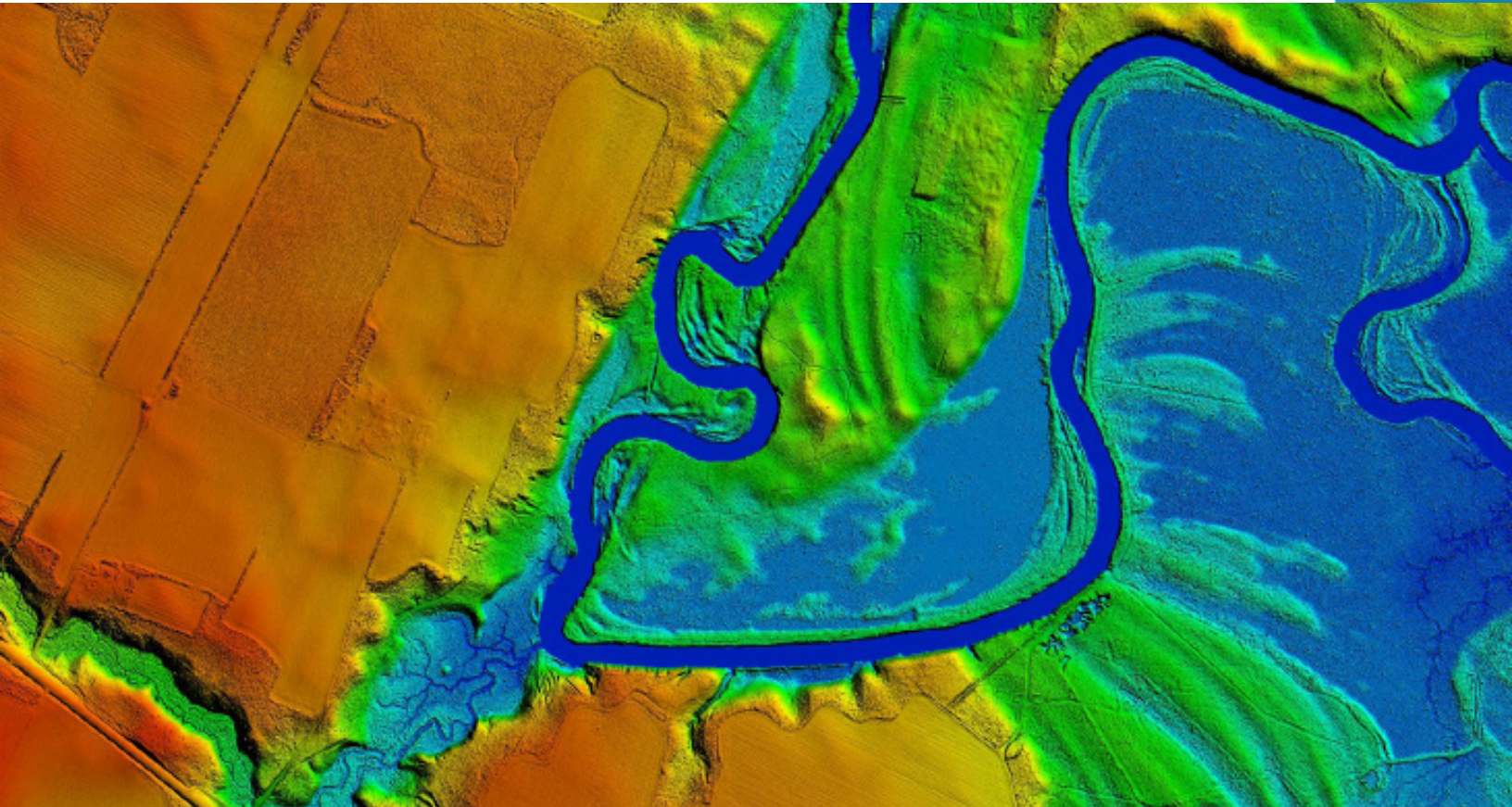


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## NC\_HURRICANEFLORENCE\_2020\_D20 LIDAR PROJECT REPORT

Work Package ID: 186591  
Work Unit ID: 220804

# 2020

Submitted: July 16, 2021

Prepared for:



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# 1. Summary / Scope

## 1.1. Summary

This report contains a summary of the NC\_HurricaneFlorence\_2020\_D20, Work Unit 220804 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on December 10, 2019. The work unit AOI yielded an area covering approximately 2,546 square miles over North Carolina. 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>	1400 m	58.5°	20%	≤ 10 cm

## 1.3. Coverage

The work unit boundary covers approximately 2,546 square miles over North Carolina. 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 January 18, 2020 to February 28, 2020 in 21 total lifts. See “Section: 2.4. Time Period” for more details.

## 1.5. Issues

There were no major issues to report for this project.

NC_HurricaneFlorence_2020_D20 Work Unit 220804 Projected Coordinate System: UTM Zone 18N Horizontal Datum: NAD1983 (2011) Vertical Datum: NAVD88 (GEOID 18) Units: Meters	
<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>• 0.5 meter Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format</li> <li>• 0.5 meter Intensity images in GeoTIFF format</li> <li>• 0.5 meter Swath Separation images in GeoTIFF format</li> </ul>
<b>Vectors</b>	Shapefiles (*.shp) <ul style="list-style-type: none"> <li>• Deliverable Swath</li> <li>• Lidar Tile Index</li> </ul> Geodatabase (*.gdb) <ul style="list-style-type: none"> <li>• Continuous Hydro-flattened Breaklines</li> </ul>
<b>Reports</b>	Reports in PDF format <ul style="list-style-type: none"> <li>• Focus on Delivery</li> <li>• Project Report</li> </ul>
<b>Metadata</b>	XML Files (*.xml) <ul style="list-style-type: none"> <li>• Breaklines</li> <li>• Classified Point Cloud</li> <li>• DEM</li> <li>• Intensity Imagery</li> </ul>

# NC\_HurricaneFlorence\_2020\_D20 Work Unit 220804 Boundary

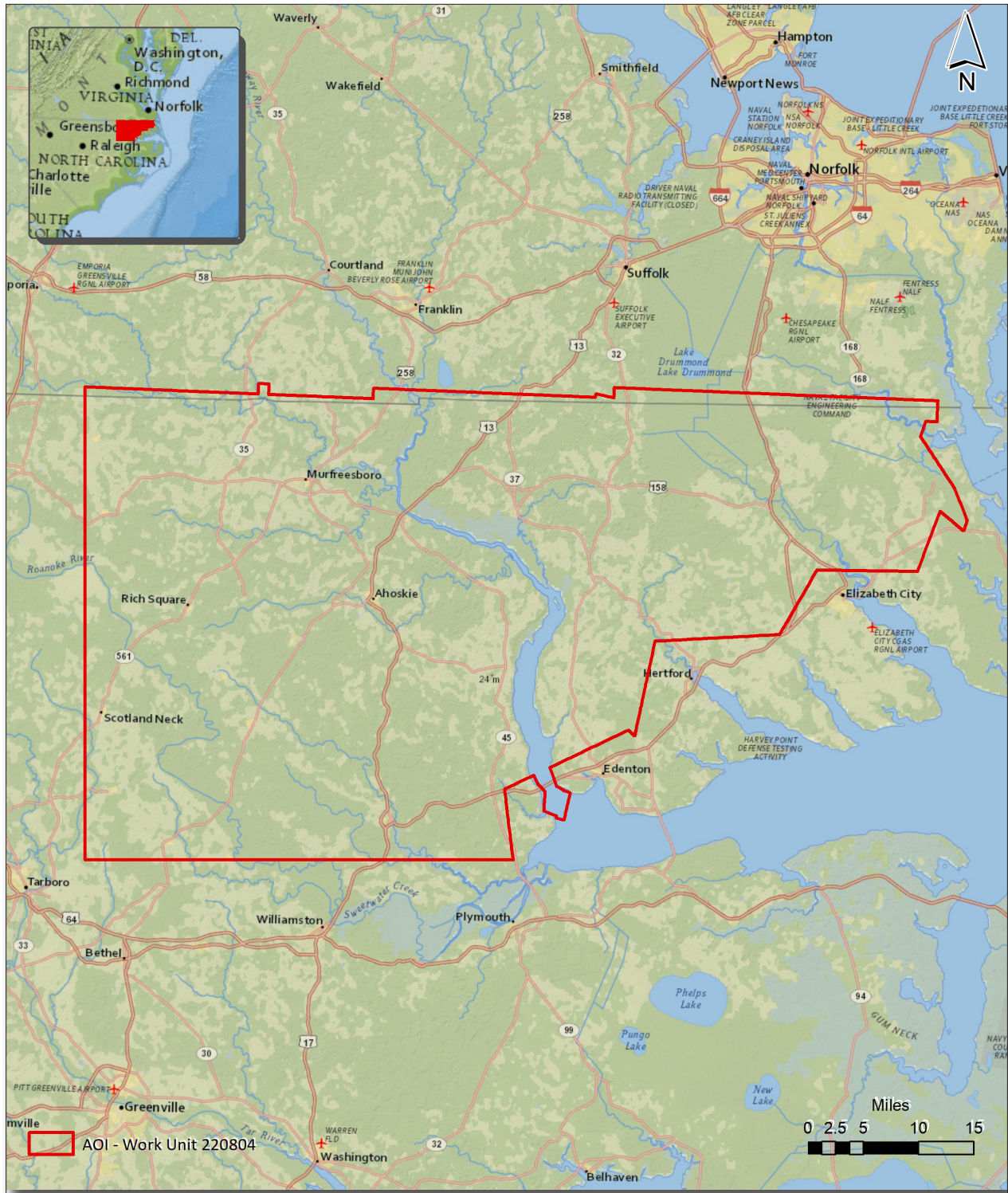


Figure 1. Work Unit Boundary

## 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 RiPARAMETER planning software. Planned flight lines are shown in Figure 2.

### 2.2. Lidar Sensor

Quantum Spatial utilized a Riegl VQ1560i lidar sensor (Figure 3), serial numbers 2737, 3548, and 3069, for data acquisition.

The Riegl 1560i system has a laser pulse repetition rate of up to 2 MHz resulting in more than 1.3 million measurements per second. The system utilizes a Multi-Pulse in the Air option (MPIA). The sensor is also equipped with the ability to measure up to an unlimited number of targets per pulse from the laser.

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

# NC\_HurricaneFlorence\_2020\_D20 Work Unit 220804 Planned Flight Lines

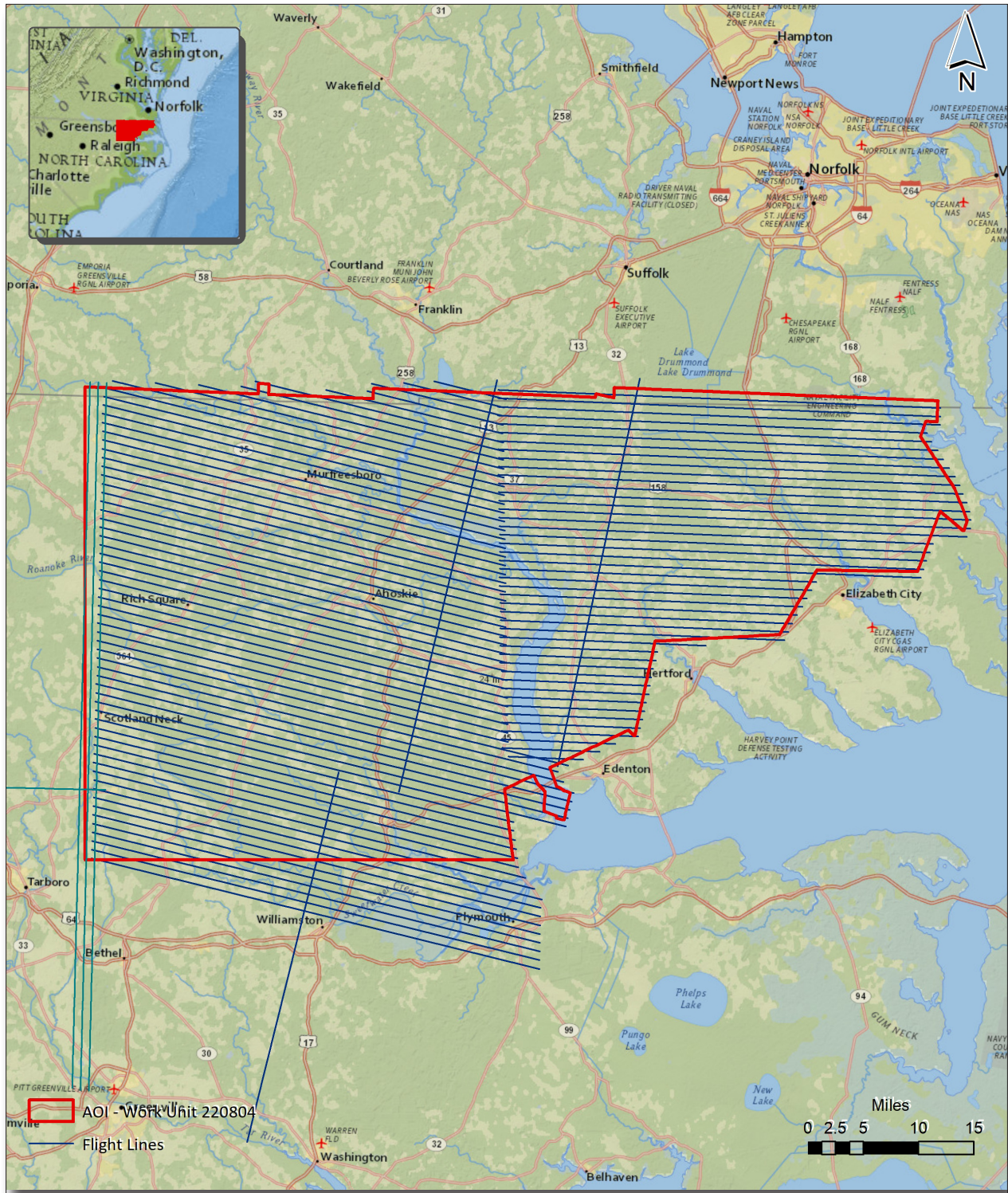


Figure 2. Planned Flight Lines



**Table 2. Planned Lidar System Specifications**

		Riegl VQ1560i (3069)	Riegl VQ1560i (2737 and 3548)
Terrain and Aircraft Scanner	Flying Height	1400 m	1400 m
	Recommended Ground Speed	120 kts	130 kts
Scanner	Field of View	58°	58.5°
	Scan Rate Setting Used	135.33 Hz	161 Hz
Laser	Laser Pulse Rate Used	700 kHz	1000 kHz
	Multi Pulse in Air Mode	yes	yes
Coverage	Full Swath Width	1552 m	1569 m
	Line Spacing	1241.6 m	1255.2 m
Point Spacing and Density	Average Point Spacing	.35 m	.35 m
	Average Point Density	8 pts / m <sup>2</sup>	8 pts / m <sup>2</sup>

**Figure 3. Riegl VQ1560i 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

- Cessna T206 Turbo Stationair (piston-single), Tail Number: N27GP
- Cessna T206H, Tail Numbers: C-GPTG, C-FXSS

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 Riegl VQ1560i 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 January 18, 2020 and February 28, 2020. Twenty-one aircraft lifts were completed. Accomplished lifts are listed below.

- 01182020A (SN2737,C-XSS)
- 01212020A (SN2737,C-XSS)
- 01272020A (SN3548,C-PTG)
- 01272020B (SN3548,C-PTG)
- 01282020A (SN3548,C-PTG)
- 01292020A (SN3069,27GP)
- 01292020A (SN3548,C-PTG)
- 01302020A (SN3548,C-PTG)
- 02032020A (SN3548,C-PTG)
- 02032020B (SN3548,C-PTG)
- 02032020C (SN3548,C-PTG)
- 02042020A (SN3548,C-PTG)
- 02042020B (SN3548,C-PTG)
- 02082020A (SN3548,C-PTG)
- 02082020B (SN3548,C-PTG)
- 02102020A (SN3548,C-PTG)
- 02142020A (SN2737,C-XSS)
- 02142020A (SN3548,C-PTG)
- 02162020A (SN3548,C-PTG)
- 02232020A (SN3548,C-PTG)
- 02282020A (SN3069,27GP)

## 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). See Appendix A for more information.

## 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 RiPROCESS 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	8.6
RiPROCESS	1.8.6
GeoCue	2020.1.22.1
Global Mapper	19.1;20.1
TerraModeler	21.008
TerraScan	21.016
TerraMatch	21.007

### 3.3. LAS Classification Scheme

The classification classes are determined by the USGS Version 2.1 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 1 meter 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 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 0.5-meter 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 withheld points 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 0.5-meter 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 0.5-meter raster images in GeoTIFF format.



# NC\_HurricaneFlorence\_2020\_D20 Work Unit 220804 Tile Layout

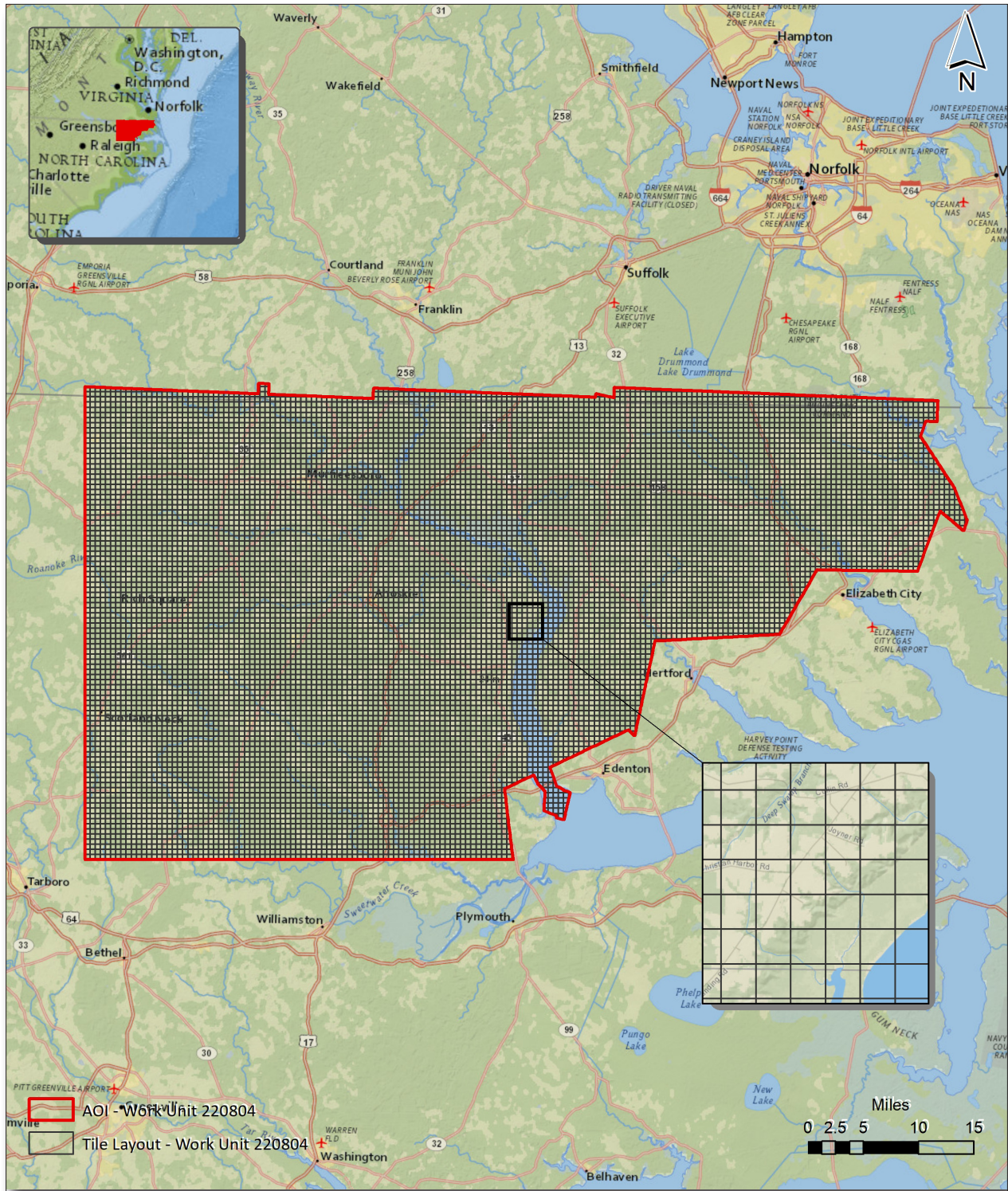


Figure 5. Lidar Tile Layout

## 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.

# NC\_HurricaneFlorence\_2020\_D20 Work Unit 220804 Lidar Coverage

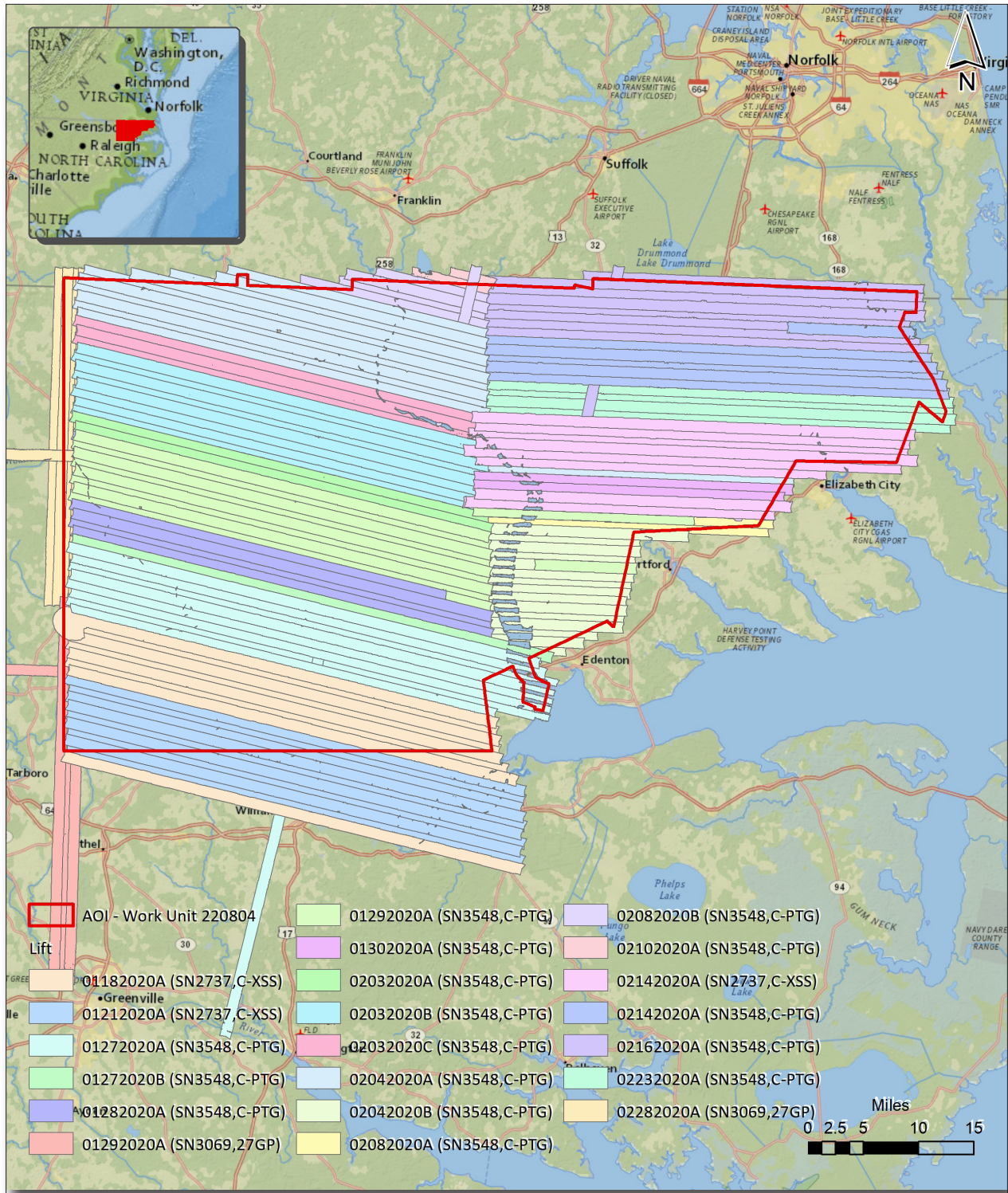


Figure 6. Lidar Coverage

## Appendix A

# Flight Logs



# Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial, Inc

(email log daily to flight\_log\_distribution\_list@quantumspatial.com)

Date: 01/29/2020

Lift: (A) B C D E Pg. 1 of 1

Project: HURRICANE FLORENCE Proj #: 2018143.13 Flight Mgmt File:

Aircraft: N27GP Begin Hobbs: 7944.8 End Hobbs: 7949.2 Total: 4.4 Pilot: S. SANTOS Co-Pilot: N/A Tech: G. ADAMS

Dep Apt: KRDU Dep Time (Lcl): 9:07 (Z): 14:07 Arr Apt: KRDU Arr Time (Local): 13:36 (Z): 18:36 Tot Time Aloft: 4:29

CORS: (Y)/N Sta 1: NCWL Sta 2: NCNA Flyovers: (Y)/N If Y, times: Sta1) 14:26 Sta2) 18:15

GPS Unit: Y/(N) Sta 1: Sta 2: Flyovers: Y/(N) If Y, times: Sta1) Sta2)

Gd Temp beg: 2 °C End: 10 °C OAT beg: 0 °C End: 4 °C Altimeter begin: 30.14 end: 30.04

Type	Serial #	Alt	Avg Terr	Max	Avg Pt	Storage
VO-15601	52223069	AGL 4500	Ht 500	Gdspd	Spacing	Name/ #
FOV	Scan Freq	MpIA Y/N	Pulses In Air	Power	PPSM	Beg. GB
58	135.33		700	100%		End GB
						Tot GB

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP# sats	GPS Altitude	Crab	Turb (0..+)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc
170	005	14:36	14:52	109	30	4600	12	0	CLEAR (CLR)
171	193	14:54	15:09	110	29	4600	-9	0	CLR
172	005	15:11	15:28	107	28	4500	13	0	CLR
173	193	15:30	15:45	115	27	4500	-8	0	CLR
174	005	15:47	16:04	107	27	4500	12	0	CLR
175	192	16:06	16:21	116	25	4600	-9	0	CLR
176	005	16:23	16:41	105	26	4500	10	0	CLR
177	193	16:43	16:58	118	26	4600	-8	0	LIGHT HAZE
178	005	17:01	17:18	110	26	4600	10	0	CLOUDS POPPING - NO FACTOR
179	193	17:20	17:35	116	25	4600	-8	0	HAZY
180	005	17:37	17:54	106	27	4500	10	+	SLIGHT DESCENT TO AVOID CLOUD
181	265	17:58	18:03	97	26	4500		+	CROSS LINE - STEADY TRACK ERROR - MOUNT OK.

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** XSS\_20\_018\_A  
**Date** 18-Jan-20  
**Julian Day** 18  
**Aircraft** C-XSS  
**Sensor** VQ 1560i SN2737 GSM4000  
**Pilot(s)** Matt Lucinski  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:23	17:40	4.9	4.28

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R3_NCQL1_1400m_130kn_1000khz	Test Shot	1442.034	126.6839405	2020-01-18 13:28:05	1/18/2020 13:28	
R3_NCQL1_1400m_130kn_1000khz	76	1421.772	125.9550005	2020-01-18 13:31:02	1/18/2020 13:48	
R3_NCQL1_1400m_130kn_1000khz	68	1417.718	101.2040858	2020-01-18 14:00:14	1/18/2020 14:20	
R3_NCQL1_1400m_130kn_1000khz	67	1427.685	126.5731416	2020-01-18 14:23:37	1/18/2020 14:41	Potential Cloud at end of line
R3_NCQL1_1400m_130kn_1000khz	57	1424.555	102.9729802	2020-01-18 14:48:22	1/18/2020 15:09	
R3_NCQL1_1400m_130kn_1000khz	56	1415.714	129.3353382	2020-01-18 15:11:35	1/18/2020 15:27	
R3_NCQL1_1400m_130kn_1000khz	55	1422.366	96.9587392	2020-01-18 15:31:07	1/18/2020 15:51	
R3_NCQL1_1400m_130kn_1000khz	54	1412.387	126.0152595	2020-01-18 15:54:23	1/18/2020 16:10	
R3_NCQL1_1400m_130kn_1000khz	53	1422.544	94.19459872	2020-01-18 16:13:13	1/18/2020 16:34	
R3_NCQL1_1400m_130kn_1000khz	52	1413.182	125.875303	2020-01-18 16:36:49	1/18/2020 16:52	
R3_NCQL1_1400m_130kn_1000khz	51	1421.001	157.025339	2020-01-18 16:55:37	1/18/2020 17:18	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** XSS\_20\_021\_A  
**Date** 21-Jan-20  
**Julian Day** 21  
**Aircraft** C-XSS  
**Sensor** VQ 1560i SN2737 GSM4000  
**Pilot(s)** Matt Lucinski  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	<b>Time</b>		
<b>Up (UTC)</b>	<b>Down (UTC)</b>	<b>Hobbs (Hours)</b>	<b>Air (Hours)</b>
13:06	17:04	4.2	3.97

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL1_1400m_130kn_1000khz	Test Shot	1397.747	105.4552638	2020-01-21 13:15:18	1/21/2020 13:15	
R4_NCQL1_1400m_130kn_1000khz	69	1419.524	122.3316827	2020-01-21 13:21:18	1/21/2020 13:40	
R4_NCQL1_1400m_130kn_1000khz	66	1422.305	131.4094155	2020-01-21 13:43:10	1/21/2020 14:00	
R4_NCQL1_1400m_130kn_1000khz	65	1417.118	120.6580365	2020-01-21 14:03:47	1/21/2020 14:22	
R4_NCQL1_1400m_130kn_1000khz	64	1415.112	128.4644979	2020-01-21 14:25:51	1/21/2020 14:43	
R4_NCQL1_1400m_130kn_1000khz	63	1417.009	120.0476707	2020-01-21 14:46:50	1/21/2020 15:05	
R4_NCQL1_1400m_130kn_1000khz	62	1424.114	133.833384	2020-01-21 15:08:22	1/21/2020 15:25	
R4_NCQL1_1400m_130kn_1000khz	58	1423.581	116.2688458	2020-01-21 15:27:34	1/21/2020 15:47	
R4_NCQL1_1400m_130kn_1000khz	59	1414.42	134.2260397	2020-01-21 15:50:19	1/21/2020 16:07	
R4_NCQL1_1400m_130kn_1000khz	60	1423.882	115.852864	2020-01-21 16:10:43	1/21/2020 16:29	
R4_NCQL1_1400m_130kn_1000khz	61	1420.512	131.5649227	2020-01-21 16:32:49	1/21/2020 16:50	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_027\_B  
**Date** 27-Jan-20  
**Julian Day** 27  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	<b>Time</b>		
<b>Up (UTC)</b>	<b>Down (UTC)</b>	<b>Hobbs (Hours)</b>	<b>Air (Hours)</b>
18:53	20:46	2.3	1.88

<b>Plan ID</b>	<b>Run</b>	<b>Lines</b>				<b>Note</b>
		<b>Altitude (m)</b>	<b>Speed (knots)</b>	<b>Start</b>	<b>Stop</b>	
R4_NCQL1_1400m_130kn_1000khz	Test Shot	723.943	99.61402464	2020-01-2	1/27/2020 18:59	
R4_NCQL1_1400m_130kn_1000khz	42	1421.028	102.8524621	2020-01-2	1/27/2020 19:32	Potential Cloud
R4_NCQL1_1400m_130kn_1000khz	41	1431.23	130.1692456	2020-01-2	1/27/2020 19:36	Aborted; cloud
R4_NCQL1_1400m_130kn_1000khz	41	1447.374	127.7608278	2020-01-2	1/27/2020 19:36	Aborted; cloud
R4_NCQL3_1400m_130kn_1000khz	19	1414.438	140.3394165	2020-01-2	1/27/2020 20:18	



**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_029\_A  
**Date** 29-Jan-20  
**Julian Day** 29  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	Time		
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:05	17:11	4.7	4.1

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL1_1400m_130kn_1000khz	Test Shot	1426.469	101.6725512		2020-01-29 13:14:04	1/29/2020 13:14	
R4_NCQL1_1400m_130kn_1000khz	38	1421.178	111.8019014		2020-01-29 13:17:35	1/29/2020 13:35	
R4_NCQL1_1400m_130kn_1000khz	37	1418.953	135.3690176		2020-01-29 13:39:54	1/29/2020 13:55	
R4_NCQL1_1400m_130kn_1000khz	36	1421.427	110.458708		2020-01-29 14:00:09	1/29/2020 14:18	
R4_NCQL1_1400m_130kn_1000khz	35	1421.054	134.5292787		2020-01-29 14:23:35	1/29/2020 14:38	
R4_NCQL1_1400m_130kn_1000khz	34	1429.764	106.9986728		2020-01-29 14:43:15	1/29/2020 15:02	
R4_NCQL1_1400m_130kn_1000khz	33	1416.351	132.9605998		2020-01-29 15:06:17	1/29/2020 15:21	
R4_NCQL1_1400m_130kn_1000khz	32	1428.076	106.267789		2020-01-29 15:26:17	1/29/2020 15:45	
R4_NCQL1_1400m_130kn_1000khz	31	1414.084	134.1891067		2020-01-29 15:50:48	1/29/2020 16:05	
R4_NCQL1_1400m_130kn_1000khz	30	1432.839	104.2656338		2020-01-29 16:10:19	1/29/2020 16:29	Potential cloud
R4_NCQL2_1400m_130kn_1000khz	29	1417.738	135.6022784		2020-01-29 16:44:36	1/29/2020 16:52	Aborted; cloud
R4_NCQL2_1400m_130kn_1000khz	35	1414.08	105.9178978		2020-01-29 16:57:03	1/29/2020 17:01	Aborted; cloud

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_030\_A  
**Date** 30-Jan-20  
**Julian Day** 30  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

		Time	
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:00	14:15	1.25	0.75

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL2_1400m_130kn_1000khz	Test Shot	1365.316	110.5870014		2020-01-30 13:06:35	1/30/2020 13:06	
R4_NCQL2_1400m_130kn_1000khz	26	1412.18	117.6178707		2020-01-30 13:26:05	1/30/2020 13:38	
R4_NCQL2_1400m_130kn_1000khz	25	1415.227	132.7584405		2020-01-30 13:43:36	1/30/2020 13:54	Potential cloud

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_034\_A  
**Date** 3-Feb-20  
**Julian Day** 34  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

		Time		
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)	
13:00	14:15	1.25	1.09	

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL1_1400m_130kn_1000khz	Test Shot	1282.552	114.7798643	2020-02-03 13:06:56	2/3/2020 13:07	Test Good
R4_NCQL1_1400m_130kn_1000khz	29	1427.083	102.5803245	2020-02-03 13:11:36	2/3/2020 13:31	Line likely lost due to internal INS-GPS Fatal Error.
R4_NCQL1_1400m_130kn_1000khz	28	1432.206	131.7359806	2020-02-03 13:36:22	2/3/2020 13:51	Line likely lost due to internal INS-GPS Fatal Error.

\*\* Mission is invalid, reflies in PTG\_20\_034\_B

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_034\_B  
**Date** 3-Feb-20  
**Julian Day** 34  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)	
15:30	20:00	4.5	4.2	

Plan ID	Run	Lines			Stop	Note
		Altitude (m)	Speed (knots)	Start		
R4_NCQL1_1400m_130kn_1000khz	Test Shot	657.812	101.6589443	2020-02-03 15:29:44	2/3/2020 15:29	Test Good
R4_NCQL1_1400m_130kn_1000khz	29	1418.292	106.3299918	2020-02-03 15:40:18	2/3/2020 15:59	Refly / 110KN
R4_NCQL1_1400m_130kn_1000khz	28	1422.58	130.2236731	2020-02-03 16:03:02	2/3/2020 16:18	Refly
R4_NCQL1_1400m_130kn_1000khz	27	1431.476	89.1930984	2020-02-03 16:22:31	2/3/2020 16:33	ABORTED DUE TO FLIGHT TRAFFIC. Had to increase altitude ~300ft
R4_NCQL1_1400m_130kn_1000khz	27	1420.304	134.0841394	2020-02-03 16:48:08	2/3/2020 17:03	
R4_NCQL1_1400m_130kn_1000khz	26	1431.108	99.19026752	2020-02-03 17:07:17	2/3/2020 17:27	110KN
R4_NCQL1_1400m_130kn_1000khz	25	1419.401	131.3685949	2020-02-03 17:32:22	2/3/2020 17:47	
R4_NCQL1_1400m_130kn_1000khz	24	1422.642	104.8371227	2020-02-03 17:52:35	2/3/2020 18:12	110KN
R4_NCQL1_1400m_130kn_1000khz	23	1422.851	133.6778768	2020-02-03 18:17:25	2/3/2020 18:32	
R4_NCQL1_1400m_130kn_1000khz	22	1429.731	101.5559208	2020-02-03 18:38:09	2/3/2020 18:57	110KN
R4_NCQL1_1400m_130kn_1000khz	21	1425.109	134.6536845	2020-02-03 19:02:27	2/3/2020 19:17	
R4_NCQL1_1400m_130kn_1000khz	20	1422.666	103.02352	2020-02-03 19:22:35	2/3/2020 19:42	110KN

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_034\_C  
**Date** 3-Feb-20  
**Julian Day** 34  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
20:45	22:15	1.5	1.3

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL1_1400m_130kn_1000khz	Test Shot	1083.693	128.6899834	2020-02-03 20:51:54	2/3/2020 20:52	
R4_NCQL1_1400m_130kn_1000khz	19	1426.63	132.0644896	2020-02-03 20:57:39	2/3/2020 21:12	
R4_NCQL1_1400m_130kn_1000khz	18	1419.541	97.03454896	2020-02-03 21:17:38	2/3/2020 21:37	
R4_NCQL1_1400m_130kn_1000khz	17	1421.768	125.9919334	2020-02-03 21:42:10	2/3/2020 21:57	

**Project** 2019-1841-4400-USGS QL1 NC-LIDAR  
**Mission ID** PTG\_20\_035\_A  
**Date** 4-Feb-20  
**Julian Day** 35  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	<b>Time</b>		
<b>Up (UTC)</b>	<b>Down (UTC)</b>	<b>Hobbs (Hours)</b>	<b>Air (Hours)</b>
12:45	17:15	4.5	4.3

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL1_1400m_130kn_1000khz	Test Shot	1061.896	97.65657776	2020-02-04 12:58:27	2/4/2020 12:58	Test Good
R4_NCQL1_1400m_130kn_1000khz	16	1419.34	99.45851744	2020-02-04 13:08:16	2/4/2020 13:28	110KN
R4_NCQL1_1400m_130kn_1000khz	15	1419.786	132.2763682	2020-02-04 13:32:52	2/4/2020 13:48	
R4_NCQL1_1400m_130kn_1000khz	14	1418.019	103.9254618	2020-02-04 13:53:38	2/4/2020 14:12	110KN
R4_NCQL1_1400m_130kn_1000khz	13	1428.849	133.2482882	2020-02-04 14:17:18	2/4/2020 14:32	
R4_NCQL1_1400m_130kn_1000khz	12	1420.922	100.0358379	2020-02-04 14:37:44	2/4/2020 14:56	slight rain at approximately 14.0 NM left of line westbound. Rain continued for approx. 20 seconds. 110 KN
R4_NCQL1_1400m_130kn_1000khz	11	1414.317	129.4733509	2020-02-04 15:01:31	2/4/2020 15:16	
R4_NCQL1_1400m_130kn_1000khz	10	1418.64	97.75376976	2020-02-04 15:21:27	2/4/2020 15:38	110KN
R4_NCQL1_1400m_130kn_1000khz	9	1420.128	131.1431094	2020-02-04 15:42:34	2/4/2020 15:54	
R4_NCQL1_1400m_130kn_1000khz	8	1423.828	98.74512816	2020-02-04 15:58:38	2/4/2020 16:11	slight rain at approximately 0.6 NM left of line westbound. Rain continued for rest of line (approx 20 seconds). 110KN
R4_NCQL1_1400m_130kn_1000khz	7	1418.599	136.5100517	2020-02-04 16:15:51	2/4/2020 16:25	Continued to encounter minor rain (few occasional drops) throughout line 7. Continued to next priority area to avoid rain.
R4_NCQL2_1400m_130kn_1000khz	24	1420.74	131.0381421	2020-02-04 16:33:07	2/4/2020 16:44	
R4_NCQL2_1400m_130kn_1000khz	25	1410.09	103.703864	2020-02-04 16:49:39	2/4/2020 17:03	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_035\_B  
**Date** 4-Feb-20  
**Julian Day** 35  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
18:45	22:15	3.5	3.3

Plan ID	Run	Lines			Stop	Note
		Altitude (m)	Speed (knots)	Start		
R4_NCQL2_1400m_130kn_1000khz	Test Shot	1407.695	100.9649934	2020-02-04 19:02:08	2/4/2020 19:02	Test Good
R4_NCQL2_1400m_130kn_1000khz	32	1410.463	100.9047344	2020-02-04 19:04:38	2/4/2020 19:12	110KN
R4_NCQL2_1400m_130kn_1000khz	31	1414.82	135.3903998	2020-02-04 19:17:37	2/4/2020 19:25	
R4_NCQL2_1400m_130kn_1000khz	33	1411.166	96.03152752	2020-02-04 19:29:43	2/4/2020 19:37	110KN
R4_NCQL2_1400m_130kn_1000khz	34	1410.352	133.6253931	2020-02-04 19:41:59	2/4/2020 19:47	
R4_NCQL2_1400m_130kn_1000khz	35	1411.221	102.2770854	2020-02-04 19:52:59	2/4/2020 20:00	Faced "SFP is broken error." Contacted ops regarding the error.
R4_NCQL2_1400m_130kn_1000khz	36	1415.637	101.4548411	2020-02-04 20:15:05	2/4/2020 20:22	110KN
R4_NCQL2_1400m_130kn_1000khz	37	1412.277	134.0024981	2020-02-04 20:26:12	2/4/2020 20:31	
R4_NCQL2_1400m_130kn_1000khz	38	1411.912	98.2902696	2020-02-04 20:38:12	2/4/2020 20:45	110KN
R4_NCQL2_1400m_130kn_1000khz	39	1415.339	135.4234451	2020-02-04 20:49:21	2/4/2020 20:54	
R4_NCQL2_1400m_130kn_1000khz	40	1409.92	95.08487744	2020-02-04 21:00:32	2/4/2020 21:07	110KN
R4_NCQL2_1400m_130kn_1000khz	41	1408.947	134.016105	2020-02-04 21:12:36	2/4/2020 21:17	
R4_NCQL2_1400m_130kn_1000khz	42	1412.453	96.2978336	2020-02-04 21:23:22	2/4/2020 21:30	
R4_NCQL2_1400m_130kn_1000khz	43	1410.321	133.1277701	2020-02-04 21:34:33	2/4/2020 21:38	
R4_NCQL2_1400m_130kn_1000khz	44	1405.314	95.73023232	2020-02-04 21:44:32	2/4/2020 21:49	
R4_NCQL2_1400m_130kn_1000khz	45	1406.387	128.6316682	2020-02-04 21:54:33	2/4/2020 21:57	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_039\_A  
**Date** 8-Feb-20  
**Julian Day** 35  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	Time		
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:02	17:24	4.9	4.37

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL3_1400m_130kn_1000khz	Test Shot	1415.004	118.5800715		2020-02-08 13:12:07	2/8/2020 13:12	
R4_NCQL3_1400m_130kn_1000khz	30	1402.814	130.9215117		2020-02-08 13:20:49	2/8/2020 13:38	
R4_NCQL3_1400m_130kn_1000khz	31	1403.641	112.5561114		2020-02-08 13:43:30	2/8/2020 14:04	
R4_NCQL3_1400m_130kn_1000khz	32	1396.091	133.8605978		2020-02-08 14:08:43	2/8/2020 14:26	
R4_NCQL3_1400m_130kn_1000khz	33	1403.01	108.3457539		2020-02-08 14:31:01	2/8/2020 14:51	
R4_NCQL3_1400m_130kn_1000khz	34	1402.04	132.8925654		2020-02-08 14:55:33	2/8/2020 15:12	
R4_NCQL3_1400m_130kn_1000khz	35	1406.22	108.9930526		2020-02-08 15:16:53	2/8/2020 15:37	
R4_NCQL3_1400m_130kn_1000khz	36	1400.91	135.291264		2020-02-08 15:44:16	2/8/2020 15:54	
R2_NCQL-SUPP_1400m_130kn_1000k	1	1415.276	113.3764118		2020-02-08 16:18:36	2/8/2020 16:20	
R2_NCQL-SUPP_1400m_130kn_1000k	2	1402.181	129.7221624		2020-02-08 16:27:18	2/8/2020 16:28	
R4_NCQL2_1400m_130kn_1000khz	30	1411.984	132.0780965		2020-02-08 16:44:03	2/8/2020 16:54	
R4_NCQL2_1400m_130kn_1000khz	29	1420.608	114.3327811		2020-02-08 16:58:51	2/8/2020 17:11	



**Project** 2019-1841-4400-USGS QL1 NC-LIDAR  
**Mission ID** PTG\_20\_039\_B  
**Date** 8-Feb-20  
**Julian Day** 35  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Raynon Rozniak  
**Operator** Christian Ouellet  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	<b>Time</b>		
<b>Up (UTC)</b>	<b>Down (UTC)</b>	<b>Hobbs (Hours)</b>	<b>Air (Hours)</b>
18:31	20:42	2.5	2.18

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL3_1400m_130kn_1000khz	Test Shot 1	1349.35	125.5740078		2020-02-08 18:40:57	2/8/2020 18:41	
R4_NCQL3_1400m_130kn_1000khz	Test Shot 2	1367.616	125.6226038		2020-02-08 18:41:11	2/8/2020 18:41	
R4_NCQL3_1400m_130kn_1000khz	51	1411.044	126.2213066		2020-02-08 18:59:30	2/8/2020 19:00	LINE ABORTED DUE TO AREA OF INTEREST BEING RESTRICTED MID LINE; unusable
R4_NCQL1_1400m_130kn_1000khz	94	1425.212	137.5927706		2020-02-08 19:28:41	2/8/2020 19:44	
R4_NCQL1_1400m_130kn_1000khz	6	1418.598	107.7392758		2020-02-08 19:49:33	2/8/2020 19:57	
R4_NCQL1_1400m_130kn_1000khz	5	1411.569	138.0631798		2020-02-08 20:00:58	2/8/2020 20:06	
R4_NCQL1_1400m_130kn_1000khz	4	1416.669	110.5092478		2020-02-08 20:10:44	2/8/2020 20:16	
R4_NCQL1_1400m_130kn_1000khz	3	1412.334	132.3832794		2020-02-08 20:19:39	2/8/2020 20:23	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_041\_A  
**Date** 10-Feb-20  
**Julian Day** 41  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Paul Pop  
**Operator** KelliAnn Hemsing  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
14:28	14:16	2.6	1.8

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL1_1400m_130kn_1000khz	Test	1190.985	72.78320112		2020-02-10 14:59:09	2/10/2020 14:59	
R4_NCQL1_1400m_130kn_1000khz		2 1440.238	140.2325053		2020-02-10 15:41:32	2/10/2020 15:44	
R4_NCQL1_1400m_130kn_1000khz		1 1408.535	139.701837		2020-02-10 15:52:34	2/10/2020 15:54	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_045\_A  
**Date** 14-Feb-20  
**Julian Day** 45  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Paul Pop  
**Operator** KelliAnn Hemsing  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

		Time	
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:15	17:00	3.75	3.67

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
	Test	1418.029	108.4876542	2020-02-14 13:28:08	2/14/2020 13:28	
R4_NCQL1_1400m_130kn_1000khz	30	1413	131.2675152	2020-02-14 13:56:46	2/14/2020 14:11	
R4_NCQL2_1400m_130kn_1000khz	13	1414.249	128.233181	2020-02-14 14:24:09	2/14/2020 14:41	
R4_NCQL2_1400m_130kn_1000khz	12	1414.432	113.2228485	2020-02-14 14:52:55	2/14/2020 15:12	Configuration to 110kn
R4_NCQL2_1400m_130kn_1000khz	11	1409.557	130.1536949	2020-02-14 15:16:54	2/14/2020 15:34	
R4_NCQL2_1400m_130kn_1000khz	10	1407.613	115.1142048	2020-02-14 15:37:10	2/14/2020 15:56	
R4_NCQL2_1400m_130kn_1000khz	9	1406.346	128.8610413	2020-02-14 16:00:47	2/14/2020 16:17	Possible cloud
R4_NCQL2_1400m_130kn_1000khz	6	1410.701	117.8958398	2020-02-14 16:25:26	2/14/2020 16:30	Aborted

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** XSS\_20\_45\_A  
**Date** 14-Feb-20  
**Julian Day** 45  
**Aircraft** C-XSS  
**Sensor** VQ 1560i SN2737 GSM4000  
**Pilot(s)** Blake Carvey  
**Operator** Cory Griffiths  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)	
13:20	17:20	5.1	4	

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
	Test	742.827	94.2859592		2020-02-16 13:11:31	2/16/2020 13:11	
	Test	1396.575	114.1500602		2020-02-16 13:41:45	2/16/2020 13:59	
R4_NCQL2_1400m_130kn_1000khz	28	1407.85	118.4226205		2020-02-16 14:20:08	2/16/2020 14:37	Aborted, flew off line
R4_NCQL2_1400m_130kn_1000khz	27	1420.273	128.7113656		2020-02-16 14:42:53	2/16/2020 14:55	
R4_NCQL2_1400m_130kn_1000khz	28	1430.894	116.5098819		2020-02-16 14:58:12	2/16/2020 15:16	
R4_NCQL2_1400m_130kn_1000khz	23	1413.186	129.0398746		2020-02-16 15:19:42	2/16/2020 15:36	
R4_NCQL2_1400m_130kn_1000khz	22	1410.966	111.8854866		2020-02-16 15:40:07	2/16/2020 15:59	
R4_NCQL2_1400m_130kn_1000khz	21	1414.807	128.9815594		2020-02-16 16:02:27	2/16/2020 16:19	Potential Clouds
R4_NCQL2_1400m_130kn_1000khz	20	1408.046	111.8135645		2020-02-16 16:22:30	2/16/2020 16:41	
R4_NCQL2_1400m_130kn_1000khz	19	1409.273	132.6709677		2020-02-16 16:44:20	2/16/2020 17:01	
R4_NCQL2_1400m_130kn_1000khz	18	1420.386	116.1619346		2020-02-16 17:04:12	2/16/2020 17:23	Potential Clouds

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_047\_A  
**Date** 16-Feb-20  
**Julian Day** 47  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Paul Pop  
**Operator** KelliAnn Hemsing  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	<b>Time</b>			
<b>Up (UTC)</b>	<b>Down (UTC)</b>	<b>Hobbs (Hours)</b>	<b>Air (Hours)</b>	
13:07	17:45	5.1	4.63	

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
	Test	1248.465	96.19675392		2020-02-14 13:32:01	2/14/2020 13:32	
R4_NCQL3_1400m_130kn_1000khz	51	1412.15	98.78400496		2020-02-14 13:33:08	2/14/2020 13:33	
R4_NCQL2_1400m_130kn_1000khz	46	1419.994	129.1876064		2020-02-14 13:50:05	2/14/2020 14:01	Speed fluctuation due to winds
R4_NCQL2_1400m_130kn_1000khz	1	1415.048	123.1694778		2020-02-14 14:09:18	2/14/2020 14:21	Speed fluctuation due to winds
R4_NCQL2_1400m_130kn_1000khz	2	1414.883	123.4027386		2020-02-14 14:26:47	2/14/2020 14:38	
R4_NCQL2_1400m_130kn_1000khz	3	1406.809	114.8187411		2020-02-14 14:58:42	2/14/2020 15:13	
R4_NCQL2_1400m_130kn_1000khz	4	1414.939	128.876592		2020-02-14 15:18:02	2/14/2020 15:34	
R4_NCQL2_1400m_130kn_1000khz	5	1419.482	112.1517926		2020-02-14 15:38:02	2/14/2020 15:56	Possible aircraft 400m below in range of collection
R4_NCQL2_1400m_130kn_1000khz	6	1416.713	130.0953797		2020-02-14 16:00:46	2/14/2020 16:16	
R4_NCQL2_1400m_130kn_1000khz	7	1414.867	114.1170149		2020-02-14 16:21:26	2/14/2020 16:39	
R4_NCQL2_1400m_130kn_1000khz	8	1418.201	130.420001		2020-02-14 16:43:35	2/14/2020 16:59	

**Project** 2019-1841-4400-USGS QL1 NC-LiDAR  
**Mission ID** PTG\_20\_054\_A  
**Date** 23-Feb-20  
**Julian Day** 54  
**Aircraft** C-PTG  
**Sensor** VQ 1560i SN3548 GSM3000  
**Pilot(s)** Paul Pop  
**Operator** KelliAnn Hemsing  
**Planned AGL** 1400 m  
**Planned Speed** 130 knots

	Time		
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
16:30	19:49	3.8	3.32

Plan ID	Lines					
	Run	Altitude (m)	Speed (knots)	Start	Stop	Note
	Test	857.065	99.8939376	2020-02-23 16:35:47	2/23/2020 16:35	
	Test	1415.755	129.2206517	2020-02-23 16:55:08	2/23/2020 16:57	
R3_NCQL-SUPP_1400m_130kn_1000	3	1044.274	100.5237418	2020-02-23 17:27:34	2/23/2020 17:27	Potential snow along tree line; reflly of flagged issue
R3_NCQL-SUPP_1400m_130kn_1000	4	1408.973	129.811579	2020-02-23 17:45:37	2/23/2020 17:47	Potential snow along tree line; reflly of flagged issue
R4_NCQL2_1400m_130kn_1000khz	14	1411.727	126.6936597	2020-02-23 17:56:03	2/23/2020 18:13	Potential snow along tree line
R4_NCQL2_1400m_130kn_1000khz	15	1415.186	99.37882	2020-02-23 18:17:26	2/23/2020 18:39	Potential snow along tree line
R4_NCQL2_1400m_130kn_1000khz	16	1408.795	127.2670925	2020-02-23 18:43:57	2/23/2020 19:01	Potential snow along tree line
R4_NCQL2_1400m_130kn_1000khz	17	1418.604	101.5131563	2020-02-23 19:05:47	2/23/2020 19:27	Potential snow along tree line



# Airborne LIDAR Data Collection Log Sheet :: Quantum Spatial, Inc

(email Log daily to flight\_log\_distribution\_list@quantumspatial.com)

Date: 02/28/20

Lift: A B C D E Pg.    of   

Project: HURRICANE FLORENCE Proj #: 35230 NC Flight Mgmt File:           

Aircraft: N948IT Begin Hobbs: 2328.1 End Hobbs: 2333.7 Total: S.6 Pilot: S. SANTOS Co-Pilot:            Tech: G. ADAMS

Dep Apt: KIXA Dep Time (Lcl): 8:08 (Z): 13:08 Arr Apt: KIXA Arr Time (Local): 13:21 (Z): 18:21 Tot Time Aloft: 5:13

CORS: 0/N Sta 1: NCJA Sta 2: NCJA Flyovers: 0/N If Y, times: Sta1) 13 18 Sta2) 18:10

GPS Unit: Y/N Sta 1:            Sta 2:            Flyovers: Y/N If Y, times: Sta1)            Sta2)           

Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing	End UTC	Gd Spd	PPOP/sats	GPS Altitude	Turb (0,+,+)	Line #	Storage Name/#		
													Scan Freq	Mpia Y/N	Pulses In Air
VO-15E01	52223069	4500	4600	100	120	120	13:30	116	26	4600	-10	88			
FOV	55	135.33					13:44	100	26	4600	12	87			
							14:15	118	25	4600	-10	86			
							14:32	101	26	4600	13	85			
							14:47	114	26	4600	-11	84			
							15:23	105	26	4600	11	83			
							15:18	113	26	4600	-11	82			
							15:33	118	26	4600	10	81			
							15:47	105	26	4600	-10	80			
							16:03	117	27	4600	10	79			
							16:18	104	27	4600	-11	78			
							16:33	119	29	4600	9	77			
							16:50	108	30	4600	-10	76			
							17:04	118	32	4600	8	75			
							17:20	109	29	4600	-9	74			
							17:34	116	30	4600	10	73			
							17:50	100	31	4600	-9	72			
							17:54	114	31	4600	11	71			

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PPOP/sats	GPS Altitude	Crab	Turb (0,+,+)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc.		
88	200	13:30	13:43	116	26	4600	-10	0	0VC (ALL)		
87	360	13:44	14:00	100	26	4600	12	0			
86	200	14:01	14:15	118	25	4600	-10	0			
85	360	14:16	14:32	101	26	4600	13	0			
84	200	14:33	14:47	114	26	4600	-11	0			
83	360	14:48	15:23	105	26	4600	11	0			
82	200	15:03	15:18	113	26	4600	-11	0			
81	360	15:19	15:33	118	26	4600	10	0			
80	200	15:34	15:47	105	26	4600	-10	+	<del>          </del> TURBULENCE STARTING		
79	360	15:49	16:03	117	27	4600	10	+			
78	200	16:04	16:18	104	27	4600	-11	+			
77	360	16:19	16:33	119	29	4600	9	+			
76	200	16:25	16:50	108	30	4600	-10	+			
75	360	16:50	17:04	118	32	4600	8	+			
74	200	17:05	17:20	109	29	4600	-9	+			
73	360	17:20	17:34	116	30	4600	10	+			
72	200	17:35	17:50	100	31	4600	-9	+			
71	360	17:51	17:54	114	31	4600	11	+	ABORT		

Total Proj Lines: 89 Lines Flown: 18 Lines Remain: 4 Online Time: 4:14 Mob Time: 0:37 Notes:

89	290	17:58	18:04	117	29	4600	-3	+	CROSS LINE		
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