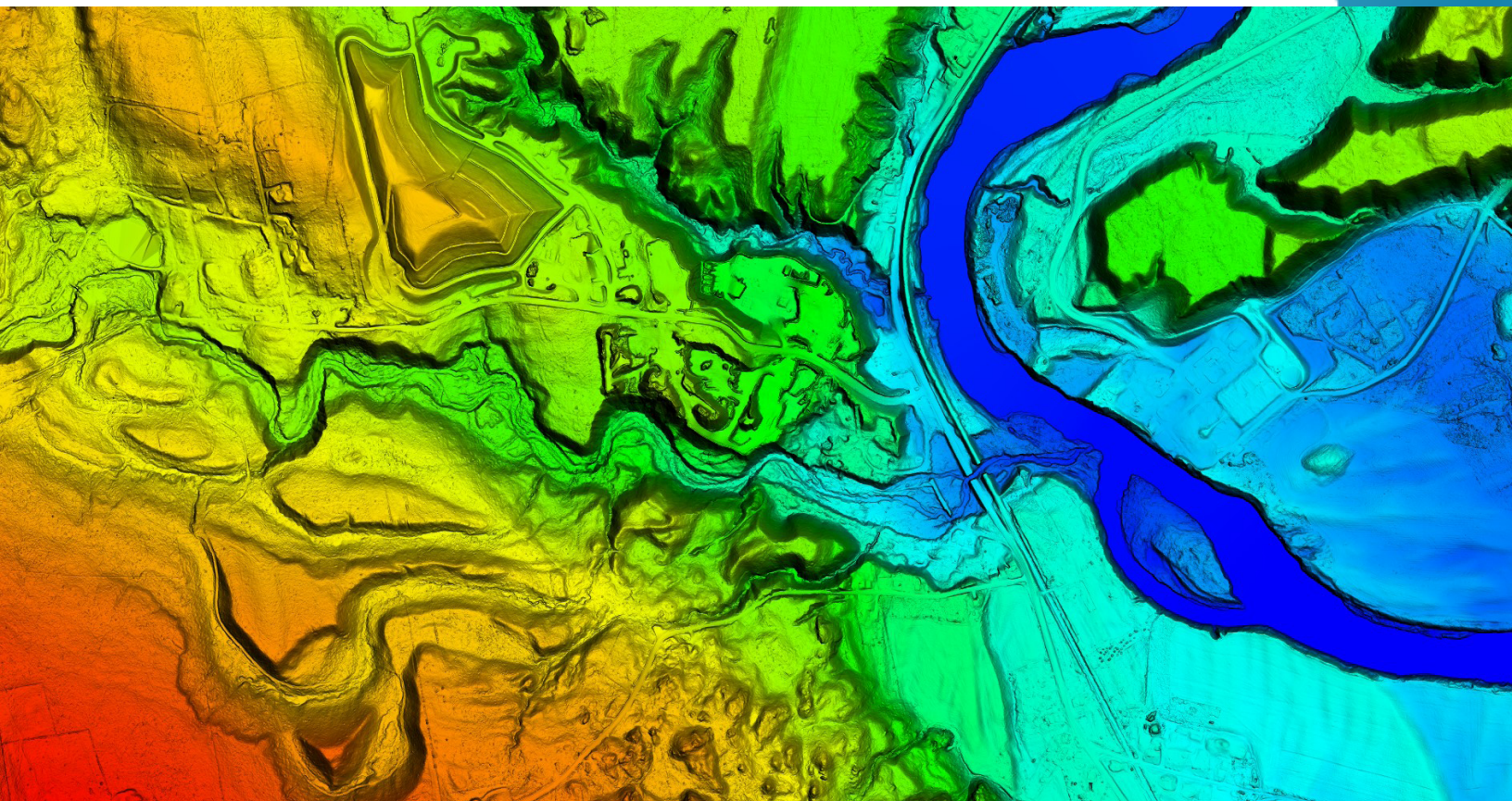




quantum  
SPATIAL

AN NV5 COMPANY



NH\_COASTAL\_2019\_B19  
LIDAR PROCESSING REPORT

Work Package: 183374

Work Unit: 183371

2020

Submitted: July 7, 2021

Prepared for:



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Appendix A: Flight Logs

# 1. Summary / Scope

## 1.1. Summary

This report contains a summary of the NH\_COASTAL\_2019\_B19, Work Unit 183371 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on September 19, 2019. This work unit yielded a project area covering approximately 1,311 square miles over New Hampshire. The intent of this document is only to provide specific validation information for the data acquisition/collection, processing, and production of deliverables completed as specified in the task order.

## 1.2. Scope

Aerial topographic LiDAR was acquired using state of the art technology along with the necessary surveyed ground control points (GCPs) and airborne GPS and inertial navigation systems. The aerial data collection was designed with the following specifications listed in Table 1 below.

Table 1. Originally Planned LiDAR Specifications

Average Point Density	Flight Altitude (AGL)	Field of View	Minimum Side Overlap	RMSEz
8 pts / m <sup>2</sup>	1100 m	31°	25%	≤10 cm

## 1.3. Coverage

The project boundary covers approximately 1,311 square miles over coastal New Hampshire. A buffer of 100 meters was created to meet task order specifications. Project extents are shown in Figure 1.

## 1.4. Duration

LiDAR data was acquired from November 23, 2019 to April 23, 2020 in thirty total lifts. See “Section: 2.4. Time Period” for more details.

## 1.5. Issues

There were no major issues to report for this project.

<b>NH_COASTAL_2019_B19 Work Unit 183371</b> <b>Projected Coordinate System: State Plane New Hampshire FIPS 2800</b> <b>Horizontal Datum: NAD 1983 2011</b> <b>Vertical Datum: NAVD88 (GEOID 12b)</b> <b>Units: Feet</b>	
<b>Lidar Point Cloud</b>	<b>Classified Point Cloud in .LAS 1.4 format</b>
<b>Rasters</b>	<ul style="list-style-type: none"> <li>• 1.25-foot Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format</li> <li>• 1.25-foot Intensity images in GeoTIFF format</li> <li>• 1.25-foot Swath Separation images in GeoTIFF format</li> </ul>
<b>Vectors</b>	<b>Shapefiles (*.shp)</b> <ul style="list-style-type: none"> <li>• Project Boundary</li> <li>• LiDAR Tile Index</li> </ul> <b>Geodatabase (*.gdb)</b> <ul style="list-style-type: none"> <li>• Continuous Hydro-flattened Breaklines</li> </ul>
<b>Reports</b>	<b>Reports in PDF format</b> <ul style="list-style-type: none"> <li>• Focus on Delivery</li> <li>• Processing Report</li> <li>• Flight Logs (appended to Processing Report)</li> </ul>
<b>Metadata</b>	<b>XML Files (*.xml)</b> <ul style="list-style-type: none"> <li>• Breaklines</li> <li>• Classified Point Cloud</li> <li>• DEM</li> <li>• Intensity Imagery</li> </ul>

# NH\_COASTAL\_2019\_B19

## Work Unit 183371 Boundary

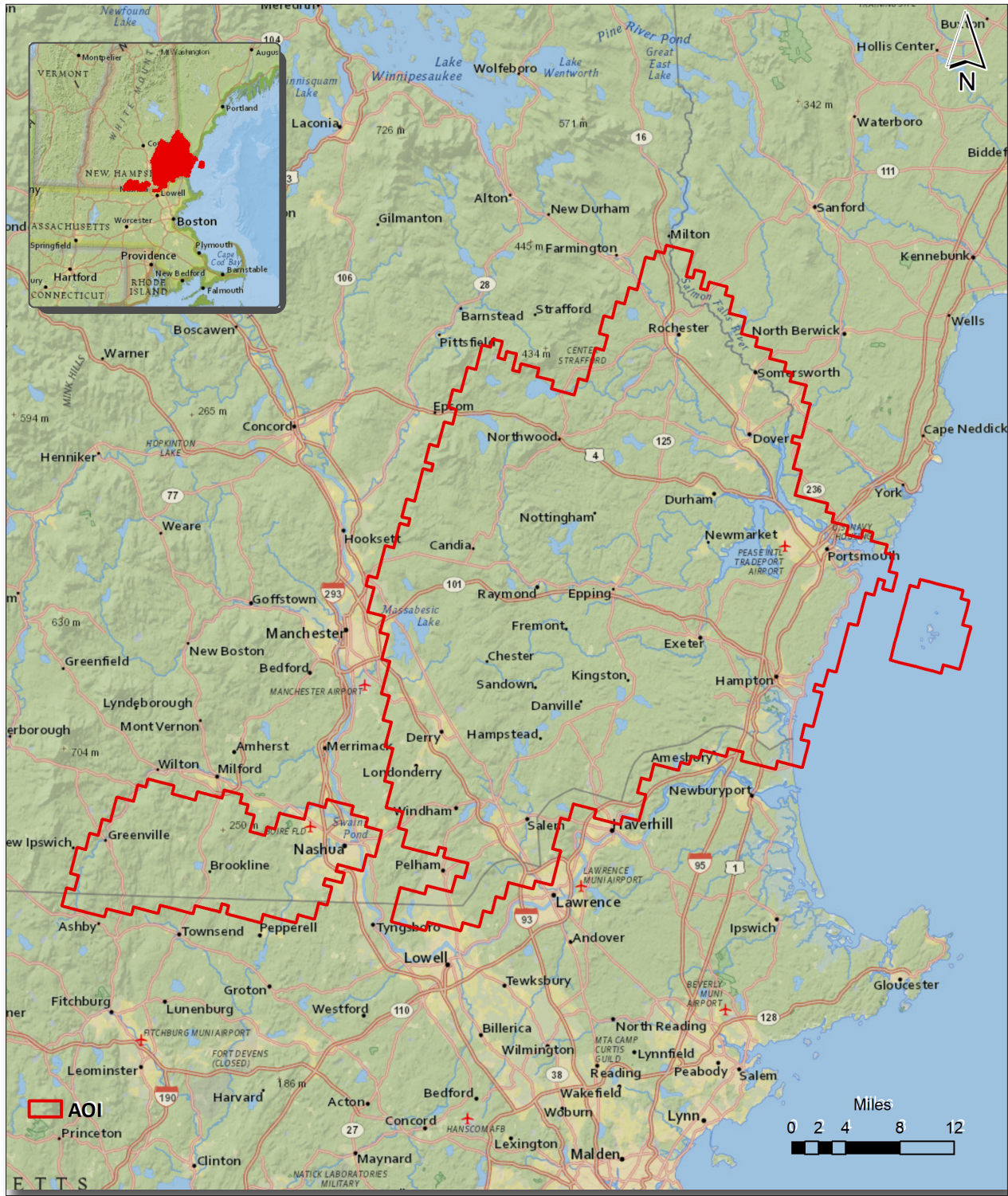


Figure 1. Work Unit Boundary

## 2. Planning / Equipment

### 2.1. Flight Planning

Flight planning was based on the unique project requirements and characteristics of the project site. The basis of planning included: required accuracies, type of development, amount / type of vegetation within project area, required data posting, and potential altitude restrictions for flights in project vicinity.

Detailed project flight planning calculations were performed for the project using FMS Planner planning software. Planned flight lines are shown in Figure 2.

### 2.2. LiDAR Sensor

Quantum Spatial utilized Optech T-1000 LiDAR sensors (Figure 3), serial numbers 354 and 391 for lidar data collection.

The Optech Galaxy T1000 is a lidar sensor capable of wide-area mapping. It features a continuous operating envelope, a dynamic field of view, real-time sensor protocol, and a high-performance galvanometric scanner. This sensor has 1-MHz “on ground” collection rates and is capable of 8 returns per emitted pulse.

A brief summary of the aerial acquisition parameters for the project are shown in the LiDAR System Specifications in Table 2.

# NH\_COASTAL\_2019\_B19

## Work Unit 183371 Planned Flight Lines

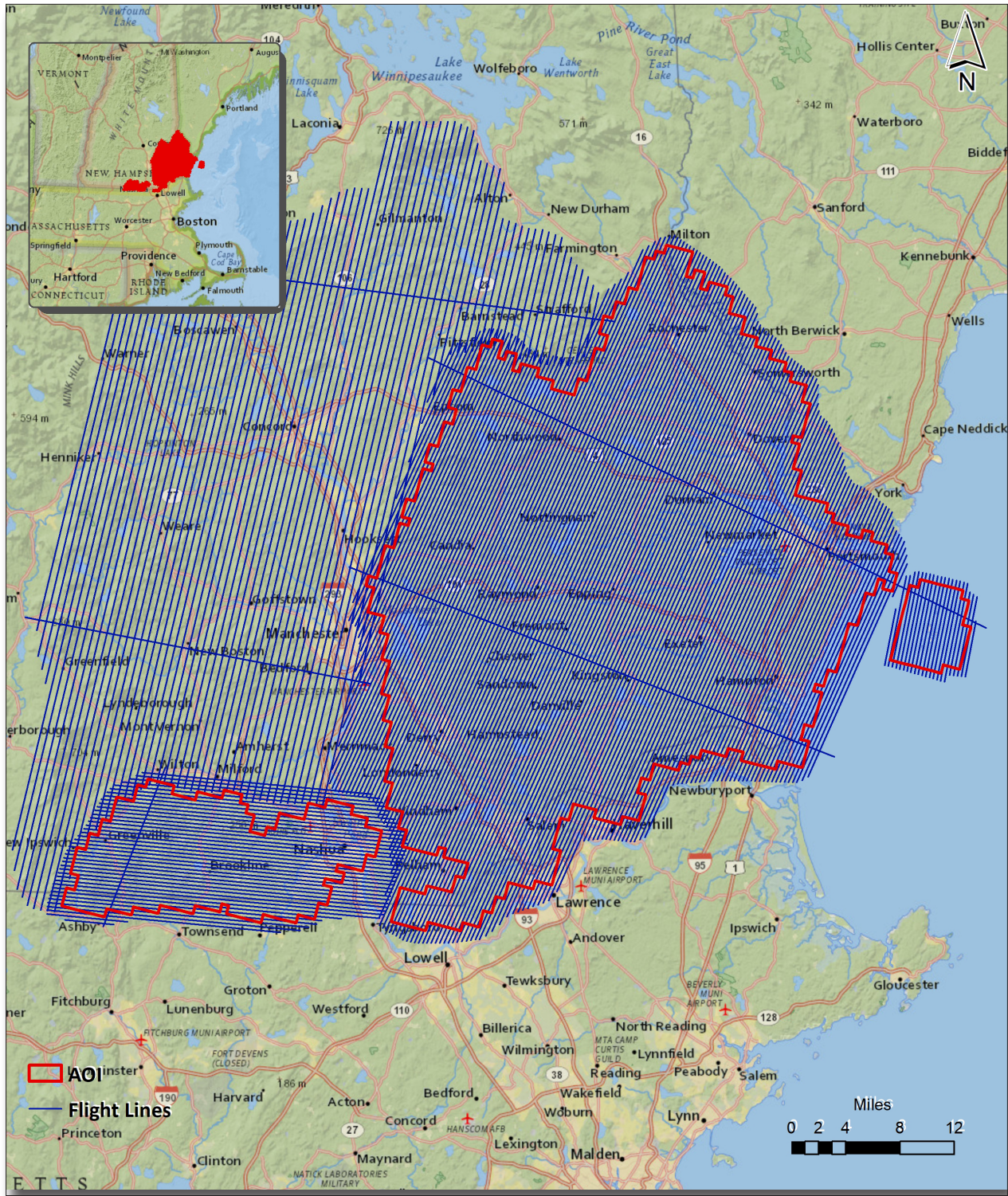


Figure 2. Planned Flight Lines



**Table 2. LiDAR System Specifications**

		Optech T-1000
Terrain and Aircraft Scanner	Flying Height	1100 m
	Recommended Ground Speed	160 kts
Scanner	Field of View	31°
	Scan Rate Setting Used	116 Hz
Laser	Laser Pulse Rate Used	600 kHz
	Multi Pulse in Air Mode	4
Coverage	Full Swath Width	610 m
	Line Spacing	457.59 m
Point Spacing and Density	Average Point Spacing	0.35 m
	Average Point Density	8 pts / m <sup>2</sup>

**Figure 3. Optech T-1000 LiDAR Sensor**


## 2.3. Aircraft

All flights for the project were accomplished through the use of customized planes. Plane type and tail numbers are listed below.

### LiDAR Collection Planes

- 2015 BEECHCRAFT CORP B300, Tail Number: N50385
- Cessna 310 (twin-piston), Tail Number: N98869
- Cessna Executive Skynight (twin-piston), Tail Numbers: N4181T

These aircraft provided an ideal, stable aerial base for LiDAR acquisition. These aerial platforms have relatively fast cruise speeds, which are beneficial for project mobilization / demobilization while maintaining relatively slow stall speeds, proving ideal for collection of high-density, consistent data posting using a state-of-the-art Optech T-1000 LiDAR system. Some of Quantum Spatial's operating aircraft can be seen in Figure 4 below.

Figure 4. Some of Quantum Spatial's Planes



## 2.4. Time Period

Project specific flights were conducted between November 23, 2019 and April 23, 2020. Thirty aircraft lifts were completed. Accomplished lifts are listed below.

- 11232019A1 (SN0354,N4281T)
- 11232019A3 (SN0354,N4281T)
- 11232019B (SN0354,N4281T)
- 11252019A (SN0354,N4281T)
- 11252019B (SN0354,N4281T)
- 11262019A (SN0354,N4281T)
- 11262019B1 (SN0354,N4281T)
- 11262019B2 (SN0354,N4281T)
- 11262019B3 (SN0354,N4281T)
- 11272019A (SN0354,N4281T)
- 11292019A (SN0354,N4281T)
- 11292019B (SN0354,N4281T)
- 11302019A1 (SN0354,N4281T)
- 11302019A2 (SN0354,N4281T)
- 11302019B1 (SN0354,N4281T)
- 11302019B2 (SN0354,N4281T)
- 04112020A (SN391,N50385)
- 04112020B (SN391,N50385)
- 04122020A (SN391,N50385)
- 04122020B (SN391,N50385)
- 04142020A (SN391,N50385)
- 04142020B (SN391,N50385)
- 04142020C (SN391,N50385)
- 04152020A (SN391,N50385)
- 04152020B (SN391,N50385)
- 04152020C (SN391,N50385)
- 04162020A (SN391,N50385)
- 04162020B (SN391,N50385)
- 04232020A1 (SN354,N98869)
- 04232020A2 (SN354,N98869)

## 3. Processing Summary

### 3.1. Flight Logs

Flight logs were completed by LIDAR sensor technicians for each mission during acquisition. These logs depict a variety of information, including:

- Job / Project #
- Flight Date / Lift Number
- FOV (Field of View)
- Scan Rate (HZ)
- Pulse Rate Frequency (Hz)
- Ground Speed
- Altitude
- Base Station
- PDOP avoidance times
- Flight Line #
- Flight Line Start and Stop Times
- Flight Line Altitude (AMSL)
- Heading
- Speed
- Returns
- Crab

Notes: (Visibility, winds, ride, weather, temperature, dew point, pressure, etc).

## 3.2. LiDAR Processing

Applanix + POSPac software was used for post-processing of airborne GPS and inertial data (IMU), which is critical to the positioning and orientation of the LiDAR sensor during all flights. Applanix POSPac combines aircraft raw trajectory data with stationary GPS base station data yielding a “Smoothed Best Estimate Trajectory” (SBET) necessary for additional post processing software to develop the resulting geo-referenced point cloud from the LiDAR missions.

During the sensor trajectory processing (combining GPS & IMU datasets) certain statistical graphs and tables are generated within the Applanix POSPac processing environment which are commonly used as indicators of processing stability and accuracy. This data for analysis include: max horizontal / vertical GPS variance, separation plot, altitude plot, PDOP plot, base station baseline length, processing mode, number of satellite vehicles, and mission trajectory.

Point clouds were created using the Optech LMS software. The generated point cloud is the mathematical three dimensional composite of all returns from all laser pulses as determined from the aerial mission. The point cloud is imported into GeoCue distributive processing software. Imported data is tiled and then calibrated using TerraMatch and proprietary software. Using TerraScan, the vertical accuracy of the surveyed ground control is tested and any bias is removed from the data. TerraScan and TerraModeler software packages are then used for automated data classification and manual cleanup. The data are manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler.

DEMs and Intensity Images are then generated using proprietary software. In the bare earth surface model, above-ground features are excluded from the data set. Global Mapper is used as a final check of the bare earth dataset.

Finally, proprietary software is used to perform statistical analysis of the LAS files.

Software	Version
Applanix + POSPac	8.4
Optech LMS	4.4
GeoCue	2017.1.14.1
Global Mapper	19.1;20.1
TerraModeler	20.004
TerraScan	20.011
TerraMatch	20.004

### 3.3. LAS Classification Scheme

The classification classes are determined by the USGS Version 1.3 specifications and are an industry standard for the classification of LIDAR point clouds. All data starts the process as Class 1 (Unclassified), and then through automated classification routines, the classifications are determined using TerraScan macro processing.

The classes used in the dataset are as follows and have the following descriptions:

Table 3. LAS Classifications

	Classification Name	Description
1	Processed, but Unclassified	Laser returns that are not included in the ground class, or any other project classification
2	Bare earth	Laser returns that are determined to be ground using automated and manual cleaning algorithms
7	Low Noise	Laser returns that are often associated with scattering from reflective surfaces, or artificial points below the ground surface
9	Water	Laser returns that are found inside of hydro features
17	Bridge Deck	Laser returns falling on bridge decks
18	High Noise	Laser returns that are often associated with birds or artificial points above the ground surface
20	Ignored Ground	Ground points that fall within the given threshold of a collected hydro feature.

### 3.4. Classified LAS Processing

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 flattening breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 3 feet was also used around each hydro flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 20). 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.

Any noise that was identified either through manual review or automated routines was classified to the appropriate class (ASPRS Class 7 and/or ASPRS Class 18) followed by flagging with the

withheld bit.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper is used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for all point cloud data. Quantum Spatial's 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.

### 3.5. Hydro-Flattened Breakline Processing

Class 2 LiDAR was 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 streams and rivers using Quantum Spatial's 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 3 feet was also used around each hydro flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 20).

The breakline files were then translated to Esri file geodatabase 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 completeness, horizontal placement, and vertical variance is reviewed, all breaklines are reviewed for topological consistency and data integrity using a combination of Esri Data Reviewer tools and proprietary tools.

### 3.6. Hydro-Flattened Raster DEM Processing

Class 2 LiDAR in conjunction with the hydro breaklines were used to create a 1.25-foot raster DEM. Using automated scripting routines within proprietary software, a GeoTIFF file was created for each tile. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

### 3.7. Intensity Image Processing

GeoCue software was used to create the deliverable intensity images. All overlap classes were

ignored during this process. This helps to ensure a more aesthetically pleasing image. The GeoCue software was then used to verify full project coverage as well. GeoTIFF files with a cell size of 1.25-foot were then provided as the deliverable for this dataset requirement.

### 3.8. Height Separation Raster Processing

Swath Separation images are rasters that represent the interswath alignment between flight lines and provide a qualitative evaluation of the positional quality of the point cloud. Proprietary software was used to create 1.25-foot raster images in GeoTIFF format.



# NH\_COASTAL\_2019\_B19

## Work Unit 183371 Tile Layout

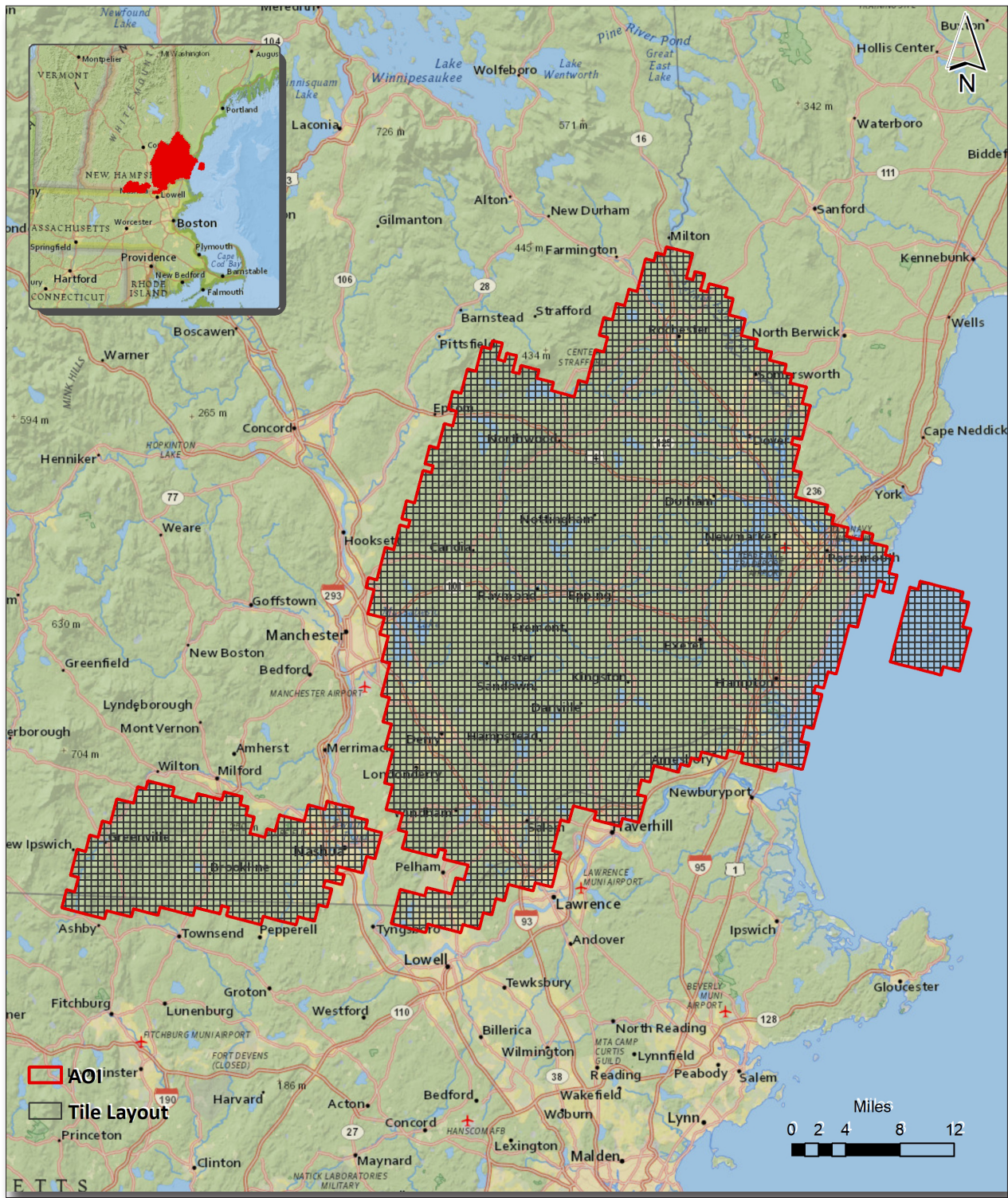


Figure 5. Lidar Tile Layout

## 4. Project Coverage Verification

Coverage verification was performed by comparing coverage of processed .LAS files captured during project collection to generate project shape files depicting boundaries of specified project areas. Please refer to Figure 6.

# NH\_COASTAL\_2019\_B19

## Work Unit 183371 Lidar Coverage

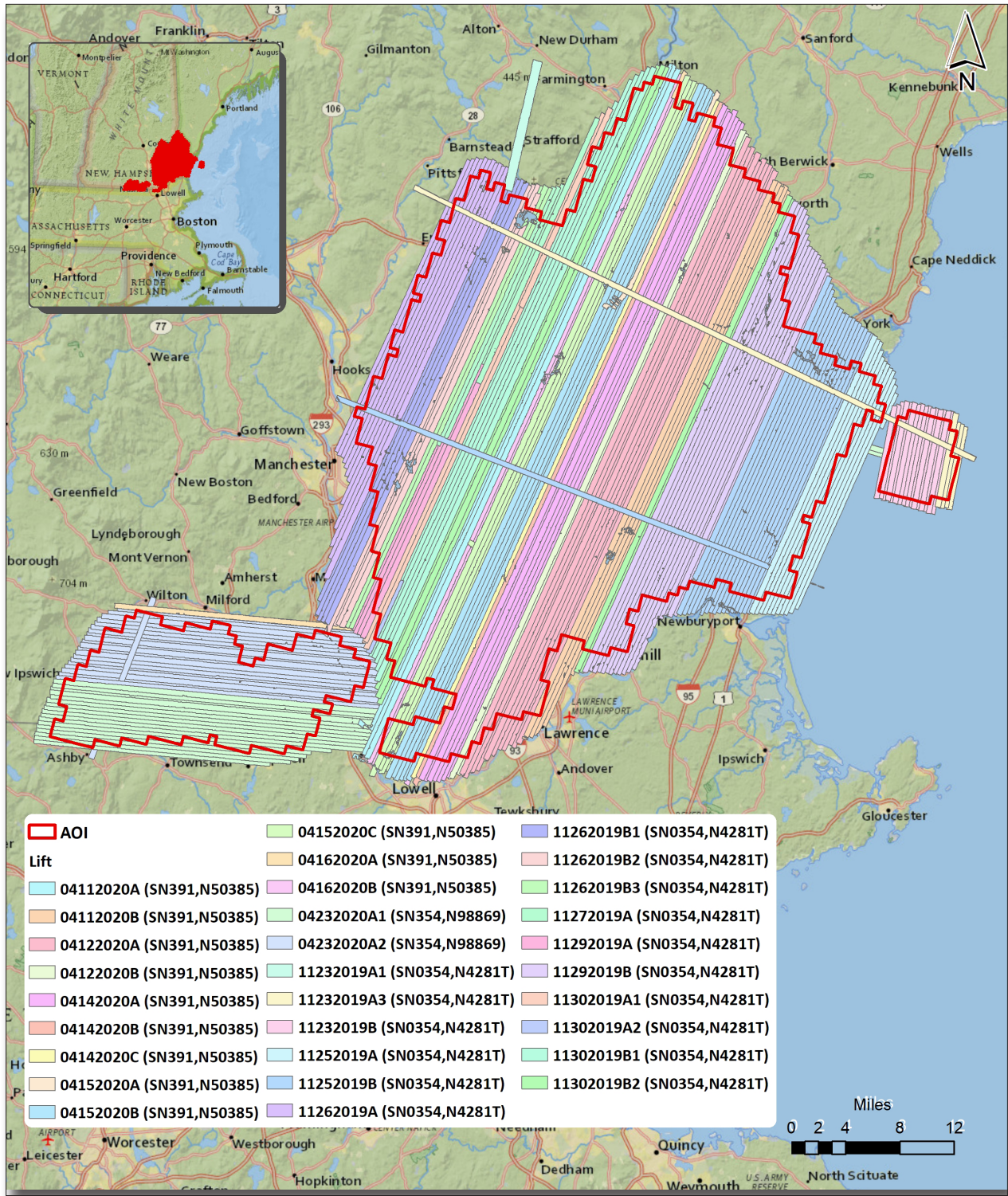


Figure 6. Lidar Coverage

## Project Report Appendices

The following section contains the appendices as listed in the NH\_Coastal\_B19\_2019 Lidar Processing Report.

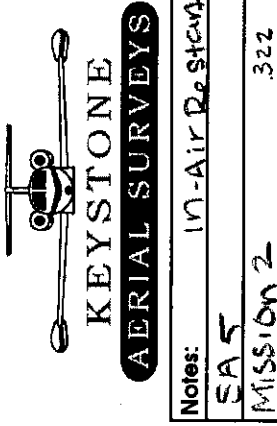
## Appendix A

# Flight Logs

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191116-811-2  
 Date: 11/16/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: (A) / B

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (inHg)	
Scan Frequency	<u>166</u>	Ground Temp (°C)	<u>-03</u>
Scan Half Angle	<u>20</u>	Air Temp (°C)	<u>-11°</u>
Laser PRF	<u>250</u>	Dew Point (°C)	<u>-16</u>
Desired Range	<u>1500</u>	Turbulence	<u>light</u>
Planned Ground Speed	<u>170</u>	Wind Speed/Gusts (kts)	<u>08</u>
System Power	<u>High</u>	Visibility (Miles)	<u>10</u>



Notes: IN-AIR Restart  
SA5  
MISSION 2 322

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOF	SV	FLIGHT NOTES	
15	212	19:20	19:36	13.4	1457	167	1.05	14	Possibly snow N. end of line → had to restart system	
16	211	19:39	19:53	13.4	1538	171	0.94	16		
17	210	19:55	20:11	13.4	1479	156	0.98	16		
18	209	20:42	20:56	13.4	1564	179	1.14	14		
19	208	20:59	21:14	13.4	1451	161	1.05	14		
20	207	21:17	21:31	13.4	1480	187	0.93	15		
21	206	21:34	21:49	13.4	1495	161	0.89	15		
22	205	21:52	22:04	13.4	1536	175	0.93	15		
23	204	22:07	22:21	13.4	1493	167	0.96	15		
24	203	22:24	22:36	13.4	1513	185	0.90	16		

Engine Start (24HR LCD): 13:39  
 Engine Stop (24HR LCD): 18:00 4.35  
 Depart: KASH Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_ Page 1 of 1

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON (UTC)
POSITION TYPE	METERS	TIME OFF (UTC)	POOP
ANTENNA HEIGHT	LATITUDE	LONGITUDE	SV'S

ABGPS	
TIME ON UTC	<u>18:47</u> <u>19:05</u>
KIN ON UTC	<u>18:46</u>
KIN OFF UTC	<u>23:00</u>
TIME OFF UTC	_____

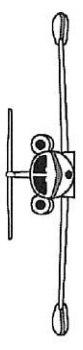


NH COASTAL  
32855

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191116\_8171  
 Date: 11/16/2019  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: SOV0354  
 Pilot: JOP  
 Operator: TL  
 HD: (A) / B

Flight Plan Info		Weather Info	
Roll Comp	On	Grnd Pressure (inHg)	30.51
Scan Frequency	666	Ground Temp (°C)	-6°
Scan Half Angle	2.0	Air Temp (°C)	-12°
Laser PRF	250	Dew Point (°C)	-17
Desired Range	1500	Turbulence	lite-norm
Planned Ground Speed	170	Wind Speed/Gusts (kts.)	7
System Power	High	Visibility (Miles)	10+



## KEYSTONE AERIAL SURVEYS

Notes: 7:30AM  
 SA5  
 Mission 1

STRIPID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
TIE 1	226	12:53	14:05	277.3	1489	175	1.04	13	possible snow last 5 miles (west)
2	225	14:09	14:19	193.4	1544	187	0.93	13	lite snow north 17 miles
3	224	14:22	14:34	13.4	1522	159	0.93	14	lite snow north 15 miles
4	223	14:37	14:48	193.4	1537	179	0.91	14	lite snow north 16 miles
5	222	14:51	15:04	13.4	1591	161	0.91	15	lite snow north 17 miles Ski Slope (Tie line) ↑
6	221	15:06	15:21	193.4	1512	181	0.94	15	lite snow north 17 miles Ski Slope (Tie line) ↓
7	220	15:24	15:41	13.4	1411	161	0.99	15	lite snow north 13 miles
8	219	15:43	15:59	193.4	1650	181	1.02	14	lite snow north 13 miles
9	218	16:02	16:19	13.4	1448	163	0.92	15	lite snow north 11 miles Ski Slopes end? ↓
10	217	16:22	16:38	193.4	1554	185	0.92	17	lite snow north miles 3-9
11	216	16:40	16:58	13.4	1464	165	0.93	15	lite snow north miles 3-6
12	215	17:00	17:16	193.4	1653	185	0.96	14	Possible snow on North end
13	214	17:19	17:37	13.4	1355	163	0.96	15	↓
14	213	17:39	17:55	193.4	1627	179	1.03	14	

ABGPS	
TIME ON UTC:	13:26
KIN ON UTC:	13:41
KIN OFF UTC:	18:08
TIME OFF UTC:	18:07

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON (UTC)
POSITION TYPE	METERS	METERS	TIME OFF (UTC)
ANTENNA HEIGHT	PDOP		
LATITUDE	SV'S		
LONGITUDE			

Engine Start (24HR LCL): 08:30  
 Engine Stop (24HR LCL): 13:08  
 Depart: KPSM Arrive: KASH  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

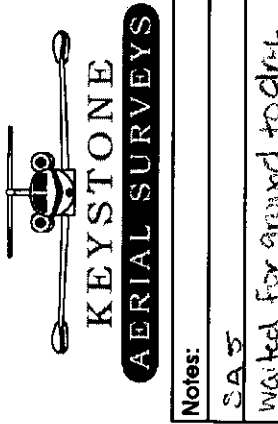
4.63 / 8.98



# LIDAR FLIGHT REPORT

POS/AV Filename: 20191121-81T-4  
 Date: 11/21/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: S060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	Grnd Pressure (inHg)	30.04
Scan Frequency	6.6	Ground Temp (°C)	3°
Scan Half Angle	2.0	Air Temp (°C)	5°
Laser PRF	250	Dew Point (°C)	-1
Desired Range	1500	Turbulence	lite
Planned Ground Speed	170	Wind Speed/Gusts (kts)	3
System Power	High	Visibility (Miles)	10+



Notes:  
 SAS  
 Waited for ground today

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES	
30	198	18:03	18:16	193.4	1515	183	0.94	16	Trace components of snow	
31	197	18:19	18:32	13.4	1564	165	0.91	16		
32	196	18:36	18:49	193.4	1502	185	0.92	17		
33	195	18:53	19:07	13.4	1523	171	1.02	16		
34	194	19:10	19:23	193.4	1447	179	0.97	16		
35	193	19:27	19:41	13.4	1478	169	0.92	16		
36	192	19:45	20:00	193.4	1446	179	0.93	15		lik snow near horizontal
37	191	20:02	20:18	13.4	1592	167	0.88	16		misfire
38	191	20:21	20:21							
39	190	20:24	20:39	193.4	1568	183	0.97	15		Plane low voltage upon landing - Shut system off
40	189	20:42	20:57	13.4	1597	175	1.01	14		
41	188	21:00	21:15	193.4	1586	175	1.04	15		
42	187	21:17	21:33	13.4	1624	175	0.93	16		

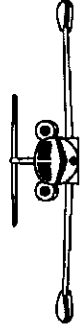
BASE STATION	
POINT ID	LOCATION
POSITION TYPE	TIME ON (UTC)
ANTENNA HEIGHT	TIME OFF (UTC)
LATITUDE	PDOP
LONGITUDE	SVS

Engine Start (24HR LCD): 12:41  
 Engine Stop (24HR LCD): 16:42  
 Depart: KLC1 Arrive: KLC1  
 Ferry Start (24HR UTC): 08:47  
 Ferry Stop (24HR UTC): 09:19  
 Depart: KFSM Arrive: KLC1

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191121-81T-5  
 Date: 11/21/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	End Pressure (inHg)	30.03
Scan Frequency	66	Ground Temp (°C)	00°
Scan Half Angle	20	Air Temp (°C)	4°
Laser PRF	250	Dew Point (°C)	-01°
Desired Range	1500	Turbulence	light
Planned Ground Speed	170	Wind Speed/Gusts (kts)	Calm
System Power	High	Visibility (Miles)	10+



KEYSTONE  
AERIAL SURVEYS

Notes:  
SA 5

STRIPID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
43	186	22:46	23:01	193.4	1449	169	0.92	16	like snow north/northwest 10 miles
44	185	23:04	23:19	13.4	1584	187	0.93	16	
45	184	23:22	23:38	193.4	1458	169	0.93	16	
46	183	23:41	23:56	13.4	1622	181	0.97	16	
47	182	00:07	00:23	193.4	1356	173	0.93	18	GPS Midnight - @ Production
48	181	00:26	00:40	13.4	1489	183	1.02	17	like snow north/northwest 10 miles
49	180	00:44	01:00	193.4	1406	169	1.15	15	like snow north/northwest 10 miles
50	179	01:03	01:17	13.4	1645	181	0.97	16	
51	178	01:21	01:33	193.4	1567	173	0.91	17	
TIES 2	227	01:36	01:45	280.9	1695	161	0.89	17	

Engine Start (24HR LCL): 17:21 3.77  
 Engine Stop (24HR LCL): 21:07  
 Depart: KLCL Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_  
 Page 1 of 1

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON (UTC)
ANTENNA HEIGHT	METERS	TIME OFF (UTC)	POOP
LATITUDE			SV'S
LONGITUDE			

ABGPS	
TIME ON UTC: <u>22:24</u>	
KIN ON UTC: <u>22:30</u>	
KIN OFF UTC: <u>02:06</u>	
TIME OFF UTC: <u>02:03</u>	

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191123-81T-6  
 Date: 11/23/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: (A) / B



**KEYSTONE**  
**AERIAL SURVEYS**

Notes: POOP 13:20 EST  
SAS  
Restart - Pilot Display

13:49

Flight Plan Info		Weather Info	
Roll Comp	On	Grnd Pressure (inHg)	29.86
Scan Frequency	666	Ground Temp (°C)	5°
Scan Half Angle	20	Air Temp (°C)	1°
Laser PRF	250	Dew Point (°C)	-12°
Desired Range	1500	Turbulence	114
Planned Ground Speed	170	Wind Speed/Gusts (kts)	14/23
System Power	HIGH	Visibility (Miles)	10+

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
753	2014	13:56	13:58	288	1490	150	0.88	15	ReFlight Tie Line (line 201 selected)
54	203	14:02	14:04	193.4	1501	171	0.96	15	ReFlight tie Industrial smoke present
55	202	14:09	14:11	13.4	1557	161	0.93	15	REFLIGHT
56	201	14:15	14:16	193.4	1519	175	0.92	16	REFLIGHT
57	177	14:22	14:27	13.4	1522	165	0.93	16	
58	176	14:31	14:35	193.4	1534	175	0.91	16	
59	175	14:39	14:43	13.4	1513	160	0.92	16	
60	174	14:47	14:57	193.4	1555	179	0.88	17	
61	173	14:54	14:57	13.4	1518	165	1.00	15	
62	172	15:00	15:03	193.4	1497	179	1.02	15	
63	171	15:07	15:10	13.4	1546	169	1.03	15	
64	170	15:13	15:15	193.4	1450	181	0.97	15	
65	169	15:19	15:22	13.4	1558	167	0.96	15	
66	168	15:25	15:28	193.4	1478	183	0.85	17	
67	167	15:31	15:34	13.4	1511	165	0.88	16	
68	166	15:37	15:40	193.4	1439	179	0.90	16	
69	165	15:43	15:46	13.4	1480	163	0.89	16	
70	164	15:49	15:52	193.4	1482	175	0.88	17	
71	163	15:55	15:58	13.4	1521	159	0.89	17	
72	162	16:01	16:04	193.4	1539	187	0.92	16	
73	161	16:07	16:10	13.4	1512	165	0.92	16	

Engine Start (24HR LCL): 08:25 4.75  
 Engine Stop (24HR LCL): 13:10  
 Depart: KPSM Arrive: KPSM

8.77

Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

ABGPS		BASE STATION	
TIME ON UTC:	13:29	POINT ID	LOCATION
KIN ON UTC:	13:35	POSITION TYPE	KNOWN / AUTONOMOUS
KIN OFF UTC:		ANTENNA HEIGHT	METERS
TIME OFF UTC:		LATITUDE	PDOP
		LONGITUDE	SV'S





# LIDAR FLIGHT REPORT

POS/AV Filename: 20191123\_817.7  
 Date: 11/23/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JCP  
 Operator: TL  
 HD: A / B



**KEYSTONE**

**AERIAL SURVEYS**

Notes: SAZ

Pilot Disposition: first on takeoff  
 Restart: 1929/19:56

Flight Plan Info		Weather Info	
Roll Comp	On	Qnd Pressure (inHg)	29.85
Scan Frequency	116	Ground Temp (°C)	
Scan Half Angle	15.5	Air Temp (°C)	
Laser PRF	600	Dew Point (°C)	
Desired Range	1100	Turbulence	11K-NONE
Planned Ground Speed	160	Wind Speed/Gusts (kts)	9
System Power	H16H	Visibility (Miles)	10+

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
85	140	20:01	20:03	191.9	1076	171	1.00	15	
86	141	20:06	20:09	11.9	1060	154	0.93	16	
87	142	20:11	20:14	191.9	1027	167	1.04	15	
88	143	20:16	20:19	11.9	1077	157	1.04	15	
89	144	20:22	20:24	191.9	1098	161	1.03	15	
90	145	20:27	20:29	11.9	1048	167	0.97	16	
91	146	20:32	20:35	191.9	1054	165	1.02	15	
92	147	20:38	20:40	11.9	1060	165	1.01	15	
93	148	20:43	20:45	191.9	1024	171	0.95	16	
94	149	20:48	20:51	11.9	1104	165	0.95	16	
95	150	20:53	20:56	191.9	1043	169	0.94	16	
96	151	20:59	21:01	11.9	1110	167	0.92	16	
97	152	21:04	21:06	191.9	1116	169	0.87	17	
98	153	21:09	21:11	11.9	1088	167	0.83	17	
99	154	21:14	21:16	191.9	1057	163	0.82	17	
100	155	21:19	21:21	11.9	1080	159	0.95	15	
101	156	21:23	21:25	191.9	1048	163	0.96	15	

Engine Start (24HR LCD): 14:32  
 Engine Stop (24HR LCD): 18:33  
 Depart: KFSM Arrive: KFSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON (UTC)
POSITION TYPE	METERS	TIME OFF (UTC)	PDOP
ANTENNA HEIGHT	LATITUDE	LONGITUDE	SV'S

ABGPS	
TIME ON UTC: <u>19:35</u>	<u>19:49</u>
KIN ON UTC: <u>19:39</u>	<u>19:56</u>
KIN OFF UTC: <u>23:31</u>	
TIME OFF UTC: <u>23:30</u>	

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191123-81T-7

Date: 11/23/19  
 Project: 19A-719  
 Aircraft: N4181T  
 Sensor: 5000354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (inHg)	
Scan Frequency	<u>100</u>	Ground Temp (°C)	
Scan Half Angle	<u>20</u>	Air Temp (°C)	
Laser PRF	<u>250</u>	Dew Point (°C)	
Desired Range	<u>1500</u>	Turbulence	
Planned Ground Speed	<u>170</u>	Wind Speed/Gusts (kts)	
System Power	<u>HIGH</u>	Visibility (Miles)	



**KEYSTONE  
AERIAL SURVEYS**

Notes:  
SAS

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
102	178	21:41	21:43	13.4	1482	177	1.01	14	REFLIGHT FOR SCANS  Target angle  REFLIGHT TIE LINE
103	179	21:46	21:4	13.4	1344	169	0.99	15	
104	180	21:52	21:55	13.4	1477	177	0.98	15	
105	181	21:58	22:01	13.4	1418	171	0.91	15	
106	182	22:04	22:07	13.4	1465	177	0.88	16	
107	183	22:10	22:13	13.4	1223	167	0.80	17	
108	184	22:16	22:19	13.4	1578	173	0.85	17	
109	185	22:22	22:25	13.4	1341	177	0.91	17	
110	186	22:28	22:31	13.4	1206	175	0.94	17	
111	187	22:34	22:37	13.4	1310	177	0.95	17	
112	188	22:40	22:43	13.4	1457	173	0.95	17	
113	189	22:46	22:49	13.4	1325	173	0.98	16	
114	190	22:52	22:55	13.4	1381	179	0.96	17	
115	191	22:58	23:01	13.4	2021	171	1.02	16	
116	192	23:04	23:07	13.4	1376	173	0.91	17	
TIE 117	226*	23:11	23:15	102	1502	179	0.92	17	

Engine Start (24HR LCD): 14:32  
 Engine Stop (24HR LCD): 18:33  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON UTC
ANTENNA HEIGHT	METERS	TIME OFF UTC	POOP
LATITUDE	POOP	SV'S	
LONGITUDE			

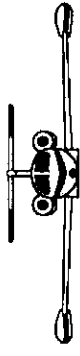
ABGPS	
TIME ON UTC:	<u>19:50</u>
KIN ON UTC:	
KIN OFF UTC:	<u>23:31</u>
TIME OFF UTC:	<u>23:30</u>

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191125\_811-8  
 Date: 11/25/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / (B)

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (inHg)	29.75
Scan Frequency	116	Ground Temp (°C)	11°
Scan Half Angle	15.5	Air Temp (°C)	-1°
Laser PRF	600	Dew Point (°C)	-2°
Desired Range	1100	Turbulence	mod-lik
Planned Ground Speed	160	Wind Speed/Gusts (kts.)	09
System Power	HIGH	Visibility (Miles)	10+

Notes:  
SAI



**KEYSTONE**  
**AERIAL SURVEYS**

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
118	1	17:57	17:58	204.6	1079	159	0.89	15	
119	2	18:03	18:09	204.6	1054	157	0.87	15	
120	3	18:12	18:18	24.6	1096	163	0.88	15	
121	4	18:20	18:27	204.6	1066	165	0.89	15	
122	5	18:29	18:36	24.6	1085	169	0.88	16	
123	6	18:39	18:45	204.6	1072	163	0.94	14	
124	7	18:48	18:54	24.6	1094	167	0.90	14	
125	8	18:57	19:04	204.6	1071	167	0.94	15	
126	9	19:06	19:13	24.6	1116	173	0.90	15	
127	10	19:16	19:23	204.6	1075	163	0.97	15	
128	11	19:25	19:32	24.6	1117	171	1.00	15	
129	12	19:34	19:42	204.6	1091	161	0.98	15	

Engine Start (24HR LCD): 12:39  
 Engine Stop (24HR LCD): 14:54 2.25  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_  
 Page | of |

BASE STATION			
POINT ID	KNOWN / AUTONOMOUS	LOCATION	
POSITION TYPE	METERS	TIME ON (UTC)	
ANTENNA HEIGHT	METERS	TIME OFF (UTC)	
LATITUDE	PDOP		
LONGITUDE	SVS		

ABDPS	
TIME ON UTC:	<u>17:43</u>
KIN ON UTC:	<u>17:47</u>
KIN OFF UTC:	<u>19:53</u>
TIME OFF UTC:	<u>19:52</u>



# LIDAR FLIGHT REPORT

POS/AV Filename: 20191126\_81T-1  
 Date: 11/26/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / (B)

Flight Plan Info		Weather Info	
Roll Comp	On	Grnd Pressure (inHg)	29.97
Scan Frequency	16	Ground Temp (°C)	14°
Scan Half Angle	15.5	Air Temp (°C)	8°
Laser PRF	1000	Dew Point (°C)	02°
Desired Range	1100	Turbulence	lite
Planned Ground Speed	140	Wind Speed/Gusts (kts)	9
System Power	High	Visibility (Miles)	10

Notes: Mission 10 205467  
 SAI  
 4:15-8:00 17



**KEYSTONE**  
**AERIAL SURVEYS**

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
151	132	15:17	15:19	24.6	1164	173	0.98	15	
152	131	15:22	15:25	204.6	1125	146	0.97	15	
153	130	15:29	15:32	24.6	1124	171	0.94	16	
154	129	15:36	15:40	204.6	1086	146	0.95	16	
155	128	15:46	15:52	24.6	1158	173	0.95	16	
156	127	15:56	16:04	204.6	1111	144	0.93	16	
157	126	16:08	16:15	24.6	1143	171	0.93	15	
158	125	16:19	16:27	204.6	1120	150	0.96	15	
159	124	16:31	16:38	24.6	1123	159	0.94	14	
160	123	16:43	16:51	204.6	1010	156	0.92	14	
161	122	16:54	17:02	24.6	1206	165	0.93	14	
162	121	17:06	17:14	204.6	1137	152	0.96	13	Possibly plan in path of laser
163	120	17:18	17:27	24.6	1166	167	0.91	14	
164	119	17:30	17:40	204.6	1066	157	0.91	15	
165	118	17:44	17:53	24.6	1186	171	0.92	15	
166	117	17:57	18:08	204.6	1049	156	1.03	14	
167	116	18:11	18:22	24.6	1078	159	0.99	16	

Engine Start (24HR LCD): 09:08  
 Engine Stop (24HR LCD): 13:34  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC):  
 Ferry Stop (24HR UTC):  
 Depart: Arrive:

BASE STATION			
POINT ID	LOCATION	KNOWN / AUTONOMOUS	TIME ON (UTC)
ANTENNA HEIGHT	METERS	TIME OFF (UTC)	POOP
LATITUDE	POOP	SV'S	
LONGITUDE			

ABDS	
TIME ON UTC:	14:12
KIN ON UTC:	
KIN OFF UTC:	16:34
TIME OFF UTC:	16:32

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191126-SJT-11  
 Date: 11/26/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	End Pressure (inHg)	29.93
Scan Frequency	116	Ground Temp (°C)	12°
Scan Half Angle	15.5	Air Temp (°C)	8°
Laser PRF	600	Dew Point (°C)	1°
Desired Range	1100	Turbulence	light-mid
Planned Ground Speed	160	Wind Speed/Gusts (kts.)	3
System Power	High	Visibility (Miles)	10

Notes: 505  
 SAI  
 15:30 16:15-20:00 14



STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOF	SV	FLIGHT NOTES
168	115	19:41	19:52	204.6	1060	156	0.76	19	
169	114	19:50	20:05	24.6	1214	163	0.92	15	Pilot Display froze Midline (Offline)
170	114	20:11	20:23	204.6	1031	152	1.00	15	
171	113	20:27	20:38	24.6	1188	171	0.94	16	
172	112	20:42	20:54	204.6	1028	156	0.94	16	
173	111	20:58	21:09	24.6	1197	173	0.92	17	Pilot Display shut off - Restored System 16:10
174	110	21:24	21:36	204.6	1120	157	0.99	16	
175	109	21:40	21:51	24.6	1203	163	0.89	17	
176	108	21:55	22:07	204.6	1218	157	0.87	17	
177	107	22:11	22:23	24.6	1210	161	0.87	19	Pilot Display shut off Restored System 22:17
178	107	22:43	22:54	24.6	1098	163	0.92	17	
179	106	22:57	23:09	204.6	1071	152	1.00	16	
180	105	23:13	23:24	24.6	1207	161	0.90	17	
181	133	23:31	23:45	116.4	1159	173	0.88	16	

BASE STATION			
POINT ID	LOCATION	TIME ON (UTC)	
POSITION TYPE	KNOWN / AUTONOMOUS	TIME OFF (UTC)	
ANTENNA HEIGHT	METERS	POOP	
LATITUDE		SV'S	
LONGITUDE			

ABRES	
TIME ON UTC:	19:16 21:14 22:59
KIN ON UTC:	19:20
KIN OFF UTC:	23:57
TIME OFF UTC:	23:54

Engine Start (24HR LCD): 14:12  
 Engine Stop (24HR LCD): 18:57  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

4,75

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191127\_01T-12  
 Date: 11/27/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	0n	Grnd Pressure (inHg)	29.93
Scan Frequency	116	Ground Temp (°C)	10°
Scan Half Angle	15.5	Air Temp (°C)	2°
Laser PRF	600	Dew Point (°C)	4°
Desired Range	1100	Turbulence	light-none
Planned Ground Speed	160	Wind Speed/Gusts (kts)	09
System Power	HIGH	Visibility (Miles)	8



Notes: \_\_\_\_\_  
 SAI \_\_\_\_\_  
 Clouds \_\_\_\_\_

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
182	104	18:07	18:14	204.6	1080	150	0.78	18	Ended for clouds @ S. Tie Line
183	103	18:18	18:25	24.6	1136	165	0.62	18	↓
184	102	18:29	18:34	204.6	1054	154	1.03	17	Ended 12 miles from N. end.
185	101	18:37	18:44	24.6	1153	171	1.03	16	Planned 18 miles from S. end north

Engine Start (24HR LCD): 12:37  
 Engine Stop (24HR LCD): 14:02  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

BASE STATION	
POINT ID	LOCATION
POSITION TYPE	KNOWN / AUTONOMOUS
ANTENNA HEIGHT	METERS
LATITUDE	PDOP
LONGITUDE	SVS
TIME ON UTC	TIME ON (UTC)
KIN ON UTC	TIME OFF (UTC)
KIN OFF UTC	PDOP
TIME OFF UTC	SVS

ABBS	
TIME ON UTC	<u>17:43</u>
KIN ON UTC	<u>17:47</u>
KIN OFF UTC	<u>18:58</u>
TIME OFF UTC	<u>18:58</u>

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191129\_811-13  
 Date: 11/29/19  
 Project: 19PA-719  
 Aircraft: N9181T  
 Sensor: 560354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info			
Roll Comp	On	End Pressure (inHg)			
Scan Frequency	<u>116</u>	Ground Temp (°C)			
Scan Half Angle	<u>15.5</u>	Air Temp (°C)	<u>-1</u>		
Laser PRF	<u>1600</u>	Dew Point (°C)			
Desired Range	<u>1100</u>	Turbulence	<u>Light</u>		
Planned Ground Speed	<u>160</u>	Wind Speed/Gusts (kts)	<u>10</u>	<u>310</u>	
System Power	<u>115KH</u>	Visibility (Miles)	<u>10</u>		



**KEYSTONE  
AERIAL SURVEYS**

**Notes:**

SAL 7, Mission 13  
Mostly Clear, few small clouds

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOF	SV	FLIGHT NOTES
186	104	14:13	14:18	204.6	1075	169	1.01	14	Pickup
187	108	14:22	14:28	24.6	1140	161	0.93	15	
188	102	14:33	14:41	204.6	1107	173	0.95	16	
189	101	14:45	14:53	24.6	1173	159	0.91	16	
190	134	14:53	15:00	111.8	1054	165	0.89	17	TIE for pickup
191	228	15:06	15:09	275.5	1178	175	0.88	17	Swapped blocks for clouds Ended for clouds (will reey whole line)

ARRPS	
TIME ON UTC:	<u>13:57</u>
KIN ON UTC:	<u>14:01</u>
KIN OFF UTC:	<u>15:45</u>
TIME OFF UTC:	<u>15:41</u>

BASE STATION			
POINT ID	LOCATION		
POSITION TYPE	KNOWN / AUTONOMOUS	TIME ON (UTC)	
ANTENNA HEIGHT	METERS	TIME OFF (UTC)	
LATITUDE	PDOF		
LONGITUDE	SVS		

Engine Start (24HR LCD): 08:51  
 Engine Stop (24HR LCD): 10:45  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_

# LIDAR FLIGHT REPORT

POS/AV Filename: 20191129-81T-L14  
 Date: 11/29/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 560354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (inHg)	30.01
Scan Frequency	116	Ground Temp (°C)	-2°
Scan Half Angle	15.5	Air Temp (°C)	-6°
Laser PRF	1600	Dew Point (°C)	-11°
Desired Range	1100	Turbulence	11E-1100
Planned Ground Speed	160	Wind Speed/Gusts (kts)	12/21
System Power	HIGH	Visibility (Miles)	10



Notes:  
SAL, Mission 14

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
192	30	23:31	23:40	204.6	1068	171	0.92	17	
193	31	23:43	23:53	24.6	1124	154	0.90	17	
194	32	00:05	00:14	204.6	1092	109	1.01	17	
195	33	00:17	00:27	24.6	1082	150	1.07	15	
196	34	00:30	00:40	204.6	1077	173	1.00	16	
197	35	00:43	00:54	24.6	1155	157	6.95	18	
198	36	00:57	01:07	204.6	1009	163	6.96	18	
199	37	01:10	01:21	24.6	1099	159	0.93	17	
200	38	01:24	01:35	204.6	1148	171	0.89	16	
201	39	01:37	01:49	24.6	1110	156	0.94	14	
202	40	01:51	02:02	204.6	1138	173	0.88	17	
203	41	02:05	02:17	24.6	1065	152	0.84	18	
204	42	02:20	02:31	204.6	1128	169	1.09	15	
205	43	02:34	02:46	24.6	1118	156	0.94	16	
206	44	02:48	03:00	204.6	1092	171	0.88	17	
207	45	03:02	03:15	24.6	1098	148	0.88	15	
TIE 208	138	03:21	03:25	116.4	1148	159	0.89	15	

ABRPS	
TIME ON UTC:	23:17
KIN ON UTC:	23:22
KIN OFF UTC:	03:36
TIME OFF UTC:	03:35

BASE STATION			
POINT ID	KNOWN / AUTONOMOUS	LOCATION	
POSITION TYPE	METERS	TIME ON (UTC)	
ANTENNA HEIGHT		TIME OFF (UTC)	
LATITUDE		PDOP	
LONGITUDE		SV'S	

Engine Start (24HR LCL): 18:13  
 Engine Stop (24HR LCL): 22:36  
 Depart: 14:51 Arrive: 14:38  
 FFSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_



# LIDAR FLIGHT REPORT

POS/AV Filename: 20191130-8TT-1k  
 Date: 11/30/19  
 Project: 19PA-719  
 Aircraft: N4181T  
 Sensor: 5060354  
 Pilot: JOP  
 Operator: TL  
 HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (inHg)	29.94
Scan Frequency	116	Ground Temp (°C)	-5°
Scan Half Angle	15.5	Air Temp (°C)	-4°
Laser PRF	1000	Dew Point (°C)	-14°
Desired Range	1100	Turbulence	1k-1100
Planned Ground Speed	1100	Wind Speed/Gusts (kts)	11/21
System Power	HIGH	Visibility (Miles)	10

Notes: 11  
 SAL, Mission 1k



STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
214	98	21:53	22:07	204.0	1122	169	0.92	17	
215	97	22:11	22:27	24.0	1183	157	1.00	17	
216	96	22:30	22:45	204.0	1133	167	1.02	17	
217	95	22:49	23:05	24.0	1139	156	0.86	19	
218	94	23:08	23:23	204.0	1158	173	0.88	17	
219	93	23:27	23:44	24.0	1104	159	0.80	18	
									System off for GPS Midnight Sat Sun 23:59
220	92	00:18	00:33	204.0	1219	107	0.95	16	
221	91	00:37	00:54	24.0	1142	157	0.94	17	
222	90	00:57	01:12	204.0	1114	167	0.96	16	
223	46	01:18	01:31	24.0	1154	156	0.80	17	
224	47	01:33	01:45	204.0	1053	167	1.00	15	
225	133	01:57	02:04	204.4	1516	167	0.87	18	

ABBS		BASE STATION	
TIME ON UTC: 21:31	00:07	POINT ID	LOCATION
KIN ON UTC: 21:38		POSITION TYPE	KNOWN / AUTONOMOUS
KIN OFF UTC: 02:17		ANTENNA HEIGHT	METERS
TIME OFF UTC: 23:59	02:15	LATITUDE	PDOP
		LONGITUDE	SV'S

Engine Start (24HR LCD): 16:30  
 Engine Stop (24HR LCD): 21:18 4.8  
 Depart: KPSM Arrive: KPSM  
 Ferry Start (24HR UTC): \_\_\_\_\_  
 Ferry Stop (24HR UTC): \_\_\_\_\_  
 Depart: \_\_\_\_\_ Arrive: \_\_\_\_\_