# LIDAR ACQUISITION REPORT

## FY 2013 GEORGIA DNR ELEVATION DATA

## NOAA COASTAL SERVICES CENTER (CSC)

**CONTRACT NUMBER: EA133C11CQ0010**
**REQUISITION ORDER NUMBER NCNP0000-12-02645**

**Woolpert Project Number: 072875**

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**July 2013**

WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

# Table of Contents



# List of Figures



# List of Tables

# SECTION 1: OVERVIEW

This report contains a comprehensive outline of the airborne LiDAR data acquisition for Morgan, Putnam, Hancock, and Baldwin Counties, as part of the FY13 GA DNR Elevation Data EA133C-11-CQ-0010/T-0014; Contract Number EA133C11CQ0010; Requisition Order Number NCNP0000-12-02645, for the NOAA Coastal Services Center (CSC). The task order area Morgan, Putnam, Hancock, and Baldwin Counties was approximately 1455 square miles. The LiDAR data was collected and processed to meet a Nominal Post Spacing (NPS) of 1.0 meter. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath.

LIDAR data was collected using an Optech Gemini LiDAR System in Multi-Pulse mode. Gemini LiDAR System collects up to four returns (echo) per pulse, recording attributes such as time stamp and intensity data, for the first three returns. If a fourth return was captured, the system does not record an associated intensity value. The aerial LiDAR was collected at the following sensor specifications:

The aerial LiDAR was collected at the following sensor specifications for Morgan, Putnam, Hancock, and Baldwin Counties Project:

| | |
|---|---|
| Post Spacing (Minimum): | 3.28 ft / 1.0 m |
| AGL (Above Ground Level) average flying height: | 5,500 ft / 1,676 m |
| MSL (Mean Sea Level) average flying height: | 5,850 ft / 1,783 m |
| Average Ground Speed: | 130 knots / 149 mph |
| Field of View (full): | 40 degrees |
| Pulse Rate: | 125 kHz |
| Scan Rate: | 34 Hz |
| Side Lap (Minimum): | 25% |
| Flight Lines Flown at these specifications: | 1 – 142 (All) |

The LiDAR data was produced in Georgia State Plane East Zone, North American Datum of 1983 (NAD83). Coordinate positions were specified in units of US Survey Feet. The vertical datum used for the project was referenced to North American Vertical Datum of 1988 (NAVD88) in units of US Survey Feet.

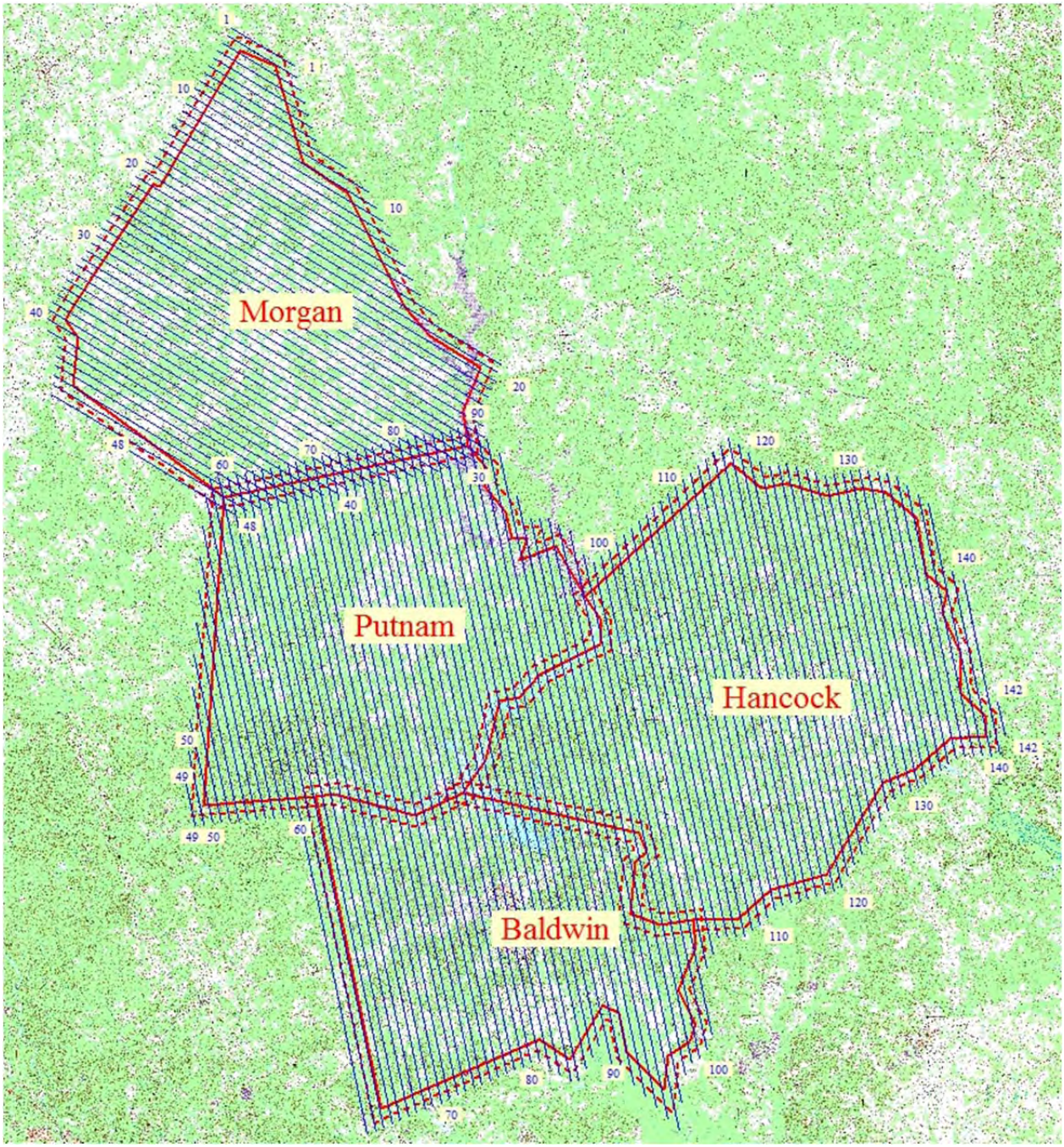
**Table 1.1:** LiDAR Acquisition Specifications

| Project | Post Spacing | Number of Flight Lines | Number of Collection Days | Acquisition Dates |
|---|---|---|---|---|
| Morgan, Putnam, Hancock, and Baldwin Counties, GA | 1.0-meter Average | 142 | 6 | December 19,2012<br>December 22,2012<br>December 28,2012<br>December 30,2012<br>January 04,2013<br>January 05,2013 |

**Table 1.2:** LiDAR Flight Summary. 1-Meter Nominal Post Spacing

| Date of Flying | Lines Flown | Time ON/Off Line (UTC) | Time On/Off Line (Local - EST/EDT) |
|---|---|---|---|
| December 19,2012<br>Optech Gemini 09SEN258<br>2 lifts | Lift 1 Lines 1-18 (Morgan Co.)<br>Lift 2 Lines 19-25 (Morgan Co.) | 15:22 – 18:40<br>20:51 – 22:35 | 10:22 AM – 1:40 PM<br>3:51 PM – 5:35 PM |
| December 22,2012<br>Optech Gemini 09SEN258<br>2 lifts | Lift 1 Lines 26-36 (Morgan Co.)<br>Lift 2 Lines 37-48 (Morgan Co.) | 15:02 – 18:15<br>20:38 – 23:03 | 10:02 AM – 1:15 PM<br>3:38 PM – 6:03 PM |
| December 28,2012<br>Optech Gemini 09SEN258 | 49–59 (Putnam Co.) | 22:48 – 00:53 | 5:48 PM – 7:53 PM |
| December 30,2012<br>Optech Gemini 09SEN258<br>2 lifts | Lift 1 Lines 60-70 (Putnam, Baldwin)<br>Lift 2 Lines 71-79 ((Putnam, Baldwin) | 14:59 – 18:58<br>20:52 – 00:15 | 9:59 AM – 1:58 PM<br>3:52 PM – 7:15 PM |
| January 4,2013<br>Optech Gemini 09SEN258<br>2 lifts | Lift 1 Lines 80-86 (Putnam, Baldwin, Hancock)<br>Lift 2 Lines 87-96 ((Putnam, Baldwin, Hancock) | 20:15 – 22:40<br>23:50 – 03:15 | 3:15 PM – 5:40 PM<br>6:50 PM – 10:15 PM |
| January 5,2013<br>Optech Gemini 09SEN258<br>4 lifts | Lift 1 Lines 97-106 (Putnam, Baldwin, Hancock)<br>Lift 2 Lines 107-113 (Baldwin, Hancock)<br>Lift 3 Lines 114-129 (Baldwin, Hancock)<br>Lift 4 Lines 130-142 (Baldwin, Hancock) | 05:57 – 08:58<br>10:30 – 12:25<br>16:44 – 21:16<br>22:07 – 00:33 | 00:57 AM – 3:58 AM<br>5:30 AM – 7:25 AM<br>11:44 AM – 4:16 PM<br>5:07 PM – 7:33 PM |

**Figure 1.1:** LiDAR Flight Diagram



# SECTION 2: FLIGHT ACQUISITION

The LiDAR data was acquired with an Optech Gemini LIDAR System (09SEN258) in Multiple Pulse in Air (MPiA) mode, on board a Cessna 310 (N1107Q). Woolpert owns all the equipment used for the ground control and ABGNSS missions with the exception of CORS stations.

Table 2.1 lists the specifications and the requirements of the ALTM Gemini, bearing serial numbers 09SEN258 and 09CON258.

**Table 2.1:** System Specifications

| **Specifications** | | | |
|---|---|---|---|
| Serial numbers | Sensor Head 09SEN258<br><br>Control Rack 09CON258 | | |
| Operating altitude | 150 – 4000 m nominal | | |
| General Enhanced Accuracy Specifications | Laser Repetition Rate | Horizontal Accuracy (m 1 δ) | Vertical Accuracy (m 1 δ) AGL |
| | 33 kHz<br><br>50 kHz | 1/5500 x altitude | < 5 cm up to 500 m<br><br>< 10 cm up to 1 km<br>< 15 cm up to 2 km<br>< 20 cm up to 3 km<br><br>< 25 cm up to 4 km |
| | 70 kHz | 1/5500 x altitude | < 5 cm up to 500 m<br><br>< 10 cm up to 1 km<br>< 15 cm up to 2 km |
| | 100 kHz | 1/5500 x altitude | < 10 cm up to 500 m<br><br>< 15 cm up to 1 km<br><br>< 20 cm up to 2 km |
| | 125 kHz | 1/5500 x altitude | < 10 cm up to 500 m<br><br>< 15 cm up to 1km |
| | 143 kHz | 1/5500 x altitude | < 15 cm up to 500 m<br><br>< 20 cm up to 1 km |
| | 167 kHz | 1/5500 x altitude | < 35 cm @ 750 m |
| Range capture | Up to 4 range measurements for each pulse including last | | |
| Intensity capture | 12 bit dynamic range for each measurement | | |

| **Table 2.1:** System Specifications | |
|---|---|
| **Specifications** | |
| Scan frequency | Variable; maximum 70 Hz |
| Scan angle | Variable from 0 to ± 25°, in increments of ±1º |
| Scanner Product | Scan Angle x Scan Frequency ≤ 1000 |
| Roll compensation | 5 Hz update rate<br><br>(Scan angle + Roll Comp. Angle = FOV, i.e. ± 25º allows ± 5º compensation) |
| Swath width | Variable; 0 to 0.93 x altitude m |
| Position Orientation System | Applanix – Optech custom POS including internal 12 channel dual frequency 50 Hz GPS receiver |
| Laser repetition rate | 33 kHz (maximum AGL 4.0 km)<br><br>50 kHz (maximum AGL 3.0 km)<br><br>70 kHz (maximum AGL 2.5 km)<br><br>100 kHz (maximum AGL 2.0 km)<br><br>125 kHz (maximum AGL 1.6 km)<br>142 kHz (maximum AGL 1.4 km)<br>166 kHz (maximum AGL 1.2 km) |
| Data storage hard drive | Ruggedized removable hard drive, (10hr continuous log time @ 100 KHz) |
| Beam divergence | Dual 0.3 mrad (1/e) and 0.8 mrad (1/e) |
| Eye safe range | *See eye safety table* |
| Laser classification | Class IV (FDA CFR 21) |
| Power requirements | 28 V (continuous), 45 A (maximum) |
| Operating temperature | Control rack: 10 to 35º C<br><br>Sensor head: -10 to 35º C (assuming the use of thermal jacket) |
| Storage Temperature | Control Rack: – 10 º to 50º C<br><br>Sensor Head: 0 º to 50º C |
| Humidity | 0 – 95% non-condensing |
| Control Rack Measurements | 653mm x 591mm x 485mm, 55kg |
| Sensor Head Measurements | 298mm x 249mm x 437mm, 23kg |

Woolpert's Aerial Acquisition Team coordinated with the necessary Air Traffic Control personnel prior to flying to ensure access.

Flight navigation is performed using Optech ALTM-NAV (Airborne Laser Terrain Mapper Navigation Software). The pilots are thoroughly trained and highly skilled at maintaining their planned trajectory, while holding the aircraft steady and level. If atmospheric conditions are such that the trajectory, ground speed, roll, pitch and heading cannot be properly maintained, the mission is aborted until suitable conditions occur.

The aircraft are all configured with a NovAtel Millennium 12-channel, L1/L2 dual frequency GNSS receivers collecting at 2 Hz.

All Woolpert aerial sensors are equipped with Litton LN200 series IMU's operating at 200 Hz.

A base-station unit was mobilized for the imagery acquisition mission, and was operated by a member of the Woolpert survey and/or flight crew. Each base-station setup consisted of one (1) Trimble 5000 series dual frequency receiver, one (1) Trimble Zephyr Geodetic L1/L2 dual frequency antenna, one (1) 2-meter fixed-height tripod, and essential battery power and cabling. Ground planes were used on the base-station antennas. Data was collected at 1 or 2 Hz.

GNSS Base Station operated during the acquisition mission is listed below.

All GNSS base station data and point locations were tied together, along with the ground control.

## WEATHER

No significant weather issues occurred during the flight mission.

## GROUND CONDITIONS

The project area was relatively flat terrain, so the project area was able to be flown at one flight altitude throughout Morgan, Putnam, Baldwin, and Hancock Counties. No flood or ponding occurred.

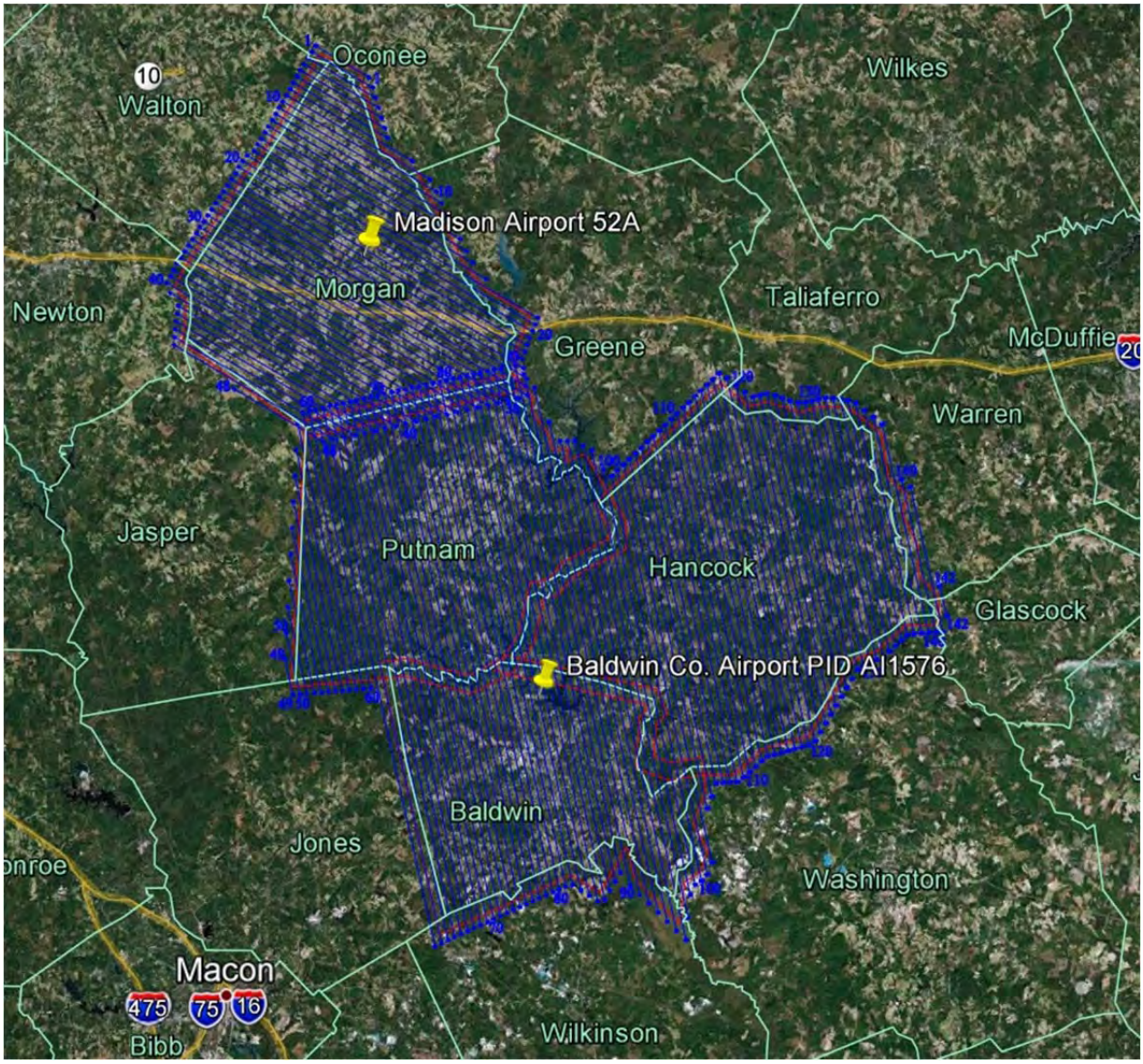
## GPS BASE STATION INFORMATION

GPS Base Station Used: MLJ A - PID# AI1576 (Putnam, Polk, Baldwin Counties) and Madison Airport 52A (Morgan County)

**Table 2.2:** GNSS Base Stations

| Station Name | Latitude (DMS) | Longitude (DMS) | Ellipsoid Height (L1 Phase Center) Feet |
|---|---|---|---|
| MLJ A | N 33° 09' 13.75604" | W 83° 14' 29.66338" | 285.121 |
| Madison Airport 52A | N 33° 36' 46.36758" | W 83° 27' 42.40181" | 605.493 |

**Figure 2.1:** GNSS Base Station Locations




# MAPS

Map of the project location is provided in shapefile format.

# SECTION 3: LIDAR DATA PROCESSING

The collected data was shipped back to the Woolpert Dayton, Ohio office for processing and quality control. All data was downloaded into a standard Woolpert directory structure. The data was immediately checked for missing files, corrupt files, etc. Once verified, the GPS data was processed using Applanix PosPac 5.3 and PosGNSS 5.1 software packages, combining airborne GPS data with base station / CORS ground data. The GPS quality control process includes checking the data to within specs in regards to positional accuracy (<10cm), PDOP (<3), etc.

The LiDAR data was processed with DashMap v5.1061 software from Optech. The processed LiDAR data was immediately checked against the flight line layout via MicroStation V8, using TerraScan. Each flight data was checked for spatial accuracy and completeness, data quality, any data voids, clarity of the intensity imagery, point spacing specs, etc.

The results of the data analysis were immediately provided back to the flight crew. Any re-flight areas were immediately re-flown.

A Maximum Position Dilution of Precision (PDOP) of < 3.0 was achieved.

## GPS/IMU PROCESSING SUMMARY

**Table 3.1:** Mission Specific Base Stations, Combined Separation, Estimated Positional Accuracy and PDOP

| Date Sensor Head | Base Station(s) | Combined Separation: Average Difference (Feet) | PDOP Average | Maximum Horizontal Positional Accuracy: (Feet) | Maximum Vertical Positional Accuracy: (Feet) |
|---|---|---|---|---|---|
| December 19,2012 09SEN258 "A" Flight | MLJ A | 0.06 | 1.9 | 0.04 | 0.07 |
| December 19,2012 09SEN258 "B" Flight | MLJ A | 0.05 | 1.6 | 0.03 | 0.06 |
| December 22,2012 09SEN258 "A" Flight | MLJ A | 0.06 | 1.8 | 0.03 | 0.06 |
| December 22,2012 09SEN258 "B" Flight | MLJ A | 0.05 | 2.1 | 0.03 | 0.07 |
| December 28,2012 09SEN258 | Madison Airport 52A | 0.06 | 1.9 | 0.04 | 0.07 |
| December 30,2012 09SEN258 "A" Flight | Madison Airport 52A | 0.05 | 1.8 | 0.03 | 0.06 |
| December 30,2012 09SEN258 "B" Flight | Madison Airport 52A | 0.06 | 2.0 | 0.04 | 0.06 |

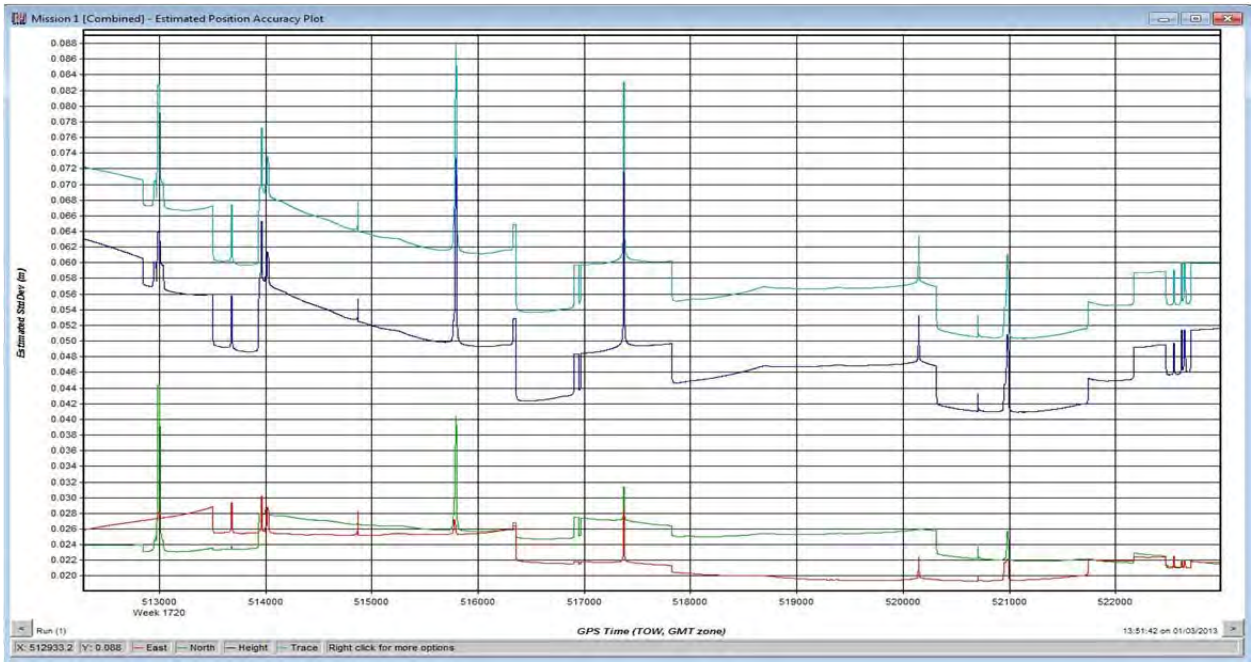
**Table 3.1:** Mission Specific Base Stations, Combined Separation, Estimated Positional Accuracy and PDOP

| Date Sensor Head | Base Station(s) | Combined Separation: Average Difference (Feet) | PDOP Average | Maximum Horizontal Positional Accuracy: (Feet) | Maximum Vertical Positional Accuracy: (Feet) |
|---|---|---|---|---|---|
| January 4,2013 09SEN258 "A" Flight | Madison Airport 52A | 0.05 | 1.6 | 0.03 | 0.06 |
| January 4,2013 09SEN258 "B" Flight | Madison Airport 52A | 0.06 | 2.1 | 0.03 | 0.07 |
| January 5,2013 09SEN258 "A" Flight | Madison Airport 52A | 0.05 | 2.0 | 0.03 | 0.06 |
| January 5,2013 09SEN258 "B" Flight | Madison Airport 52A | 0.05 | 1.8 | 0.03 | 0.06 |
| January 5,2013 09SEN258 "C" Flight | Madison Airport 52A | 0.06 | 1.9 | 0.03 | 0.06 |
| January 5,2013 09SEN258 "D" Flight | Madison Airport 52A | 0.06 | 2.0 | 0.04 | 0.07 |

The Estimated Positional Accuracy plots the standard deviations of the east, north, and vertical directions along a time scale of the trajectory. It illustrates loss of satellite lock issues, as well as issues arising from long baselines, noise, and/or other atmospheric interference.

Woolpert's goal is to maintain an Estimated Positional Accuracy of less than ten (10) cm, often achieving results well below this threshold.

**Figure 3.1:** Horizontal and Vertical Positional Accuracies from Day 363



The Combined Separation is a measure of the difference between the forward run and the backward run solution of the trajectory. The Kalman filter is run in both directions to remove directional specific anomalies. The closer these two solutions match; in general, the better is the overall reliability of the solution. Woolpert's goal is to maintain a Combined Separation Difference of < 10cm, often achieving results well below this cap.

**Figure 3.2:** GPS Combined Separation from Day 363

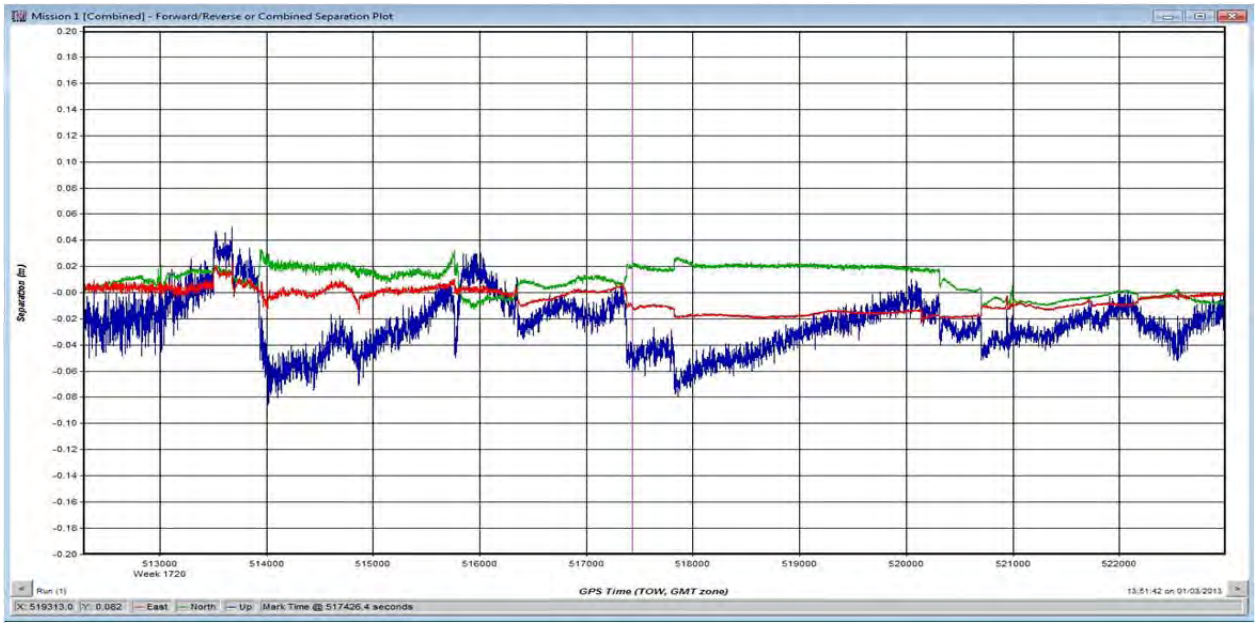



**Figure 3.3:** GPS Altitude Plot from Day 363

**Figure 3.4:** Horizontal GPS Distance from Base Station from Day 363

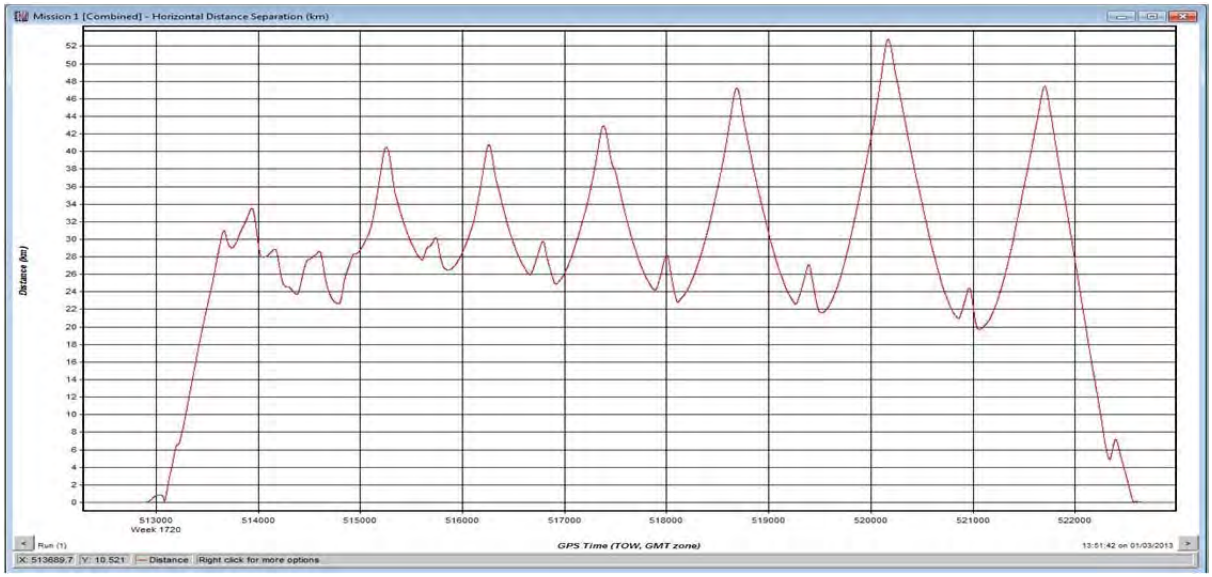
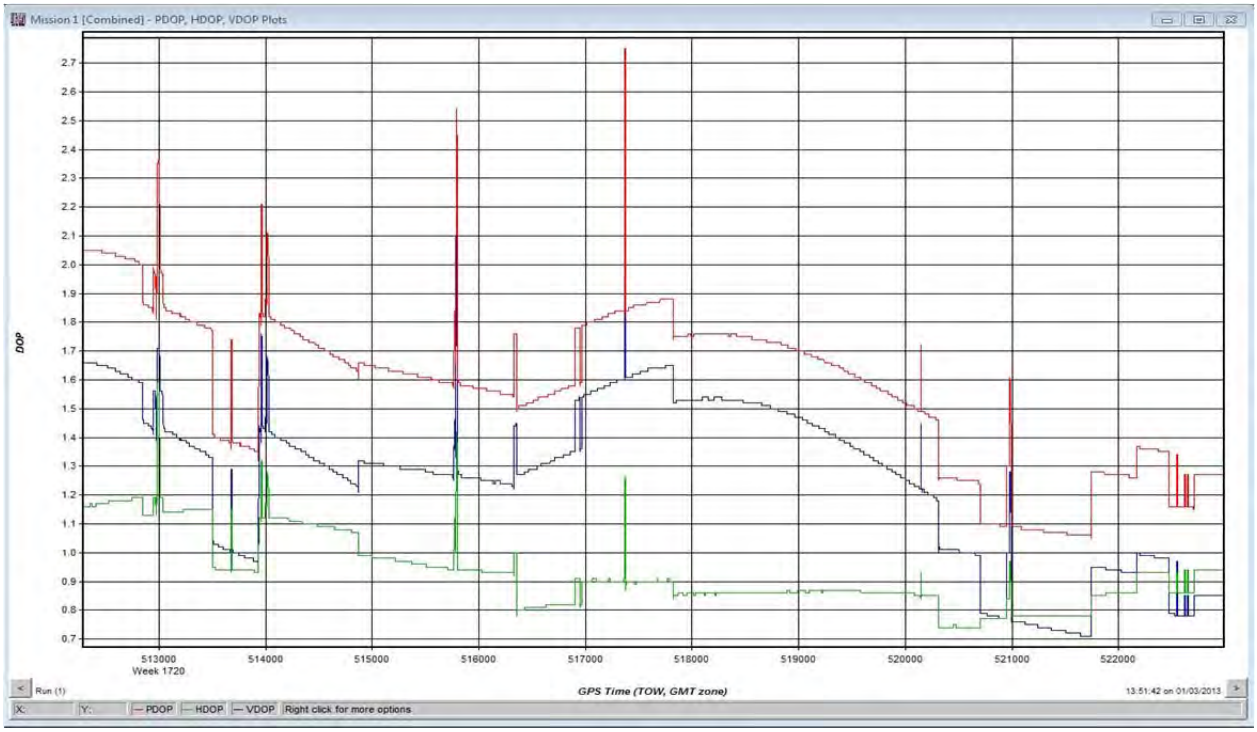



**Figure 3.5:** PDOP from Day 363



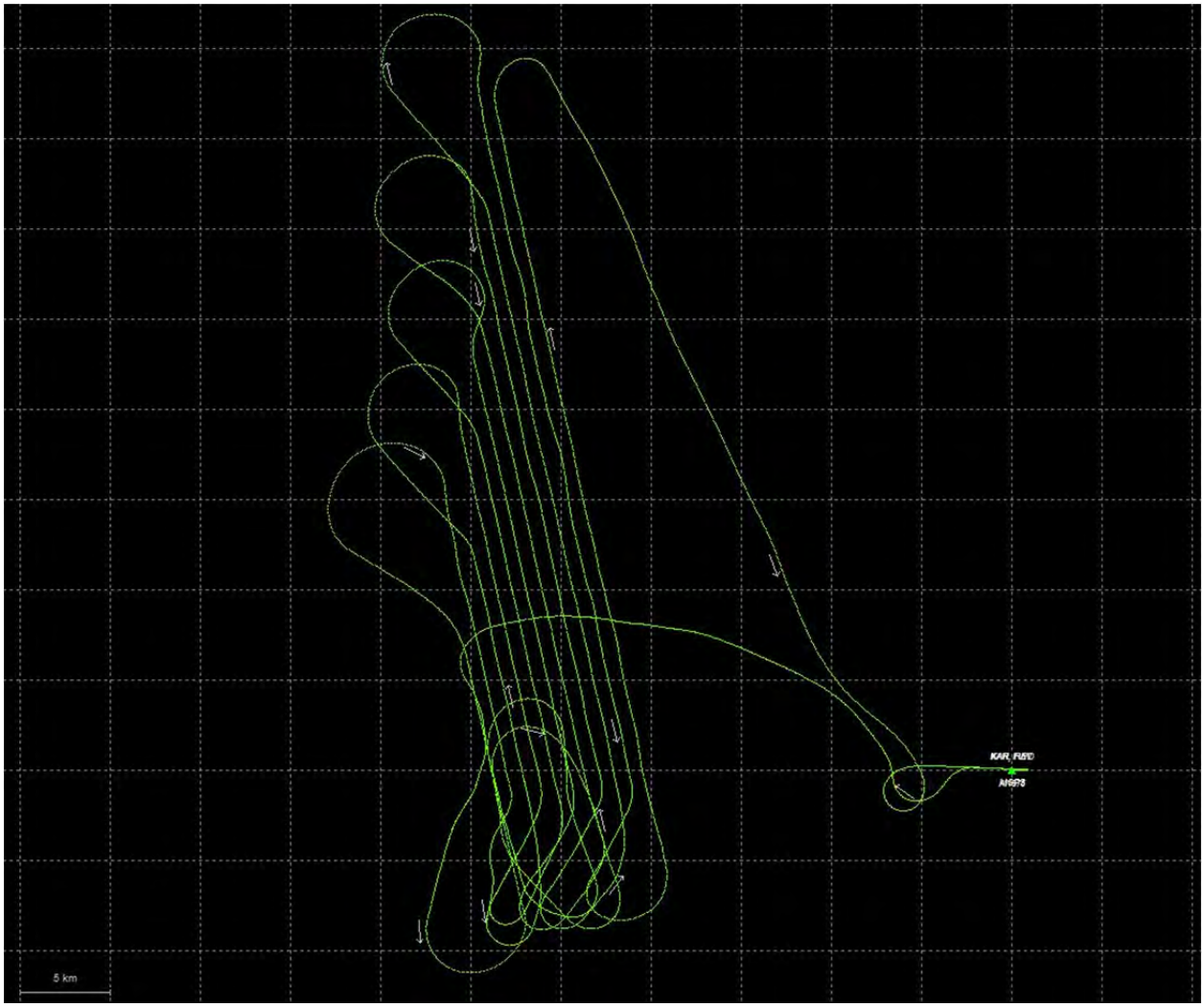
# COVERAGE CHECKS

Project verification coverage checks are provided in shapefile format.

# FLIGHTS

The GNSS Trajectory, along with high quality IMU data, is a key factor in determining the overall positional accuracy of the final sensor data.

**Figure 3.6:** Flight Trajectory from Day 363




Each mission "As-flown" trajectories were provided in shapefile format.

# APPLICATIONS AND WORK FLOW OVERVIEW

1. Resolved kinematic corrections for three subsystems: inertial measurement unit (IMU), sensor orientation information and airborne GPS data. Developed a blending post-processed aircraft position with attitude data using Kalman filtering technology or the smoothed best estimate trajectory (SBET).
   **Software:** POSPac Software v. 5.3, IPAS Pro v.1.35.

2. Calculated laser point position by associating the SBET position to each laser point return time, scan angle, intensity, etc. Created raw laser point cloud data for the entire survey in .LAS format. Automated line-to-line calibrations were then performed for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift.
   **Software:** ALS Post Processing Software v.2.70, Proprietary Software, TerraMatch v. 13.01.

3. Imported processed .LAS point cloud data into the task order tiles. Resulting data were classified as ground and non-ground points with additional filters created to meet the task order classification specifications. Statistical absolute accuracy was assessed via direct comparisons of ground classified points to ground RTK survey data. Based on the statistical analysis, the LiDAR data was then adjusted to reduce the vertical bias when compared to the survey ground control.
   **Software:** TerraScan v. 13.003.

4. The .LAS files were evaluated through a series of manual QA/QC steps to eliminate remaining artifacts and small undulations from the ground class.
   **Software:** TerraScan v. 13.003.

5. All water bodies greater than two acres and all rivers with a nominal 100 foot width or larger were hydro-flattened using stereo compilation methods.
   **Software:** LP360, proprietary tools, Microstation v8**,** TerraScan v.13.003.

# LIDAR DATA PROCESSING

When the sensor calibration, data acquisition, and GPS processing phases were complete, the formal data reduction processes by Woolpert LiDAR specialists included:

- Processed individual flight lines to derive a raw “Point Cloud” LAS file. Matched overlapping flight lines, generated statistics for evaluation comparisons, and made the necessary adjustments to remove any residual systematic error.

- Calibrated LAS files were imported into the task order tiles and initially filtered to create a ground and non-ground class. Then additional classes were filtered as necessary to meet client specified classes.

- Once all of the task order data was imported and classified, cross flights and survey ground control data was imported and calculated for an accuracy assessment. As a QA/QC measure, Woolpert has developed a routine to generate accuracy statistical reports by comparison among LiDAR points, ground control, and TINs. The LiDAR is adjusted accordingly to reduce any vertical bias to meet or exceed the vertical accuracy requirements.

- The LiDAR tiles were reviewed using a series of proprietary QA/QC procedures to ensure it fulfills the task order requirements. A portion of this requires a manual step to ensure

anomalies have been removed from the ground class.

- The bare earth DEM surface was hydrologically flattened for water body features that were greater than 2 acres and rivers and streams of 30.5 meters (100 feet) and greater nominal width.

- The LiDAR LAS files for this task order have been classified into the Default (Class 1), Ground (Class 2), Noise (Class 7), Water (Class 9) Ignored Ground (Class 10), Overlap Default (Class 17), and Overlap Ground (Class 18).

- FGDC Compliant metadata was developed for the task order in .xml format for the final data products.

- The final LiDAR data was delivered in 5,000' x 5,000' tiles using NAD 1983(2011), Georgia State Plane Coordinate System, West Zone, and expressed in US Survey Feet for Morgan and Putnam Counties. The final LiDAR data was delivered in 5,000' x 5,000' tiles using NAD 1983(2011), Georgia State Plane Coordinate System, East Zone, and expressed in US Survey Feet for Baldwin and Hancock Counties. The vertical datum used for this survey is North American Vertical Datum 1988 (NAVD88), and expressed in US Survey Feet. The vertical datum used for this project was referenced to NAVD 1988, US Survey Feet, GEOID 12A.

# SECTION 4: SENSOR CALIBRATION

Calibration flights were performed prior to arriving on the project site. The calibration was performed at Falcon Field Airport in Peachtree City, GA. To accomplish the formal calibration, Woolpert has established a calibration range of an airport runway. The calibration ranges has been ground surveyed to an accuracy of better than 1 cm. The mission consisted of 3 different altitudes flown along and across the runway and opposing directions which is required in order to capture the pitch, roll, heading, and torsion errors.

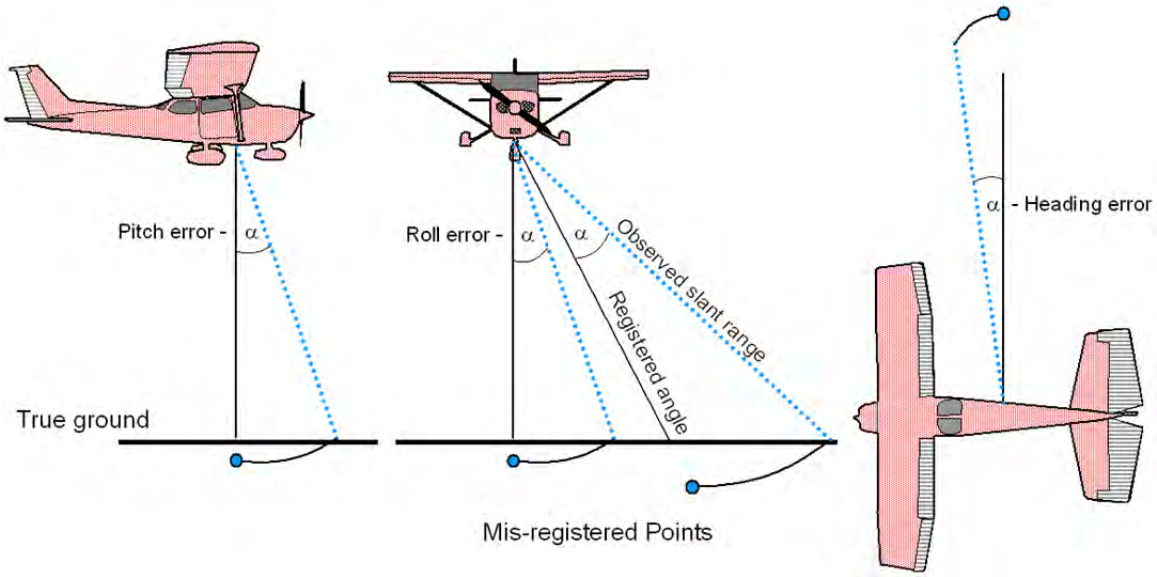



**Figure 4.1:** Misalignment Errors

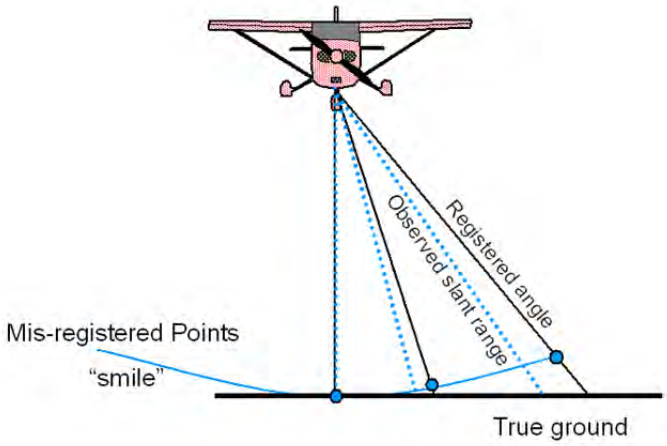
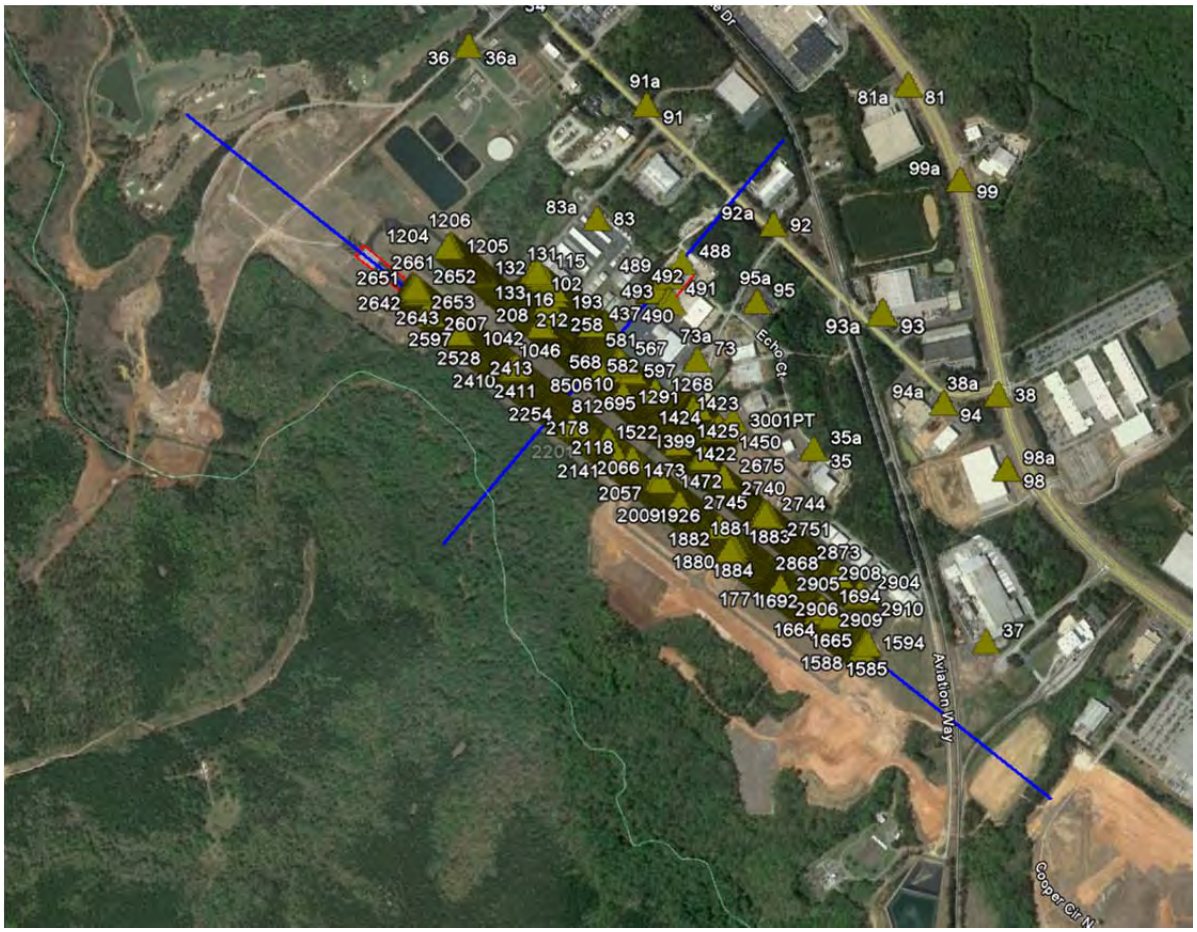


**Table 4.1:** Calibration Flight Parameters

| Altitude (AGL) | Scan Angle (half) | Scan Freq | PRF | Speed (Knots) | Direction | Description | # of Passes |
|---|---|---|---|---|---|---|---|
| 1219m | 0.5 | 35 | 100 | 130 | Bi-direction | Building/Across Runway | 4 |
| 1219m | 20 | 35 | 100 | 130 | Bi-direction | Building/Across Runway | 4 |
| 1219m | 25 | 35 | 100 | 130 | Bi-direction | Along/Across Runway | 4 |
| 1737 | 20 | 29.5 | 100 | 130 | Bi-direction | Along/Across Runway | 4 |
| 2250 | 20 | 32 | 100 | 150 | Bi-direction | Along/Across Runway | 4 |



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NumCameras=0

TimeLag=0.00001300

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IMUPitchMis=0.014

IMUHeadingMis=0.002

IMURoll=-0.004000

IMUPitch=-0.044680

IMUHeading=0.000000

UserToImuEx=0.00000

UserToImuEy=-0.0016

UserToImuEz=-0.390

UserToImuDx=-0.090

UserToImuDy=-0.008

UserToImuDz=-0.096

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UserToRefDy=-0.030000

UserToRefDz=-0.488000

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UseLeftDroopCorrection=15.000000

UseRightDroopCorrection=15.000000

meteoCorrMethod=2

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Pressure=1012.872240

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ScannerAngleLimitingSmootherOn=0

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FirstPulseRange=-2.971802

SecondPulseRange=-3.113822

ThirdPulseRange=-3.205173

LastPulseRange=-5.379880

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BEAM0_ROLL=0.000000

DX0=0.000000

DY0=0.000000

DZ0=0.000000

MIRROR_PITCH=0.000000

WINDOW_PITCH=0.000000

WINDOW_YAW=0.000000

[ScannerPolynomialCoefficients]

DegreeOfPoly=5

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a1=1.018877000000000

a2=0.000040000000000

a3=0.000001000000000

a4=-0.000000523000000

a5=0.000000000000000

[MeteoCrystalPolyCoeff]

CrystalFreq=100.000000

CrystalResolution=10.000000

DegreeOfPoly=-1

f0=0.000000000000000

f1=0.000000000

f2=0.000000000

f3=0.000000000

f4=0.000000000

f5=0.000000000

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IntensityTable125Khz=G:\PH\Aerial\Data_Acquisition\Calibration_Reports\LiDAR\Optech\56108\56108 res file\intensity.tbl

IntensityTable142Khz=G:\PH\Aerial\Data_Acquisition\Calibration_Reports\LiDAR\Optech\56108\56108 res file\intensity.tbl

IntensityTable166Khz=G:\PH\Aerial\Data_Acquisition\Calibration_Reports\LiDAR\Optech\56108\56108 res file\intensity.tbl

The following measurements were calculated in the lab at Optech and will remain constant.

| **Table 4.2:** Optech Gemini S/N 09SEN258 IMU Lever Arm Values | |
|---|---|
| **Reference (Scanner Mirror) to IMU Misalignment (POS/AV)** | |
| X | 0.000 ° |
| Y | -0.016 ° |
| Z | -0.390 ° |
| **Reference to IMU Lever Arm (POS/AV)** | |
| X | -0.090 m |
| Y | 0.008 m |
| Z | -0.096 m |

The positioning of the GPS antenna on the aircraft was field surveyed by Woolpert using a total station to ± 0.02m.

| **Table 4.3: N1107Q:** Cessna 310 with Optech Gemini S/N 09SEN258 installed Lever Arm Values | |
|---|---|
| **Reference Point to GPS Antenna** | |
| X | -0.043 m |
| Y | -0.052 m |
| Z | -1.134 m |

# SECTION 5: FLIGHT LOGS

This section contains the Flight Log(s) covering the project. Flight Logs list mission specific details such as crew members, airports, weather conditions, real time PDOP values and document any issues encountered during the mission. Flight Logs are filled out by the sensor operator during the acquisition flight.

**Woolpert**

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/19/2012 | 354 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1779.3 | 9:56:00 | 14:56:00 PM | WOOLPERT PIN |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1782.8 | 14:00:00 PM | 19:00:00 PM | N/A |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | 52A |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 10 | 2 | 30.1 | CL | Arriving | 52A |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 10:00 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 15:00:00 | 15:07:00 | | 18 | 1 | 1.8 | Static Alignment |
| 1 | 120 | 15:22:22 | 15:22:46 | 0:00:24 | 18 | 1 | 1.8 | Aborted- Airspeed too high (reject) |
| 1 | 120 | 15:36:44 | 15:39:14 | 0:02:30 | 18 | 1 | 1.9 | |
| 2 | 300 | 15:44:51 | 15:47:47 | 0:02:56 | 18 | 1 | 1.9 | |
| 3 | 120 | 15:52:07 | 15:55:04 | 0:02:57 | 17 | 1 | 1.9 | |
| 4 | 300 | 15:59:48 | 16:03:12 | 0:03:24 | 18 | 1 | 1.6 | |
| 5 | 120 | 16:07:29 | 16:10:46 | 0:03:17 | 17 | 1 | 1.6 | |
| 6 | 300 | 16:15:40 | 16:19:28 | 0:03:48 | 18 | 1 | 1.3 | |
| 7 | 120 | 16:23:27 | 16:27:12 | 0:03:45 | 18 | 1 | 1.4 | |
| 8 | 300 | 16:33:04 | 16:38:06 | 0:05:02 | 17 | 0.8 | 1.4 | |
| 9 | 120 | 16:43:04 | 16:48:29 | 0:05:25 | 16 | 0.8 | 1.6 | |
| 10 | 300 | 16:53:25 | 16:59:34 | 0:06:09 | 16 | 0.8 | 1.6 | |
| 11 | 120 | 17:04:10 | 17:10:10 | 0:06:00 | 16 | 0.8 | 1.6 | |
| 12 | 300 | 17:16:06 | 17:22:53 | 0:06:47 | 17 | 0.9 | 1.8 | |
| 13 | 120 | 17:27:34 | 17:34:19 | 0:06:45 | 17 | 0.9 | 1.8 | |
| 14 | 300 | 17:39:14 | 17:46:24 | 0:07:10 | 18 | 0.9 | 1.7 | |
| 15 | 120 | 17:50:23 | 17:57:50 | 0:07:27 | 19 | 0.9 | 1.6 | |
| 16 | 300 | 18:02:56 | 18:10:48 | 0:07:52 | 17 | 0.9 | 1.5 | |
| 17 | 120 | 18:15:07 | 18:23:30 | 0:08:23 | 18 | 0.9 | 1.4 | |
| 18 | 300 | 18:29:55 | 18:39:57 | 0:10:02 | 16 | 0.9 | 2.1 | |
| | | 18:49:00 | 18:54:00 | | 17 | 1 | 2 | Static Alignment |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | | Yes [X] No [ ] |

Additional Comments:

Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/19/2012 | 354 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1782.8 | 15:24:00 | 20:24:00 | WOOLPERT PIN |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1784.9 | 17:56:00 | 22:56:00 | N/A |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | 52A |
|---|---|---|---|---|---|---|---|---|---|
| 200/4 | 10+ | CL | 0 | 20 | 6.1 | 30.04 | CL | Arriving | 52A |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 10:00 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 20:30:00 | 20:36:00 | | 21 | 0.8 | 1.5 | Static Alignment |
| 19 | 120 | 20:51:08 | 21:01:41 | 0:10:33 | 22 | 0.7 | 1.3 | |
| 20 | 300 | 21:06:54 | 21:17:57 | 0:11:03 | 22 | 0.7 | 1.3 | |
| 21 | 120 | 21:22:31 | 21:33:27 | 0:10:56 | 23 | 0.7 | 1.3 | |
| 22 | 300 | 21:38:22 | 21:48:58 | 0:10:36 | 21 | 0.8 | 1.6 | |
| 23 | 120 | 21:53:37 | 22:04:02 | 0:10:25 | 19 | 0.9 | 2.2 | |
| 24 | 300 | 22:08:38 | 22:19:41 | 0:11:03 | 21 | 0.9 | 2.1 | |
| 25 | 120 | 22:24:30 | 22:35:29 | 0:10:59 | 21 | 1 | 1.9 | |
| | | 22:48:00 | 22:53:00 | 0:05:00 | 21 | 1 | 1.9 | Static Alignment |

| ↑ Times entered are Zulu / GMT ↑ | | Page | 1 | Verify S-Turns After Mission | Yes | x | No | |
|---|---|---|---|---|---|---|---|---|

Additional Comments:

Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/22/2012 | 357 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDAN | N1107Q | 1785.7 | 9:26:00 | 14:26:00 | WOOLPERT PIN |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1789.4 | 13:41:00 | 18:41:00 | N/A |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | | |
|---|---|---|---|---|---|---|---|---|---|
| 260/6 | 10+ | CL | 0 | 1 | -10 | 30.16 | CL | Departing | 52A |
| | | | | | | | | Arriving | 52A |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 9:41 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 14:41:00 | 14:46:00 | 0:05:00 | 20 | 1 | 1.4 | Static Alignment |
| 26 | 300 | 15:02:18 | 15:03:09 | 0:00:51 | 20 | 0.9 | 1.8 | Multipulse was off- reject |
| 26 | 300 | 15:10:50 | 15:22:17 | 0:11:27 | 20 | 0.9 | 1.8 | |
| 27 | 120 | 15:27:00 | 15:38:07 | 0:11:07 | 18 | 1 | 1.9 | |
| 28 | 300 | 15:43:53 | 15:55:08 | 0:11:15 | 18 | 1 | 1.9 | |
| 29 | 120 | 16:00:03 | 16:11:21 | 0:11:18 | 19 | 0.8 | 1.3 | DC Buffer Overflow- Reject Line |
| 29 | 300 | 16:17:45 | 16:29:03 | 0:11:18 | 18 | 0.8 | 1.4 | |
| 30 | 120 | 16:33:21 | 16:43:55 | 0:10:34 | 17 | 0.8 | 1.6 | |
| 31 | 300 | 16:48:48 | 16:59:52 | 0:11:04 | 18 | 0.8 | 1.7 | |
| 32 | 120 | 17:04:48 | 17:14:53 | 0:10:05 | 17 | 0.8 | 1.8 | |
| 33 | 300 | 17:20:14 | 17:30:48 | 0:10:34 | 17 | 0.8 | 1.8 | |
| 34 | 120 | 17:35:35 | 17:45:21 | 0:09:46 | 19 | 0.8 | 1.4 | |
| 35 | 300 | 17:51:21 | 18:01:12 | 0:09:51 | 17 | 0.8 | 1.5 | |
| 36 | 120 | 18:05:39 | 18:15:18 | 0:09:39 | 18 | 0.8 | 1.4 | |
| | | 18:34:00 | 18:39:00 | 0:05:00 | 18 | 0.8 | 1.4 | Static Alignment |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
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| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes [X] | No [ ] |

| Additional Comments: | Drive # |
|---|---|
| | |

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/22/2012 | 357 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| Other | N1107Q | 1789.4 | 15:11:00 | 20:11:00 | WOOLPERT PIN |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1792.0 | 18:19:00 | 23:19:00 | N/A |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | 52A |
|---|---|---|---|---|---|---|---|---|---|
| 260/10 | 10+ | CL | 0 | 12 | -11 | 30.14 | CL | Arriving | 52A |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 15:19 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | Yes [X] | No [ ] |
| | | 20:19:00 | 20:24:00 | 0:05:00 | 21 | 0.8 | 1.5 | Static Alignment |
| 37 | 300 | 20:38:25 | 20:48:55 | 0:10:30 | 22 | 0.8 | 1.36 | |
| 38 | 120 | 20:54:10 | 21:03:07 | 0:08:57 | 22 | 0.8 | 1.5 | |
| 39 | 300 | 21:08:14 | 21:17:26 | 0:09:12 | 21 | 0.8 | 1.7 | |
| 40 | 120 | 21:22:02 | 21:30:33 | 0:08:31 | 20 | 0.9 | 1.6 | |
| 41 | 300 | 21:36:08 | 21:44:45 | 0:08:37 | 20 | 1.2 | 2.2 | |
| 42 | 120 | 21:49:21 | | ########### | 20 | 1.3 | 2.1 | Finished Line, but ALTM-NAV shut down unexpectedly |
| 43 | 300 | 22:04:19 | 22:11:48 | 0:07:29 | 20 | 1.3 | 2 | |
| 44 | 120 | 22:16:39 | 22:23:37 | 0:06:58 | 19 | 1.1 | 1.8 | |
| 45 | 300 | 22:29:07 | 22:35:57 | 0:06:50 | 19 | 1 | 1.3 | |
| 46 | 120 | 22:39:27 | 22:46:05 | 0:06:38 | 19 | 1 | 1.3 | |
| 47 | 300 | 22:50:37 | 22:57:02 | 0:06:25 | 20 | 0.9 | 1.3 | |
| 48 | 120 | 23:00:02 | 23:03:31 | 0:03:29 | 20 | 1 | 1.8 | |
| | | 23:12:49 | 23:17:00 | 0:04:11 | 20 | 1 | 1.8 | Static Alignment |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
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| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes [X] | No [ ] |

Additional Comments: Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/28/2012 | 363 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDAN | N1107Q | 1792.9 | 16:37:00 | 21:37:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1795.5 | 20:17:00 | 1:17:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 12 | 2 | 30 | CL | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 17:18 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | | | Verify S-Turns Before Mission: Yes [X] No [ ] |
| | | 22:18:00 | 22:28:00 | 0:10:00 | 22 | 0.8 | 1.2 | Static Alignment |
| 49 | 347 | 22:48:18 | 22:48:48 | 0:00:30 | 20 | 0.9 | 1.7 | DC Buffer Overflow Re-Fly 49 |
| 49 | 347 | 22:55:43 | 22:56:16 | 0:00:33 | 20 | 0.9 | 1.7 | DC Buffer Overflow Re-Fly 49 |
| 49 | 347 | 23:02:32 | 23:04:27 | 0:01:55 | 19 | 0.8 | 1.6 | |
| 50 | 167 | 23:10:20 | 23:13:12 | 0:02:52 | 20 | 0.8 | 1.4 | |
| 51 | 347 | 23:17:55 | 23:21:39 | 0:03:44 | 19 | 0.8 | 1.4 | |
| 52 | 167 | 23:26:23 | 23:30:48 | 0:04:25 | 19 | 0.8 | 1.4 | |
| 53 | 347 | 23:35:07 | 23:40:20 | 0:05:13 | 19 | 0.8 | 1.3 | |
| 54 | 167 | 23:45:07 | 23:51:04 | 0:05:57 | 18 | 0.9 | 1.7 | |
| 55 | 347 | 23:55:28 | 0:02:03 | 0:06:35 | 17 | 1.1 | 1.8 | |
| 56 | 167 | 0:06:37 | 0:14:09 | 0:07:32 | 17 | 1 | 1.9 | |
| 57 | 347 | 0:18:39 | 0:26:33 | 0:07:54 | 18 | 1 | 1.9 | |
| 58 | 167 | 0:31:42 | 0:40:39 | 0:08:57 | 19 | 1 | 1.5 | |
| 59 | 347 | 0:44:51 | 0:53:49 | 0:08:58 | 18 | 1 | 1.5 | |
| | | 1:10:00 | 1:15:00 | 0:05:00 | 19 | 1 | 1.4 | Static Alignment |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
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| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | | | Verify S-Turns After Mission: Yes [X] No [ ] |

| Additional Comments: | Drive # |
|---|---|
| | |

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/30/2012 | 367 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1796.3 | 9:29:00 | 14:29:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1800.8 | 14:25:00 | 19:25:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 2 | -2 | 30.38 | CL | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] DN [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 9:37 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 14:37:00 | 14:42:00 | 0:05:00 | 18 | 1 | 1.9 | Static Alignment |
| 60 | 347 | 14:59:41 | 15:09:06 | 0:09:25 | 18 | 1 | 1.9 | |
| 61 | 167 | 15:14:32 | 15:19:30 | 0:04:58 | 18 | 1 | 1.9 | DC Buffer Overload Re-Fly |
| 61 | 167 | 15:31:27 | 15:47:53 | 0:16:26 | 19 | 1 | 1.3 | |
| 62 | 347 | 15:53:02 | 16:09:33 | 0:16:31 | 18 | 1 | 1.4 | |
| 63 | 167 | 16:14:55 | 16:31:08 | 0:16:13 | 18 | 1 | 1.7 | |
| 64 | 347 | 16:36:13 | 16:52:49 | 0:16:36 | 17 | 1 | 1.8 | |
| 65 | 167 | 16:57:28 | 17:14:37 | 0:17:09 | 18 | 1 | 1.7 | |
| 66 | 347 | 17:19:40 | 17:35:58 | 0:16:18 | 17 | 0.9 | 1.5 | |
| 67 | 167 | 17:40:43 | 17:57:01 | 0:16:18 | 17 | 1.1 | 2 | |
| 68 | 347 | 18:01:58 | 18:18:04 | 0:16:06 | 16 | 1.1 | 1.9 | |
| 69 | 167 | 18:22:15 | 18:38:17 | 0:16:02 | 16 | 1.1 | 1.7 | |
| 70 | 347 | 18:42:15 | 18:58:23 | 0:16:08 | 19 | 1 | 1.7 | |
| | | 19:18:00 | 19:23:00 | 0:05:00 | 19 | 1 | 1.8 | Static Alignment |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | | 1 | | Verify S-Turns After Mission: Yes [X] No [ ] |

Additional Comments: Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 12/30/2012 | 367 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1800.8 | 15:25:00 | 20:25:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1804.2 | 19:13:00 | 0:13:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 11 | -4 | 30.38 | CL | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 15:31 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 20:31:00 | 20:36:00 | 0:05:00 | 21 | 0.7 | 1.3 | Static Alignment |
| 71 | 347 | 20:52:54 | 21:09:14 | 0:16:20 | 20 | 0.9 | 1.6 | |
| 72 | 167 | 21:13:34 | 21:29:41 | 0:16:07 | 20 | 1.3 | 2.1 | |
| 73 | 347 | 21:33:37 | 21:49:58 | 0:16:21 | 20 | 1.2 | 2 | |
| 74 | 167 | 21:55:26 | 22:11:25 | 0:15:59 | 19 | 0.8 | 1.3 | |
| 75 | 347 | 22:15:24 | 22:31:35 | 0:16:11 | 21 | 0.7 | 1.2 | |
| 76 | 167 | 22:35:59 | 22:51:52 | 0:15:53 | 21 | 0.8 | 1.3 | |
| 77 | 347 | 22:55:50 | 23:12:28 | 0:16:38 | 18 | 0.8 | 1.4 | |
| 78 | 167 | 23:16:07 | 23:31:45 | 0:15:38 | 18 | 0.8 | 1.4 | |
| 79 | 347 | 23:35:51 | 23:51:34 | 0:15:43 | 16 | 0.9 | 1.6 | |
| | | 0:06:00 | 0:11:00 | 0:05:00 | 16 | 0.9 | 1.6 | Static Alignment |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes [X] | No [ ] |

| Additional Comments: | Drive # |
|---|---|
| | |

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/4/2013 | 4 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1806.9 | 14:43:00 | 19:43:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1809.7 | 17:59:00 | 22:59:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 12 | 5 | 30.29 | CL | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 14:55 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | Yes [X] | No [ ] |
| | | 19:55:00 | 20:00:00 | 0:05:00 | 22 | 0.8 | 1.4 | Static Alignment |
| 80 | 347 | 20:15:51 | 20:31:33 | 0:15:42 | 22 | 0.9 | 1.7 | |
| 81 | 167 | 20:37:51 | 20:53:39 | 0:15:48 | 19 | 1.2 | 2.1 | |
| 82 | 347 | 20:58:50 | 21:15:08 | 0:16:18 | 21 | 1.3 | 2.1 | |
| 83 | 167 | 21:20:01 | 21:36:02 | 0:16:01 | 20 | 1.2 | 1.8 | |
| 84 | 347 | 21:40:42 | 21:57:45 | 0:17:03 | 20 | 0.8 | 1.3 | |
| 85 | 167 | 22:02:59 | 22:19:00 | 0:16:01 | 22 | 0.8 | 1.2 | |
| 86 | 347 | 22:23:15 | 22:40:25 | 0:17:10 | 20 | 0.8 | 1.6 | |
| | | 22:52:00 | 22:57:00 | 0:05:00 | 20 | 0.8 | 1.4 | Static Alignment |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes [X] | No [ ] |

Additional Comments: Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/4/2013 | 4 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDON | N1107Q | 1809.7 | 18:24:00 | 23:24:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1813.7 | 22:42:00 | 3:42:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | | |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 12 | 5 | 30.29 | CL | Departing | KMLJ |
| | | | | | | | | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 18:31 |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes X No |
| | | 23:31:00 | 23:36:00 | 0:05:00 | 18 | 1 | 1.9 | Static Alignment |
| 87 | 347 | 23:50:28 | 0:06:49 | 0:16:21 | 19 | 0.8 | 1.5 | |
| 88 | 167 | 0:11:37 | 0:27:39 | 0:16:02 | 18 | 0.8 | 1.5 | |
| 89 | 347 | 0:34:15 | 0:49:59 | 0:15:44 | 19 | 0.7 | 1.3 | |
| 90 | 167 | 0:54:28 | 1:10:27 | 0:15:59 | 18 | 0.8 | 1.5 | |
| 91 | 347 | 1:15:43 | 1:32:26 | 0:16:43 | 17 | 0.8 | 1.8 | |
| 92 | 167 | 1:36:50 | 1:52:39 | 0:15:49 | 18 | 0.7 | 1.5 | |
| 93 | 347 | 1:57:56 | 2:13:17 | 0:15:21 | 20 | 0.7 | 1.2 | |
| 94 | 167 | 2:18:24 | 2:32:59 | 0:14:35 | 19 | 0.7 | 1.5 | |
| 95 | 347 | 2:38:09 | 2:53:44 | 0:15:35 | 17 | 0.7 | 1.6 | |
| 96 | 167 | 2:58:26 | 3:13:35 | 0:15:09 | 20 | 0.7 | 1.2 | |
| | | 3:24:00 | 3:29:00 | 0:05:00 | 20 | 0.8 | 1.4 | In-flight Alignment |
| | | | | 0:00:00 | | | | |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | | Yes X No |

Additional Comments: Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/5/2013 | 5 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| SIMMONS | N1107Q | 1814.0 | 12:15:00 | 5:15:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| SWAIN | Optech- Gemini 108 | 1818.0 | 4:20:00 | 9:20:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KFFC |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 4 | -5 | 3035 | | Arriving | K52A |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 5:44:00 | 5:50:00 | 0:06:00 | 19 | | 1.38 | In-flight Alignment |
| 97 | N | 5:57:30 | 6:14:00 | 0:16:30 | 19 | | 1.42 | |
| 98 | S | 6:23:01 | 6:37:00 | 0:13:59 | 21 | | 1.41 | |
| 99 | N | 6:44:10 | 6:58:00 | 0:13:50 | 21 | | 1.5 | |
| 100 | S | 7:02:00 | 7:15:00 | 0:13:00 | 20 | | 1.55 | |
| 101 | N | 7:20:09 | 7:34:00 | 0:13:51 | 19 | | 1.49 | |
| 102 | S | 7:39:03 | 7:52:26 | 0:13:23 | 20 | | 1.22 | |
| 103 | N | 7:58:14 | 8:10:39 | 0:12:25 | 19 | | 1.51 | |
| 104 | S | 8:15:08 | 8:26:36 | 0:11:28 | 18 | | 1.39 | |
| 105 | N | 8:31:48 | 8:43:30 | 0:11:42 | 18 | | 1.32 | |
| 106 | S | 8:47:33 | 8:58:57 | 0:11:24 | 16 | | 2.13 | |
| | | 9:03:00 | 9:07:00 | 0:04:00 | | | | In-flight Alignment |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | | Yes [X] No [ ] |

Additional Comments:

Drive #

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/5/2013 | 5 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| SIMMONS | N1107Q | 1818.0 | 4:55:00 | 9:55:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| SWAIN | Optech- Gemini 108 | 1820.8 | 7:47:00 | 12:47:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KSZA |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 4 | -4 | 3039 | | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON [X] OFF [ ] | WD [ ] NR [X] | OFF [ ] ON [ ] FIX [X] | OFF [X] ON [ ] SAMPLE [ ] BOUNDARY [ ] | Range Gate [ ] Threshold [ ] Laser Trigger Edge [ ] 1 PPS edge [ ] |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: |
| ↕ Times entered are Zulu / GMT ↕ | | | | | | Verify S-Turns Before Mission | | Yes [X] No [ ] |
| | | 10:19:00 | 10:23:00 | 0:04:00 | 21 | | 1.42 | In-flight Alignment |
| 107 | N | 10:30:09 | 10:41:54 | 0:11:45 | 19 | | 1.68 | |
| 108 | S | 10:47:23 | 10:59:10 | 0:11:47 | 19 | | 1.6 | |
| 109 | N | 11:05:26 | 11:17:33 | 0:12:07 | 19 | | 1.43 | |
| 110 | S | 11:22:40 | 11:34:25 | 0:11:45 | 20 | | 1.33 | |
| 111 | N | 11:39:20 | 11:51:11 | 0:11:51 | 21 | | 1.32 | |
| 112 | S | 11:56:26 | 12:08:31 | 0:12:05 | 18 | | 1.56 | |
| 113 | N | 12:13:54 | 12:25:57 | 0:12:03 | 19 | | 1.72 | |
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| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes [X] | No |

| Additional Comments: | Drive # |
|---|---|
| | |

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/5/2013 | 5 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDAN | N1107Q | 1821.6 | 11:19:00 | 16:19:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1826.1 | 16:18:00 | 21:18:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 9 | -3 | 30.4 | | Arriving: | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARF | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON X / OFF | WD / NR X | OFF / ON / FIX X | OFF X ON / SAMPLE / BOUNDARY | Range Gate / Threshold / Laser Trigger Edge / 1 PPS edge |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# A T | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 11:24 |
| | | | | | | | | Verify S-Turns Before Mission: Yes X No |
| | | 16:24:00 | 16:30:00 | 0:06:00 | 17 | 0.9 | 1.7 | Static Alignment |
| 114 | 347 | 16:44:52 | 16:56:34 | 0:11:42 | 17 | 0.8 | 1.6 | |
| 115 | 167 | 17:01:13 | 17:13:08 | 0:11:55 | 17 | 0.8 | 1.4 | |
| 116 | 347 | 17:17:06 | 17:28:59 | 0:11:53 | 16 | 1.1 | 2.1 | |
| 117 | 167 | 17:33:24 | 17:45:23 | 0:11:59 | 16 | 1 | 1.9 | |
| 118 | 347 | 17:49:16 | 18:01:32 | 0:12:16 | 17 | 1 | 1.7 | |
| 119 | 167 | 18:06:08 | 18:17:40 | 0:11:32 | 19 | 0.8 | 1.5 | |
| 120 | 347 | 18:22:11 | 18:33:45 | 0:11:34 | 18 | 0.9 | 1.8 | |
| 121 | 167 | 18:38:04 | 18:49:10 | 0:11:06 | 19 | 1 | 1.9 | |
| 122 | 347 | 18:53:14 | 19:04:06 | 0:10:52 | 18 | 1 | 2.3 | |
| 123 | 167 | 19:08:06 | 19:18:36 | 0:10:30 | 20 | 0.8 | 1.5 | |
| 124 | 347 | 19:22:44 | 19:32:48 | 0:10:04 | 20 | 0.8 | 1.5 | |
| 125 | 167 | 19:36:39 | 19:39:55 | 0:03:16 | 22 | 0.7 | 1.3 | Reject- flew off line |
| 125 | 167 | 19:50:05 | | ########### | 21 | 0.7 | 1.3 | Completed line- ALTM-NAV shut down |
| 126 | 347 | 20:03:56 | 20:04:42 | 0:00:46 | 21 | 0.7 | 1.3 | Reject- Swath did not save properly. |
| 126 | 347 | 20:11:35 | 20:21:03 | 0:09:28 | 21 | 0.7 | 1.3 | |
| 127 | 167 | 20:25:22 | 20:34:40 | 0:09:18 | 21 | 0.7 | 1.6 | |
| 128 | 347 | 20:38:42 | 20:47:24 | 0:08:42 | 19 | 0.7 | 2.2 | |
| 129 | 167 | 20:52:02 | 21:00:48 | 0:08:46 | 21 | 1.3 | 2.1 | |
| | | 21:11:00 | 21:16:00 | 0:05:00 | 21 | 1.2 | 2 | Static Alignment |
| | | | | 0:00:00 | | | | |
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| A T | | | Page | 1 | | | | Verify S-Turns After Mission: Yes X No |

Additional Comments: Drive #

SEND ERROR REPORT MESSAGE AFTER LINE 125. CLOSED OUT OF ALTM AND RESTART IN TURN.

# Woolpert

| Optech LIDAR | DD/MM/YEAR | Day of Year | Project # | Phase # | Project Name |
|---|---|---|---|---|---|
| | 1/5/2013 | 5 | 72875 | 2 | FY13 4 Georgia Counties |

| Operator | Aircraft | HOBBS Start | Local Start Time | ZULU Start Time | Base |
|---|---|---|---|---|---|
| JORDAN | N1107Q | 1826.1 | 16:42:00 | 21:42:00 | NGS |
| **Pilot** | **Sensor Type** | **HOBBS END** | **Local End Time** | **Zulu End Time** | **PID** |
| FLOYD | Optech- Gemini 108 | 1828.9 | 19:55:00 | 0:55:00 | AI1576 |

| Wind Dir/Speed | Visibility | Ceiling | Cloud Cover % | Temp | Dew Point | Pressure | Haze/Fire/Cloud | Departing | KMLJ |
|---|---|---|---|---|---|---|---|---|---|
| Calm | 10+ | CL | 0 | 12 | 0 | 30.29 | | Arriving | KMLJ |

| Frequency | Half-Angle | System PRF | Roll Compensation | Divergence Mode | Multipulse | ARE | DIGITIZER |
|---|---|---|---|---|---|---|---|
| 34 | 20 | 125 | ON X / OFF | WD / NR X | OFF / ON / FIX X | OFF X ON / SAMPLE / BOUNDARY | Range Gate / Threshold / Laser Trigger Edge / 1 PPS edge |

| Air Speed | AGL | MSL | Avg. Elev. | Adj. AGL | Max Range |
|---|---|---|---|---|---|
| 130 | 5500 | 5700 | | | |

| Line # | Dir. | Mission ID# | Line End Time | Time On Line | SV's | HDOP | PDOP | Line Notes/Comments |
|---|---|---|---|---|---|---|---|---|
| Test | n/a | | | n/a | n/a | n/a | n/a | GPS Began Logging At: 16:48 |
| | | ↕ Times entered are Zulu / GMT ↕ | | | | Verify S-Turns Before Mission | | Yes X No |
| | | 21:48:00 | 21:53:00 | 0:05:00 | 21 | 0.8 | 1.3 | Static Alignment |
| 130 | 347 | 22:07:41 | 22:16:02 | 0:08:21 | 21 | 0.7 | 1.3 | |
| 131 | 167 | 22:20:47 | 22:29:34 | 0:08:47 | 20 | 0.7 | 1.6 | |
| 132 | 347 | 22:34:07 | 22:42:23 | 0:08:16 | 19 | 0.8 | 1.4 | |
| 133 | 167 | 22:47:23 | 22:55:42 | 0:08:19 | 19 | 0.8 | 1.4 | |
| 134 | 347 | 23:00:21 | 23:08:17 | 0:07:56 | 18 | 0.8 | 1.4 | |
| 135 | 167 | 23:13:16 | 23:21:05 | 0:07:49 | 17 | 0.8 | 1.6 | |
| 136 | 347 | 23:26:00 | 23:33:28 | 0:07:28 | 17 | 1.1 | 1.8 | |
| 137 | 167 | 23:38:18 | 23:45:29 | 0:07:11 | 17 | 1 | 1.9 | |
| 138 | 347 | 23:50:05 | 23:56:57 | 0:06:52 | 19 | 0.8 | 1.5 | |
| 139 | 167 | 0:01:50 | 0:08:41 | 0:06:51 | 19 | 0.8 | 1.5 | |
| 140 | 347 | 0:13:07 | 0:18:13 | 0:05:06 | 18 | 0.8 | 1.5 | |
| 141 | 167 | 0:22:44 | 0:27:43 | 0:04:59 | 18 | 0.8 | 1.5 | |
| 142 | 347 | 0:31:59 | 0:33:44 | 0:01:45 | 19 | 0.7 | 1.3 | |
| | | 0:48:00 | 0:53:00 | 0:05:00 | 19 | 0.8 | 1.4 | Static Alignment |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| | | | | 0:00:00 | | | | |
| ↑ Times entered are Zulu / GMT ↑ | | | | Page | 1 | Verify S-Turns After Mission | Yes X No | |

Additional Comments: Drive #

# SECTION 6: FINAL ACCURACY ASSESSMENT

## FINAL VERTICAL ACCURACY ASSESSMENT

The vertical accuracy statistics were calculated by comparison of the LiDAR bare earth points to the ground surveyed QA/QC points.

| **Table 6.1:** Overall Vertical Accuracy Statistics | | |
|---|---|---|
| Average error | -0.027 | Survey Feet |
| Minimum error | -0.297 | Survey Feet |
| Maximum error | 0.281 | Survey Feet |
| Average magnitude | 0.139 | Survey Feet |
| Root mean square | 0.171 | Survey Feet |
| Standard deviation | 0.171 | Survey Feet |

**Table 6.2:** Control Point Comparison Analysis

| Point ID | Easting Survey Feet | Northing Survey Feet | Elevation Survey Feet | Dz Survey Feet |
|---|---|---|---|---|
| 2014 | 461845.2 | 1220269 | 399.989 | 0.281 |
| 2006 | 284544.5 | 1211705 | 556.761 | 0.279 |
| 2019 | 247288 | 1257905 | 630.629 | 0.231 |
| 2011 | 255855 | 1187178 | 500.385 | 0.195 |
| 2054 | 251857.7 | 1333943 | 689.546 | 0.124 |
| 2008 | 303742.7 | 1231531 | 543.704 | 0.066 |
| 2009 | 254363.4 | 1205341 | 561.528 | 0.032 |
| 2003 | 346203.7 | 1139345 | 389.716 | 0.024 |
| 2050 | 225483.4 | 1345774 | 763.551 | -0.001 |
| 2018 | 293265.8 | 1266901 | 514.687 | -0.017 |
| 2012 | 358547.9 | 1214199 | 381.218 | -0.018 |
| 2017 | 275066.2 | 1273238 | 564.126 | -0.046 |

**Table 6.2:** Control Point Comparison Analysis

| Point ID | Easting Survey Feet | Northing Survey Feet | Elevation Survey Feet | Dz Survey Feet |
|---|---|---|---|---|
| 2000 | 329009.4 | 1101476 | 487.254 | -0.074 |
| 2021 | 377186.1 | 1163980 | 582.788 | -0.078 |
| 2020 | 217565.9 | 1301883 | 758.728 | -0.088 |
| 2013 | 398457.6 | 1250450 | 707.804 | -0.134 |
| 2002 | 336055.4 | 1123353 | 282.772 | -0.152 |
| 2001 | 331404.1 | 1097642 | 426.692 | -0.182 |
| 2004 | 283361.1 | 1137396 | 465.403 | -0.213 |
| 2005 | 314083.4 | 1153274 | 461.458 | -0.248 |
| 2015 | 450554.7 | 1186329 | 534.188 | -0.268 |
| 2051 | 256005.9 | 1357686 | 713.357 | -0.297 |

## VERTICAL ACCURACY CONCLUSIONS

LAS Swath Fundamental Vertical Accuracy (FVA) Tested 0.333 feet fundamental vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 Tested against the TIN using independent check points.

| Approved By: | | | |
|---|---|---|---|
| Title | Name | Signature | Date |
| Associate<br>LiDAR Specialist<br>Certified Photogrammetrist #1281 | Qian Xiao |  | July 18, 2013 |

WOOLPERT

DESIGN | GEOSPATIAL | INFRASTRUCTURE