	125	227.2
Scan Freq (Hz)	75.8-88	41.3	55	40.3	39.4
Scan Angle (°)	26-45	34	43	29	38
Swath Width (m)	693-1092	1529	1221	931	1673
NPS (m)	0.35	0.7	0.7	0.7	0.7
Point Density (ppm^2)	8.0	2.0	2.0	2.0	2.0
Overlap (%)	20-60	20	40	30	20



2.2 LiDAR Sensors

Optech Galaxy PRIME

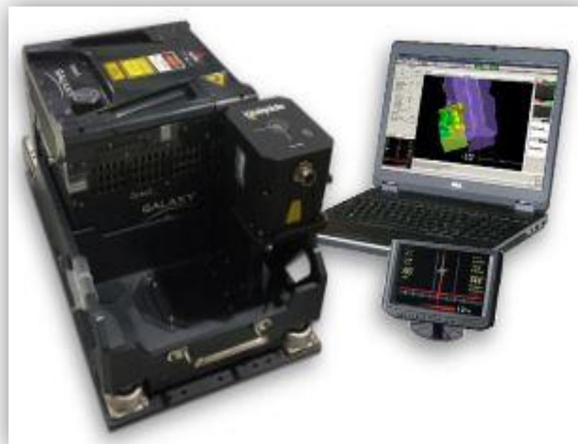
The Optech Galaxy PRIME is currently the most productive sensor available in the industry. This sensor features SwathTRAK technology, which dynamically adjusts the scan FOV in real time during data acquisition. It also features a 1MHz effective pulse rate, providing on-the-ground point density and efficiency formerly reserved for dual-beam sensors. Up to 8 returns per pulse are possible for increased vertical resolution of complex targets without the need for full waveform recording and processing. Industry-leading data precision and accuracy (<5cm $RMSE_z$) results in the highest-quality datasets possible.

Optech Orion H300

The Orion H300 can send/receive up to 300,000 pulses per second and is capable of receiving up to four range measurements, including 1st, 2nd, 3rd, and last returns for every pulse sent from the system. The Orion H300 features roll compensation that adjusts the mirror to maintain the full scan angle integrity in relation to nadir, even when less than perfect weather conditions push the sensor off nadir. It is also equipped with a GPS/IMU unit that continually records the XYZ position and roll, pitch and yaw attitude of the plane throughout the flight.

Optech Galaxy T550

The Optech Galaxy T550 is capable of up to 8 returns per emitted pulse and guarantees the highest vertical density possible without the burden of voluminous waveform capture. It features PulseTRAK technology, which enables a continuous operating envelope that can accommodate high-relief terrain with no data gaps or loss of density across multipulse transition zones. It also features SwathTRAK technology, which dynamically adjusts the scan FOV in real time during data acquisition. The accuracy of the ALTM Galaxy enables survey-grade deliverables for complete USGS LiDAR Base Specification compliance (QL0/QL1/QL2).



Leica ALS70-HP

The Leica ALS70-HP is designed for general purpose mapping at the flying heights most widely used, and can accommodate greater terrain relief due to its higher maximum flying height. This system can achieve measurement rates of 500 kHz, reducing on-line flying time by up to 60%. It allows for unlimited range returns from each outbound pulse for greater detail in forest canopy. It is also equipped with a Multiple Pulses in Air (MPIA) feature, which allows a variation of above ground flight heights in high relief areas.

2.3 Flight Logs

Acquisition for the Southern Utah QL1 and QL2 project areas occurred between April 27 and October 12, 2018, when ground conditions were free of snow, ice, and standing water; rivers were at a stage of low flow; and lakes and reservoirs were close to the lowest levels of the year. The specified leaf-off/leaf-on requirements were accounted for each of the Southern Utah project areas.

A total of 21 (QL1) and 38 (QL2) lifts were required to complete lidar acquisition for the assigned Southern Utah project areas. Flight dates are listed in the tables below along with the sub-AOI, sensor name, sensor number, and aircraft tail number for each lift. Additional flight details including sensor settings and lift extent coordinates can be found in the individual lift metadata files.

Southern Utah QL1 Flight Logs				
Flight Date	**Sub-AOI Covered**	**Sensor Name**	**Sensor Number**	**Aircraft Tail Number**
20180427	Hanksville	Optech Galaxy PRIME	SN5060410	N7269T
20180616-A	Frog Hollow	Optech Galaxy PRIME	SN5060410	N7269T
20180616-B	Frog Hollow	Optech Galaxy PRIME	SN5060410	N7269T
20180618	Hildale-Colorado City	Optech Galaxy PRIME	SN5060410	N7269T
20180619-A	Hildale-Colorado City	Optech Galaxy PRIME	SN5060410	N7269T
20180619-B	Bryce Canyon NP	Optech Galaxy PRIME	SN5060410	N7269T
20180620-A	Bryce Canyon NP	Optech Galaxy PRIME	SN5060410	N7269T
20180620-B	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180621	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180622-A	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180622-B	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180622-C	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180623-A	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180623-B	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180624-A	Moab-Spanish Valley	Optech Galaxy PRIME	SN5060410	N7269T
20180624-B	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180627	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180630	Moab-Spanish Valley	Optech Galaxy PRIME	SN5060410	N7269T
20180727	Brian Head, Cedar City	Optech Galaxy PRIME	SN5060410	N7269T
20180728	Beaver, Minersville-Milford	Optech Galaxy PRIME	SN5060410	N7269T
20180729	Beaver	Optech Galaxy PRIME	SN5060410	N7269T

Southern Utah QL2 Flight Logs				
Flight Date	**Sub-AOI Covered**	**Sensor Name**	**Sensor Number**	**Aircraft Tail Number**
20180428	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180429	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180503	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180505-A	Monticello	Leica ALS70-HP	SN7220	N603ET
20180505-B	Monticello	Leica ALS70-HP	SN7220	N603ET
20180506-A	Monticello	Leica ALS70-HP	SN7220	N603ET
20180506-B	Monticello	Leica ALS70-HP	SN7220	N603ET
20180506	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180507	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180508	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180509	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180509	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180510	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180511	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180514	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180515-A	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180515-B	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180516-A	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180516-B	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180517-A	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180517-B	Greater Sevier River W.A.	Optech Galaxy T550	SN5060386	N2JJ
20180517	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180519	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180520	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180521	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180524	Greater Sevier River W.A.	Optech Orion H300	SN12SEN315	N27DV
20180602	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
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20180603	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180604	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180620	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180621	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180624	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180717	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180727	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180729-A	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20180729-B	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T
20181012	Greater Sevier River W.A.	Optech Galaxy PRIME	SN5060410	N7269T

3. LiDAR Processing Workflow

a. **Absolute Sensor Calibration.** Our absolute sensor calibration adjusted for the difference in roll, pitch, heading, and scale between the raw laser point cloud from the sensor and surveyed control points on the ground.

b. **Kinematic Air Point Processing.** Differentially corrected the 1-second airborne GPS positions with ground base station; combined and refined the GPS positions with 1/200-second IMU (roll-pitch-yaw) data through development of a smoothed best estimate of trajectory (SBET).

c. **Raw LiDAR Point Processing (Calibration).** Combined SBET with raw LiDAR range data; solved real-world position for each laser point; produced point cloud data by flight strip in ASPRS v1.4 .LAS format; output in NAD83 (2011) UTM Zone 12, meters.

d. **Relative Calibration.** Performed relative calibration by correcting for roll, pitch, heading, and scale discrepancies between adjacent flightlines; tested resulting relative accuracy.

e. **Vertical Accuracy Assessment.** Performed comparative tests that showed Z-differences between surveyed points and the laser point surface.

f. **Tiling & Long/Short Filtering.** Cut data into project-specified tiles and filtered out grossly long and short returns.

g. **Classified LAS Processing.** The point classification is performed as described below. The bare earth surface is then manually reviewed to ensure correct classification on the Class 2 (Ground) points. After the bare-earth surface is finalized, it is then used to generate all hydro-breaklines through heads-up digitization.

All ground (ASPRS Class 2) LiDAR data inside of the Lake Pond and Double Line Drain hydro-flattened breaklines were then classified to Water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 1 meter was also used around each hydro-flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 10). All Lake Pond Island and Double Line Drain Island features were checked to ensure that the ground (ASPRS Class 2) points were reclassified to the correct classification after the automated classification was completed. All bridge decks were classified to Class 17. All overlap data was processed through automated functionality provided by TerraScan to classify the overlapping flight line data to approved classes by USGS. The overlap data was classified using standard LAS overlap bit. These classes were created through automated processes only and were not verified for classification accuracy.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. LP360 was used as a final check of the bare earth dataset. LP360 was then used to create the deliverable industry-standard LAS files for both the All Point Cloud Data and the Bare Earth. Aero-Graphics, Inc. proprietary software was used to perform final statistical analysis of the classes in the LAS files, on a per tile level to verify final classification metrics and full LAS header information.

USGS Version 1.2 minimum point cloud classification scheme		
CLASS #	CLASS NAME	DESCRIPTION
1	Processed, but unclassified	Points that do not fit any other classes
2	Bare earth	Bare earth surface
7	Low noise	Low points identified below surface
9	Water	Points inside of lakes/ponds
10	Ignored ground	Points near breakline features; ignored in DEM creation process
17	Bridge decks	Points on bridge decks
18	High noise	High points identified above surface

h. **Hydro-Flattened Breakline Creation.** Class 2 (ground) LiDAR points were used to create a bare earth surface model. The surface model was then used to heads-up digitize 2D breaklines of inland streams and rivers with a 100-foot nominal width and inland ponds and lakes of 2 acres or greater surface area. Elevation values were assigned to all Inland Ponds and Lakes, Inland Pond and Lake Islands, Inland Stream and River Islands, using LP360 functionality. Elevation values were assigned to all inland streams and rivers using Aero-Graphics, Inc. proprietary software. All Ground (ASPRS Class 2) LiDAR data inside of the collected inland breaklines were then classified to Water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 1 meter was also used around each hydro-flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 10).

The breakline files were then translated to ESRI shapefile format using ESRI conversion tools. Breaklines are reviewed against LiDAR intensity imagery to verify completeness of capture. All breaklines are then compared to TINs (triangular irregular networks) created from ground only points prior to water classification. The horizontal placement of breaklines is compared to terrain features and the breakline elevations are compared to LiDAR elevations to ensure all breaklines match the LiDAR within acceptable tolerances. Some deviation is expected between breakline and LiDAR elevations due to monotonicity, connectivity, and flattening rules that are enforced on the breaklines. Once horizontal placement, vertical variance is reviewed, all breaklines are reviewed for topological consistency and data integrity using a combination of ESRI ArcMap tools and proprietary tools.

i. **Hydro-Flattened Raster DEM Creation.** Class 2 (Ground) LiDAR points in conjunction with the hydro breaklines were used to create a 0.5 meter (QL1) and 1 meter (QL2) hydro-flattened raster DEMs. Using LP360 along with automated scripting routines within ArcMap, a GeoTIFF was created for each tile. Each surface is reviewed using ESRI ArcMap and ArcScene to check for any surface anomalies or incorrect elevations found within the surface.

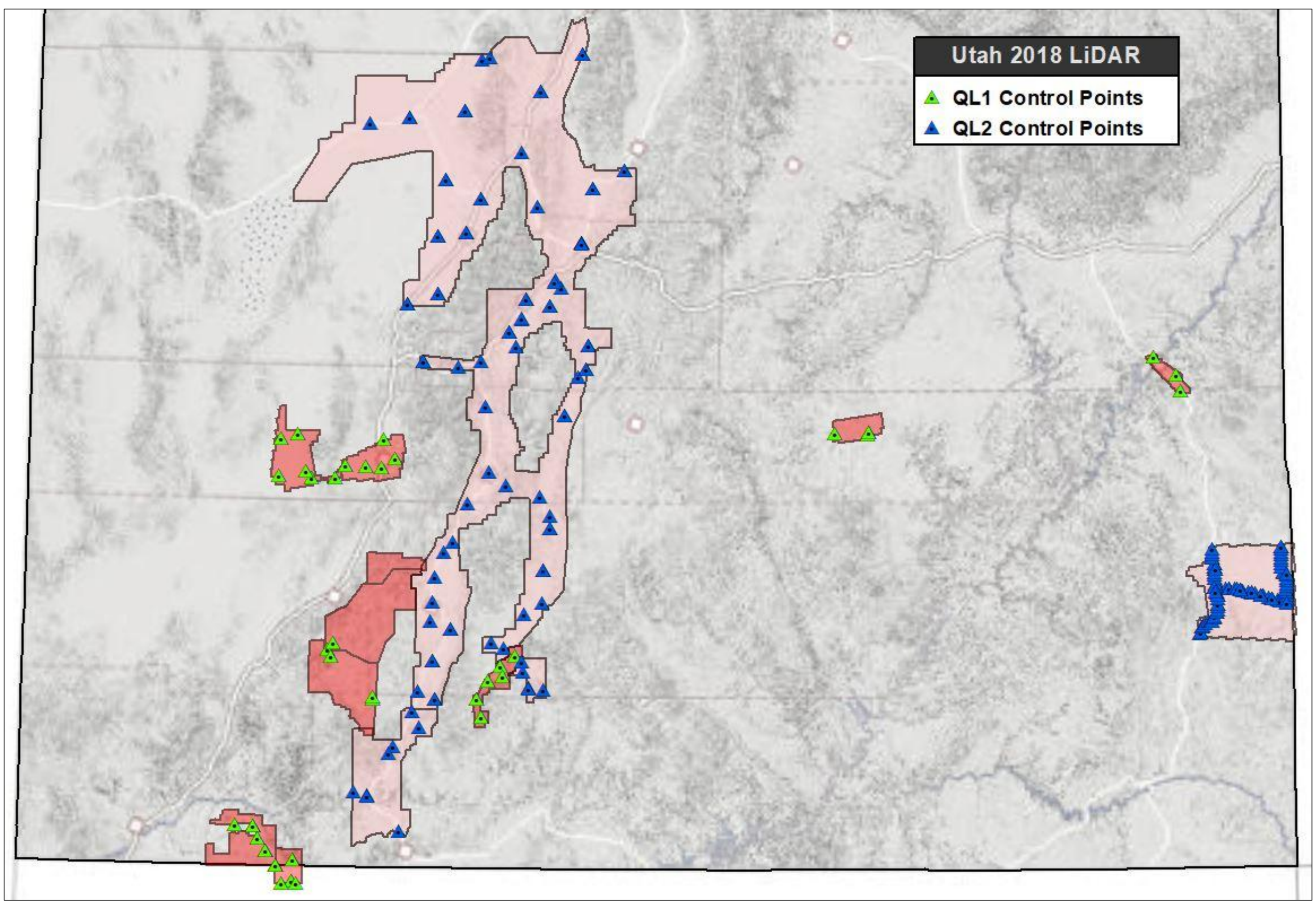
j. **First Return Raster DSM Creation.** First return LiDAR points were used to create a 0.5 meter (QL1) and 1 meter (QL2) first-return raster DEMs. Using LP360 along with automated scripting routines within ArcMap, a GeoTIFF file was created for each tile. Each surface is reviewed using ESRI ArcMap and ArcScene to check for any surface anomalies or incorrect elevations found within the surface.

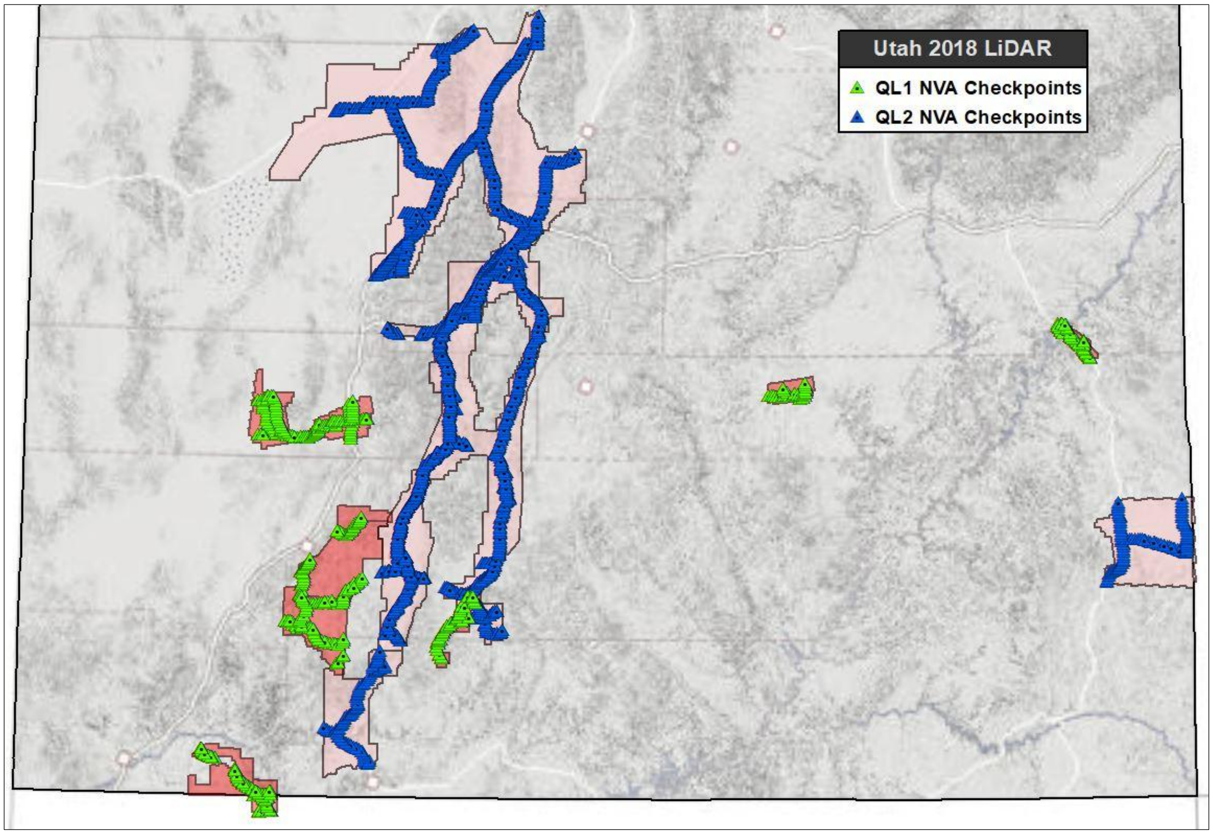
k. **Intensity Image Creation.** TerraScan software was used to create the deliverable Intensity Images. All overlap classes were ignored during this process as it helps to ensure a more aesthetically pleasing image. ESRI ArcMap software was then used to verify full project coverage. TIF/TFW files were provided as the deliverable for this dataset requirement.

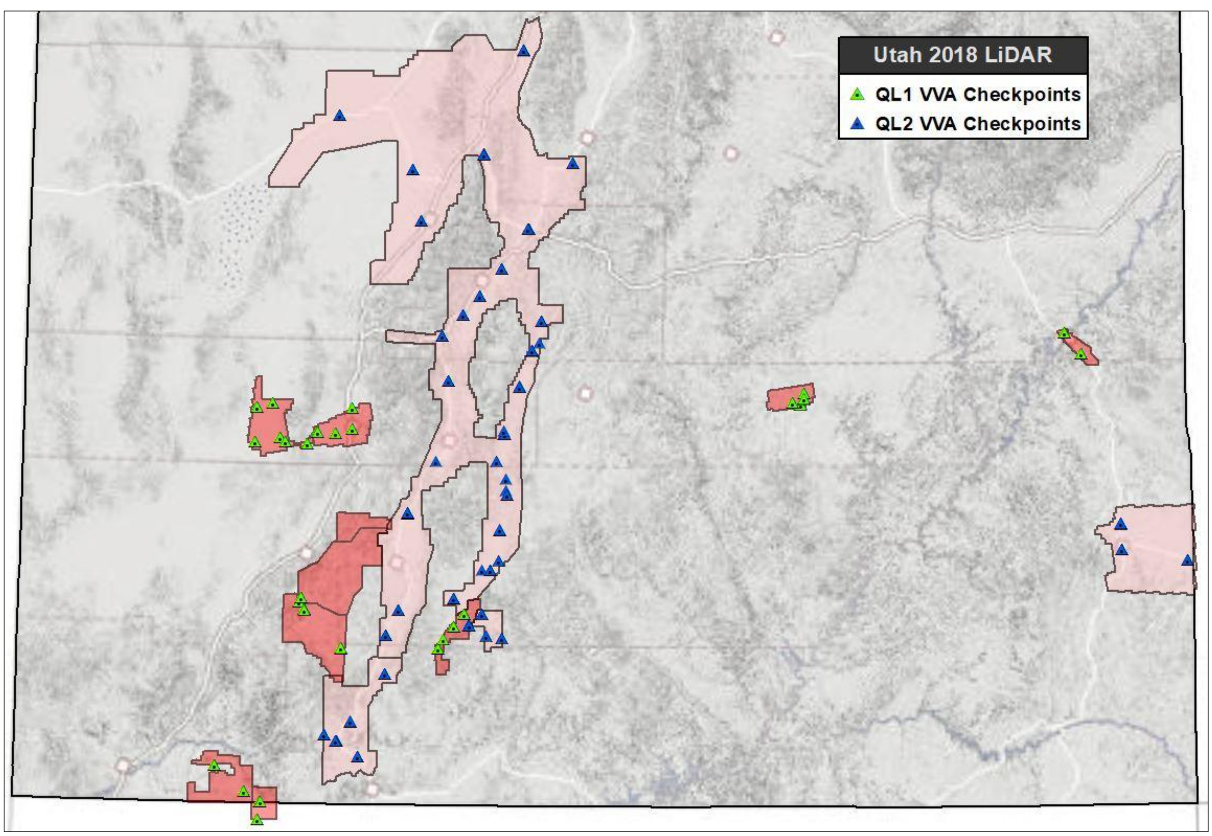
l. **Issues.** During acquisition, the aircraft experienced turbulence that affected the lidar scan pattern; this presents as clustering along the flight path. Data was tested and meets specifications for ANPS, Smooth Surface Repeatability, and Vertical Accuracy. No artifacts or irregularities exist in the surface model as a result of the scan pattern.

4. Ground Control and Check Point Survey

Aero-Graphics' professional land surveyor identified, targeted, and surveyed 43 (QL1) and 194 (QL2) ground control points for use in data calibration as well as 761 (QL1) and 3,121 (QL2) QC check points in Vegetated and Non-Vegetated land cover classifications as an independent test of accuracy for this project. A combination of precise GPS surveying methods, including static and RTK observations were used to establish the 3D position of ground calibration points and QC check points. Calibration control point and QC check point coordinates are included in the deliverable ESRI shapefiles. Base station coordinates can be found in Appendix A.




Utah 2018 LiDAR
QL1 NVA Checkpoints
QL2 NVA Checkpoints


Utah 2018 LiDAR
QL1 VVA Checkpoints
QL2 VVA Checkpoints

5. Accuracy Testing and Results

5.1 Relative Calibration Accuracy Results

Between-swath relative accuracy is defined as the elevation difference in overlapping areas between a given set of two adjacent flightlines. The results are based on the comparison of the flightlines and points for each area.

Southern Utah QL1 project area

- Between-swath relative accuracy **average** of 0.016 meters

Southern Utah QL2 project area:

- Between-swath relative accuracy **average** of 0.019 meters

Within-swath relative accuracy is the amount of vertical separation, or "noise," among a set of points on open, paved ground that should have the same elevation. The within-swath relative accuracy average is less than **0.008 meters.**

5.2 Calibration Control Point Testing

Calibration Control Point reports were generated as a quality assurance check. Note that the results are not an independent assessment of the accuracy of the project deliverables, but rather an additional indication of the overall accuracy of the dataset. The location of each control point is displayed on page 11.

5.3 Point Cloud Testing

The project specifications require that only Non-Vegetated Vertical Accuracy (NVA) be computed for raw LiDAR point cloud swath files. NVA is defined as the elevation difference between the LiDAR surface and ground surveyed static points collected in open terrain (bare soil, sand, rocks, and short grass) as well as urban terrain (asphalt and concrete surfaces). The NVA for this project was tested with 543 (QL1) and 2,895 (QL2) check points. These check points were not used in the calibration or post processing of the LiDAR point cloud data. Elevations from the unclassified LiDAR surface were measured for the xy location of each check point. Elevations interpolated from the LiDAR surface were then compared to the elevation values of the surveyed control points.

Raw Non-vegetated Vertical Accuracy (Raw NVA): The tested Raw NVA for this dataset was found to be 0.066 meters (QL1) and 0.061 meters (QL2) in terms of the RMSEz. The resulting NVA stated as the 95% confidence level (RMSEz x 1.96) is 0.129 meters (QL1) and 0.120 meters (QL2). Therefore this dataset meets the required NVA of 0.196 meters at the 95% confidence level as defined by the National Standards for Spatial Data Accuracy (NSSDA).

5.4 Digital Elevation Model (DEM) Testing

The project specifications require the accuracy of the derived DEM be calculated and reported in two ways: (1) Non-Vegetated Vertical Accuracy (NVA) calculated at a 95% confidence level in "bare earth" and "urban" land cover classes and (2) Vegetated Vertical Accuracy (VVA) in all vegetated land cover classes combined calculated based on the 95th percentile error. The NVA for this project was tested with 543 (QL1) and 2,895 (QL2) check points. The VVA was tested with 218 (QL1) and 350 (QL2) check points.

The tested Non-Vegetated Vertical Accuracy (NVA) for this dataset captured from the DEM using bi-linear interpolation to derive the DEM elevations was found to be 0.065 meters (QL1) and 0.060 meters (QL2) in terms of the RMSEz. The resulting accuracy stated as the 95% confidence level (RMSEz x 1.96) is 0.128 meters (QL1) and 0.117 meters (QL2). Therefore this dataset meets the required NVA of 0.196 meters at the 95% confidence level.

The tested Vegetated Vertical Accuracy (VVA) for this dataset captured from the DEM using bi-linear interpolation for all classes was found to be 0.146 meters (QL1) and 0.141 meters (QL2). Therefore this dataset meets the required VVA of 0.294 meters based on the 95th percentile error.

5.5 Data Accuracy Summary

Accuracy has been tested to meet 19.6 cm or better Non-Vegetated Vertical Accuracy at 95% confidence level using RMSEz x 1.96 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation (NDEP)/ASPRS Guidelines.

Area	Raw Point Cloud NVA	DEM NVA	DEM VVA	Points Tested NVA	Points Tested VVA
Southern UT QL1	0.129 m	0.128 m	0.146 m	543	218
Southern UT QL2	0.120 m	0.117 m	0.141 m	2,895	350

6. Project Coordinate System

Projection:		Universal Transverse Mercator (UTM) Zone 12
Datum	Vertical:	NAVD88 (GEOID12B)
	Horizontal:	NAD83 (2011)
Units:		Meters
WKID:		6341

7. Project Deliverables

All required project deliverables and file formats are listed in the table below.

Delivery Item	Format
Raw LiDAR point cloud data swaths	LAS 1.4 (.las)
Classified LiDAR point cloud data tiles	LAS 1.4 (.las)
Bare-earth raster DEM tiles with a cell size of 0.5 meter (QL1) and 1 meter (QL2)	GeoTIFF (.tif)
First-return raster DSM tiles with a cell size of 0.5 meter (QL1) and 1 meter (QL2)	GeoTIFF (.tif)
Intensity image tiles at a resolution of 0.5 meter (QL1) and 1 meter (QL2)	GeoTIFF (.tif)
AOI, Processing Boundary (BPA), and Tile Index	ESRI Shapefile (.shp)
Breaklines used for hydro-flattening	ESRI Shapefile (.shp)
Control Points and QC Checkpoints	ESRI Shapefile (.shp)
Project, Deliverable, and Lift Metadata	XML (.xml)

*Tiling for the LiDAR deliverables is based on the U.S. National Grid System. Tile names are based on the SW corner of the tile. All .LAS tiles are 1,000 meters x 1,000 meters. Raster tiles are a mix of 1,000 meters x 1,000 meters and 2,000 meters x 2,000 meters.

APPENDIX A

BASE STATION COORDINATES

Survey Point	WGS84		
	Latitude	Longitude	Ellipsoid Height (mtr)
UTBR	38.284096634	-112.640030742	1795.065
UTMI	38.401891615	-113.010330017	1506.239
UTCE	37.704215212	-113.086806242	1705.467
UTJU	38.244806025	-112.220783168	1828.225
UTHN	37.185694861	-113.298669064	1013.602
UTHA	38.374780170	-110.721317268	1299.036
UTMB	38.573921098	-109.548469217	1217.851
UTES	37.756916850	-111.576175808	1756.112
H607210o_EIGW	37.701554734	-112.154830002	2292.377
UTMT	39.264472070	-111.636574781	1712.620
P108	39.588879000	-111.944551000	1683.242
SPIC	39.306214001	-112.127475000	1670.433
UTRI	38.763066636	-112.101953379	1629.224
UTDE	39.353536184	-112.578611857	1403.134
2516	37.700934690	-112.156312944	2291.390
PANG	37.849138735	-112.389176345	2043.741
SR20515n	38.091374536	-111.981735590	1969.482
UTTP	37.627468570	-112.084026005	1914.787
9031	38.357840707	-111.589646583	2125.776