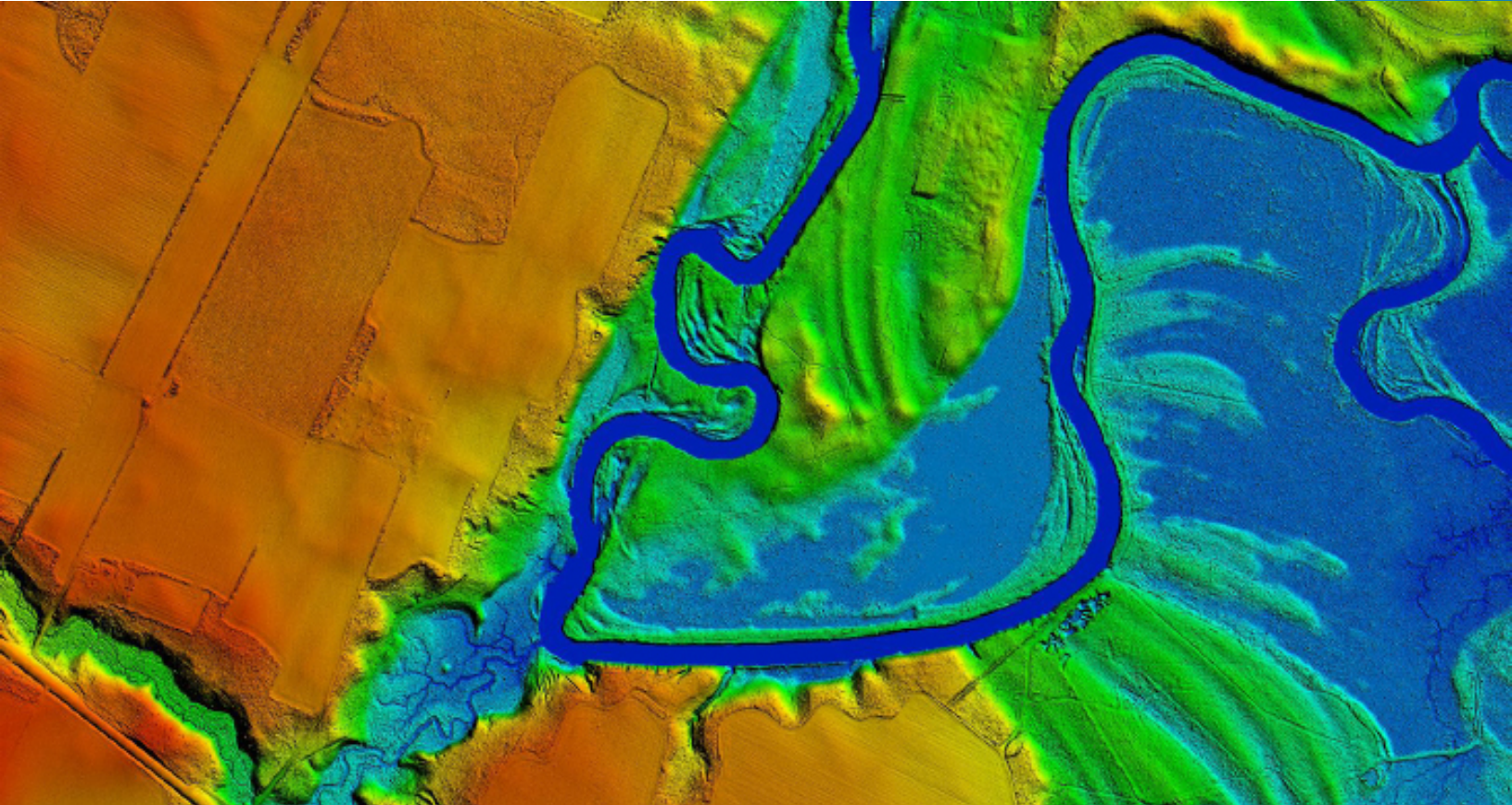


N|V|5 GEOSPATIAL

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NC_HURRICANEFLORENCE_2020_D20 LIDAR PROJECT REPORT

Work Package ID: 186591

Work Unit ID: 225793

2020

Submitted: February 25, 2022

Prepared for:



Prepared by:



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Appendix A: Flight Logs

1. Summary / Scope

1.1. Summary

This report contains a summary of the NC_HurricaneFlorence_2020_D20, Work Unit 225793 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on December 10, 2019. The work unit AOI yielded an area covering approximately 2,120 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 ²	1400 m	58.5°	20%	≤ 10 cm

1.3. Coverage

The work unit boundary covers approximately 2,120 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 December 15, 2019 to February 28, 2020 in 22 total lifts. See “Section: 2.4. Time Period” for more details.

1.5. Issues

There are no issues to report.

NC_HurricaneFlorence_2020_D20 Work Unit 225793
Projected Coordinate System: UTM Zone 18N
Horizontal Datum: NAD1983 (2011)
Vertical Datum: NAVD88 (GEOID 18)
Units: Meters

Lidar Point Cloud	Classified Point Cloud in .LAS 1.4 format
Rasters	<ul style="list-style-type: none"> • 0.5 meter Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format • 0.5 meter Intensity images in GeoTIFF format • 0.5 meter Swath Separation images in GeoTIFF format
Vectors	Shapefiles (*.shp) <ul style="list-style-type: none"> • Deliverable Swath • Lidar Tile Index Geodatabase (*.gdb) <ul style="list-style-type: none"> • Continuous Hydro-flattened Breaklines
Reports	Reports in PDF format <ul style="list-style-type: none"> • Focus on Delivery • Project Report
Metadata	XML Files (*.xml) <ul style="list-style-type: none"> • Breaklines • Classified Point Cloud • DEM • Intensity Imagery

NC_HurricaneFlorence_2020_D20 Work Unit 225793 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

NV5 Geospatial utilized a Riegl VQ1560i lidar sensor (Figure 3), serial numbers 2737, 3069, 3070, and 4046 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.

The Riegl 1560ii system is a dual channel waveform processing airborne scanning system. It has a laser pulse repetition rate of up to 4 MHz resulting in up to 2.66 million measurements per second. The system utilizes a Multi-Pulse in the Air option (MPIA) and an integrated IMU/GNSS unit.

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 225793 Planned Flight Lines

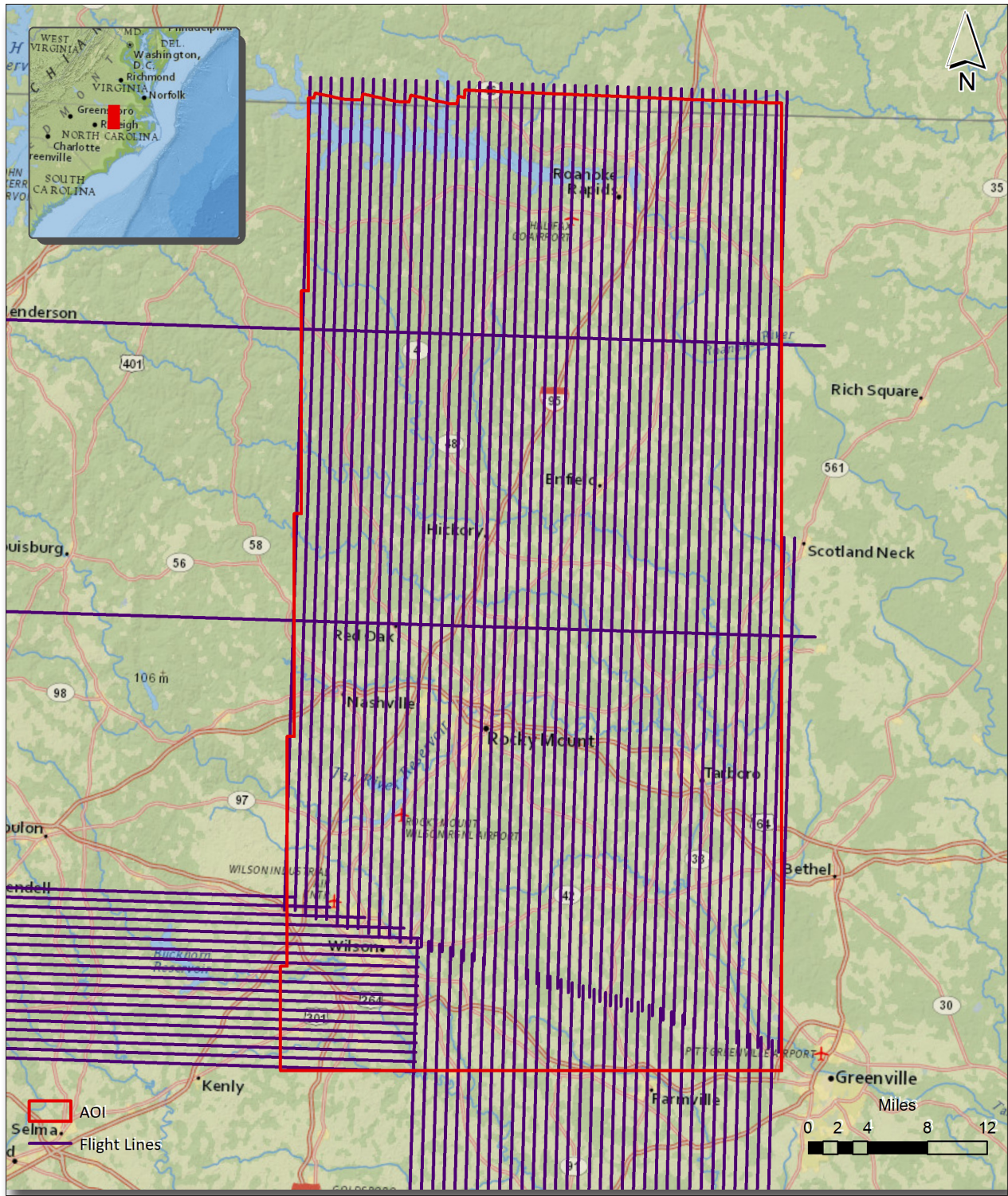


Figure 2. Planned Flight Lines

Table 2. Planned Lidar System Specifications

		Riegl VQ1560i (3069)	Riegl VQ1560i (2737)	Riegl VQ1560ii (4046)	Riegl VQ1560i (3070)
Terrain and Aircraft Scanner	Flying Height	1400 m	1400 m	1400 m	1400 m
	Recommended Ground Speed	120 kts	130 kts	160 kts	160 kts
Scanner	Field of View	58°	58.5°	58.5°	58.5°
	Scan Rate Setting Used	135.33 Hz	161 Hz	180Hz	180Hz
Laser	Laser Pulse Rate Used	700 kHz	1000 kHz	1000 kHz	1000 kHz
	Multi Pulse in Air Mode	yes	yes	yes	yes
Coverage	Full Swath Width	1552 m	1569 m	1568 m	1568 m
	Line Spacing	1241.6 m	1255.2 m	1254 m	1254 m
Point Spacing and Density	Average Point Spacing	.35 m	.35 m	.35 m	.35 m
	Average Point Density	8 pts / m ²	8 pts / m ²	8 pts / m ²	8 pts / m ²

Figure 3. Riegl VQ1560i and VQ1560ii Lidar Sensors



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-FXSS
- 2015 TEXTRON AVIATION INC 208B, Tail Number: N256DG
- Piper Navajo (twin-piston), Tail Number: N22GE

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 NV5 Geospatial's operating aircraft can be seen in Figure 4 below.

Figure 4. Some of NV5 Geospatial's Planes



2.4. Time Period

Project specific flights were conducted between December 15, 2019 and February 28, 2020. Twenty-two aircraft lifts were completed. Accomplished lifts are listed below.

- 12152019A (SN3070,N256DG)
- 12152019B (SN3070,N256DG)
- 12162019A (SN3070,N256DG)
- 12162019A (SN4046,N22GE)
- 12162019B (SN4046,N22GE)
- 01052020A (SN3069,27GP)
- 01062020A (SN3069,27GP)
- 01102020A (SN3069,27GP)
- 01172020A (SN2737,C-XSS)
- 01172020B (SN2737,C-XSS)
- 01182020A (SN2737,C-XSS)
- 01182020B (SN2737,C-XSS)
- 01192020A (SN3069,27GP)
- 01202020A (SN2737,C-XSS)
- 01212020A (SN2737,C-XSS)
- 01292020A (SN3069,27GP)
- 02162020A (SN3069,27GP)
- 02172020A (SN3069,27GP)
- 02232020A (SN3069,27GP)
- 02272020A (SN3069,27GP)
- 02282020A (SN3069,27GP)
- 02282020B (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. NV5 Geospatial'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 NV5 Geospatial'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 225793 Tile Layout

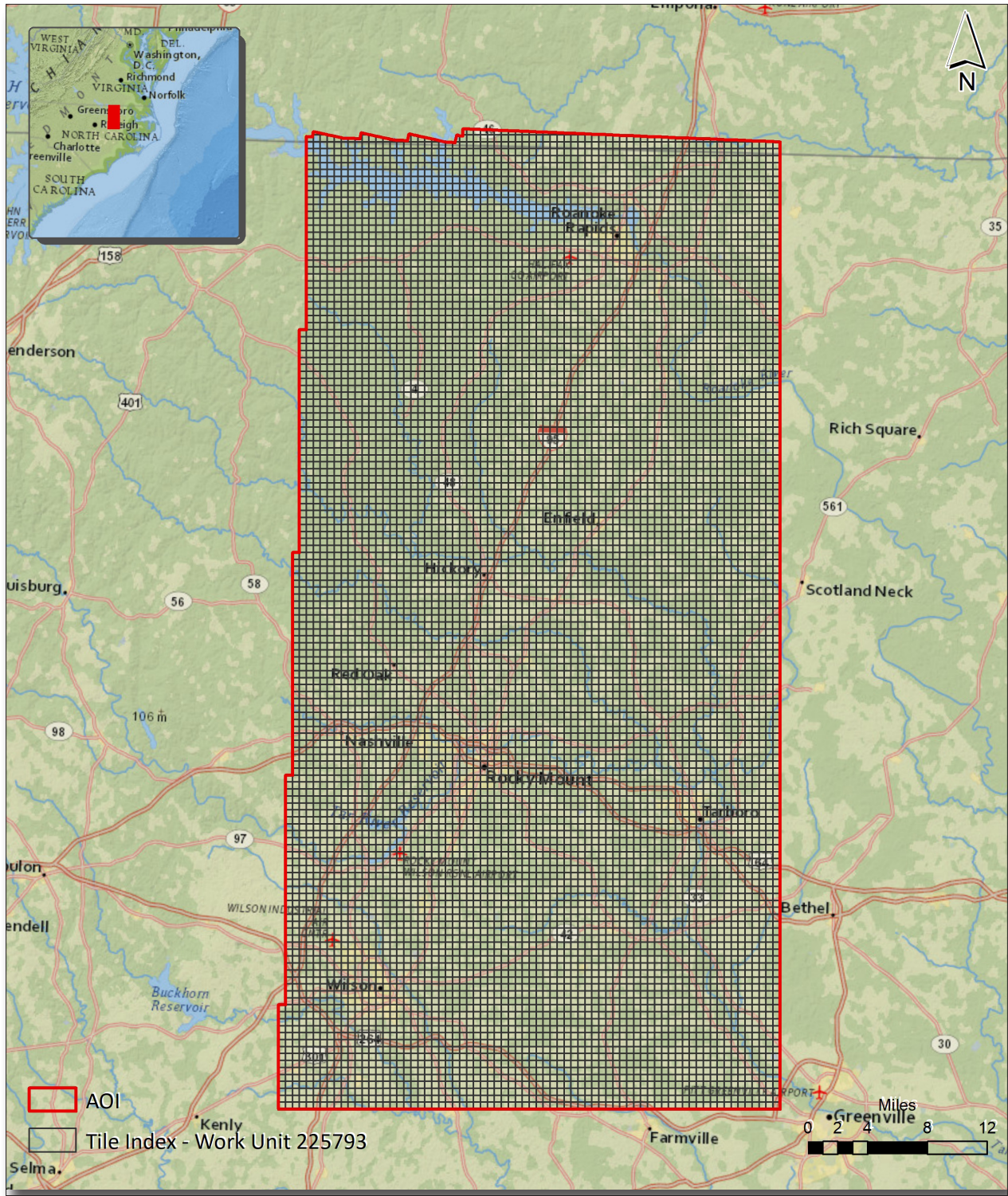


Figure 5. Lidar Tile Layout

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 225793 Lidar Coverage

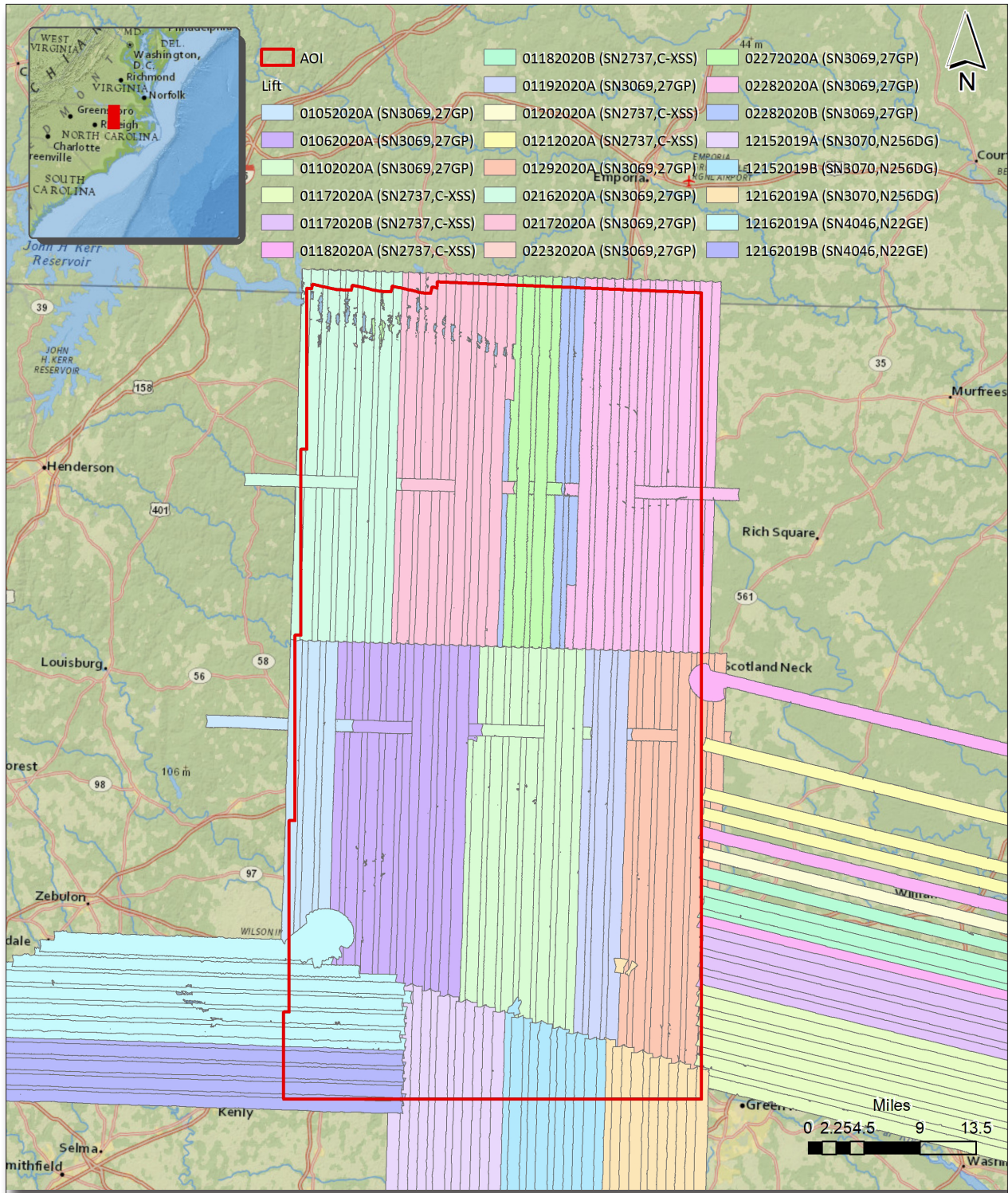


Figure 6. Lidar Coverage

Appendix A

Flight Logs



Customer QSI
Job Name NCBK04
AGL 4600
Speed 160
Density 8 ppsm
Laser Power 100%
PRR 2x1000 KHz
Scan Rate Auto

Sensor Operator Jackson Beebe
Pilot Brian Quindt
Imagery No
GSD

Date Flown	Line Number	Distance (NM)	Density QC Ok?	Need Reflight?	Error Message? If yes, add brief description
12/15/2019	1	50.71	Yes	No	
12/15/2019	2	50.71	Yes	No	
12/15/2019	3	50.54	Yes	No	
12/15/2019	4	50.33	Yes	No	
12/15/2019	5	50.11	Yes	No	
12/15/2019	6	49.90	Yes	No	
12/15/2019	7	49.68	Yes	No	
12/15/2019	8	49.46	Yes	No	
12/15/2019	9	49.25	Yes	No	
12/15/2019	10	49.03	Yes	No	
12/15/2019	11	48.82	Yes	No	
12/15/2019	12	48.60	Yes	No	
12/15/2019	13	48.38	Yes	No	
12/15/2019	14	48.17	Yes	No	
12/15/2019	15	47.95	Yes	No	
12/15/2019	16	47.74	Yes	No	
12/15/2019	17	47.52	Yes	No	

Date Flown	Line Number	Distance (NM)	Density QC OK?	Need Reflight?	Error Message? If yes, add brief description
12/15/2019	18	47.30	Yes	No	
12/15/2019	19	47.09	Yes	No	
12/15/2019	20	46.87	Yes	No	
12/15/2019	21	46.66	Yes	No	
12/15/2019	22	46.44	Yes	No	
12/15/2019	23	46.22	Yes	No	
12/16/2019	24	46.01	Yes	No	
12/16/2019	25	45.79	Yes	No	
12/16/2019	26	45.58	Yes	No	
12/16/2019	27	45.36	Yes	No	
12/16/2019	28	45.14	Yes	No	
12/16/2019	29	44.93	Yes	No	
12/16/2019	30	44.71	Yes	No	
12/16/2019	31	44.50	Yes	No	
12/16/2019	32	44.28	Yes	No	
12/16/2019	33	44.06	Yes	No	
12/16/2019	34	43.85	Yes	No	
12/16/2019	35	43.63	Yes	No	
12/16/2019	36	43.42	Yes	No	
12/16/2019	37	43.15	Yes	No	
12/16/2019	38	42.93	Yes	No	
12/16/2019	39	42.71	Yes	No	
12/16/2019	40	42.50	Yes	No	
12/16/2019	41	42.28	Yes	No	

Date Flown	Line Number	Distance (NM)	Density QC OK?	Need Reflight?	Error Message? If yes, add brief description
12/16/2019	42	42.07	Yes	No	
12/16/2019	43	41.85	Yes	No	
12/16/2019	44	41.63	Yes	No	
12/16/2019	45	41.42	Yes	No	
12/16/2019	46	41.20	Yes	No	
12/16/2019	47	40.99	Yes	No	
12/16/2019	48	40.77	Yes	No	
12/16/2019	49	40.55	Yes	No	



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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 12 16 19
Lift: A B C D E Pg. 1 of 1

Project:	NC LIDAR	Proj #:	35630	Flight Mgmt File:	20191216_NC-35630								
Aircraft:	226F	Begin Hobbs:	10185.0	End Hobbs:	10189.4 Total: 1.4								
Dep Apt:	RDU	Dep Time (Lcl):	849 (Z): 1349	Arr Apt:	RWI								
				Arr Time (Local):	111 (Z): 1811								
CORS:	Y (N)	Sta 1:		Sta 2:									
				Flyovers:	Y (N) If Y, times: Sta1) Sta2)								
GPS Unit:	Y (N)	Sta 1:		Sta 2:									
				Flyovers:	Y (N) If Y, times: Sta1) Sta2)								
Gd Temp beg:	°c	End:	°c	OAT beg:	°c								
				End:	°c								
Altimeter begin:				end:	30.19								
LIDAR	Type	1560i	Serial #	4046	Alt AGL	4593	Alt AMSL		Avg Terr Ht	Max Gdspd	Avg Pt Spacing	beg GB	Storage Name/P
	FOV	58	Scan Freq	1000	MplA	Y I N	Pulse In Air		Pulse Rate	Power	PPSM		

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP # Sats	GPS Altitude	Crab	Turb (0, -1)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc.
3001	099	1406	1407	175	0.9/27	4675	0	1	S-TURN
3002	279	1412	1415	112	0.8/29	4668	0	2	
3003	099	1419	1422	158	0.9/29	4636	0	2	
3004	279	1427	1433	115	0.9/29	4623	0	1	
3005	099	1436	1442	157	0.9/29	4626	0	1	Scanner stayed on Thru Turn
3006	279	1446	1454	119	0.9/29	4616	0	1	
2007	099	1459	1507	166	1.0/27	4347	0	0	
3008	279	1511	1525	108	0.8/30	4462	0	1	
3009	099	1528	1538	157	0.9/27	4550	0	1	
3010	279	1541	1558	112	0.9/29	4550	0	1	
3011	099	1601	1612	149	0.9/20	4541	0	0	
3012	279	1616	1633	107	0.9/29	4541	0	1	
3013	099	1636	1647	159	0.9/30	4541	0	0	
3014	279	1651	1708	112	0.9/30	4544	0	0	
3015	099	1711	1724	145	0.9/27	4544	0	0	
3016	279	1726	1745	116	0.9/25	4484	0	0	
3017	099	1748	1802	151	0.9/25	4485	0	0	S-TURN

Total Proj Lines:	Lines Flown:	17	Lines Remain:	Online Time:	4.0	Job Time:	0.7	Notes:	123.85 Wash
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Airborne LIDAR Data Collection Log Sheet :: Quantum Spatial, Inc

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 1/5/20

Lit: D B C D E

Pg 1 of 1

Project: Hurricane Florence Proj #: 18143,13 Flight Mgmt File:

Aircraft: 276P Begin Hobbs: 7887.5 End Hobbs: 7892.3 Total: 4.8 Pilot: SS Co-Pilot: — Tech: 413

Dep Apt: KRDU Dep Time (Ldt): 9:27Z Arr Apt: KRDU Air Time (Local): 2:25 (Z): 19:25 Tot Time Aloft:

CORS: BIN Sta 1: NCVT Sta 2: UCRD Flyovers: BIN IF Y, times: Sta1) 14:50 Sta2) 19:14

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

Gd Temp beg: 5 °C End: 5 °C OAT beg: 30.15 end: 30.15

Alt AMSL 4500 Avg Terr Ht 500 Max Gdspd 120 Avg Pt Spacing PPSM

Serial # 5223069 Pulses In Air 700 Power 100

Type FOV 1560, 58.52 Mpia Y / N

Mag GS 385.14 Storage Name/ID
End GS 384.57
Tot GS 247.15

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	FOOP/Sec	GPS Altitude	Crab	Turb (0-1)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc
123	189	1504	1515	118	1/29	4400	-6	0	Clear 40 knt tailwind
124	9	1519	1535	86	1/29	4700	6	0	40 knt headwind
125	189	1537	1548	118	.98/29	4800	-6	0	35 knt Tailwind
126	9	1552	1608	75	1/26	4700	6	0	36 knt headwind
127	189	1611	1622	115	1/25	4700	-6	0	26 knt Tailwind
128	9	1626	1642	81	.93/26	4700	6	0	35 knt headwind
129	189	1644	1656	115	.85/26	4800	-7	0	23 knt Tailwind
130	9	1659	1714	92	.84/27	4700	5	0	33 knt headwind
131	189	1716	1728	118	.96/25	4800	-6	0	30 knt Tailwind
132	9	1731	1746	100	.95/25	4700	5	0	32 knt headwind
133	189	1748	1800	118	1/25	4800	-4	0	35 knt #Tailwind
134	9	1803	1818	93	1/24	4600	4	0	35 knt Headwind
135	189	1820	1832	118	1/24	4700	-4	0	35 knt Tailwind
136	9	1835	1850	107	.84/25	4600	5	0	70 knt Headwind
181	279	1854	1900	105	.92/26	4700	-8	0	Cross line

Total Proj Lines: 91 Lines Flown: 14 Lines Remain: 44 Online Time: 3:56 Mob Time: 1:02 Notes:

37 25

52



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

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Date: 1/6/20

Ultr: Q B C D E

Pg 1 of 1

Project: Hurricane Florence Proj #: 18143.13 Flight Mgmt File: _____

Aircraft: 276P Begin Hobbs: _____ End Hobbs: ~~18143.13~~ Total: ~~18143.13~~ Pilot: SS Co-Pilot: _____ Tech: A03

Dep Apt: KRDU Dep Time (Lcl): 9:15 (Z): 14:15 Arr Apt: KRDU Arr Time (Local): 2:29 (Z): 19:28 Tot Time Aloft: 5:13

CORS: YN Sta 1: WCRD Sta 2: WCUA Flyovers: YN IF Y, times: Sta 1) _____ IF Y, times: Sta 2) 14:22 Sta 2) 19:03

GPS Unit: Y / N Sta 1: _____ Sta 2: _____ Flyovers: Y / N IF Y, times: Sta 1) _____ IF Y, times: Sta 2) _____

Gd Temp beg: 3 °C End: 14 °C OAT beg: _____ °C End: 8 °C Altimeter begin: 30.13 end: 30.08

Mag GB 252.52
End GB 247.15
Tot GB

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	POOF/Sec	GPS Altitude	Crab	Turb (0-1)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc		
									Alt AMSL	Avg Terr Ht	Avg Pt Spading PPSM
137	9	1436	1751	93	.85/31	4600	10	0	Clear		
138	189	1454	1506	115	.83/31	4700	-12	0			
139	9	1509	1524	95	.87/30	4600	7	0			
140	189	1526	1538	115	1/28	4600	-13	0			
141	9	1541	1557	96	.95/29	4600	8	0			
142	189	1559	1612	112	.9/28	4700	-11	0			
143	9	1614	1630	93	.95/27	4600	11	0			
144	189	1632	1645	114	.9/26	4600	-10	0			
145	9	1648	1703	98	.91/26	4600	7	0			
146	189	1705	1718	115	.96/26	4600	-9	0			
147	9	1721	1736	98	.93/25	4600	10	0			
148	189	1738	1751	116	.9/25	4600	-10	0			
149	9	1754	1810	97	1/23	4600	9	0			
150	189	1812	1825	116	.87/26	4600	-9	0			
151	9	1827	1843	97	.9/26	4600	10	0			
152	189	1846	1849	114	1.03/27	4600	-8	0			
181	280	1853	1900	99	1.1/24	4600	-5	0	Partial Cross line		

Tach Time Start: 7892.3
Stop: 7897.4
Total: 5.1

Total Proj Lines: 9/ Lines Flown: 15/15 Lines Remain: 29 Online Time: 4:24 Mob Time: 49 Notes: 21 28

Screen Shot Pos Level Arms Lidar SOCs



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

Date: 1/10/20

Page 1 of 1

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Project: hurricane Florence Proj #: 18143113 Flight Mgmt File:

Aircraft: 276P Begin Hobbs: 7905 End Hobbs: 7909.7 Total: 4.7 Pilot: SS Co-Pilot: APJ Tech: APJ

Dep Apt: KRDU Dep Time (Ldt): 9:00 (Z): 14:00 Arr Apt: KRDU Arr Time (Local): 2:05 (Z): 19:05 Tot Time Aloft: 5:05

CORS: Y/N Sta 1: NCRD Sta 2: NCUA Flyovers: Y/N If Y, times: Sta1 14:14 Sta2) 18:34

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

Gd Temp beg: 7 °C End: 9 °C OAT beg: 6 °C End: 7 °C Altimeter begin: 3057 end: 3056

Storage Name: 721.28
 Beg GB: 721.95
 End GB: 721.95
 Tot GB: 721.95

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	POOP/e-Stat	GPS Altitude	Crab	Turb (0-1)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc.		
									Alt AGL	Alt AMSL	Pulses In Air
152	9	1435	1449	116	1/26	4600	8	0	Overcast Overcast & haze		
153	189	1451	1508	86	1/29	4600	-8	0			
154	9	1510	1524	111	1/29	4600	8	0			
155	190	1526	1542	90	1/28	4600	-8	0			
156	10	1544	1557	116	1/27	4600	9	0			
157	190	1559	1616	92	1/27	4600	-7	0			
158	10	1617	1631	116	.9/27	4600	5	0			
159	190	1634	1650	100	1/25	4600	-4	0			
160	10	1652	1706	118	.9/26	4500	6	0			
161	190	1709	1725	99	1/24	4500	-6	0			
162	10	1727	1741	117	1/25	4500	8	0			
163	190	1743	1800	97	1/24	4600	-6	0			
164	10	1802	1816	117	1/24	4600	7	0			
181	280	1821	1821	102	1/24	4600	11	0			

Cross Line

Total Proj Lines: 91 Lines Flown: 13 Lines Remain: 16 Online Time: 3:52 Mob Time: 1:13 Notes: 35 78

1:51



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

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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)** Arr Apt: **KRDU** Arr Time (Local): **13:36 (Z)** 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	Pulse Rate	Power	PPSM	Beg. GB
58	135.33	Y/N	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_017_A
Date 17-Jan-20
Julian Day 17
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)
13:29	18:02	5.1	4.55

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R3_NCQL1_1400m_130kn_1000khz	Test Shot	1455.396	116.521545	2020-01-17 13:41:31	1/17/2020 13:41	
R3_NCQL1_1400m_130kn_1000khz	93	1413.485	118.2515626	2020-01-17 13:46:46	1/17/2020 13:57	
R3_NCQL1_1400m_130kn_1000khz	92	1419.296	125.4904227	2020-01-17 14:03:00	1/17/2020 14:19	
R3_NCQL1_1400m_130kn_1000khz	91	1413.471	114.0839696	2020-01-17 14:22:30	1/17/2020 14:35	Aborted, Mount overrun
R3_NCQL1_1400m_130kn_1000khz	91	1419.191	129.325619	2020-01-17 14:45:01	1/17/2020 15:01	
R3_NCQL1_1400m_130kn_1000khz	90	1434.732	110.8980158	2020-01-17 15:05:06	1/17/2020 15:24	
R3_NCQL1_1400m_130kn_1000khz	89	1420.564	134.7742026	2020-01-17 15:26:46	1/17/2020 15:43	
R3_NCQL1_1400m_130kn_1000khz	88	1417.62	112.2412093	2020-01-17 15:46:27	1/17/2020 16:06	
R3_NCQL1_1400m_130kn_1000khz	87	1422.393	132.995589	2020-01-17 16:08:37	1/17/2020 16:25	
R3_NCQL1_1400m_130kn_1000khz	86	1414.9	117.1785629	2020-01-17 16:29:17	1/17/2020 16:49	
R3_NCQL1_1400m_130kn_1000khz	85	1417.636	129.762983	2020-01-17 16:52:31	1/17/2020 17:09	
R3_NCQL1_1400m_130kn_1000khz	84	1420.093	114.4377485	2020-01-17 17:12:55	1/17/2020 17:32	
R3_NCQL1_1400m_130kn_1000khz	83	1426.053	135.5983907	2020-01-17 17:35:06	1/17/2020 17:52	

Project 2019-1841-4400-USGS QL1 NC-LiDAR
Mission ID XSS_20_017_B
Date 17-Jan-20
Julian Day 17
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)
19:30	22:00	3	2.5

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R3_NCQL1_1400m_130kn_1000khz	Test Shot	1427.582	94.63390656	2020-01-17 19:34:34	1/17/2020 19:35	
R3_NCQL1_1400m_130kn_1000khz	82	1422.974	119.2759662	2020-01-17 19:38:02	1/17/2020 19:57	
R3_NCQL1_1400m_130kn_1000khz	81	1420.2	134.6031446	2020-01-17 20:01:01	1/17/2020 20:18	
R3_NCQL1_1400m_130kn_1000khz	80	1422.721	115.1764077	2020-01-17 20:22:23	1/17/2020 20:42	
R3_NCQL1_1400m_130kn_1000khz	79	1429.974	125.3115894	2020-01-17 20:45:13	1/17/2020 21:03	
R3_NCQL1_1400m_130kn_1000khz	78	1422.596	117.2893618	2020-01-17 21:06:30	1/17/2020 21:25	
R3_NCQL1_1400m_130kn_1000khz	77	1417.363	130.734903	2020-01-17 21:28:31	1/17/2020 21:46	

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_018_B
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)
19:00	22:03	3.5	3.05

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R3_NCQL1_1400m_130kn_1000khz	Test Shot	1437.021	106.5282635	2020-01-18 19:20:18	1/18/2020 19:20	
R3_NCQL1_1400m_130kn_1000khz	75	1415.591	129.8174106	2020-01-18 19:21:56	1/18/2020 19:39	
R3_NCQL1_1400m_130kn_1000khz	74	1418.634	90.44104368	2020-01-18 19:43:19	1/18/2020 20:06	
R3_NCQL1_1400m_130kn_1000khz	73	1424.44	127.4828587	2020-01-18 20:09:51	1/18/2020 20:27	
R3_NCQL1_1400m_130kn_1000khz	72	1423.281	86.30066448	2020-01-18 20:30:24	1/18/2020 20:54	
R3_NCQL1_1400m_130kn_1000khz	71	1421.517	130.7757237	2020-01-18 20:57:40	1/18/2020 21:14	
R3_NCQL1_1400m_130kn_1000khz	70	1417.689	84.69699648	2020-01-18 21:18:48	1/18/2020 21:43	

Project 2019-1841-4400-USGS QL1 NC-LiDAR
Mission ID XSS_20_020_A
Date 20-Jan-20
Julian Day 20
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)
13:32	16:05	3.4	2.55

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R3_NCQL1_1400m_130kn_1000khz	69	1425.229	89.85206016		2020-01-20 13:40:44	1/20/2020 13:40	Aborted; clouds
R3_NCQL3_1400m_130kn_1000khz	50	1411.42	126.6567267		2020-01-20 13:46:19	1/20/2020 13:57	
R3_NCQL3_1400m_130kn_1000khz	49	1403.261	126.9055382		2020-01-20 14:41:05	1/20/2020 14:43	
R3_NCQL3_1400m_130kn_1000khz	48	1403.876	110.6375413		2020-01-20 14:46:14	1/20/2020 14:50	
R3_NCQL3_1400m_130kn_1000khz	47	1409.158	128.548083		2020-01-20 14:53:17	1/20/2020 14:58	
R3_NCQL3_1400m_130kn_1000khz	46	1408.629	113.3433666		2020-01-20 15:01:06	1/20/2020 15:07	Aborted; clouds
R3_NCQL3_1400m_130kn_1000khz	44	1405.452	132.3346834		2020-01-20 15:12:26	1/20/2020 15:18	Aborted; clouds

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

		Time	
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
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 XSS_20_022_A
Date 22-Jan-20
Julian Day 22
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)
14:18	18:23	4.6	4.08

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL3_1400m_130kn_1000khz	Test Shot	721.09	85.68057952	2020-01-22 14:19:45	1/22/2020 14:19	
R4_NCQL3_1400m_130kn_1000khz	46	1402.492	111.1157259	2020-01-22 14:48:45	1/22/2020 14:56	
R4_NCQL3_1400m_130kn_1000khz	45	1409.793	132.5135166	2020-01-22 14:59:59	1/22/2020 15:08	
R4_NCQL3_1400m_130kn_1000khz	44	1413.706	110.9524434	2020-01-22 15:11:03	1/22/2020 15:21	
R4_NCQL3_1400m_130kn_1000khz	43	1409.614	132.8206434	2020-01-22 15:24:04	1/22/2020 15:33	
R4_NCQL3_1400m_130kn_1000khz	42	1409.612	110.9893763	2020-01-22 15:36:19	1/22/2020 15:47	
R4_NCQL3_1400m_130kn_1000khz	41	1408.295	131.1022888	2020-01-22 15:49:47	1/22/2020 15:59	
R4_NCQL3_1400m_130kn_1000khz	40	1413.974	112.9934754	2020-01-22 16:02:25	1/22/2020 16:13	
R4_NCQL3_1400m_130kn_1000khz	39	1414.922	134.2746357	2020-01-22 16:16:29	1/22/2020 16:26	
R4_NCQL3_1400m_130kn_1000khz	38	1409.128	110.9310611	2020-01-22 16:29:36	1/22/2020 16:41	
R4_NCQL3_1400m_130kn_1000khz	37	1410.942	133.7459112	2020-01-22 16:44:25	1/22/2020 16:44	Aborted; clouds
R4_NCQL3_1400m_130kn_1000khz	37	1407.165	133.2580074	2020-01-22 16:48:09	1/22/2020 16:58	
R4_NCQL3_1400m_130kn_1000khz	36	1412.633	113.9265186	2020-01-22 17:01:59	1/22/2020 17:07	Aborted; clouds
R4_NCQL3_1400m_130kn_1000khz	1	1408.575	132.2919189	2020-01-22 17:41:45	1/22/2020 17:42	
R4_NCQL3_1400m_130kn_1000khz	2	1401.83	115.4932536	2020-01-22 17:45:19	1/22/2020 17:47	
R4_NCQL3_1400m_130kn_1000khz	3	1410.691	129.7843653	2020-01-22 17:49:22	1/22/2020 18:01	Flagged for Refly due to POS

Project 2019-1841-4400-USGS QL1 NC-LiDAR
Mission ID XSS_20_026_A
Date 26-Jan-20
Julian Day 26
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)
14:08	18:20	4.8	4.2

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL3_1400m_130kn_1000khz	Test Shot	1328.478	103.3967373	2020-01-26 14:19:12	1/26/2020 14:19	
R4_NCQL3_1400m_130kn_1000khz	3	1409.021	133.0869494	2020-01-26 14:23:28	1/26/2020 14:35	Refly of collection 022A
R4_NCQL3_1400m_130kn_1000khz	4	1406.089	105.0198437	2020-01-26 14:41:32	1/26/2020 14:56	
R4_NCQL3_1400m_130kn_1000khz	5	1403.734	129.836849	2020-01-26 15:01:53	1/26/2020 15:14	
R4_NCQL3_1400m_130kn_1000khz	6	1405.766	100.5490117	2020-01-26 15:26:55	1/26/2020 15:52	
R4_NCQL3_1400m_130kn_1000khz	7	1423.021	132.2025022	2020-01-26 15:56:15	1/26/2020 16:16	
R4_NCQL3_1400m_130kn_1000khz	8	1403.244	101.1341075	2020-01-26 16:21:42	1/26/2020 16:48	
R4_NCQL3_1400m_130kn_1000khz	9	1423.762	131.2033685	2020-01-26 16:51:51	1/26/2020 17:12	
R4_NCQL3_1400m_130kn_1000khz	10	1412.137	104.0168222	2020-01-26 17:17:51	1/26/2020 17:44	
R4_NCQL3_1400m_130kn_1000khz	11	1420.718	133.5495834	2020-01-26 17:48:48	1/26/2020 18:08	

Project 2019-1841-4400-USGS QL1 NC-LiDAR
Mission ID PTG_20_026_B
Date 26-Jan-20
Julian Day 26
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)
19:25	23:20	4.3	3.92

Plan ID	Run	Lines			Start	Stop	Note
		Altitude (m)	Speed (knots)				
R4_NCQL3_1400m_130kn_1000khz	Test Shot	1411.375	112.7213378		2020-01-26 19:37:36	1/26/2020 19:37	
R4_NCQL3_1400m_130kn_1000khz	13	1404.512	107.5332288		2020-01-26 19:50:30	1/26/2020 20:15	
R4_NCQL3_1400m_130kn_1000khz	12	1412.227	132.7351144		2020-01-26 20:20:50	1/26/2020 20:41	Potential Cloud
R4_NCQL3_1400m_130kn_1000khz	14	1408.576	106.291115		2020-01-26 20:49:40	1/26/2020 21:14	Potential Cloud
R4_NCQL3_1400m_130kn_1000khz	15	1422.391	131.2053123		2020-01-26 21:19:14	1/26/2020 21:40	
R4_NCQL3_1400m_130kn_1000khz	16	1415.08	110.7405648		2020-01-26 21:44:21	1/26/2020 22:09	
R4_NCQL3_1400m_130kn_1000khz	17	1432.009	137.0368323		2020-01-26 22:14:30	1/26/2020 22:34	
R4_NCQL3_1400m_130kn_1000khz	18	1402.693	109.2146504		2020-01-26 22:39:32	1/26/2020 23:04	

Project 2019-1841-4400-USGS QL1 NC-LiDAR
Mission ID PTG_20_027_A
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

Time			
Up (UTC)	Down (UTC)	Hobbs (Hours)	Air (Hours)
13:25	17:43	5.1	4.3

Plan ID	Run	Lines		Start	Stop	Note
		Altitude (m)	Speed (knots)			
R4_NCQL1_1400m_130kn_1000khz	Test Shot	877.434	92.1963312	2020-01-27 13:30:45	1/27/2020 13:30	
R4_NCQL1_1400m_130kn_1000khz	95	1420.957	105.7915482	2020-01-27 13:46:08	1/27/2020 14:03	
R4_NCQL1_1400m_130kn_1000khz	50	1425.307	102.2712539	2020-01-27 14:20:06	1/27/2020 14:39	
R4_NCQL1_1400m_130kn_1000khz	49	1434.241	137.1729011	2020-01-27 14:44:03	1/27/2020 15:01	
R4_NCQL1_1400m_130kn_1000khz	48	1416.931	97.55744192	2020-01-27 15:06:29	1/27/2020 15:30	
R4_NCQL1_1400m_130kn_1000khz	47	1412.957	143.2998848	2020-01-27 15:35:42	1/27/2020 15:52	
R4_NCQL1_1400m_130kn_1000khz	46	1418.884	99.31661712	2020-01-27 15:57:54	1/27/2020 16:22	
R4_NCQL1_1400m_130kn_1000khz	45	1415.578	135.1901843	2020-01-27 16:26:04	1/27/2020 16:43	
R4_NCQL1_1400m_130kn_1000khz	44	1414.011	103.1518134	2020-01-27 16:48:33	1/27/2020 17:11	
R4_NCQL1_1400m_130kn_1000khz	43	1417.227	141.0430866	2020-01-27 17:15:36	1/27/2020 17:32	

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

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

Plan ID	Run	Lines			Note
		Altitude (m)	Speed (knots)	Start	
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

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

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

Date: 02/17/20

Lift: 6 B C D E Pg. 1 of 1

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Project: **HURRICANE FLORENCE** Flight Mgmt File:
 Aircraft: **N27GP** Begin Hobbs: **7982.0** End Hobbs: **7986.2** Total: Pilot: **S. SANTOS** Co-Pilot: Tech: **G. ADAMS**
 Dep Apt: **KRDU** Dep Time (Lcl): **9:14 [Z]** Arr Apt: **KRDU** Arr Time (Local): **13:38** [Z]: **18:38** Tot Time Aloft: **4:24**
 CORS: **Y/N** Sta 1: **NCWR** Sta 2: **NCNA** Flyovers: **Y/N** If Y, times: **Sta1) 9:39(14:35) Sta2) 13:16(18:16)**
 GPS Unit: **Y/N** Sta 1: Sta 2: Flyovers: **Y/N** If Y, times: **Sta1) Sta2)**

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP# Sats	GPS Altitude	Crab	Turb (0..+)	Alt			Max Gdspd	Power	Avg Pt Spacing	PPSM	Beg GB	End GB	Tot GB	Storage Name#					
									AMS	Msl	Agl													
FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc.																								
51	180	14:49	15:03	113	26	4800	2	0	CLEAR (ALL)															
52	020	15:04	15:18	108	25	4700	3	0																
53	180	15:19	15:33	116	25	4700	-1	0																
54	020	15:34	15:48	106	26	4700	2	0																
55	180	15:50	16:04	117	24	4700	1	0																
56	020	16:05	16:19	109	25	4700	1	0																
57	180	16:20	16:34	116	26	4800	-1	0																
58	020	16:35	16:49	114	26	4700	-1	0																
59	180	16:50	17:04	116	27	4800	-2	0																
60	020	17:05	17:19	111	26	4700	-1	0																
61	180	17:20	17:33	119	28	4800	1	0																
62	020	17:34	17:49	110	30	4600	3	0																
63	180	17:50	17:54	116	30	4700	0	0																
89	265	17:59	18:05	114	29	4600	-2	0																
LIDAR ERROR - LINE ABORTED																								
CROSS LINE																								



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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 02/23/20

Lift: A B C D E Pg. of

Project: HURRICANE FLORENCE

Flight Mgmt File:

Proj #: 35630 NC

Tech: G. ADAMS

Aircraft: N9481T Begin Hobbs: 2322.6 Total: 4.8 Pilot: S. SANTOS Co-Pilot:

Dep Apt: KRDU Dep Time (Lcl): 9:14 (Z): 14:14 Arr Time (Local): 13:46 (Z): 18:46 Tot Time Aloft: 4:32

CORS: Y/N Sta 1: NCRD Sta 2: NCRW Flyovers: Y/N If Y, times: Sta1) 14:24 Sta2) 18:19

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

Gd Temp beg: 3 °C End: 17 °C OAT beg: °C End: 15 °C Altimeter begin: 30.30 end: 30.20

Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gspd	Power	Avg Pt Spacing	PPSM	Storage		
									Beg GB	End GB	Tot GB
LIDAR	NQ-1560	52223069	4500	4800	300	120					
FOV	58	135.33	MPIA Y/N		Pulse Rate	700					

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP# Sats	GPS Altitude	Crab	Turb (0,+,*)	FLIGHT LINE NOTES - visibility, clouds, smoke, partial, etc.		
35	007	14:43	14:57	113	25	4800	2	0	CLR		
36	190	14:58	15:12	110	25	4800	-3	0	CLR		
37	007	15:13	15:27	114	25	4800	3	0	CLR		
38	190	15:28	15:42	112	24	4800	4	0	CLR		
39	007	15:43	15:57	118	24	4700	4	0	CLR		
40	190	15:58	16:13	107	24	4800	-4	0	CLR		
41	007	16:14	16:28	115	25	4800	4	0	CLR		
42	190	16:29	16:44	108	27	4800	-5	0	CLR		
43	007	16:45	16:59	118	28	4700	5	0	CLR		
44	190	17:00	17:15	103	31	4800	-4	+	MILD TURBULENCE STARTING		
45	007	17:15	17:29	117	30	4700	5	+	CLR		
46	190	17:30	17:46	105	29	4700	-5	+	CLR		
47	007	17:46	18:00	119	30	4700	5	+	CLR; MODERATE TURBULENCE		
89	276	18:10	18:15	106	28	4700	4	+	CROSS LINE		

Total Proj Lines: 89 Lines Flown: 14 Lines Remain: 29 Online Time: 3:12 Mob Time: 1:00 Notes:



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)

Gd Temp beg: 0 °C End: 10 °C OAT beg: 0 °C End: 7 °C Altimeter begin: 30.09 end: 29.98

Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
<u>VQ-15E01</u>	<u>52223069</u>	<u>4500</u>	<u>4600</u>	<u>100</u>	<u>120</u>	<u> </u>
FOV	Scan Freq	MpiA Y/N	Pulses In Air	Pulse Rate	Power	PFSM
<u>55</u>	<u>135.33</u>	<u> </u>	<u> </u>	<u>700</u>	<u>100</u>	<u> </u>

Storage Name/#	Beg GB	End GB	Tot GB

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	POOP/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	0 VC (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	15:03	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	+	 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	16:35	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

