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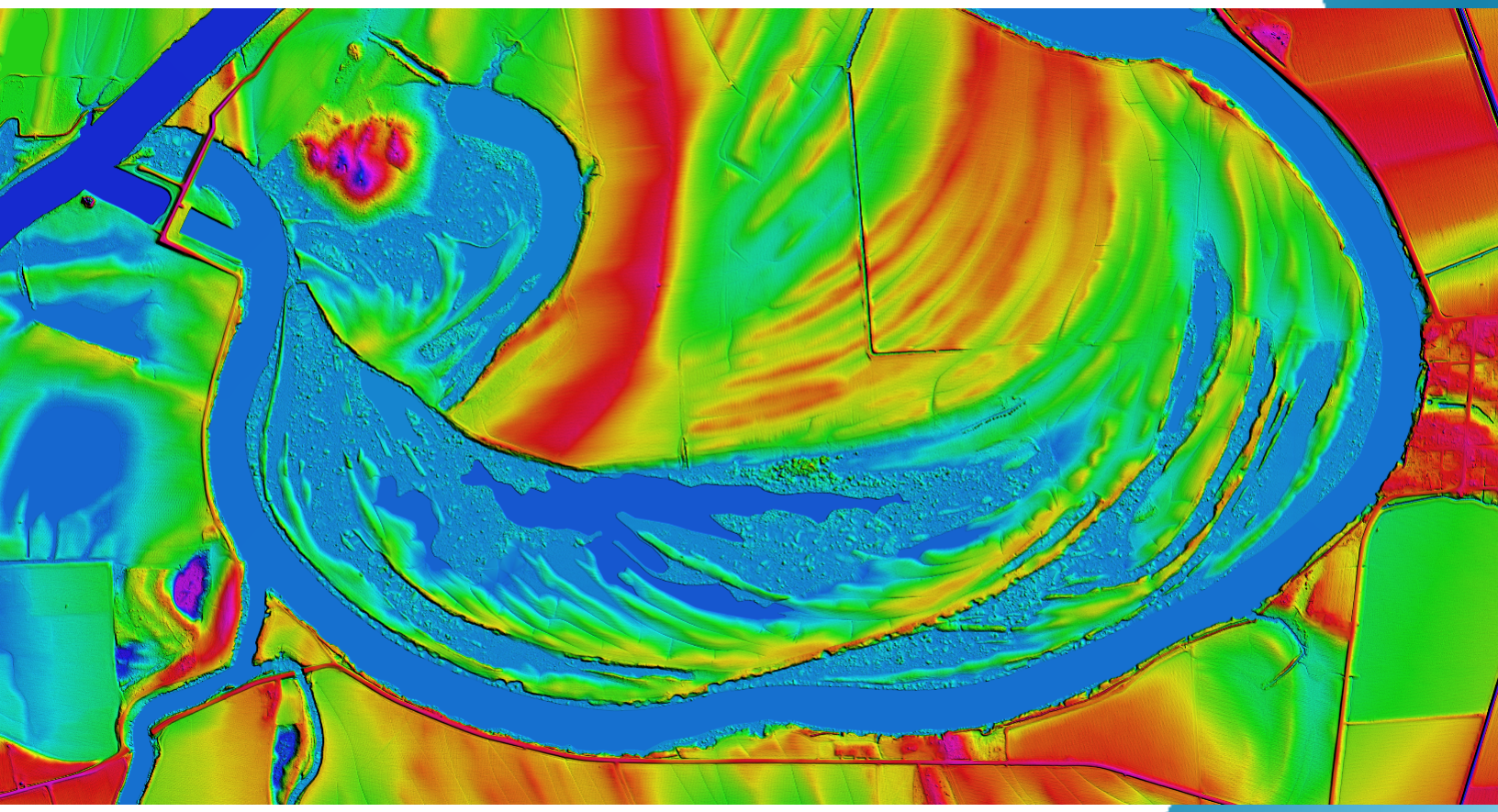

MS_MISSISSIPPIDELTA_2018_D18 LIDAR PROCESSING REPORT

2022

Project ID: 78034

Projection: UTM15

Submitted: November 28, 2022

Prepared for:

USGS

science for a changing world

Prepared by:

NV5 GEOSPATIAL

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1. Summary / Scope

1.1. Summary

This report contains a summary of the MS_MississippiDelta_2018_D18 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on February 27, 2018. This project yielded an area covering approximately 9,103 square miles over Mississippi. 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
2 pts / m^2	2000-2200 m	36°-60°*	20%	≤ 10 cm

*FOV is dependent upon sensor utilized. See Table 2 for more info

1.3. Coverage

The project boundary covers approximately 9,103 square miles over Mississippi. 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 24, 2019 to December 13, 2020 in 21 total lifts. See "Section: 2.4. Time Period" for more details.

1.5. Issues

Because we collected this project over a few years, temporal differences exist in the data.

MS_MississippiDelta_2018_D18 UTM16 Projected Coordinate System: UTM Zone 15N Horizontal Datum: NAD 1983(2011) Vertical Datum: NAVD88 (GEOID 12b) Units: Meters	
Lidar Point Cloud	Classified Point Cloud in .LAS 1.4 format
Rasters	• 1-meter Hydro-flattened Bare Earth Digital Elevation Model (DEM) in IMG format • 1-meter Intensity images in GeoTIFF format
Vectors	Shapefiles (*.shp) • Project Boundary • LiDAR Tile Index Geodatabase (*.gdb) • Continuous Hydro-flattened Breaklines
Reports	Reports in PDF format • Focus on Delivery • Processing Report • Focus on Accuracy
Metadata	XML Files (*.xml) • Breaklines • Classified Point Cloud • DEM • Intensity Imagery

MS_MississippiDelta_2018_D18
UTM15 Boundary

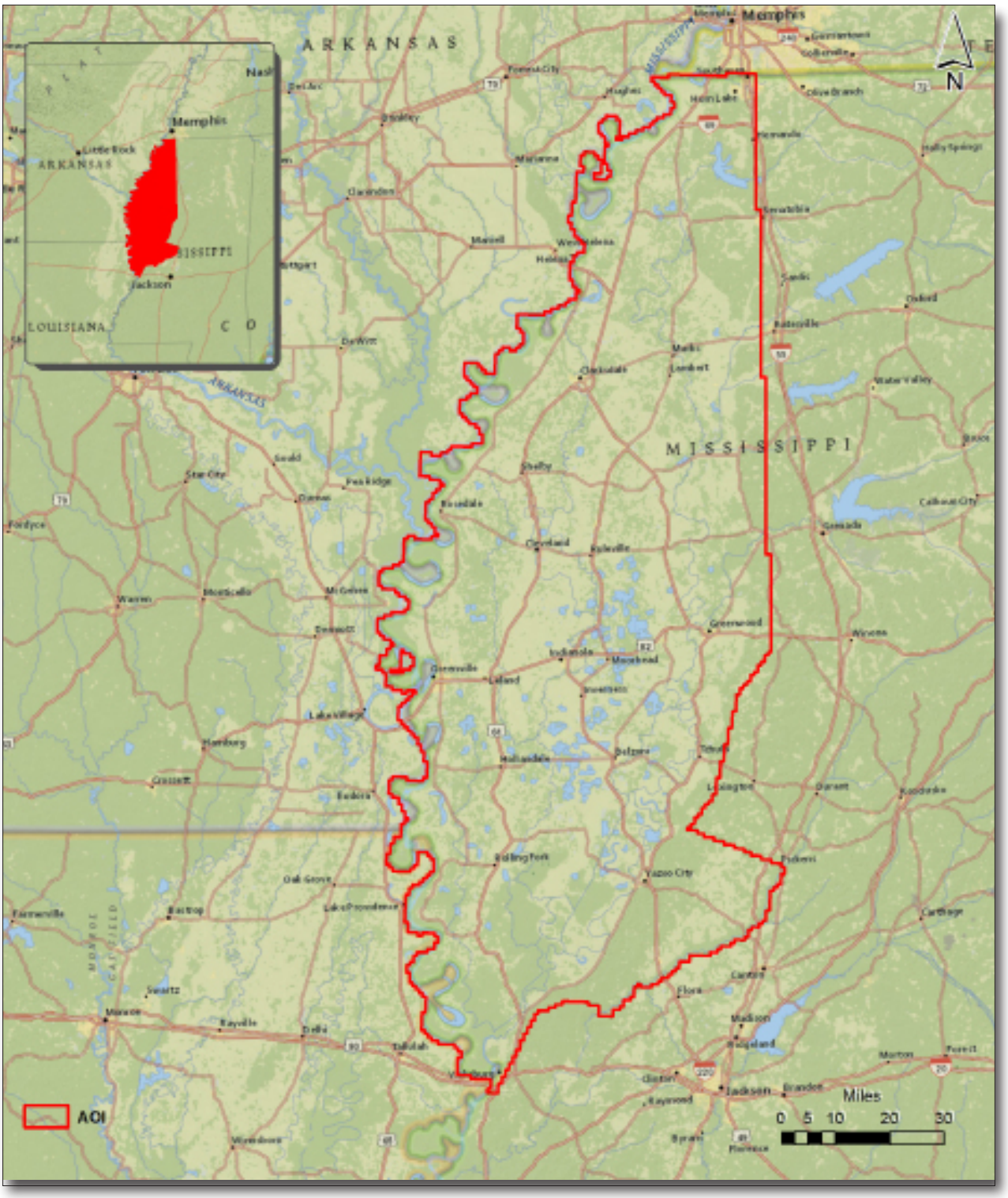

Figure 1. Work Unit Boundary

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 Leica MissionPro and RiPARAMETER planning software.

2.2. Lidar Sensor

NV5 Geospatial utilized Leica ALS70, Leica ALS80, Riegl VQ1560i/VQ1560ii LiDAR sensors (Figure 2) for lidar acquisition.

The Leica ALS 70 system is capable of collecting data at a maximum frequency of 500 kHz, which affords elevation data collection of up to 500,000 points 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 4 returns per outgoing pulse from the laser and these come in the form of 1st, 2nd, 3rd and last returns. The intensity of the returns is also captured during aerial acquisition.

The Leica ALS 80 system is capable of collecting data at a maximum frequency of 1,000 kHz. The system utilizes a Multi-Pulse in the Air option (MPIA). The sensor also has the capacity for unlimited range returns from each outbound pulse. The intensity of the returns is also captured during aerial 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.

Table 2. LiDAR System Specifications

		Leica ALS70	Leica ALS80	Riegl VQ1560i/ Riegl VQ1560ii
Terrain and Aircraft Scanner	Flying Height	2000 m	2200 m	2000 m
	Recommended Ground Speed	150 kts	150 kts	160 kts
Scanner	Field of View	36°	40°	60°
	Scan Rate Setting Used	56 Hz	49 Hz	129 Hz
Laser	Laser Pulse Rate Used	278 kHz	372.8 kHz	700 kHz
	Multi Pulse in Air Mode	yes	yes	yes
Coverage	Full Swath Width	1300 m	1601 m	2309 m
	Line Spacing	1040 m	1120.7 m	1847.2 m
Point Spacing and Density	Average Point Spacing	0.6 m	0.6 m	0.7 m
	Average Point Density	2.78 pts / m^2	2.78 pts / m^2	2.04 pts / m^2

Figure 2. Leica ALS70, Leica ALS80, and Riegl VQ1560i/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

- Piper Navajo (twin-piston), Tail Numbers: N73TM, C-FFRY, C-GJMT, C-GMEC
- Cessna Caravan (single-turboprop), Tail Number: N704MD

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 lidar systems. Some of NV5 Geospatial's operating aircraft can be seen in Figure 3 below.

Figure 3. Some of NV5 Geospatial's Planes

2.4. Time Period

Project specific flights were conducted between January 24, 2019 and December 13, 2020. 21 aircraft lifts were completed. Accomplished lifts are listed below.

- 01242019A (SN043-AI,C-FFRY)
- 01252019A (SN043-AI,C-FFRY)
- 01292019A (SN043-AI,C-FFRY)
- 01302019A (SN043-AI,C-FFRY)
- 01302019B (SN546,N73TM)
- 01312019A (SN043-AI,C-FFRY)
- 01312019A (SN546,N73TM)
- 01312019B (SN546,N73TM)
- 02022019A (SN546,N73TM)
- 02082019A (SN043-AI,C-FFRY)
- 02092019A (SN043-AI,C-FFRY)
- 02242019A (SN043-AI,C-FFRY)
- 02292019A (SN043-AI,C-FFRY)
- 12062020A (SN4040,N704MD)
- 12072020A (SN2737,C-GJMT)
- 12082020A (SN2737,C-GJMT)
- 12092020A (SN2737,C-GJMT)
- 12092020A (SN3062,C-GMEC)
- 12092020A (SN4040,N704MD)
- 12102020A (SN2737,C-GJMT)
- 12132020A (SN3062,C-GMEC)

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 and Leica Inertial Explorer software were 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 and Inertial Explorer 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 and Leica CloudPro 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
Leica Inertial Explorer	8.90
Leica CloudPro	1.2.4
RiPROCESS	1.8.6
Applanix + POSPac	8.6
GeoCue	2020.1.22.1
Global Mapper	19.1;20.1
TerraModeler	21.008
TerraScan	21.0016
TerraMatch	21.007

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 scaterring from reflective surfaces, or artificial points below the ground surface
9	Water	Laser returns that are found inside of hydro features
10	Ignored Ground	Ground points that fall within the given threshold of a collected hydro feature.
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
22	Temporal Exclusion	Points that are excluded due to differences in collection dates

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 proprietary tools. A buffer of 1 meter was also used around each hydro flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 10). All Lake Pond Island and Double Line Drain Island features were checked to ensure that the ground (ASPRS Class 2) points were reclassified to the correct classification after the automated classification was completed.

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 3 feet was also used around each hydro flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 10).

The breakline files were then translated to Esri 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-meter raster DEM. Using automated scripting routines within proprietary software, an IMG 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 1-meter were then provided as the deliverable for this dataset requirement.

MS_MississippiDelta_2018_D18
UTM15 Tile Layout

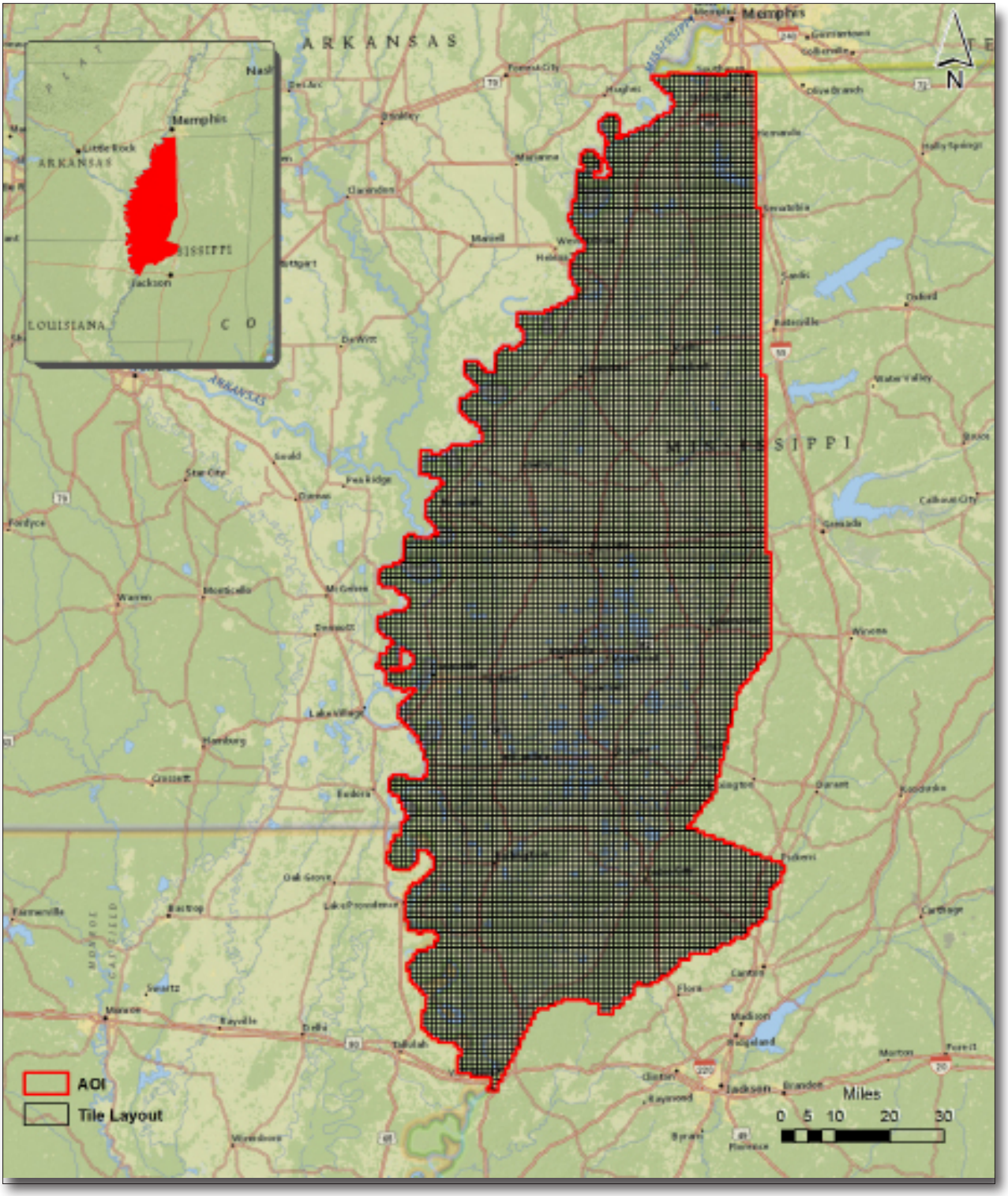

Figure 4. Lidar Tile Layout

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 5.

MS_MississippiDelta_2018_D18
UTM16 Lidar Coverage

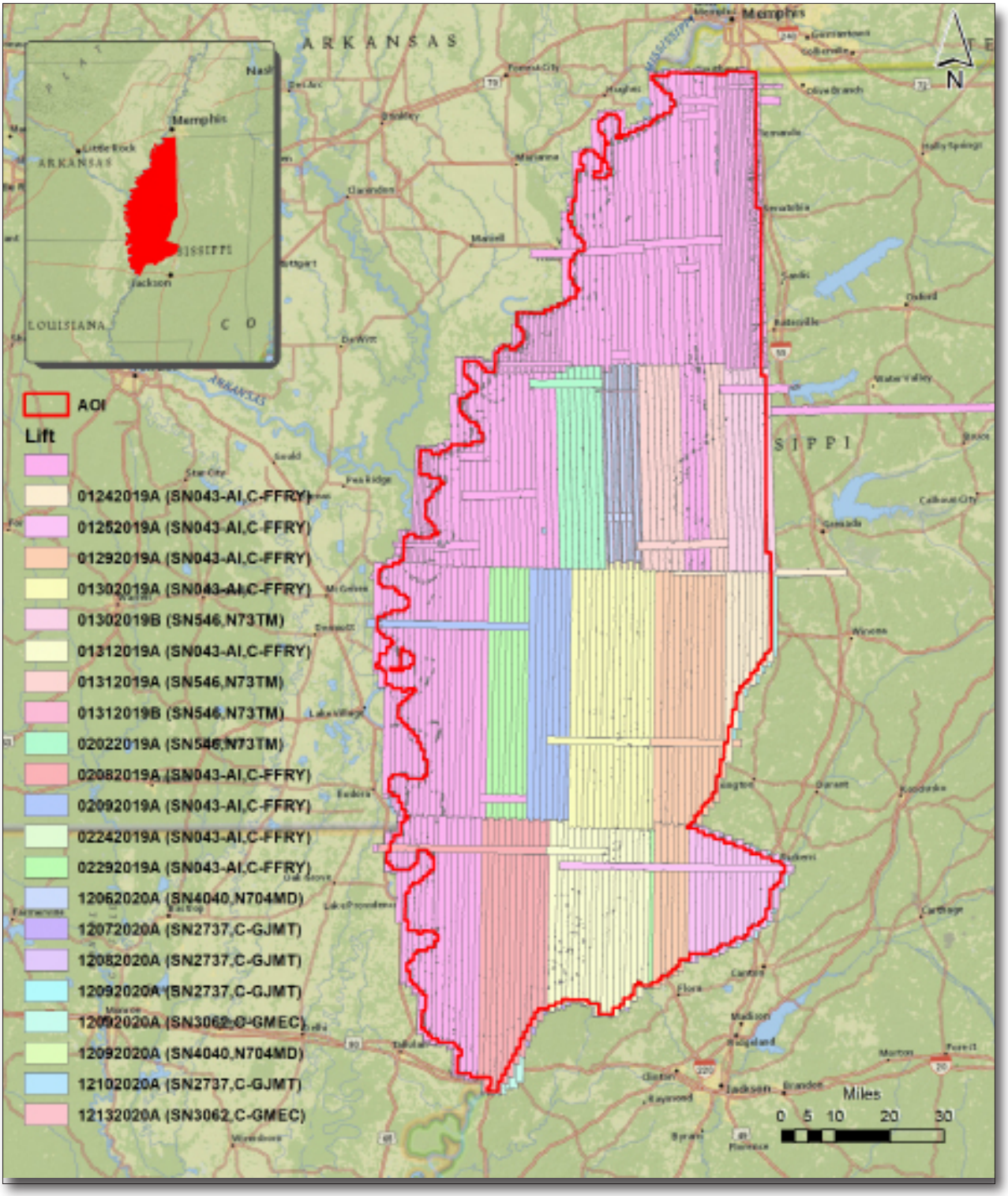

Figure 5. Lidar Coverage

5. Ground Control and Check Point Collection

5.1. Calibration Control Point Testing

Figure 6 shows the location of each bare earth calibration point for the project area. TerraScan was used to perform a quality assurance check using the lidar bare earth calibration points. The results of the surface calibration are not an independent assessment of the accuracy of these project deliverables, but the statistical results do provide additional feedback as to the overall quality of the elevation surface.

5.2. Point Cloud Testing

The project specifications require that only Non-Vegetated Vertical Accuracy (NVA) be computed for raw lidar point cloud swath files. The required accuracy (ACCz) is: 19.6 cm at a 95% confidence level, derived according to NSSDA, i.e., based on RMSE of 10 cm in the "bare earth" and "urban" land cover classes. The NVA was tested with 264 checkpoints located in bare earth and urban (non-vegetated) areas. These check points were not used in the calibration or post processing of the lidar point cloud data. The checkpoints were distributed throughout the project area and were surveyed using GPS techniques. See survey report for additional survey methodologies.

Elevations from the unclassified lidar surface were measured for the x,y location of each check point. Elevations interpolated from the lidar surface were then compared to the elevation values of the surveyed control points. AccuracyZ has been tested to meet 19.6 cm or better Non-Vegetated Vertical Accuracy at 95% confidence level using RMSE(z) x 1.9600 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines.

5.3. Digital Elevation Model (DEM) Testing

The project specifications require the accuracy (ACCz) of the derived DEM be calculated and reported in two ways:

1. The required NVA is: 19.6 cm at a 95% confidence level, derived according to NSSDA, i.e., based on RMSE of 10 cm in the "bare earth" and "urban" land cover classes. This is a required accuracy. The NVA was tested with 264 checkpoints located in bare earth and urban (non-vegetated) areas. See Figure 7.

2. Vegetated Vertical Accuracy (VVA): VVA shall be reported for "brushlands/low trees" and "tall weeds/crops" land cover classes. The target VVA is: 29.4 cm at the 95th percentile, derived according to ASPRS Guidelines, Vertical Accuracy Reporting for lidar Data, i.e., based on the 95th percentile error in all vegetated land cover classes combined. This is a target accuracy. The VVA was tested with 193 checkpoints located in tall weeds/ crops and brushlands/low trees (vegetated) areas. The checkpoints were distributed throughout the project area and were surveyed using GPS techniques. See Figure 8.

AccuracyZ has been tested to meet 19.6 cm or better Non-Vegetated Vertical Accuracy at 95% confidence level using RMSE(z) x 1.9600 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ ASRPS Guidelines.

A brief summary of results are listed below.

	Target	Measured	Point Count
Raw NVA	**0.196m**	**0.1126m**	**264**
NVA	**0.196m**	**0.1137m**	**264**
VVA	**0.294m**	**0.1611m**	**193**

MS_MississippiDelta_2018_D18
Calibration Points

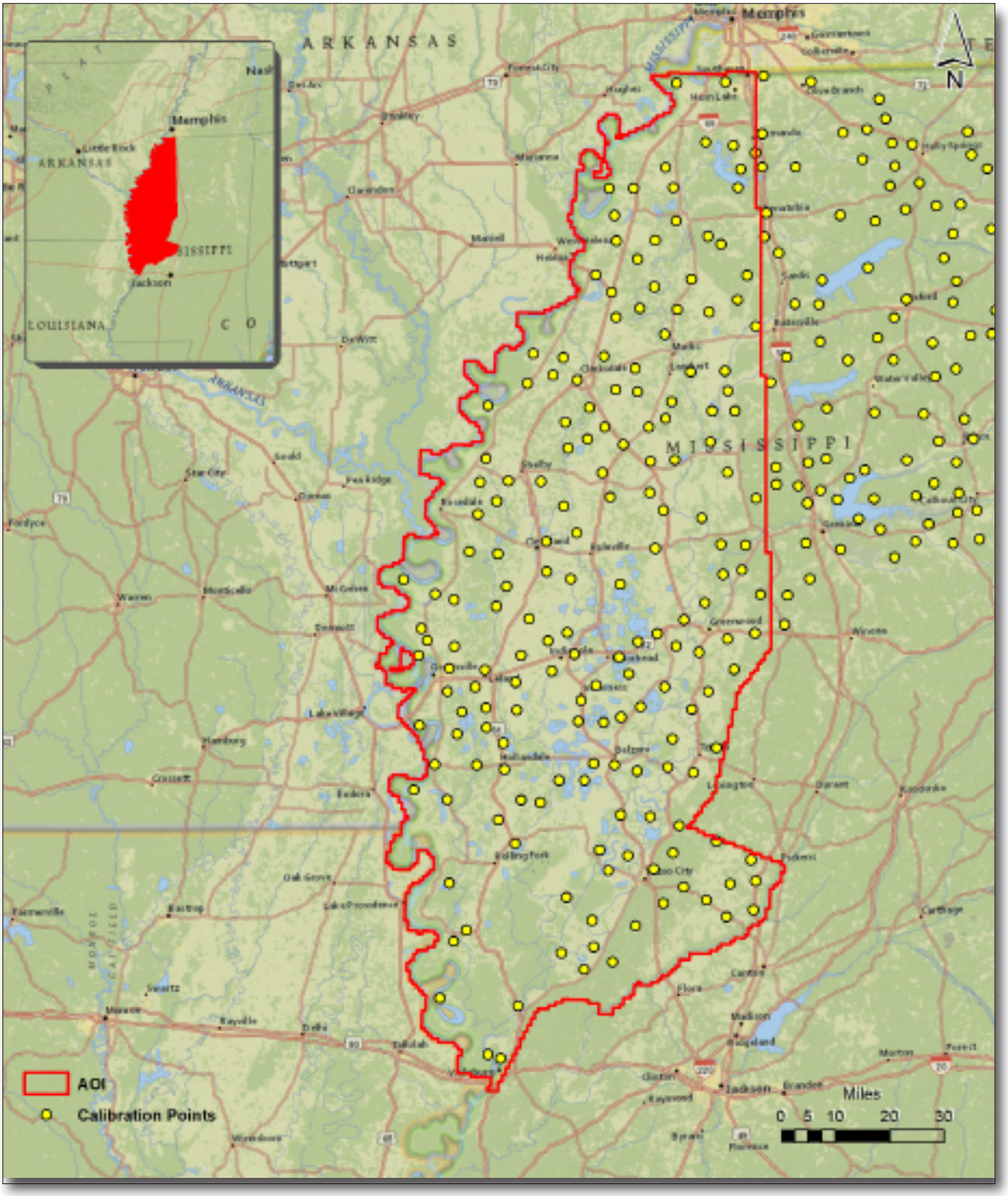

Figure 6. Calibration Control Point Locations

MS_MississippiDelta_2018_D18
NVA Points

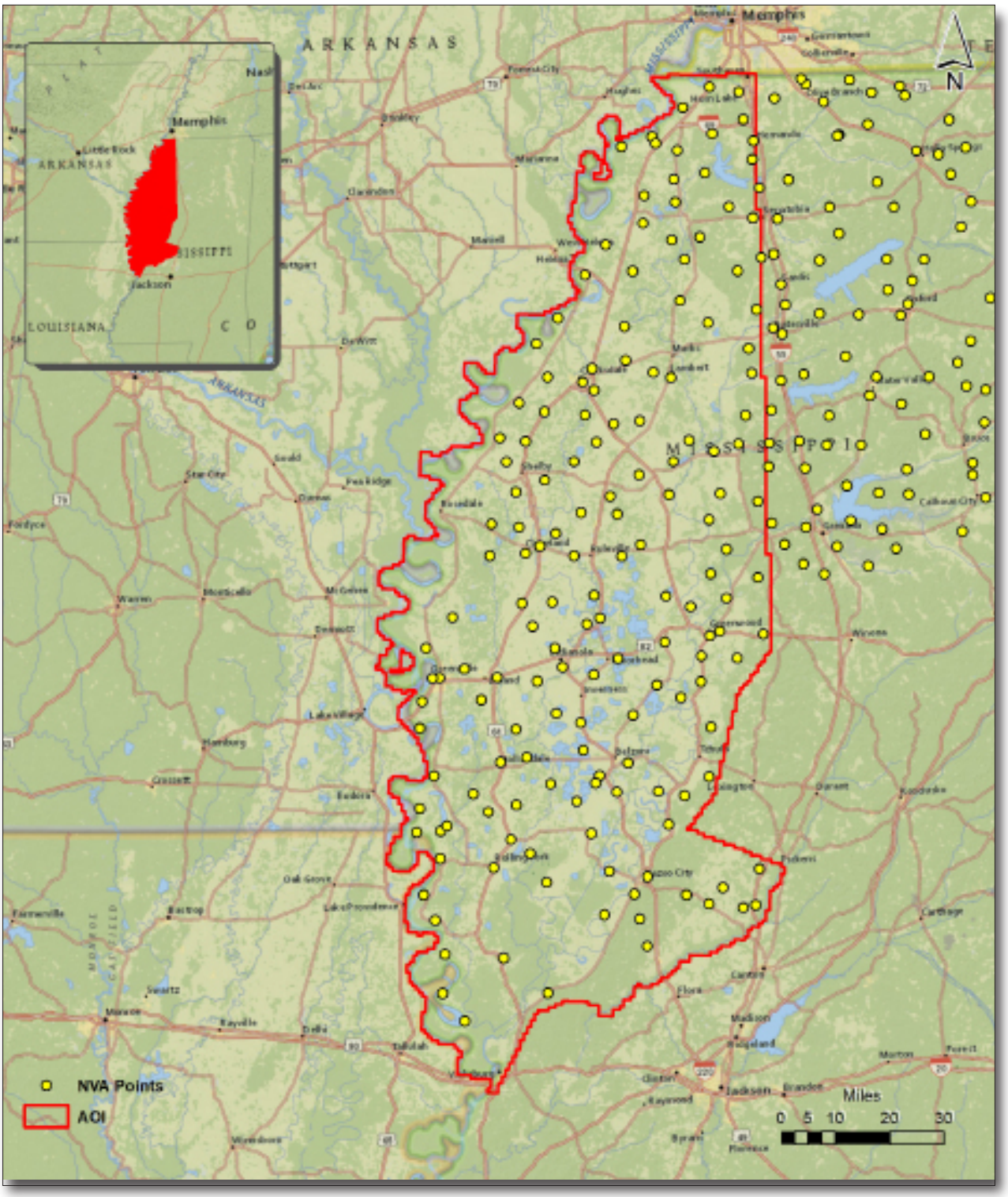

Figure 7. QC Checkpoint Locations - NVA

MS_MississippiDelta_2018_D18
VVA Points

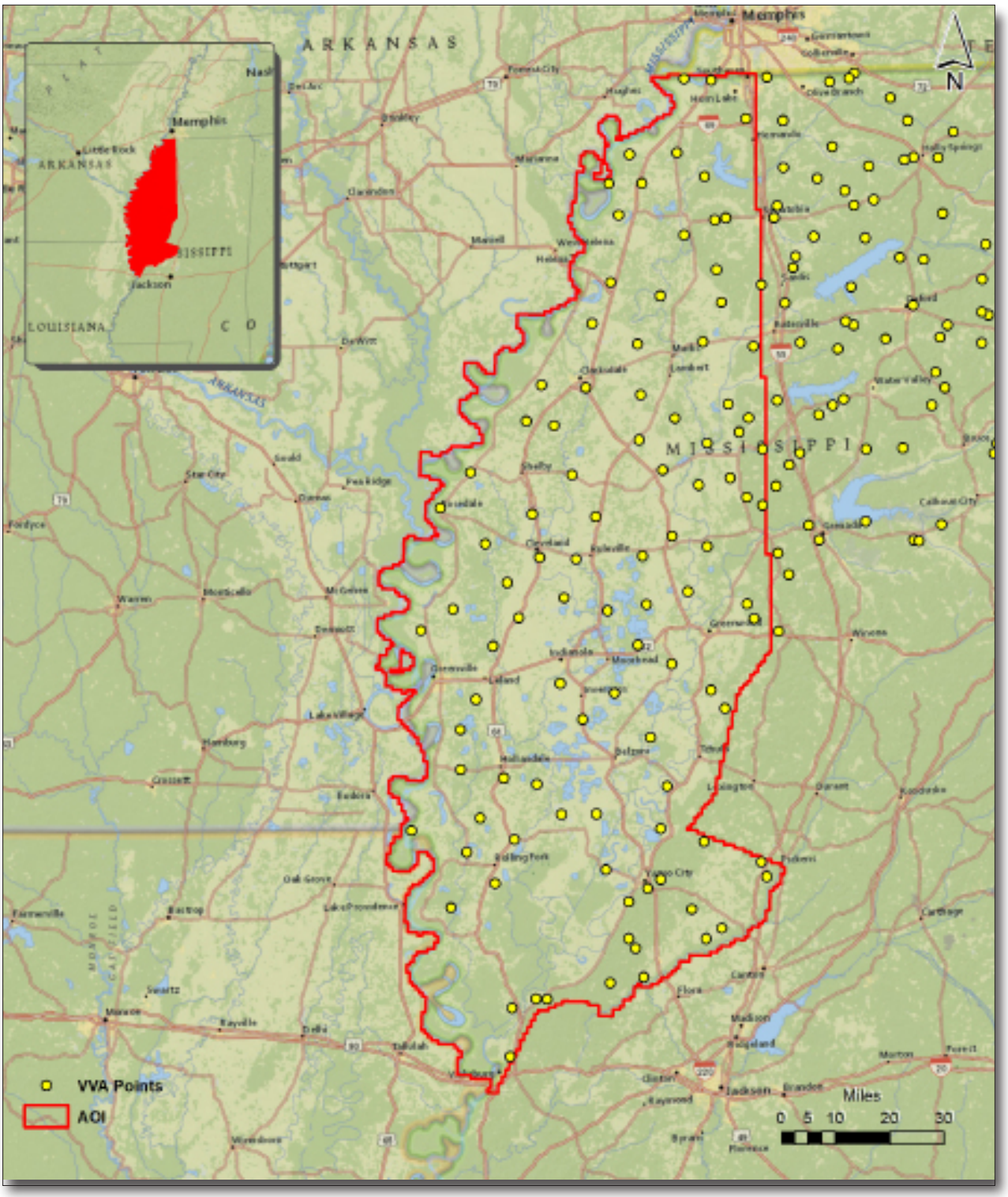

Figure 8. QC Checkpoint Locations - VVA

Project Report Appendices

The following section contains the appendices as listed in the MS_MississippiDelta_2018_D18 Lidar Processing Report.

Appendix A

Flight Logs

Julian Day 29	Flight A

LIDAR Flight Log

Date January 29, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot** N. Fraiser
Location KHKS	**Operator** R. Canelon
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

There's still a lot of water

Sitting in the fields

Aircraft Block Time		
Engine On 1525	**Ramp Out**	**Takeoff** 1554
Engine Off 2155	**Ramp In**	**Landing** 2146
Total 6.5 hrs	**Total** hrs	**Total** 5.9 hrs

Mission Plan	
AGL Height 2000**m**	**Pulse Rate** 700**KHz**
Target Speed 160**kts**	**Scan Rate** 129**lps**
Laser Current 100%	**FOV** 60 **degs**

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1545	1550
Post Mission	2149	2154

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Test strip	—	N	16:04:50	16:05:05			190129_160450	
Figure 8	—	//////	16:14:30	16:20:00			///////	
1059	431902901	N	16:20:28	16:35:20			162028	
1058	02	S	16:37:02	16:50:40			163702	
1057	03	N	16:53:48	17:11:00			165348	
1056	04	S	17:12:53	17:28:00			171253	
1055	05	N	17:30:01	17:48:05			173001	
1054	06	S	17:49:37	18:04:35			174937	
1053	07	N	18:06:57	18:24:50			180657	
1052	08	S	18:26:29	18:41:00			182629	
1051	09	N	18:43:46	19:01:50			184346	
1050	10	S	19:04:04	19:19:10			190404	
1049	11	N	19:21:31	19:39:00			192131	
1048	12	S	19:41:05	19:56:50			194105	

Julian Day 29	Flight A

LIDAR Flight Log

Date January 29, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot** N. Fraiser
Location KHKS	**Operator** R. Canelon
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1525	**Ramp Out**	**Takeoff** 1554
Engine Off 2155	**Ramp In**	**Landing** 2146
Total 6.5 hrs	**Total** hrs	**Total** 5.9 hrs

Mission Plan	
AGL Height 2000**m**	**Pulse Rate** 700**KHz**
Target Speed 160**kts**	**Scan Rate** 129**lps**
Laser Current 100%	**FOV** 60 **degs**

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1545	1550
Post Mission	2149	2154

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Xtie	43190291 3	E	20:05:28	20:12:30			200528	
1130	14	S	20:18:02	20:25:55			201802	
1129	15	N	20:28:46	20:38:30			202826	
1128	16	S	20:40:07	20:48:40			204007	
1127	17	N	20:50:12	21:00:15			205012	
1126	18	S	21:01:18	21:10:50			210118	
1125	19	N	21:12:07	21:22:45			211207	
Xtie	20	W	21:28:22	21:32:40			212830	
Figure 8	—	/////	21:32:45	21:35:30			/////////	

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 13119

Lift: (A) B C D E — Pg 1 of 1

Project: Miss Ouita **Proj #:** 22274 **Flight Mgmt File:** 13119_MS_VQ1560IA

Aircraft: 73TM **Begin Hobbs:** 7576.2 **End Hobbs:** 7580.4 **Total:** 4.2 **Pilot:** Carl **Co-Pilot:** **Tech:** Smith

Dep Apt: KOLV **Dep Time (Lcl):** 0836 **(Z):** 1436 **Arr Apt:** KGWO **Arr Time (Local):** 1244 **(Z):** 1844 **Tot Time Aloft:**

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:** 3031 **end:** 3030

LIDAR							
Type: VQ1560I	Serial #: 3541	Alt AGL: 7200	Alt AMSL: 7500	Avg Terr Ht:	Max Gdspd:	Avg Pt Spacing:	Beg GB:
FOV:	Scan Freq:	MpiA Y / N	Pulses in Air:	Pulse Rate:	Power: 100%	PPSM:	End GB:
							Tot GB:

Storage Name/#:

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	POOF/+bars	GPS Altitude	Crab	Turb (0-4)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
2050	181	1458	1512	137	7230			0	S-Turn – LT Haze
2049	001	1514	1528	145	7235			0	LT-Haze
2048	181	1530	1544	147	7230			0	LT-Haze
2047	001	1546	1559	150	7220			0	LT-Haze
2046	181	1603	1616	143	7235			0	LT-Haze
2045	001	1619	1632	152	7227			0	LT-Haze
2044	181	1635	1648	153	7240			0	LT-Haze
2043	001	1650	1703	155	7230			0	LT-Haze
2042	181	1706	1719	140	7220			0	LT-Haze
2041	001	1722	1735	153	7220			0	LT-Haze
2040	181	1738	1751	145	7215			0	LT-Haze
2039	001	1754	1807	155	7233			0	LT-Haze
2038	181	1810	1823	143	7220			0	LT-Haze
X-Tie	089	1827	1833	178	7300			0	LT-Haze X-Tie = Unplanned
									S-Turn

Total Proj Lines: **Lines Flown:** **Lines Remain:** **Online Time:** 3.6 **Mob Time:** 0.7 **Notes:**

Julian Day 31	Flight A

LIDAR Flight Log

Date January 31, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot** N. Fraiser
Location KHKS	**Operator** R. Canelon
Mission Objective 5,240mi2, QL2, Preliminary calibrated LAS	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1514	**Ramp Out**	**Takeoff** 1529
Engine Off 2028	**Ramp In**	**Landing** 2020
Total 5.2 hrs	**Total** hrs	**Total** 4.9 hrs

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700 **KHz**
Target Speed 160**kts**	**Scan Rate** 179 **lps**
Laser Current 100%	**FOV** 60 **degs**

Static Alignment	GPS Time	
	Start	End
Pre Mission	15:17:30	15:22:30
Post Mission	20:22:45	20:27:45

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Figure 8	—	///////	15:45:00	15:50:30			/////////	
995	431903101	E	15:51:13	15:57:00			190131_155113	
1124	—	S	16:01:29	16:02:10			160129	Do not use
1124	02	S	16:04:41	16:15:15			160441	Re-fly
1123	03	N	16:16:47	16:26:45			161647	
1122	04	S	16:27:51	16:39:05			162751	
1121	05	N	16:40:50	16:51:30			164050	
1120	06	S	16:52:52	17:04:30			165252	
1119	07	N	17:06:26	17:17:35			170626	
1118	08	S	17:19:04	19:31:50			171904	
1117	09	N	17:33:40	17:44:15			173340	
1116	10	S	17:45:26	17:57:40			174526	
1115	11	N	17:59:00	18:10:40			175900	
1114	12	S	18:11:37	18:23:45			181137	
1113	13	N	18:24:59	18:35:45			182459	

Julian Day 31	Flight A

LIDAR Flight Log

Date January 31, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot** N. Fraiser
Location KHKS	**Operator** R. Canelon
Mission Objective 5,240mi2, QL2, Preliminary calibrated LAS	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1514	**Ramp Out**	**Takeoff** 1529
Engine Off 2228	**Ramp In**	**Landing** 2020
Total 5.2 hrs	**Total** hrs	**Total** 4.9 hrs

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700 **KHz**
Target Speed 160**kts**	**Scan Rate** 179 **lps**
Laser Current 100%	**FOV** 60 **degs**

Static Alignment	GPS Time	
	Start	End
Pre Mission	15:17:30	15:22:30
Post Mission	20:22:45	20:27:45

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
1112	4319031 14	S	18:37:19	18:49:05			183719	
1111	15	N	18:50:35	19:01:05			185035	
1110	16	S	19:02:42	19:14:35			190242	
1109	17	N	19:16:06	19:26:40			191606	
1108	18	S	19:28:16	19:40:15			192816	
1107	19	N	19:42:28	19:53:15			194228	
996	20	E	19:57:33	20:01:15			195733	Cross tie 2
Figure 8	—	/////	20:01:20	20:04:25			//////	

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

Date: 12/19

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Project: NWS DelTA Proj #: 32274 Flight Mgmt File: 12119-NJ-VQ1560IB

Aircraft: 7JTM Begin Hobbs: 7510.4 End Hobbs: 7582.9 Total: 2.5 Pilot: Cal Co-Pilot: Tech: Smith

Dep Apt: KGNV Dep Time (Lcl): 0429 (Z): 2029 Arr Apt: KOLV Arr Time (Local): 1659 (Z): 2259 Tot Time ALoft:

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: 30.25 end: 30.22

LiDAR	Type: VQ1560I	Serial #: 3546	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	FOV	Scan Freq	MpiA Y / N	Pulses In Air	Pulse Rate	Power	PPSM

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	FOOTPrint	GPS Altitude	Crab	Turb (0-3+)	FLIGHT LINE NOTES – visibility, clouds, smoke, persist, etc
2038	001	2028	2051	153	7240			0	S-TURN —
2037	181	2054	2108	140	7240			+	
2036	001	2110	2123	146	7216			+	
2035	181	2126	2140	149	7225			+	
2034	001	2143	2156	148	7226			+	
2033	181	2159	2112	150	7230			1+	
2032	001	2215	2229	143	7213			1+	
X-Tie	092	2232	2236	~~[illegible]~~	7200			1+	X Tie = unplanned S-TURN

Total Proj Lines: Lines Flown: Lines Remain: Online Time: 2.0 Mob Time: 0.5 Notes:

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/3/2019

Lift: (A) B C D E Pg 1 of 2

Project: MS_ALS70 | Proj #: 32274 | Flight Mgmt File: 20190203-142024

Aircraft: N262AS | Begin Hobbs: 7339.3 | End Hobbs: 7343.5 | Total: 4.2 | Pilot: GSIMONDS | Co-Pilot: | Tech: SKROHN

Dep Apt: KOLV | Dep Time (Lcl): 8:34 (Z): 14:34 | Arr Apt: KOLV | Arr Time (Local): 12:49 (Z): 18:49 | Tot Time Aloft: 4.2

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: 15 °c End: °c | OAT beg: 10 °c End: °c | Altimeter begin: 30.06 end:

LIDAR	Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	ALS70	7160		6600			
	FOV	Scan Freq	MpIA (Y) / N	Pulses In Air	Pulse Rate	Power	PPSM
	36°	56Hz		2	275khz	100%	2

Seg GB: 490 | End GB: | Tot GB: | Storage Name/s: 017

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		14:22	14:27						5 min static
		15:11	15:14						S-turn
021	N	152034	15:25	154	1.2 20	6616	5L	-	
020	S	152948	15:34	144	1.2 20	6616	5R	-	
019	N	153810	15:42	159	1.2 19	6619	5L	-	
018	S	154720	15:52	139	1.3 19	6620	5R	-	
017	N	155556	15:59	156	1.3 19	6620	4L	-	
016	S	160457	16:09	141	1.2 20	6620	5R	-	
015	N	161332	16:17	158	1.1 20	6613	3L	-	
014	S	162206	16:26	136	1.1 20	6613	5R	-	possible cloud (fog) 4.5 fse
013	N	163044	16:34	157	1.1 20	6598	3L	-	
012	S	164005	16:44	143	1.1 20	6598	5R	-	
011	N	164822	16:52	160	1.1 19	6598	3L	-	
010	S	165728	17:01	141	1.2 18	6609	4R	-	
009	N	170542	17:09	158	1.1 18	6609	4L	-	Shipping Drive: Seagate: 1ET3
008	S	171416	17:19	140	1.3 17	6615	4R	-	Refly - lateral Limits B/U Drive: Seagate: 6045
007	N	172217	17:25	156	1.3 17	6612	4L	-	
006	S		17:34	140	1.3 17	6612	4R	-	

Total Proj Lines:	Lines Flown: 21	Lines Remain: 55	Online Time: 3.1	Mob Time: 1.1	Notes:

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/3/2019

Lift: (A) B C D E Pg 2 of 2

Project: MS-ALS70 Proj #: 32274 Flight Mgmt File: 20190203 - 142024

Aircraft: N262AS Begin Hobbs: 7339.3 End Hobbs: 7343.5 Total: 4.2 Pilot: GSIMONDS Co-Pilot: Tech: SKROHN

Dep Apt: KOLV Dep Time (Lcl): 8:34 (Z): 14:34 Arr Apt: KOLV Arr Time (Local): 12:49 (Z): 18:49 Tot Time Aloft: 4.2

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: 15 °c End: °c OAT beg: 10 °c End: 10 °c Altimeter begin: 30.02 end: 30.00

LIDAR	Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	ALS70	7160		6600			
	FOV 36°	Scan Freq 56 Hz	MpiA (Y) N	Pulses In Air 2	Pulse Rate 2	Power 100%	PPSM 2

Beg GB	End GB	Tot GB	Storage Name/#
490	462	28	017

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
005	N	173742	17:39	160	1.0 19	6609	4L	-	
004	S	174340	17:45	140	1.1 18	6612	4R	-	
003	N	174833	17:50	165	1.1 18	6608	4L	-	
002	S	175604	17:57	141	1.2 17	6608	4R	-	
001	N	180033	18:02	162	1.2 17	6603	4L	-	
008	S	180830	18:12	140	1.2 17	6615	4R	-	Reflight
"UL001"	E	181814	18:23	159	1.2 16				X-tie "UL001"
		18:23	18:27						Figure "8"
		18:53	30						5 min static

Shipping Drive: Seagate: 1ET3
B/U Drive: Seagate: 6045

Total Proj Lines:	Lines Flown: 21	Lines Remain: 55	Online Time: 3.1	Mob Time: 1.1	Notes:

Julian Day 039	Flight A

LIDAR Flight Log

Date February 8, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Figure 8 @ 15:50

Time to 50Hr Maintenance: 43.7 hours

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1519		**Takeoff** 1533
Engine Off 2200		**Landing**2151
Total 6.7 hrs		**Total**6.3 hrs

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1522	1527
Post Mission	2153	2158

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Test	—		1548	1549			154818	Test Strip
1106	43190390 1	N	1555	1608			155531	
1105	02	S	1609	1621			160928	
1104	03	N	1623	1637			162351	
1103	04	S	1638	1652			163848	
1102	05	N	1655	1711			165541	
1101	06	S	1712	1726			171208	
1100	07	N	1729	1745			172918	
1099	08	S	1747	1803			174718	
1098	09	N	1805	1822			180534	
1097	10	S	1824	1841			182421	
1096	11	N	1842	1859			184241	
1095	12	S	1901	1917			190122	
1094	13	N	1919	1935			191911	

Julian Day 039	Flight A

LIDAR Flight Log

Date February 8, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Figure 8 @ 15:50

Time to 50Hr Maintenance: 43.7 hours

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1519		**Takeoff** 1533
Engine Off 2200		**Landing** 2151
Total 6.7 hrs		**Total** 6.3 hrs

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1522	1527
Post Mission	2153	2158

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
1093	43190314	S	1936	1952			193627	
1091	15	N	1953	2009			195345	
1090	16	S	2011	2027			201129	Up to 100m offline
1089	17	N	2029	2044			202938	
1088	18	S	2045	2058			204455	
1087	19	N	2100	2114			210003	
996	20	E	2120	2134			212005	Full X-Tie

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/8/2019 Lift: A B C D E Pg 1 of 1

Project: FEMA_MS_DELTA_LiDAR Proj #: 32274 Flight Mgmt File: 32274_MS_VQ1560i_Middle

Aircraft: N73TM Begin Hobbs: 7589.6 End Hobbs: 7593.4 Total: 3.8 Pilot: Stephen Bates Co-Pilot: Tech: Gary Lee

Dep Apt: KOLV Dep Time (Lcl): 14:10 (Z): 20:10 Arr Apt: KOLV Arr Time (Local): 17:59 (Z): 23:59 Tot Time Aloft: 3:49

CORS: Y (N) Sta 1: PPP 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:

LiDAR	Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	1560i	546	7210'	7360'	150'	145kt	.8 m
	FOV 58.5°	Scan Freq Auto14	MpiA Y / N	Pulses in Air	Pulse Rate 350 kHz	Power 100%	PPSM 2x1.27

Beg GB 0 End GB 60 Tot GB 60 Storage Name/# 5222347 Drive #3

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0,-,+)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		20:42	20:47						Opening S turn
2021	S	20:54	21:08	148kt	.97/28	7222'		0	signs of standing water in some fields ; clear
2020	N	21:12	21:27	138kt	1.1/27	7221'		0	standing water; clear
2019	S	21:33	21:48	146	.83/30	7221'		—	"
2018	N	21:53	22:07	143	.9/32	7203'		0	"
2017	S	22:12	22:26	146	.94/31	7213'		0	"
2016	N	22:31	22:45	145	.87/32	7215'		0	"
2015	S	22:50	23:04	144kt	.86/32	7219'		0	"
XTIE	90°	23:13	23:20	145kt					GSM stabilization not on during manual XTE??
		23:20	23:22						Closest S-turn ; RTB

* INS-GPS error on landing and Gyromount seemed to reboot itself.

Total Proj Lines: 116 Lines Flown: 7 Lines Remain: 9 On line Time: 2.7 Mob Time: 1.1 Notes:

Middle Block

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/9/2019

Lift: (A) B C D E Pg 1 of 2

Project: MS_ALS70 | Proj #: 32274 | Flight Mgmt File: 20190209_142653

Aircraft: N262AS | Begin Hobbs: 7350.9 | End Hobbs: 7354.5 | Total: 3.6 | Pilot: GSIMONDS | Co-Pilot: | Tech: SKROHN

Dep Apt: KOLV | Dep Time (Lcl): 8:42 (Z): 14:42 | Arr Apt: KOLV | Arr Time (Local): 12:16 (Z): 18:16 | Tot Time Aloft: 3.6

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: 2 °c End: 2 °c | Altimeter begin: 30.73 end: 30.66

LIDAR	Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	ALS70	7161					
	FOV 36°	Scan Freq 56Hz	MpiA (Y) / N	Pulses In Air 2	Pulse Rate 275kHz	Power 100%	PPSM 2

Bag GB 315 | End GB 260 | Tot GB 55 | Storage Name/# 016

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/#Sats	GPS Altitude	Crab	Turb (0,-,+)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		14:28	14:33						Static
		14:52	14:56						S-turn
076	S	145607	15:15	151	1.1 19	6642	0	0	
075	N	152000	15:38	152	1.2 19	6639	1L	0	
074	S	154300	16:02	152	1.2 19	6639		0	
073	N	160651	16:25	151	1.0 20	6633		0	
072	S	162954	16:49	152	1.2 18	6629		0	
071	N	165302	17:11	156	1.4 17	6625		0	
070	S	171600	17:35	149	1.1 18	6621	2L	–	standing water on S. End of line
069	N	173922	17:57	159	1.1 17	6618		–	" " " " " " "
4L001	E	180110	18:03	149	1.2 16	6615			Crosstie "4L001"
		18:07	18:11						Figure "8"
		18:22:41	18:27						Static

Shipping Drive: Seagate : 27CG
B/U Drive: Seagate 6045

Total Proj Lines:	Lines Flown: 8	Lines Remain:	Online Time: 3.1	Mob Time: .5	Notes:

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

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/9/2019

Ufc: A B C D E Pg 2 of 2

Project: Proj #: Flight Mgmt File: MOB FLIGHT TO KSBM

Aircraft: N262AS Begin Hobbs: 7354.5 End Hobbs: 5357.7 Total: 3.2 Pilot: GSIMONDS Co-Pilot: Tech: SKROHN

Dep Apt: KOLV Dep Time (Lcl): 16:10 (Z): 22:10 Arr Apt: Arr Time (Local): (Z): Tot Time Aloft: 3.2

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:

LiDAR	Type: N/A	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	FOV	Scan Freq	MpiA Y / N	Pulses In Air	Pulse Rate	Power	PPSM

Beg GB	Storage Name/#
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.
									MOB FLIGHT FROM KOLV to KSBM

Total Proj Lines: Lines Flown: Lines Remain: OnLine Time: Mob Time: 3.2 Notes: MOB FLIGHT

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

Date: 2/9/2019

(email Log daily to Flight_Log_distribution_List@quantumspatial.com)

Liftr A B C D E Pg 1 of 1

Project: FEMA_MS_DELTA_LiDAR Proj #: 32274 Flight Mgmt File: 32274_MS_VQ1560i (North)

Aircraft: N73TM Begin Hobbs: 7593.4 End Hobbs: 7597.3 Total: 3.9 Pilot: Steven Bates Co-Pilot: Tech: Geoff Tao

Dep Apt: KOLV Dep Time (Lcl): 9:27 (Z): 15:27 Arr Apt: KOLV Arr Time (Local): 13:24 (Z): 19:24 Tot Time Aloft: 3:57

CORS: Y / (N) Sta 1: PPP 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:

LiDAR	Type: Real VQ 1560i	Serial #: 5222-3546	Alt AGL: 7080'	Alt AMSL: 7250'	Avg Terr Ht: 170'	Max Gdspd: 145kt	Avg Pt Spacing: 2
	FOV: 58.5°	Scan Freq: Auto 71	MpiA: (Y) / N	Pulses in Air:	Pulse Rate: 350kHz	Power: 100%	PPSM: 2x1.27

Beg GB: 60 End GB: 1283 Tot GB: 683 Storage Name/#: 52223407 Drive # 2 #3

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		15:56	16:00						Opening Sturn
~~14~~ VOID	S	16:07	///	142	.8/31	7219'		-	Middle Block cloud ceiling too low just 6nm into line abort line, repositioning to North block
		16:22	16:26						Sturn; NORTH Block
18	N	16:31	16:48	148	1/27	7267'		-	clear
17	S	16:53	17:10	138	1.1/26	7267'		0	clear
16	N	17:15	17:30	143	.96/26	7264'		0	standing water in fields
15	S	17:35	17:51	142	.9/27	7251'		-	
14	N	17:55	18:11	144	1.1/24	7218'		0	
13	S	18:15	18:27	142	1.1/23	7218'		0	last 3 miles overclouds; refly last 3 miles to south (FSE)
12	N	18:34	18:45	HS	1.1/21	7228'		0	Southern 6 miles over clouds; reflyo-6 FSE
		18:57	19:04						INS-GPS "internal memory file failed warning (Ok Acquire)
		19:05	19:08						X TIE
									Close out Sturn; RTB

Total Proj Lines: North Lines Flown: 7 Lines Remain: 18 OnLine Time: 3.2 Mob Time: .7 Notes:

1560i

Julian Day 040	Flight A

LIDAR Flight Log

Date February 9, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Figure 8 @ 16:50 & 21:58

Time to 50Hr Maintenance: 37.8

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1615		**Takeoff** 1630
Engine Off 2232		**Landing** 2224
Total 6.3		**Total** 5.9

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1619	1624
Post Mission	2225	2230

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Test	—		1641	1642			164106	Test Strip
X-Tie	4319040001	W	1658	1703			165803	Partial flight line 996
1079	02	S	1707	1709			170721	
1080	03	N	1712	1715			171243	
1081	04	S	1718	1725			171826	
1082	05	N	1731	1741			173124	
1083	06	S	1744	1755			174434	
1084	07	N	1758	1809			175836	
1085	08	S	1812	1826			181216	
1086	09	N	1829	1842			182909	
1003	10	N	1845	1858			184521	
1002	11	S	1902	1909			190213	
1001	12	N	1913	1919			191343	
997	13	E	1927	1941			192716	Full Flight Line

Julian Day 040	Flight A

LIDAR Flight Log

Date February 9, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Figure 8 @ 16:50 & 21:58

Time to 50Hr Maintenance: 37.8

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1615		**Takeoff** 1630
Engine Off 2232		**Landing** 2224
Total 6.3		**Total** 5.9

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1619	1624
Post Mission	2225	2230

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
1033	43190401 4	S	1949	2006			194944	
1032	15	N	2009	2024			200920	
1031	16	S	2027	2044			202726	Rain drops at 6nm from south end
1030	17	N	2046	2101			204652	
1029	18	S	2105	2121			210503	
1028	19	N	2124	2139			212429	
1027	20	S	2142	2157			214215	Light rain at 8nm from south end
-	-	-	-	-	-	-	-	-

Julian Day 044	Flight A

LIDAR Flight Log

Date February 13, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Figure 8 @ 1608

Time to 50Hr Maintenance: 31.4

Aircraft Block Time		
Engine On 1540		**Takeoff** 1553
Engine Off 2223		**Landing** 2215
Total 6.7		**Total 6.4**

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1543	1548
Post Mission	2217	2222

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
Test	—		1601	1601			160116	
1092	43190444 01	N	1616	1632			161640	
xtie	02	W	1637	1638			163737	996-partial
1004	03	N	1644	1700			164454	
1005	04	S	1703	1718			170357	
1006	05	N	1721	1737			172137	
1007	06	S	1740	1756			174051	
1008	07	N	1759	1815			175942	
1009	08	S	1818	1834			181837	
1010	09	N	1837	1853			183750	
1011	10	S	1856	1912			185628	
1012	11	N	1915	1930			191537	
1013	12	S	1934	1950			193406	
1014	13	N	1953	2008			195315	

Julian Day 044	Flight A

LIDAR Flight Log

Date February 13, 2019	**Aircraft** C-FFRY
Project 3142 QSI Mississippi	**Pilot N. Fraiser**
Location KHKS	**Operator** C.Edgar
Mission Objective	

System	Riegl Q1560i
Unit	43
IMU	Applanix AP50
GPS Rx	Trimble
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to 50Hr Maintenance:

AIRBORNE IMAGING
A Clean Harbors Company

Aircraft Block Time		
Engine On 1540		**Takeoff** 1553
Engine Off 2223		**Landing** 2215
Total 6.7		**Total 6.4**

Mission Plan	
AGL Height 2000m	**Pulse Rate** 700KHz
Target Speed 160kts	**Scan Rate** 182lps
Laser Current 100%	**FOV** 60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1543	1548
Post Mission	2217	2222

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End		
1015	4319 044 14	S	2011	2027			201146	
1016	15	N	2030	2045			203050	
1017	16	S	2049	2105			204912	
1018	17	N	2108	2123			210834	
xtie	18	W	2131	2138			213123	997-partial

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

Date: 2/18/2019

(email Log daily to flight_log_distribution_list@quantumspatial.com)

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

Project: NCRS_MS_Delta Proj #: 32274 Flight Mgmt File: 32274_MS - VQ1560I

Aircraft: N737M Begin Hobbs: 7598.4 End Hobbs: 7601.9 Total: 3.5 Pilot: Steven Bates Co-Pilot: Tech: Gary Tao

Dep Apt: KCGI Dep Time (Lcl): 9:41 (Z): 15:41 Arr Apt: KOLV Arr Time (Local): 13:17 (Z): 19:17 Tot Time Aloft: 3:36

CORS: Y / (N) Sta 1: PPP 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:

LiDAR: Type Riegl VQ1560i Serial # xxx5846 Alt AGL 7010' Alt AMSL 7280' Avg Terr Ht 270' Max Gdspd 145kt Avg Pt Spacing 2
FOV 58.5° Scan Freq Auto 74 MpiA Y / N Pulses In Air Pulse Rate Power 100% PPSM 2x1.27

Beg GB 128.3 End GB 180 Tot GB 52 Storage Name/# 32223407 Drive#2 #3

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES -- visibility, clouds, smoke, partial, etc.
		16:35	16:38	/					Opening Sturn for North Block
36	S	16:42	16:49	140kt	1.0/26	7267'	0	0	had to turn off line due to traffic; refly
36R	S	17:05	17:27	144kt	1.1/23	7267'	0	0	
35	N	17:32	17:53	142kt	1.1/23	7270'	0	-	moderate turbulence
35PR	S	18:00	18:06	144 kt	1.1/23	7290	0	0	reflight of northern P.N.M of line
40PR	N	18:08	18:14	140 kt	.8/29	7290	0	0	
XTIE1	W	18:22	18:29	136	.9/26	7261	0	0	Manual CrossTie 1; no gyro correction
19	S	18:36	///	VOID					stopped 28 n.m FSE; flooded, Bad line; refly all
XTIE2	E	18:50	18:58						Manual CrossTie2; no gyro correction
		18:59	19:02						Closeout Sturn

Total Proj Lines: VQ1560i (North) Lines Flown: 2 Whole 2PR Lines Remain: 16 Whole 2PR Online Time: 2.5 Mob Time: 1.0 Notes:

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/12/2019 Lift: A (B) C D E Pg 1 of 1

Project: NCRS_MS-Delta Proj #: 32274 Flight Mgmt File: 32274_MS_VQ1560I_MDB

Aircraft: N73TM Begin Hobbs: 7606.9 End Hobbs: 7608.5 Total: 1.6 Pilot: Steven Bates Co-Pilot: Tech: Gary Tao

Dep Apt: KOLV Dep Time (Lcl): 14:52 (Z): 20:52 Arr Apt: KOLV Arr Time (Local): 16:29 (Z): 22:29 Tot Time Aloft: 1:37

CORS: Y / (N) Sta 1: PPP 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:

LiDAR	Type	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	Riegl VQ1560i	xxx546	~~7000'~~	7250'	250'	145kt	2
	FOV	Scan Freq	MpiA Y / N	Pulses in Air	Pulse Rate	Power	PPSM
	58.5°	Auto 74			350 kHz	100%	2x127

Beg GB	End GB	Tot GB	Storage Name/#
180	28	208	5222340 Drive # 2 3

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		21:05	21:10						Opening Sturn
34	S	21:14	21:35	143kt	9/32	7261'	0	-	mild flooding in fields @ 12nm FSE - end heading S
33	N	21:43	22:09	142kt	9/32	7251'	0	-	standing water from 0 - 15nm FSE
									Issues latch on door shortening mission
		22:10	22:14						XTIE ; no gyro correction
		22:15	22:18						Closeout Sturn ; RTB KOLV

Total Proj Lines: VQ1560 (North) Lines Flown: 2 Whole Lines Remain: 14 Whole 2 PR Online Time: 1.2 Mob Time: .4 Notes:

Julian Day	049	Flt	A

LIDAR Flight Log

Date	February ~~29~~, 2019 (Feb 18 2019)	Aircraft	C-FFRY
Project	3142 QSI Mssissippi	Pilot	N. Fraser
Location	KHKS	Operator	C.Edgar
Mission Objective			

System	VQ 1560i
Unit	43
IMU	**Applanix AP50**
GPS Rx	**Trimble**
Scanner 1 Drive	2
Scanner 2 Drive	3

Additional Notes

Time to 50hr maintenance: 26.1hrs
Fields appear to be more flooded from recent rain

Aircraft Block Time					
Engine On	1718	Ramp Out		Takeoff	1731
Engine Off	2115	Ramp In		Landing	2107
Total	4.0 **hrs**	Total	**hrs**	Total	3.6 **hrs**

Mission Plan					
AGL Height	2000 **m**			Pulse Rep Rate	350*2 **kHz**
Ground Speed	160 **kts**			Scan Rate	91*2 **Hz**
Laser Current	100 **%**			FOV	60 **Deg's**

Static Alignment	GPS Time	
	Start	End
Pre Mission	1719	1724
Post Mission	2109	2114

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Ln Aborted	Date Stamp	ALS Time Stamp	Comments
			Start	End	Time			
test			1742	1742			174230	test strip
1124	43190490 1	N	1747	1756			174719	
1026	02	N	1807	1823			180713	
1025	03	S	1826	1842			182630	
1024	04	N	1845	1901			184505	
1023	05	S	1904	1919			190416	
1022	06	N	1922	1938			192224	small clouds 15nm from South end
1021	07	S	1941	1956			194126	small clouds 34nm from North end
1020	08	N	1959	2015			195917	
1019	09	S	2018	2032			201808	
xtie	10	E	2036	2040			203628	manual x-tie
xtie	11	E	2048	2049			204816	partial 995
-	- —	-	-	-	-	-	-	-

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2 2 19

Project: Miss Delta | Proj #: 32274 | Flight Mgmt File: 20219 - MS_VQ1560I-B

Aircraft: 73TM | Begin Hobbs: 7583.8 | End Hobbs: 7588.5 | Total: 4.7 | Pilot: Carl | Co-Pilot: | Tech: Smith

Dep Apt: KCKM | Dep Time (Lcl): 1125 | (Z): 1723 | Arr Apt: KOLV | Arr Time (Local): 1616 | (Z): 2216 | Tot Time Aloft: 4.7

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: 30.22 | end:

LiDAR: Type 1560I | Serial # 3546 | Alt AGL | Alt AMSL | Avg Terr Ht | Max Gdspd | Avg Pt Spacing | FOV | Scan Freq | MpiA Y / N | Pulses in Air | Pulse Rate | Power | PPSM | Beg GB | End GB | Tot GB | Storage Name/#

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	Alt	GPS Altitude	Crab	Turb	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
~~2116~~	~~091~~								
2031	181	1742	1755	147	7200			0	
2030	001	1758	1811	148	7225			0	
2029	181	1814	1826	148	7210			0	
2028	001	1829	1842	156	7210			0	
2027	181	1845	1858	146	7210			0	
2026	001	1901	1914	155	7215			0	
2025	181	1917	1929	145	7225			0	
2024	001	1933	1945	152	7220			0	
2023	181	1948	2001	145	7230			0	
2022	001	2004	2017	152	7230			0	
X-Tie	091	2021	2025	171	7100			0	X-Tie = unplanned
2116	091	2032	2053	150	7220			0	X-Tie = planned – To complete west end of line to 2099
2099	182	2054	2109	150	7380			0	Reflight
2097	002	2112	2119	153	7560			0	Reflight - South end - 13 nm F/E
2084	181	2126	2139	150	7310			0	Reflight - smoke
2083	001	2142	2154	155	7310			0	Reflight - smoke – S-Turn

Total Proj Lines: 16 | Lines Flown: 17 | Lines Remain: | Online Time: 4.2 | Mob Time: [illegible] | Notes:

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

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/24/2019 Lift: A (B) C D E Pg 1 of 1

Project: NCRS MS Delta Proj #: 32274 Flight Mgmt File: 32274_MS_VQ1560I MIDDLE

Aircraft: N737M Begin Hobbs: 7605.3 End Hobbs: 7606.9 Total: 1.6 Pilot: Steven Bates Co-Pilot: Tech: Gary Tao

Dep Apt: KOLV Dep Time (Lcl): see (A) (Z): see (A) Arr Apt: KGLH Arr Time (Local): 12:26 (Z): 18:26 Tot Time Aloft: 3:32

CORS: Y (N) Sta 1: PPP 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:

LiDAR	Type / Freq	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing
	VQ1560i	xxx546	7025'	7225'	200'	145kt	2
	FOV	Scan Freq	MpiA Y / N	Pulses In Air	Pulse Rate	Power	PPSM
	58.5	Auto 74Hz			350kHz	100%	2x1.27

Beg GB	Storage Name/#
227	S_22234_07
End GB 256	#2
Tot GB 23	#3

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		16:43	16:48						In air Initialization
		16:48	16:52						opening Sturn (Middle MS Delta Block)
2006	N	17:07	17:11	140kt	1/27	7216'	0	0	clear
2007	S	17:16	17:24	150kt	1/24	7219' ~~7226~~	0	0	a bit fast due to strong tailwind from N; clear
2008	N	17:29	17:38	127kt	.9/26	7226	0	0	some flooding / standing water
2009	S	17:46	17:57	151	.9/27	7230'	0	0	standing water
									heavy tailwind; possible standing water on N end.
XTIE	W	18:02	18:08	137					Cross Tie
		18:08	18:10						Closeout Sturn

Total Proj Lines: Lines Flown: 4 (middle AOI) Lines Remain: 5 (middle AOI) Online Time: 1.4 Mob Time: .2 Notes:

Julian Day 055	Flt A

LIDAR Flight Log

AIRBORNE IMAGING

Date 2019/02/24	Aircraft FERY
Project 3142 Mississippi	Pilot Matheison
Location KHKS	Operator Blair
Mission Objective	

System	Riegl Q1560
Unit	~~2220754~~ 43
IMU	**Applanix AP50**
GPS Rx	**Trimble**
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes
Temp at Grd 11°C Temp at Alt 10°C
Humidity 60%
Altimeter 1062

Aircraft Block Time		
Engine On 1602	Ramp Out	Takeoff 1642
Engine Off 1908	Ramp In	Landing 1854
Total 3.1 hrs	Total hrs	Total 2.2 hrs

Mission Plan			
AGL Height	2000 m	Pulse Rep Rate	700 kHz
Ground Speed	160 kts	Scan Rate	129 Hz
Laser Current	100 %	FOV	60 Deg's

Static Alignment	GPS Time	
	Start	End
Pre Mission	1627	1632
Post Mission	1857	1902

Flight Line	LiDAR File Name	Flight Direction	GPS Time Start	GPS Time End	Ln Aborted Time	Date Stamp	ALS Time Stamp	Comments
Test Strip	—	G	1649	1650		190224	164908	
00	—	G	1700	1706				
1088	4319055 01	003°	1715	1733			171507	
1087	02	183°	1736	1750			173617	
1086	03	003°	1754	1811			175405	
996	04	090°	1820	1834			182009	
00	—	G	1835	1840				

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 2/24/2019 Lift: A B (C) D E Pg 1 of 1

Project: NCRS MS Delta Proj #: 32274 Flight Mgmt File: 32274_MS_VQ1560I_MIDDLE+ NOR TH

Aircraft: N737M Begin Hobbs: 7606.9 End Hobbs: 7610.7 Total: 3.8 Pilot: Steven Bates Co-Pilot: Tech: Gary Tao

Dep Apt: KGLH Dep Time (Lcl): 1:59 (Z): 19:59 Arr Apt: KOLV Arr Time (Local): 17:50 (Z): 23:50 Tot Time Aloft:

CORS: Y / (N) Sta 1: PPP 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:

LiDAR	Type / FOV	Serial #	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd	Avg Pt Spacing	Beg GB	Storage Name/s
	Riegl 1560i / 58.5	XXX546	7020'	7220'	200'	145kt	2	250	32234017 Drive tt 2 #3
		Scan Freq Auto 74	MpIA Y / N	Pulses In Air	Pulse Rate 350kHz	Power 100%	PPSM 2x1.27	End GB 320	
								Tot GB 70	

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
		~~20~~							
		20:09	21:13						Opening S turn ; MS Delta Middle Block
2010	N	20:18	20:35	135kt	9/32	7231'	0	0	clear ; standing water on southern half
2011	S	20:38	20:52	145kt	.87/33	7240'	0	0	clear ; standing water on southern half
2012	N	20:58	21:13	131	.91/31	7212'	0	0	" " "
2013	S	21:18	21:31	153	.88/33	7222'	0	0	Strong tailwind ; standing water in fields
2014	N	21:37	21:53	135	.87/33	7219'	0	0	
XTIE1	W	22:00	22:05	129					Cross Tie
		22:05	22:10						Closeout S turn
		22:25	22:28						North Block opening Sturn (7609.3)
32	N	22:30	22:52	129kt	.92/30	7251'	0	0	low returns due to flooded fields 0-10 nm FSE, heavy saturation throughout.
31	S	22:57	23:16	137	.88/30	7244'	0	0	heavy tailwind, low returns last 15 nm FSE - Southend Quarter)
XTIE2	E	23:26	23:30	151					CROSSTIE; Closeout Sturn 23:30-23:33 → RTB KOLV

Total Proj Lines: Lines Flown: 5 (Cadillac) 2(N) Lines Remain: Ø 13 whole (N) 2 Partial (N) Online Time: 3.4 Mob Time: .4 Notes:

Julian Day	340	Flight	A

LIDAR Flight Log

Date	December 5, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Snapshot required Laptop
Restart when starting up in the morning

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	16:59	**Takeoff**	17:29	
Engine Off	23:10	**Landing**	23:00	
Total	6.2 hrs	**Total**	5.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	17:05	17:10
Post Mission	23:03	23:08

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201205	Comments
			Start	End	Time	nmi to End		
PPP-8	-	-	18:01	18:05			-	Figure 8
1001	622034001	002°	18:09	18:16			180940	
1002	62203402	182°	18:21	18:29			182148	
1003	622034003	002°	18:38	18:53			183826	
X-TIE	622034004	92°	18:57	19:00			185713	
1004	622034005	182°	19:09	19:25			190923	
1005	622034006	002°	19:28	19:44			192822	
1006	622034007	182°	19:47	20:02			194707	
1007	622034008	002°	20:06	20:22			200626	
1008	622034009	182°	20:25	20:41			202528	
1009	622034010	002°	20:44	21:00			204447	
1010	622034011	182°	21:03	21:19			210351	
1011	622034012	002°	21:23	21:38			212312	
1012	622034013	182°	21:42	21:57			214204	
1013	622034014	002°	22:00	22:16			220043	

Julian Day	340	Flight	A

LIDAR Flight Log

Date	December 5, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Snapshot required Laptop
Restart when starting up in the morning

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	16:59	**Takeoff**	17:29	
Engine Off	23:10	**Landing**	23:00	
Total	6.2 hrs	**Total**	5.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	17:05	17:10
Post Mission	23:03	23:08

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201205	Comments
			Start	End	Time	nmi to End		
1014	622034015	182°	22:19	22:34			221918	
PPP-8	-	-	22:34	22:38			-	Figure 8

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 12-5-20

Lift: (A) B C D E Pg 2 of 2

Project: MS DELTA Proj #: R032274 Flight Mgmt File: 20201205_BN4040_A_R032274

Aircraft: N704MD Begin Hobbs: End Hobbs: Total: Pilot: NELSON Co-Pilot: – Tech: Schoone

Dep Apt: Dep Time (Lcl): (Z): Arr Apt: Arr Time (Local): (Z): Tot Time Aloft:

CORS: Y / (N) Sta 1: PPP 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:

LIDAR	Type 150011	Serial # 4040	Alt AGL 2195	Alt AMSL	Avg Terr Ht	Max Gdspd ~~400~~	Avg Pt Spacing
	FOV	Scan Freq	MpIA Y / N	Pulses In Air	Pulse Rate 350kHz	Power 100%	PPSM 2

	Beg GB	End GB	Tot GB	Storage Name/s
	548.95	523.38	25.57	2019MR

Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0,-,+)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.
6015	181	18:38	18:52	139	.9/29	7303			
6014	001	18:54	19:08	148	.9/26	7299			
6013	181	19:10	19:24	147	.9/25	7290			
6012	001	19:27	19:41	154	1.0/24	7290			
6011	181	19:43	19:57	160	.9/25	7313			
6010	001	20:00	20:11	148	1.0/24	7306			
CROSS	E	20:14	20:17	148	1.0/23	Y			

Total Proj Lines: Lines Flown: 6 Lines Remain: On line Time: 1.7 Mob Time: 1.9 Notes:

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

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Date: 12-06-2020

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

Project: MS Delta Proj #: 32274 Flight Mgmt File: 20201206A Swan

Aircraft: 704MD Begin Hobbs: 15006,2 End Hobbs: 15011,9 Total: 5.7 Pilot: Baumgarten Co-Pilot: Tech: ~~Schoone~~

Dep Apt: OLV Dep Time (Lcl): 939 (Z): +6 Arr Apt: OLV Arr Time (Local): 1524 (Z): +6 Tot Time Aloft: 5.7

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: 145 end: 3001

LiDAR	Type: 1560 ii	Serial #: 4040	Alt AGL: 2195	Alt AMSL:	Avg Terr Ht:	Max Gdspd: ~~160~~	Avg Pt Spacing:
	FOV:	Scan Freq: 83/85	MpIA: Y / N	Pulses In Air:	Pulse Rate: 350 kHz	Power: 100%	PPSM: 2

	Beg GB: 848	Storage Name/s
	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.
6009	181	1638	1640	131	1/33	7310			
6008	1	1643	1652	138	1/31	7296			
6007	181	1653	1703	125	1/28	7296			
6006	1	1706	1714	134	1/29	7286			
6005	181	1717	1726	120	1/28	7286			(A) Hobbs = 5.7
6004	1	1729	1737	135	1/27	7308			ONline = 4.2
6003	181	1744	1745	138	1/30	7295			mob = 1.5
6002	1	1749	1752	138	1/29	7342			
6001	181	1755	1757	144	1/29	7301			
6025	91	1801	1807	155	1/30	7290			Xtie planned
6016	1	1815	1830	147	1/29	7299			
6017	181	1832	1846	120	1/26	7299			
6018	1	1848	1903	149	1/25	7299			- [redacted] precip on last 2 Lines! 6026/6024
6019	181	1906	1920	120	1/24	7299			
6020	1	1923	1937	143	1/26	7299			
6021	181	1939	1953	140	1/24	7299			
6022	1	1956	2010	143	1/24	7322			
6023	181	2013	2027	144	1/24	7306			

Xtie planned	Dir	start	stop	speed	Alt	
6026 =	270	2033	2038	144	7299	Refly
6024 =	01	2045	Abort	130	7306	Refly

Total Proj Lines:	Lines Flown:	Lines Remain:	OnLine Time:	Mob Time:	Notes:

Julian Day	342	Flight	A

LIDAR Flight Log

Date	December 7, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Mississippi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

T-2C
H-100%
AMLS-106
Hpa-1019

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:38	**Takeoff**	14:54	
Engine Off	18:21	**Landing**	18:06	
Total	3.7 hrs	**Total**	3.2 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	182hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1445	1450
Post Mission	1810	1815

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
F8		-	1504	1509				
X-tie	372034201	-	1514	1525			151424	
4025	372034202	002	1531	1550			153136	
4026	372034203	183	1552	1605			155228	
4027	372034204	002	1610	1626			161052	
4028	372034205	183	1629	1643			162945	
4029	372034206	002	1646	1701			164638	
4030	372034207	183	1704	1716			170408	
4031	372034208	002	1719	1734			171942	
4032	372034209	183	1737	1750			173715	
F8		-	1751	1756				

Julian Day	343	Flight	A

LIDAR Flight Log

Date	December 8, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	15:21	**Takeoff**	15:35	
Engine Off	21:39	**Landing**	21:30	
Total	6.3 hrs	**Total**	5.9 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	15:25	15:30
Post Mission	21:32	21:37

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201208	Comments
			Start	End	Time	nmi to End		
PPP-8	-	-	15:59	16:04			-	Figure 8
1015	622034301	003°	16:09	16:26			160911	
1016	622034302	183°	16:30	16:34			163006	snapshot crashed, stopped scanning
1016	622034303	183°	16:45	17:00			164527	reflew line
1017	622034304	003°	17:04	17:22			170437	
1018	622034305	183°	17:25	17:40			172505	
1019	622034306	003°	17:44	18:01			174411	
1020	622034307	183°	18:04	18:05			180444	
1021	622034308	003°	18:09	18:11			180932	
2002	622034309	183°	18:15	18:16			181510	
2001	622034310	003°	18:19	18:21			181933	
X-TIE1015-19	622034311	273°	18:24	18:28			182411	
X-TIE 4001-10	622034312	269°	18:41	18:48			184115	
4001	622034313	003°	18:52	18:55			185225	
4002	622034314	273°	18:58	19:00			185817	

Julian Day	343	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	December 8, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	15:21	**Takeoff**	15:35	
Engine Off	21:39	**Landing**	21:30	
Total	6.3 hrs	**Total**	5.9 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	15:25	15:30
Post Mission	21:32	21:37

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201208	Comments
			Start	End	Time	nmi to End		
4003	622034315	003°	19:04	19:08			190430	
4004	622034316	183°	19:11	19:22			191150	
4005	622034317	003°	19:25	19:37			192550	
4006	622034318	183°	19:40	19:51			194038	
4007	622034319	003°	20:01	20:16			200142	
4008	622034320	183°	20:19	20:33			201939	
4009	622034321	003°	20:36	20:52			203656	
4010	622034322	183°	20:55	21:09			205535	
PPP-8		-	21:10	21:16			-	Figure 8

Julian Day	343	Flight	A

LIDAR Flight Log

Date	December 8, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Misisipi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

PostView not connecting need to restart 2 times.
T-3C
H-100%

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:36	**Takeoff**	15:06	
Engine Off	21:46	**Landing**	21:33	
Total	7.2 hrs	**Total**	6.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	320hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1455	1500
Post Mission	2136	2141

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
F8		-	1523	1528				
X-tie	372034301	-	1529	1536			152933	
4033	372034302	002	1540	1552			154017	
4034	372034303	183	1556	1607			155633	
4035	372034304	002	1611	1624			161130	
4036	372034305	183	1628	1639			162822	
4037	372034306	002	1644	1658			164405	
4038	372034307	183	1701	1713			170121	
4039	372034308	002	1717	1729			171723	
4040	372034309	183	1734	1745			173423	
4041	372034310	002	1750	1803			175057	
4042	372034311	183	1807	1818			180735	
4043	372034312	002	1824	1835			182402	
4044	372034313	183	1839	1849			183953	
4045	372034314	002	1855	1905			185538	

Julian Day 343	Flight A

LIDAR Flight Log

Date	December 8, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Misisipi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

PostView not connecting need to restart 2 times.
T-3C
H-100%

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:36	**Takeoff**	15:06	
Engine Off	21:46	**Landing**	21:33	
Total	7.2 hrs	**Total**	6.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	320hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1455	1500
Post Mission	2136	2141

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
4047	372034315	183	1910	1911			191016	
X-tie	372034316	-	1913	1915			191342	
4046	372034317	183	1922	1931			192228	
6001	372034318	002	1937	1945			193733	
6002	372034319	183	1950	1957			195014	
6003	372034320	002	2002	2010			200258	
6004	372034321	183	2015	2021			201505	
6005	372034322	002	2026	2033			202633	
6006	372034323	183	2038	2044			203812	
6007	372034324	002	2049	2055			204930	
6008	372034325	183	2100	2106			210028	
X-tie	372034326	-	2110	2114			211046	
F8			2114	2119				

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

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Date: 12-08-20 Lift: A B C D E Pg 1 of _

Project: MS Delta QSI Block Proj #: 32274 Flight Mgmt File: 20201208_SN4040_A_R032274 swan

Aircraft: 704MD Begin Hobbs: 15011.9 End Hobbs: 15087.6 Total: 5.7 Pilot: Baumgarten Co-Pilot: Tech: Sstoone

Dep Apt: OLV Dep Time (Lcl): 749 (Z): +6 Arr Apt: EKM Arr Time (Local): 1332 (Z): +6 Tot Time Aloft: 5.7

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: 145 end:

LiDAR	Type	Serial # H040	Alt AGL 2195	Alt AMSL	Avg Terr Ht	Max Gdspd ~~160~~	Avg Pt Spacing
	FOV	Scan Freq 83	MpIA Y / N	Pulses In Air	Pulse Rate 350kHz	Power 100	PPSM 2

	Beg GB	Storage Name/s
	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.
QSI	19	1	~~1334~~ 1419	1445	111	1/27	7246			
	18	181	1446	1506	112	1/25	7237			
	17	1	1509	1534	145	1/28	7227			
	16	181	1536	1556	120	1/27	7214			
	15	1	1559	1623	113	1/32	7247			
	14	181	1626	1646	120	1/33	7250			
	13	1	1648	1713	113	1/32	7265			
	12	181	1715	1735	149	1/32	7234			
	11	1	1737	1757	148	1/33	7344			
	10	181	1800	1818	143	1/32	7281			
	9	1	1819	1840	115	1/30	7270			
	8	181	1841	1856	120	1/27	7234			
22	~~Xtie~~	1	1908	1918	125	1/28	7235			xtie

@ Hobbs = 5.7
online = 5.0
mob = 0.7

Total Proj Lines:	Lines Flown:	Lines Remain:	Online Time:	Mob Time:	Notes:

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

(email log daily to flight_log_distribution_list@quantumspatial.com)

Date: 12-8-2020

Lift: (A) B C D E — Pg 2 of 2

Project: MS DELta QSI Block **Proj #:** 32274 **Flight Mgmt File:** 20201208_SN4040_B_R032274

Aircraft: 704MD **Begin Hobbs:** 15017.6 **End Hobbs:** 15020.3 **Total:** **Pilot:** Baumgarten **Co-Pilot:** Swan

Tech: Schoone

Dep Apt: CKM **Dep Time (Lcl):** 1419 **(Z):** +6 **Arr Apt:** OLV **Arr Time (Local):** 1700 **(Z):** +6 **Tot Time Aloft:**

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:** 145 **end:**

LIDAR													
Type	15Coil	Serial #	4040	Alt AGL	8195 m	Alt AMSL		Avg Terr Ht		Max Gdspd	160	Avg Pt Spacing	
FOV		Scan Freq	83	MpIA Y / N		Pulses in Air		Pulse Rate	350 kHz	Power	100 %	PPSM	2

Beg GB: End GB: Tot GB: Storage Name/e:

Line #	Hdg	Start (UTC)	End (UTC)	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0,-,+)	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc
7	1	2036	2058	125	1/23	7234			
6	181	2100	2118	137	1/23	7257			
5	1	2122	2142	133	1/24	7244			
4	181	2144	2202	120	1/25	7250			
3	1	2208	2209	145	1/28	7257			
2	181	2213	2217	126	1/29	7250			
1	1	2220	2225	138	1/29	7300			
XAic	90	2228	2233	140	" "	" "			unplanned

(B) Hobbs = 2.7
ONline = 2.0
mob = 0.7

(A+B) Hobbs = 8.4
ONline = 7.0
mob = 1.4

Total Proj Lines: **Lines Flown:** **Lines Remain:** **Online Time:** **Mob Time:** **Notes:**

Julian Day	344	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
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Date	December 9, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	15:16	**Takeoff**	15:31	
Engine Off	21:08	**Landing**	20:59	
Total	5.9 hrs	**Total**	5.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	15:23	15:28
Post Mission	21:01	21:06

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201209	Comments
			Start	End	Time	nmi to End		
PPP-8	-	-	15:40	15:45			-	Figure 8
X-TIE	622034440	274°	15:49	15:55			154955	
4011	622034441	003°	16:00	16:16			160055	
4012	622034442	183°	16:19	16:33			161918	
4013	622034443	003°	16:38	16:55			163852	
4014	622034444	183°	16:59	17:15			165934	
4015	622034445	003°	17:19	17:36			171903	
4016	622034446	183°	17:39	17:55			173926	
4017	622034447	003°	17:59	18:16			175917	
4018	622034448	183°	18:19	18:36			181938	
4019	622034449	003°	18:40	18:57			184010	
4020	622034450	183°	19:01	19:18			190114	
4021	622034451	003°	19:21	19:39			192134	
4022	622034452	183°	19:42	19:58			194223	
4023	622034453	003°	20:02	20:19			200200	

Julian Day	344	Flight	A

LIDAR Flight Log

Date	December 9, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	Y. Kadota
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	15:16	**Takeoff**	15:31	
Engine Off	21:08	**Landing**	20:59	
Total	5.9 hrs	**Total**	5.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 kHz	
Target Speed	160	kts	**Scan Rate**	182 hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	15:23	15:28
Post Mission	21:01	21:06

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201209	Comments
			Start	End	Time	nmi to End		
4024	622034454	183°	20:22	20:38			202236	
PPP-8		-	20:39	20:44			-	Figure 8

v 20200520

Julian Day	344	Flight	A

LIDAR Flight Log

Date	December 9, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Misisipi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

T-1C
H-86%
AMLS-106m
Hpa-1022

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:11	**Takeoff**	14:35	
Engine Off	20:52	**Landing**	20:41	
Total	6.7 hrs	**Total**	6.1 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	320hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1423	1428
Post Mission	2044	2049

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
F8		-	1444	1449				
6009	372034401	003	1452	1459			145245	
5001	372034402	003	1506	1515			150608	
X-tie	372034403	-	1522	1528			152215	
5019	372034404	183	1533	1534			153342	
5018	372034405	003	1538	1539			153806	
5017	372034406	183	1543	1545			154304	
5016	372034407	003	1547	1549			154757	
5015	372034408	183	1553	1555			155315	
5014	372034409	003	1559	1602			155920	
5013	372034410	183	1605	1609			160548	
5012	372034411	003	1612	1617			161243	
5011	372034412	183	1619	1624			161953	
5010	372034413	003	1627	1632			162743	
5009	372034414	183	1636	1641			163602	

Julian Day	344	Flight	A

LIDAR Flight Log

Date	December 9, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Misisipi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

T-1C
H-86%
AMLS-106m
Hpa-1022

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time					
Engine On	14:11	**Takeoff**	14:35		
Engine Off	20:52	**Landing**	20:41		
Total	6.7 hrs	**Total**	6.1 hrs		

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	320hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1423	1428
Post Mission	2044	2049

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
5008	372034415	003	1645	1651			164503	
5007	372034416	183	1654	1701			165438	
5006	372034417	003	1704	1712			170445	
5005	372034418	183	1715	1722			171550	
5004	372034419	003	1726	1734			172636	
5003	372034420	183	1737	1747			173758	
5002	372034421	003	1751	1802			175149	
3015	372034422	183	1810	1825			181001	
3014	372034423	003	1829	1845			182902	
3013	372034424	183	1848	1903			182822	
X-tie	372034425	-	1907	1909			190717	
6010	372034426	183	1915	1920			191506	
6011	372034427	003	1924	1929			192402	
6012	372034428	183	1933	1938			193314	
6013	372034429	003	1942	1946			194234	

Julian Day 344	Flight A

LIDAR Flight Log

Date	December 9, 2020	**Aircraft**	C-GJMT
Project	3210_QSI_Misisipi	**Pilot**	J.Mathieson
Location	Jackson MS	**Operator**	D.Arteaga
Mission Objective			

System	Riegl VQ-1560i
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

T-1C
H-86%
AMLS-106m
Hpa-1022

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:11	**Takeoff**	14:35	
Engine Off	20:52	**Landing**	20:41	
Total	6.7 hrs	**Total**	6.1 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700khz	
Target Speed	160	kts	**Scan Rate**	320hz	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1423	1428
Post Mission	2044	2049

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
6014	372034430	183	1950	1954			195030	
6015	372034431	003	1959	2002			195914	
6016	372034432	183	2006	2007			200605	
6017	372034433	003	2012	2013			201202	
X-Tie	372034434	-	2017	2021			201723	
F8		-	2021	2026				

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

(email Log daily to flight_log_distribution_list@quantumspatial.com)

Date: 12-9-2020

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

Project: MS Delta AO/QSI Proj #: 32274 Flight Mgmt File: 20201209_SN4040_AR032274 swan

Aircraft: 704MD Begin Hobbs: 15020.3 End Hobbs: ~~15023.1~~ Total: 2.8 Pilot: Baumgarten Co-Pilot: Tech: ~~Schoone~~

Dep Apt: OLV Dep Time (Lcl): 925 (Z): +6 15023.1 Arr Apt: OLV Arr Time (Local): (Z): +6 Tot Time Aloft: 2.8

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:

LiDAR	Type 1560i	Serial # 4040	Alt AGL	Alt AMSL	Avg Terr Ht	Max Gdspd 160	Avg Pt Spacing		Beg GB	Storage Name/#
	FOV	Scan Freq 83 lps	MpIA Y / N	Pulses In Air	Pulse Rate 350kHz	Power 100%	PPSM 2		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.
AO	6024	181	1602	1616	145	1/29	7300			Reflight good
	6026	271	1623	1628	120	1/32	7323			Reflight good
	6023	1	1636	1652	126	1/31	7293			Reflight good * AO site complete *
	QSI site									
5023	5023	92	1712	1713	160	1/31	7460			planned xtie
5021	5021	2	1718	1736	145	1/30	7391			5021
5020	5020	182	1738	1756	145	1/29	7391			* QSI site Complete *
										(A) Hobbs = 2.8
										on line = 1.9
										mob = 0.9

Total Proj Lines:	Lines Flown:	Lines Remain:	Online Time:	Mob Time:	Notes:

Julian Day	348	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	December 13, 2020	**Aircraft**	C-GMEC
Project	3210 QSI Mississippi	**Pilot**	A. Lavalliere
Location	Jackson, MS	**Operator**	B. Eisenbart
Mission Objective			

System	1560i
Unit	S2223062
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

System required restart after startup

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	15:41	**Takeoff**	16:13	
Engine Off	18:15	**Landing**	18:05	
Total	2.6 hrs	**Total**	1.9 hrs	

Mission Plan			
AGL Height	2000 m	**Pulse Rate**	700 kHz
Target Speed	160 kts	**Scan Rate**	182 hz
Laser Current	100 %	**FOV**	60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	15:59	16:04
Post Mission	18:08	18:13

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 201213	Comments
			Start	End	Time	nmi to End		
PPP-8	-	-	16:27	16:32			-	Figure 8
4031	622034801	003°	16:34	16:46			163439	
4030	622034802	183°	16:49	17:03			164958	
4029		003°	17:07		17:15		170721	Flew through virga, line aborted
4032		183°	17:23		17:38		172327	clouds on the south end, line aborted
X-TIE		93°	17:42	17:45			174217	
PPP-8	-	-	17:45	17:49			-	Figure 8