atlantic

LiDAR Acquisition Report

13-165

Mobile County LiDAR

October 20th, 2014

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Name of Job: Mobile County LiDAR
Job No: 13-165
Period of Performance: 01/12/2014 – 10/20/2014

Atlantic was contracted to acquire high resolution LiDAR (Light Detection and Ranging) data located in Mobile County, Alabama. The intent was to collect one (1) Area of Interest (AOI) that encompasses Mobile County. The total client defined AOI was 1,402 square miles or 3,361 square kilometers.

Successful completion of the project required accurate and reliable capture of airborne LiDAR and flight line calibration.

Project Area

Atlantic collected and processed topographic airborne LiDAR for the client defined AOI of 1,402 square miles in West Alabama.

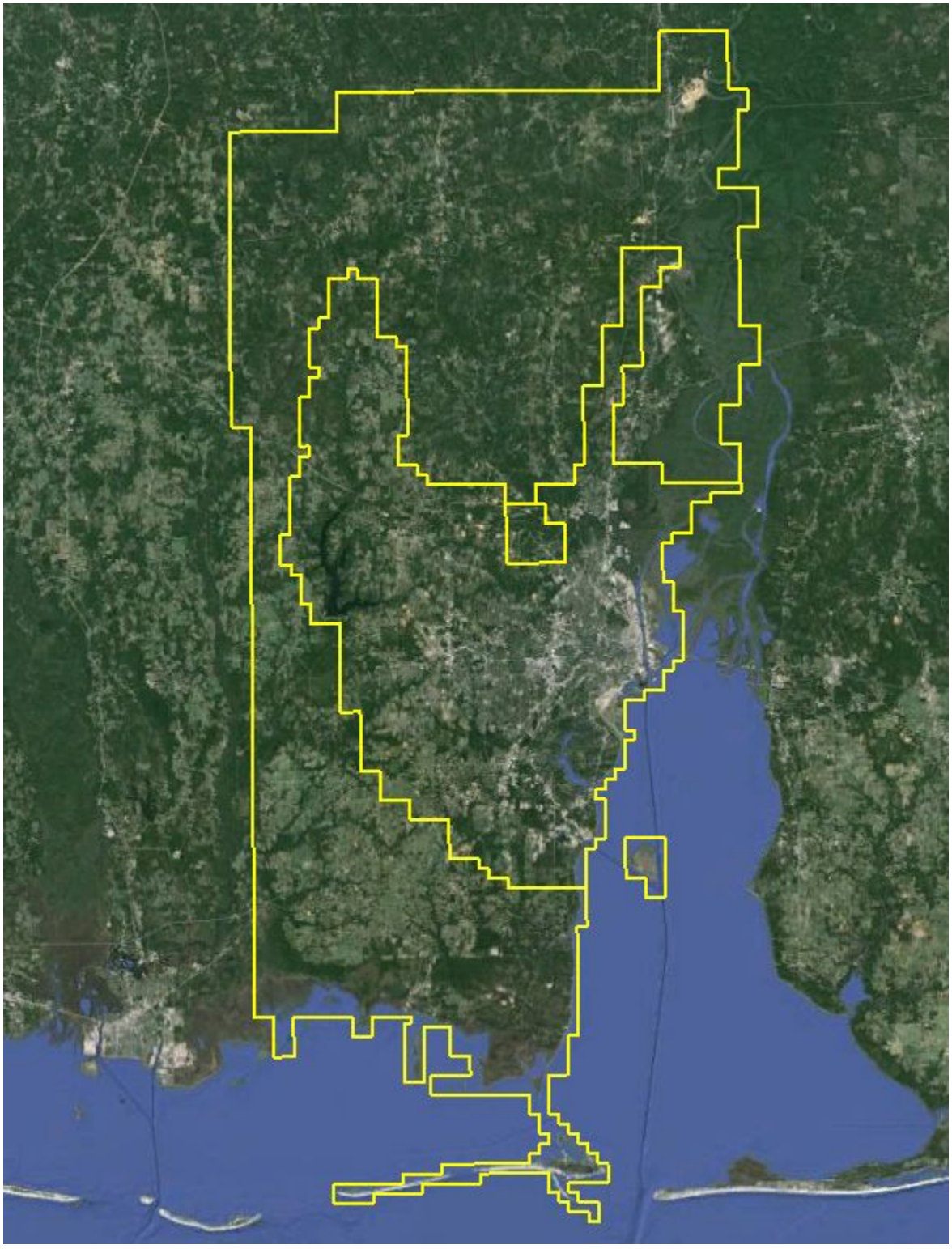

Figure 1: Project Area

Reference System

Horizontal Datum: North American Datum of 1983
Coordinate System: State Plane Alabama West Zone (FIPS 0102)
Vertical Datum: North American Vertical Datum of 1988
Geoid Model: Geoid12A
Units: U.S. Survey Feet

LiDAR Acquisition Details

Atlantic acquired 74 passes of the AOI as a series of sequential and perpendicular flight lines. The flight plan included zigzag flight line collection as a result of the inherent IMU drift associated with all IMU systems. In order to reduce any margin for error in the flight plan, Atlantic followed FEMA's Appendix A "guidelines" for flight planning which, at a minimum, included the following criteria:

- A digital flight line layout using LEICA MISSION PRO flight design software for direct integration into the aircraft flight navigation system.
- LiDAR coverage extended by a predetermined margin beyond all project borders to ensure necessary over-edge coverage appropriate for specific task order deliverables.
- Local restrictions related to air space and any controlled areas were investigated so that required permissions could be obtained in a timely manner with respect to schedule.
- File all flight plans as required by local Air Traffic Control (ATC) prior to each mission.

Atlantic monitored weather and atmospheric conditions and conducted LiDAR missions only when conditions existed that would not degrade sensor ability in the collection of data. These conditions included no snow, rain, fog, smoke, mist and/or low clouds. LiDAR systems are active sensors, not requiring light, thus missions may be conducted during night hours when weather restrictions do not prevent collection. Atlantic accessed reliable weather sites and indicators (webcams) to establish the highest probability for successful collection in order to position our sensor to maximize successful data acquisition.

Within 72-hours prior to the planned day(s) of acquisition, Atlantic closely monitored the weather, checking all sources for forecasts at least twice daily. As soon as weather conditions were conducive to acquisition, our aircraft mobilized to the project site to begin data collection. Once on site, the acquisition team took responsibility for weather analysis. Atlantic LiDAR sensors are calibrated at a designated site located at the Fayetteville Municipal Airport (FYM) in Fayetteville, TN and are periodically checked and adjusted to minimize corrections at project sites.

Acquisition Equipment

Atlantic operated a Partenavia S.P.A. P 68 C/TC (N775MW) outfitted with a Leica ALS70-HP LiDAR system during the collection of the project area. **Table 1** represents a list of the features and characteristics for the Leica ALS70-HP LiDAR system:

Atlantic's Sensor Characteristics		
Leica ALS70-HP		
Manufacturer	Leica	
Model	ALS70 - HP	
Platform	Fixed-wing	
Scan Pattern	sine, triangle, raster	
Maximum Scan rate (Hz)	sine	200
	triangle	158
	raster	120
Field of view (°)	0 - 75 (full angle, user adjustable)	
Maximum Pulse rate (kHz)	500	
Maximum Flying height (m AGL)	3500	
Number of returns	unlimited	
Number of intensity measurements	3 (first, second, third)	
Roll stabilization (automatic adaptive, °)	75 - active FOV	
Storage media	removable 500 GB SSD	
Storage capacity (hours @ max pulse rate)	6	
size (cm)	Scanner	37 W x 68 L x 26 H
	Control Electronics	45 W x 47 D x 36 H
Weight (kg)	Scanner	43
	Control Electronics	45
Operating Temperature	0 - 40 °C	
Flight Management	FCMS	
Power Consumption	927 @ 22.0 - 30.3 VDC	

Table 1: Atlantic's Sensor Characteristics

LiDAR System Parameters

Table 2 illustrates Atlantic's system parameters for LiDAR acquisition on this project.

LiDAR System Acquisition Parameters	
Item	**Parameter**
System	Leica ALS-70 HP
Altitude (AGL meters)	2350
Approx. Ground Speed (kts)	120
Laser Firing Rate (kHz)	231.2
Scan Frequency (hz)	53.4
Swath width (m)	1710
Swath Overlap (%)	30
Line Spacing (m)	1129
Pass heading (degree)	180
Field of View (degree)	40
Points per meter^2 (m)	2
Scan Pattern	Triangle

Table 2: LiDAR System Acquisition Parameters

LiDAR Acquisition Control

One (1) NGS monument was used to control the LiDAR acquisition for the project area. The coordinates are provided in Table 3 below in NAD83 (2011), Geographic Coordinate System, Ellipsoid, Meters.

Acquisition Control Coordinates				
Name	**PID**	**Latitude (N)**	**Longitude (W)**	**Height**
MOB AP STA A1	AA8546	30°40'50.96007"	88°14'12.44564"	35.434

Table 3: Acquisition Control Coordinates

LiDAR Acquisition Dates

Table 4 illustrates Atlantic's LiDAR acquisition dates per mission.

LiDAR Acquisition Dates			
Mission	**Julian Date (2014)**	**Date (YYYYMMDD)**	**Date (MM/DD/YYYY)**
JD012F01	012	20140112	01/12/2014
JD014F01	014	20140114	01/14/2014
JD014F02	014	20140114	01/14/2014
JD015F01	015	20140115	01/15/2014
JD016F01	016	20140116	01/16/2014
JD016F02	016	20140116	01/16/2014
JD016F02B	016	20140116	01/16/2014
JD017F01	017	20140117	01/17/2014
JD018F01	018	20140118	01/18/2014
JD021F01	021	20140121	01/21/2014
JD021F02	021	20140121	01/21/2014
JD022F01	022	20140122	01/22/2014

Table 4: LiDAR Acquisition Dates

Acquisition Status Report and Flightlines

Upon notification to proceed, the flight crew loaded the flight plans and validated the flight parameters. The Acquisition Manager contacted air traffic control and coordinated flight pattern requirements. LiDAR acquisition began immediately upon notification that control base stations were in place. During flight operations, the flight crew monitored weather and atmospheric conditions. LiDAR missions were flown only when no condition existed below the sensor that would affect the collection of data. The pilot constantly monitored the aircraft course, position, pitch, roll, and yaw of the aircraft. The sensor operator monitored the sensor, the status of PDOPs, and performed the first Q/C review during acquisition. The flight crew constantly reviewed weather and cloud locations. Any flight lines impacted by unfavorable conditions were marked as invalid and re-flown immediately or at an optimal time.

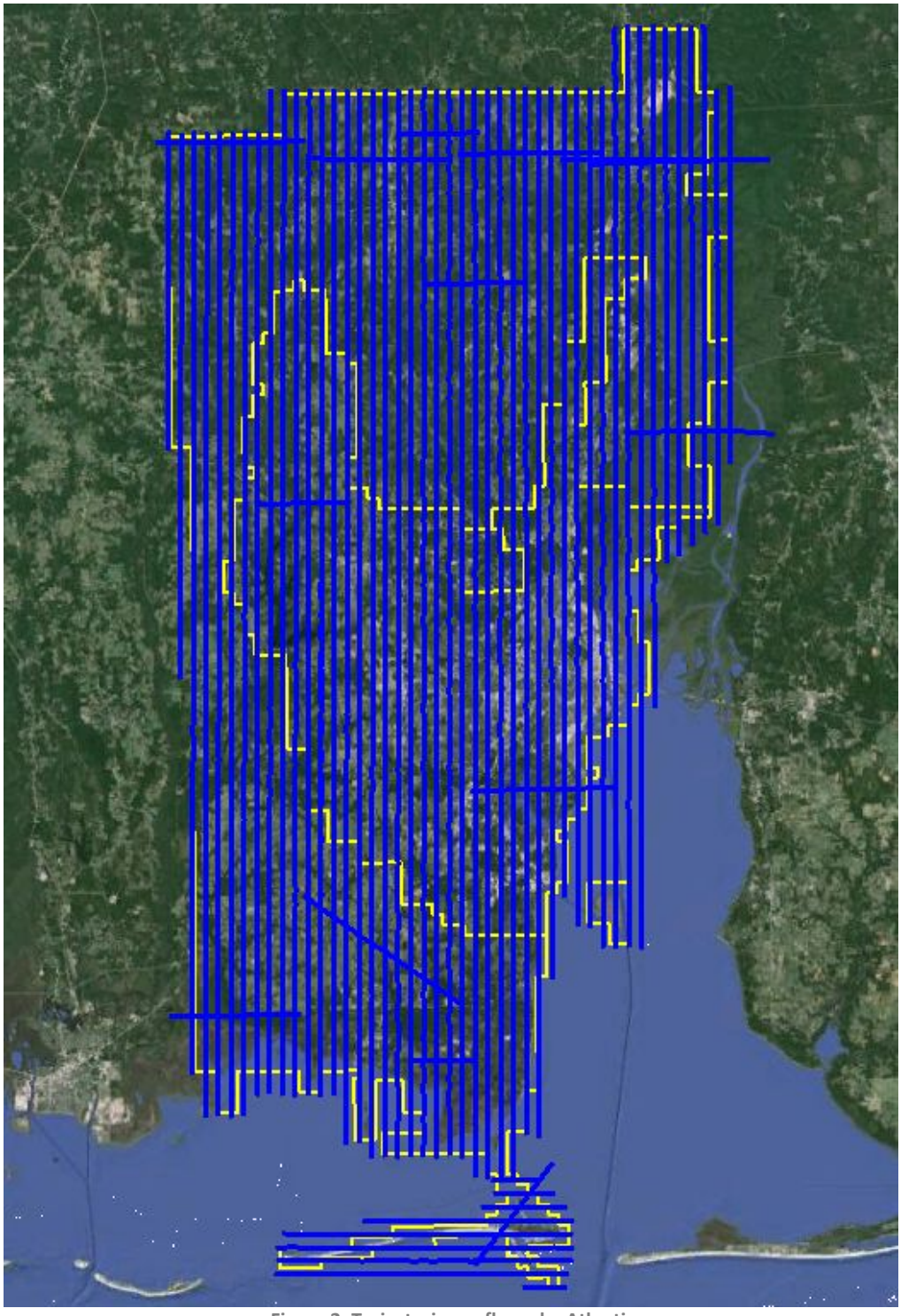

Figure 2: Trajectories as flown by Atlantic