AIRBORNE LIDAR TASK ORDER REPORT

NEW JERSEY CMGP SANDY 0.7M NPS LIDAR
UNITED STATES GEOLOGICAL SURVEY (USGS)

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PROJECT REPORT

USGS NEW JERSEY CMGP SANDY LIDAR 0.7M NPS LIDAR PROCESSING

WOOLPERT PROJECT #73714

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SECTION 1: OVERVIEW

PROJECT NAME: NEW JERSEY CMGP SANDY 0.7M NPS LIDAR

WOOLPERT PROJECT #73714

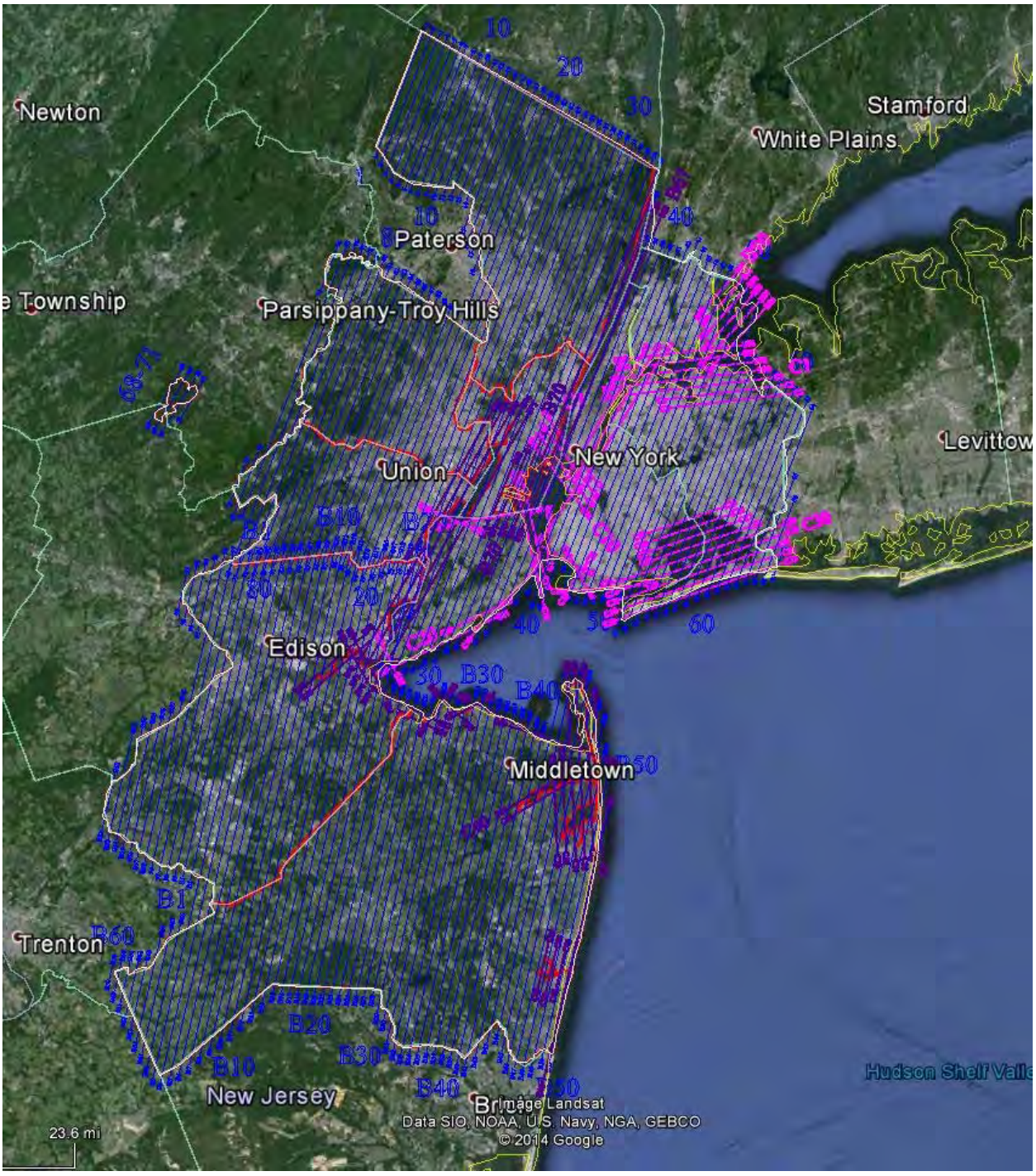
This report contains a comprehensive outline of the New Jersey CMGP Sandy 0.7M NPS Lidar Processing task order for the United States Geological Survey (USGS). This task is issued under Contract Number G10PC00057, as task order number G13PD00854. This task order requires lidar data to be acquired over several areas in New Jersey to include the entire counties of Bergen, Essex, Hudson, Middlesex, Monmouth, and Union and including Morristown National Historical Park are part of the New Jersey area of interest (AOI), and will be acquired as part of this task order. The total area of the New Jersey Sandy Lidar AOI is approximately 1312 square miles. The lidar was collected and processed to meet a maximum Nominal Post Spacing (NPS) of 0.7 meters. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath. This acquisition was part of a larger effort designed to capture one other USGS task order AOI in New York.

The data was collected using a Leica ALS70 500 kHz Multiple Pulses in Air (MPiA) lidar sensor installed in a Leica gyro-stabilized PAV30 mount. The ALS70 sensor collects up to four returns per pulse, as well as 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:

Post Spacing (Minimum):	2.3 ft / 0.7m
AGL (Above Ground Level) average flying height:	7,500 ft / 2,286 m
MSL (Mean Sea Level) average flying height:	variable
Average Ground Speed:	150 knots / 173 mph
Field of View (full):	32 degrees
Pulse Rate:	239 kHz
Scan Rate:	41.6 Hz
Side Lap (Average):	25%

The lidar data was processed and projected in UTM, Zone 18, North American Datum of 1983 (2011) in units of meters. The vertical datum used for the task order was referenced to NAVD 1988, GEOID12A, in units of meters.

Figure 1.1 Lidar Task Order AOI



SECTION 2: ACQUISITION

The existing lidar data was acquired with a Leica ALS70 500 kHz Multiple Pulses in Air (MPiA) Lidar Sensor System, on board Woolpert Cessna aircraft. The ALS70 lidar system, developed by Leica Geosystems of Heerbrugg, Switzerland, includes the simultaneous first, intermediate and last pulse data capture module, the extended altitude range module, and the target signal intensity capture module. The system software is operated on an OC50 Operation Controller aboard the aircraft.

Table 2.1: ALS70 Lidar System Specifications

The ALS70 500 kHz Multiple Pulses in Air (MPiA) Lidar System has the following specifications:

Specification	
Operating Altitude	200 – 3,500 meters
Scan Angle	0 to 75° (variable)
Swath Width	0 to 1.5 X altitude (variable)
Scan Frequency	0 – 200 Hz (variable based on scan angle)
Maximum Pulse Rate	500 kHz (Effective)
Range Resolution	Better than 1 cm
Elevation Accuracy	7 - 16 cm single shot (one standard deviation)
Horizontal Accuracy	5 – 38 cm (one standard deviation)
Number of Returns per Pulse	7 (infinite)
Number of Intensities	3 (first, second, third)
Intensity Digitization	8 bit intensity + 8 bit AGC (Automatic Gain Control) level
MPiA (Multiple Pulses in Air)	8 bits @ 1nsec interval @ 50kHz
Laser Beam Divergence	0.22 mrad @ $1/e^2$ (~0.15 mrad @ 1/e)
Laser Classification	Class IV laser product (FDA CFR 21)
Eye Safe Range	400m single shot depending on laser repetition rate
Roll Stabilization	Automatic adaptive, range = 75 degrees minus current FOV
Power Requirements	28 VDC @ 25A
Operating Temperature	0-40°C
Humidity	0-95% non-condensing
Supported GNSS Receivers	Ashtech Z12, Trimble 7400, Novatel Millenium

Prior to mobilizing to the project site, Woolpert flight crews coordinated with the necessary Air Traffic Control personnel to ensure airspace access.

Woolpert survey crews were onsite, operating a Global Navigation Satellite System (GNSS) Base Station for the airborne GPS support.

The lidar data was collected in seventeen (17) separate missions, flown as close together as the weather permitted, to ensure consistent ground conditions across the project area. This acquisition was part of a larger effort designed to capture one other USGS task order AOI in New York.

An initial quality control process was performed immediately on the lidar data to review the data coverage, airborne GPS data, and trajectory solution. Any gaps found in the lidar data were relayed to the flight crew, and the area was re-flown.

Figure 2.1: Lidar Flight Layout, 2014 combined NJ/NY Task Orders

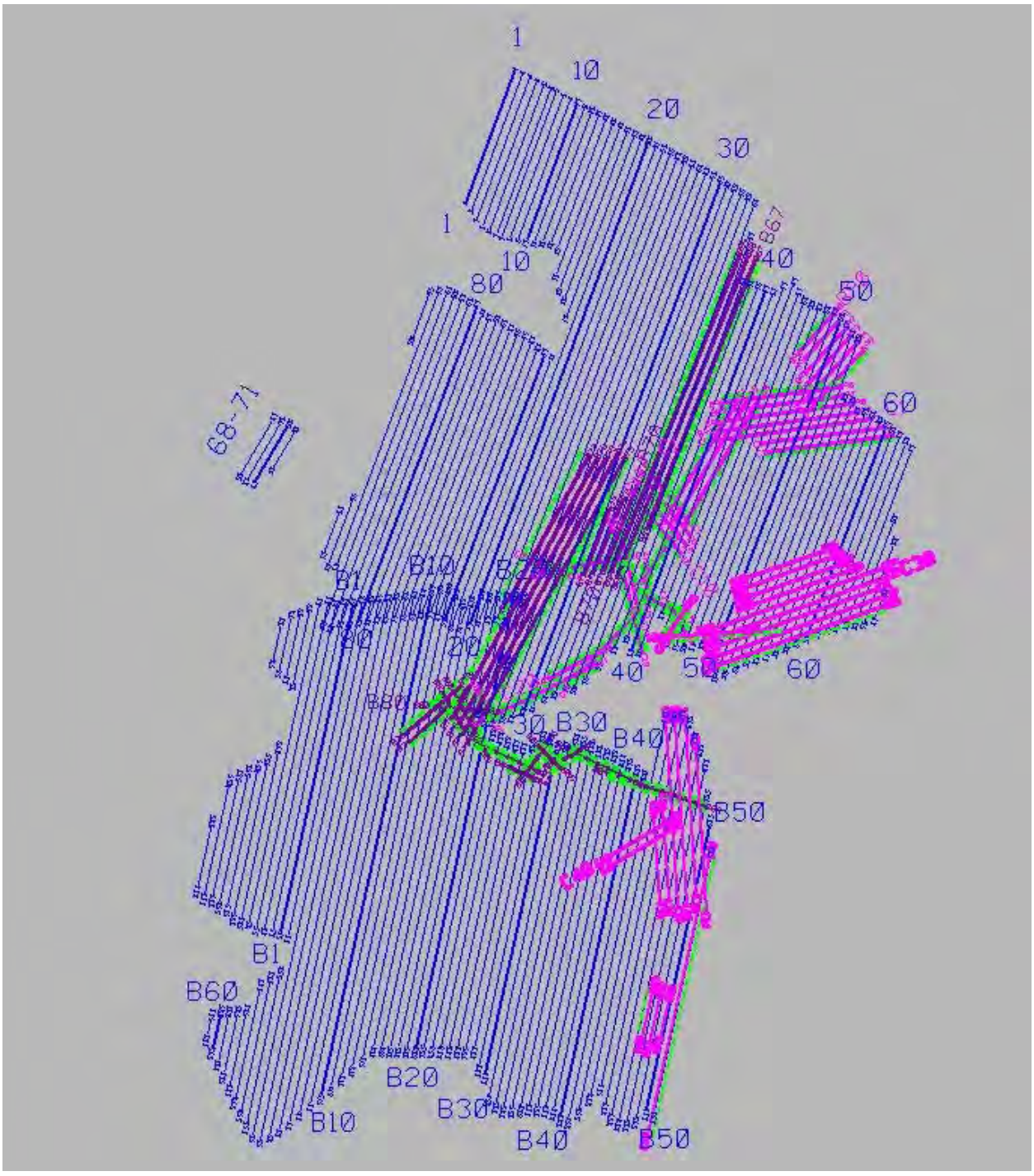


Table 2.2: Airborne Lidar Acquisition Flight Summary

Airborne Lidar Acquisition Flight Summary			
Date of Mission	**Lines Flown**	**Mission Time (UTC) Wheels Up/ Wheels Down**	**Mission Time (Local = EDT) Wheels Up/ Wheels Down**
March 21, 2014 – Sensor 7108	B7-B25	22:00 – 03:00	06:00PM – 11:00PM
March 21, 2014 - Sensor 7177	B42-B51	22:21 - 00:14	06:21PM - 08:14PM
March 22, 2014 – Sensor 7108_A	B1-B6, B66	14:40 – 16:50	10:40AM – 12:50PM
March 22, 2014 – Sensor 7177_A	B30-B42	14:23 – 16:44	10:23AM – 12:44PM
March 22, 2014 – Sensor 7177_B	B26-B30	20:05 – 20:56	04:05PM – 04:56PM
March 24, 2014 – Sensor 7177_A	B52-B66	13:19 – 14:40	09:13AM – 10:40AM
March 24, 2014 – Sensor 7177_B	B3-B11	22:38 – 23:27	06:38PM – 07:27PM
March 26, 2014 – Sensor 7108	A32-A41	19:40 – 23:00	03:40PM – 07:00PM
March 26, 2014 – Sensor 7177_A	A68-A69,A72-A73,A92-A99,B1	16:30 – 18:10	12:30PM – 02:10PM
March 26, 2014 – Sensor 7177_B	69-85	23:54 – 02:23	07:54PM – 10:23PM
March 27, 2014 – Sensor 7108	A4-A6,A9-A13,A15-A31,A52-A56,A61	13:10 – 20:40	09:10AM – 04:40PM
March 27, 2014 – Sensor 7177_A	A13-A14,A86-A91	14:41 – 15:54	09:41AM – 11:50AM
March 31, 2014 – Sensor 7177	7-9,69-76,78-80, A42-A45,A52-A53,B31,B56-B57,B66	23:53 – 03:55	07:53PM – 11:55PM
April 1, 2014 – Sensor 7108	B78-B89,C14,C17-C22,C34-C45	04:45 – 11:20	12:45AM – 06:20AM
April 6, 2014 – Sensor 7108	A42-A45,A77,B67-B69,C4,C42-C45	10:24 – 20:14	05:24AM – 04:14PM
April 19, 2014 – Sensor 7177	A96 – A99,C5-C10,C34	18:34 – 20:09	12:30PM - 04:14PM
April 21, 2014 – Sensor 7177	B74-B77	22:29 – 23:03	06:29PM – 07:27PM

SECTION 3: LIDAR DATA PROCESSING

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.2.75 build #25, Proprietary Software, TerraMatch v. 14.01.

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.14.011.

4. The LAS files were evaluated through a series of manual QA/QC steps to eliminate remaining artifacts from the ground class.
   Software: TerraScan v.14.011.

GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)-INERTIAL MEASUREMENT UNIT (IMU) TRAJECTORY PROCESSING

EQUIPMENT

Flight navigation during the lidar data acquisition mission is performed using IGI CCNS (Computer Controlled Navigation System). The pilots are 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/or 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 Global Navigation Satellite System (GNSS) receivers collecting at 2 Hz.

All Woolpert aerial sensors are equipped with a Litton LN200 series Inertial Measurement Unit (IMU) operating at 200 Hz.

A base-station unit was mobilized for each acquisition mission, and was operated by a member of the Woolpert acquisition team. Each base-station setup consisted of one Trimble 4000 – 5000 series dual frequency receiver, one Trimble Compact L1/L2 dual frequency antenna, one 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.

Woolpert's acquisition team was on site, operating GNSS base stations at the Trenton Mercer Airport (KTTN), along with utilizing NJJ2, NJTP, NYBP, and NJTR CORS stations.

The GNSS base station operated during the Lidar acquisition missions are listed below:

Table 3.1: GNSS Base Station

Station Name	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height (L1 Phase center) (Meters)
KTTN Airport Base	40°16'51.15372"	74°48'34.15158"	25.786
KTTN Airport Base 2	40°16'51.18651"	74°48'34.18759"	25.907
NJI2 CORS	40°44'29.30552"	74°10'39.72659"	18.006
NJTP CORS	40°32'25.84158"	74°28'04.13510"	0.438
NYBP CORS	40°42'03.81687"	74°00'51.54905"	-14.385
NJTR CORS	40°16'51.18651"	74°48'34.18759"	41.360

DATA PROCESSING

All airborne GNSS and IMU data was post-processed and quality controlled using Applanix MMS software. GNSS data was processed at a 1 and 2 Hz data capture rate and the IMU data was processed at 200 Hz.

TRAJECTORY QUALITY

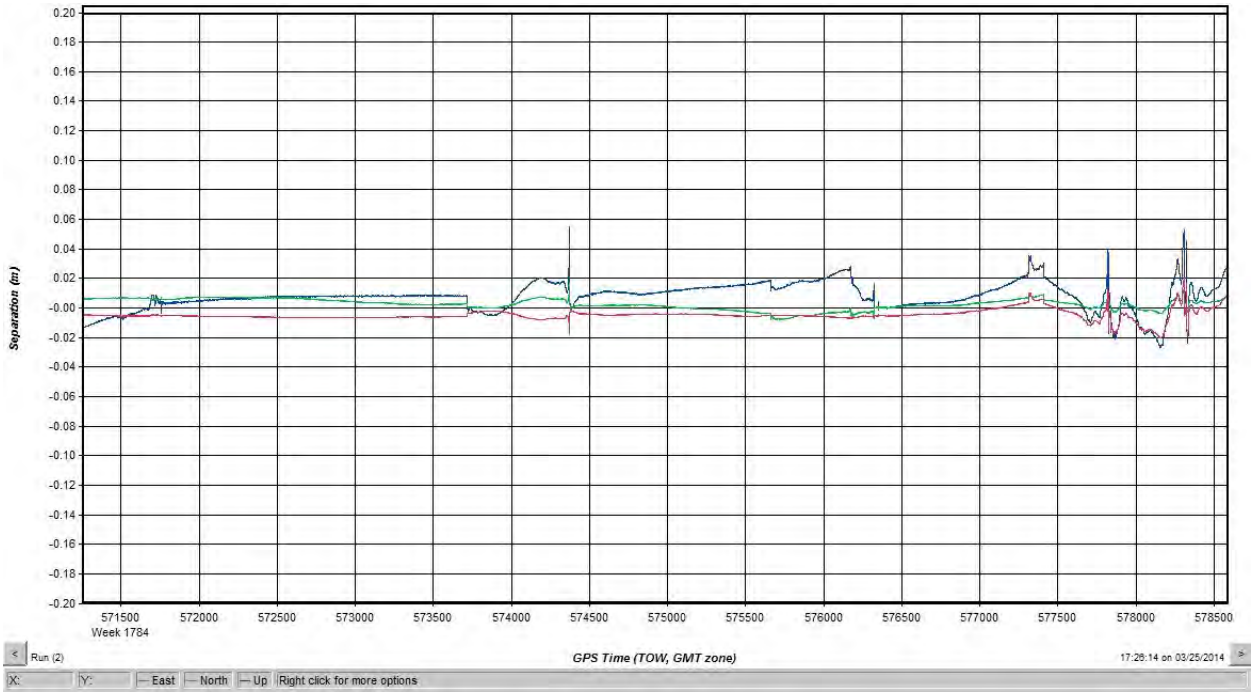
The GNSS Trajectory, along with high quality IMU data are key factors in determining the overall positional accuracy of the final sensor data. Within the trajectory processing, there are many factors that affect the overall quality, but the most indicative are the Combined Separation, the Estimated Positional Accuracy, and the Positional Dilution of Precision (PDOP).

Combined Separation

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 processed in both directions to remove the combined directional anomalies. In general, when these two solutions match closely, an optimally accurate reliable solution is achieved.

Woolpert's goal is to maintain a Combined Separation Difference of less than ten (10) centimeters. In most cases we achieve results below this threshold.

Figure 3.1: Combined Separation, Day08114 SH7108_A

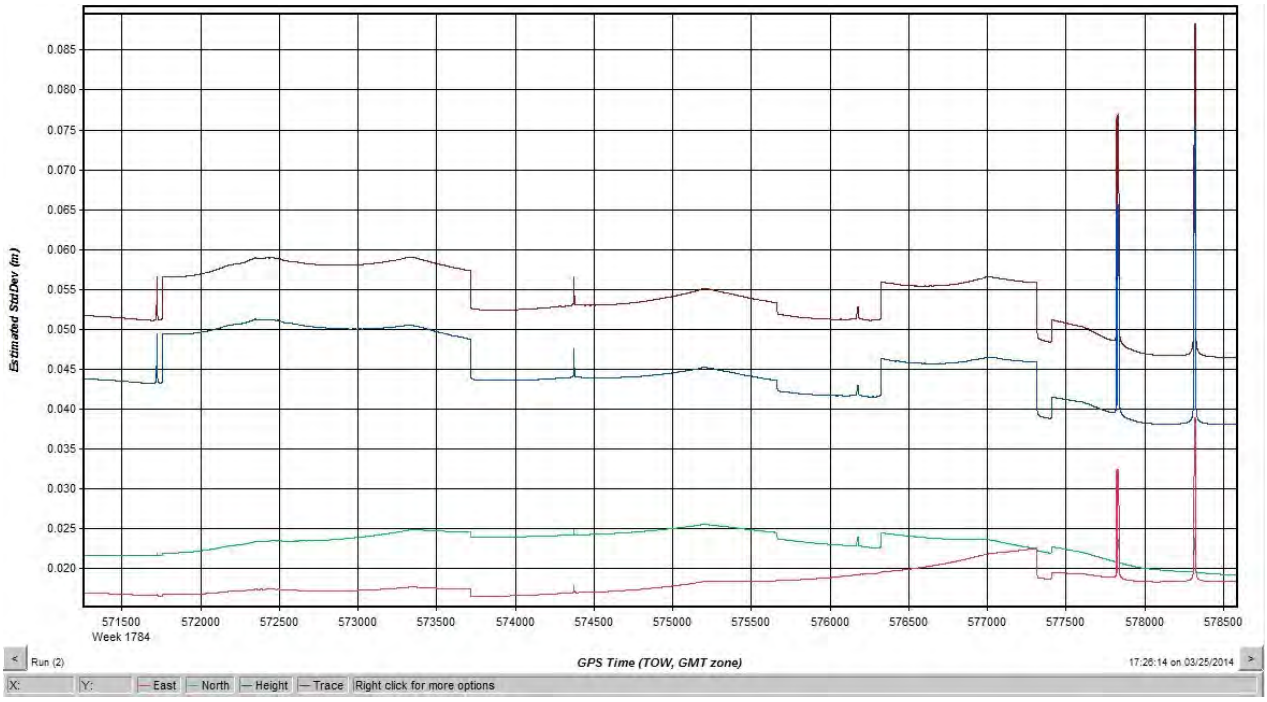


Estimated Positional Accuracy

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) centimeters, often achieving results well below this threshold.

Figure 3.2: Estimated Positional Accuracy, Day08114 SH7108_A

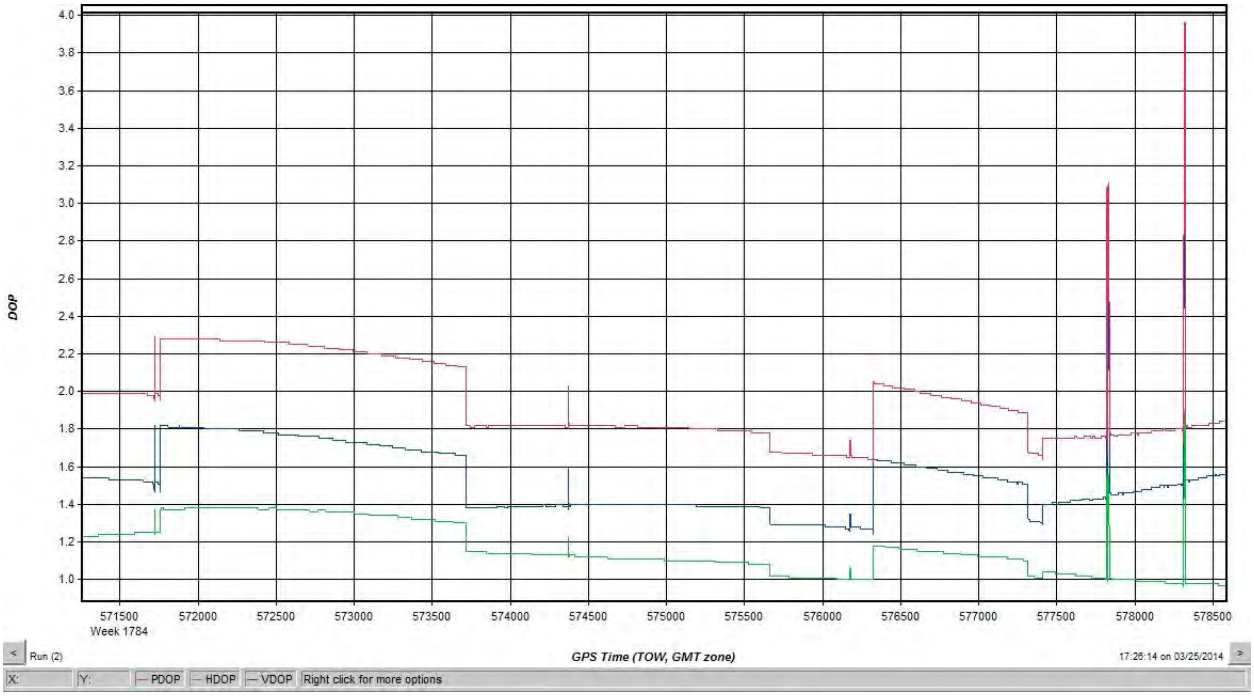


PDOP

The PDOP measures the precision of the GPS solution in regards to the geometry of the satellites acquired and used for the solution.

Woolpert's goal is to maintain an average PDOP value below 3.0. Brief periods of PDOP over 3.0 are acceptable due to the calibration and control process if other metrics are within specification.

Figure 3.3: PDOP, Day08114 SH7108_A



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 project data was imported and classified, survey ground control data was imported and calculated for an accuracy assessment. As a QC measure, Woolpert has developed a routine to generate accuracy statistical reports by comparisons against the TIN and the DEM using surveyed ground control of higher accuracy. The lidar is adjusted accordingly 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 lidar LAS files are 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) classifications.

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

- The horizontal datum used for the task order was referenced to UTM18N American Datum of 1983 (2011). The vertical datum used for the task order was referenced to NAVD 1988, meters, GEOID12A. Coordinate positions were specified in units of meters.

SECTION 4: HYDROLOGIC FLATTENING

HYDROLOGIC FLATTENING OF LIDAR DEM DATA

New Jersey CMGP Sandy 0.7m NPS Lidar Processing task order required the compilation of breaklines defining water bodies and rivers. The breaklines were used to perform the hydrologic flattening of water bodies, and gradient hydrologic flattening of double line streams and rivers. Lakes, reservoirs and ponds, at a minimum size of 2-acres or greater, were compiled as closed polygons. The closed water bodies were collected at a constant elevation. Rivers and streams, at a nominal minimum width of 30.5 meters (100 feet), were compiled in the direction of flow with both sides of the stream maintaining an equal gradient elevation.

LIDAR DATA REVIEW AND PROCESSING

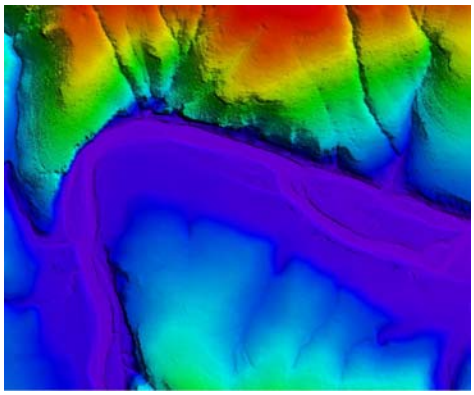
Woolpert utilized the following steps to hydrologically flatten the water bodies and for gradient hydrologic flattening of the double line streams within the existing lidar data.

1. Woolpert used the newly acquired Lidar data to manually draw the hydrologic features in a 2D environment using the lidar intensity and bare earth surface. Open Source imagery was used as reference when necessary.

2. Woolpert utilizes an integrated software approach to combine the lidar data and 2D breaklines. This process "drapes" the 2D breaklines onto the 3D lidar surface model to assign an elevation. A monotonic process is performed to ensure the streams are consistently flowing in a gradient manner. A secondary step within the program verifies an equally matching elevation of both stream edges. The breaklines that characterize the closed water bodies are draped onto the 3D lidar surface and assigned a constant elevation at or just below ground elevation.

3. The lakes, reservoirs and ponds, at a minimum size of 2-acres or greater, were compiled as closed polygons. **Figure 4.1** illustrates a good example of 2-acre lakes and 30.5 meters (100 feet) nominal streams identified and defined with hydrologic breaklines. The breaklines defining rivers and streams, at a nominal minimum width of 30.5 meters (100 feet), were draped with both sides of the stream maintaining an equal gradient elevation.

Figure 4.1



4. All ground points were reclassified from inside the hydrologic feature polygons to water, class nine (9).

5. All ground points were reclassified from within a buffer along the hydrologic feature breaklines to buffered ground, class ten (10).

6. The lidar ground points and hydrologic feature breaklines were used to generate a new digital elevation model (DEM).

Figure 4.2 **Figure 4.3**

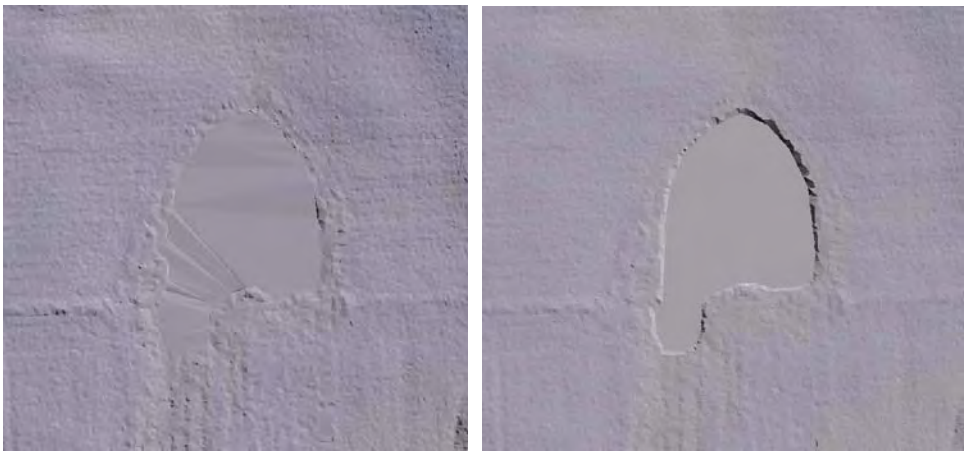


Figure 4.2 reflects a DEM generated from original lidar bare earth point data prior to the hydrologic flattening process. Note the "tinning" across the lake surface.

Figure 4.3 reflects a DEM generated from lidar with breaklines compiled to define the hydrologic features. This figure illustrates the results of adding the breaklines to hydrologically flatten the DEM data. Note the smooth appearance of the lake surface in the DEM.

Terrascan was used to add the hydrologic breakline vertices and export the lattice models. The hydrologically flattened DEM data was provided to USGS in ERDAS .IMG format at a 1-meter cell size.

The hydrologic breaklines compiled as part of the flattening process were provided to the USGS as an ESRI shapefile. The breaklines defining the water bodies greater than 2-acres were provided as a PolygonZ file. The breaklines compiled for the gradient flattening of all rivers and streams at a nominal minimum width of 30.5 meters (100 feet) were provided as a PolylineZ file.

DATA QA/QC

Initial QA/QC for this task order was performed in Global Mapper v15, by reviewing the grids and hydrologic breakline features. Additionally, ESRI software and proprietary methods were used to review the overall connectivity of the hydrologic breaklines.

Edits and corrections were addressed individually by tile. If a water body breakline needed to be adjusted to improve the flattening of the DEM data, the area was cross referenced by tile number, corrected accordingly, a new DEM file was regenerated and reviewed.

SECTION 5: 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 quality check points.

Table 5.1: Overall Vertical Accuracy Statistics

Average error	0.019	meters
Minimum error	-0.060	meters
Maximum error	0.14	meters
Root mean square	0.058	meters
Standard deviation	0.056	meters

Table 5.2: Swath Quality Check Point Analysis, FVA, UTM 18N, NAD83, NAVD88 GEOID12A, New Jersey CMGP Sandy Lidar

Point ID	Easting (UTM meters)	Northing (UTM meters)	TIN Elevation (meters)	Dz (meters)
2001	561820.5	4541880	109.7	0.11
2002	578372.9	4541429	68.39	0.05
2003	589885.5	4531881	132.93	-0.05
2004	556855.2	4525375	51.15	-0.02
2005	568262.1	4517019	35.61	-0.04
2006	577915.4	4524461	24.13	0.06
2007	580784.2	4511731	49.41	0.06
2007A	579686	4507942	1.93	-0.04
2018	540157.6	4514181	187.23	-0.04
2019	562544.1	4500247	16.31	-0.03
2020	552904	4485873	37.03	0.02
2021	534726	4467185	33.24	-0.06
2022	547006.9	4462530	43.81	0.08
2023	548175.5	4474628	38.57	0.03
2024	561779.6	4471359	34.97	0.03

Point ID	Easting (UTM meters)	Northing (UTM meters)	TIN Elevation (meters)	Dz (meters)
2025	574200.5	4466364	19.88	0.02
2026	580877.6	4444146	6.62	0.03
2027	555584.6	4454046	41.84	0.14
2028	533758	4446868	27.41	0.08
1	550974.2	4477560	25.74	0.055
2	561326.8	4480958	5.58	0.046
3	551174.1	4486499	31.2	-0.06
5	552712.3	4497674	41.98	0.046
6	565522.7	4503701	9.23	-0.046
23	571127.2	4512698	14.42	0.001

VERTICAL ACCURACY CONCLUSIONS

LAS Swath Fundamental Vertical Accuracy (FVA) Tested 0.113 meters fundamental vertical accuracy at 95 percent confidence level, derived according to NSSDA, in open terrain in open using (RMSEz) x 1.9600, tested against the TIN.

Bare-Earth DEM Fundamental Vertical Accuracy (FVA) Tested 0.115 meters fundamental vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 Tested against the DEM.

SUPPLEMENTAL VERTICAL ACCURACY ASSESSMENTS

Table 5.3: Quality Check Point Analysis, Urban, UTM 18N, NAD83, NAVD88 GEOID12A, New Jersey CMGP Sandy Lidar

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
3001	561877.2	4541898.34	102.94	0.07
3002	577777	4543626.72	127.28	0.05
3003	589931.9	4532015.59	130	0.09
3004	557583.3	4524764.93	51.31	0.09

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
3005	568265.7	4516887.63	38.9	0.02
3006	579014.7	4525069.35	12.47	0.04
3007	579434.1	4513620.05	3.11	0.03
3018	550230	4505358.28	67.7	0.15
3019	549237.9	4501381.32	84.7	0.01
3020	547437.6	4489313.74	24.72	0.03
3021	534659	4467168.55	31.89	0.12
3022	547001.5	4462481.82	41.21	0.07
3023	549369.1	4474155.73	33.13	0.02
3024	559697.1	4472990.53	25.28	0.05
3025	574217	4466348.4	19.91	0.03
3025A	574094.7	4466439.2	21.96	0.11
3026	580622.6	4444293.49	7.62	0.04
3027	555639	4454024.96	39.92	0.08
3028	533729.7	4446739.06	27.37	0.07
8	558478.2	4518687.698	89.62	0.019
19	580957.6	4506859.057	1.63	0.017
URBAN_8	563125	4499626.375	11.61	0.035
URBAN_9	567543.6	4498809.311	2.94	0.024

ACCURACY CONCLUSIONS

Urban Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.119 meters supplemental vertical accuracy at the 95th percentile, tested against the DEM. Urban Errors larger than 95th percentile include:

- Point 3018, Easting 550229.97, Northing 4505358.28, Z-Error 0.15 meters
- Point 3021, Easting 534658.98, Northing 4467168.55, Z-Error 0.12 meters

Table 5.4: Quality Check Point Analysis, Tall Weeds and Crops, UTM 18N, NAD83, NAVD88 GEOID12A, New Jersey CMGP Sandy Lidar

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
4001	561912.8	4541882.33	99.9	0.31
4002	577591.1	4543721.55	127.01	0.04
4003	589650.5	4529464.86	119.7	0.09
4004	557568	4524741.54	51.4	0.06
4005	569281.8	4515872.16	35.58	0.09
4006	579079.1	4525077.3	10.37	0.03
4007	579306.4	4513133.11	1.81	0.1
4008	566882.5	4546904.37	72.88	0.05
4009	579616.7	4546297.32	118.87	0.1
4010	536493.9	4469071.83	36.51	0.04
4011	537939	4466962.35	31.08	0.07
4012	535978.1	4462505.98	23.9	0
4013	536780.3	4461419.32	23.85	0.06
4014	543313.5	4458839.46	28.87	0.1
4015	549383	4457319.81	39.1	0.11
4016	552621.5	4465927.71	20.19	0.09
4019	549264.7	4501530.4	96.03	0.02
4019A	540141.1	4514126.18	183.67	0
4020	547310.3	4488418.77	23.83	0.01
4021	534877.9	4467684.11	33.42	0.06
4023	549627.7	4474253.87	33.65	0.09
4024	559801.1	4472909.07	30.2	0.18
4025	573938	4467353.03	21.65	0.07
4026	579823.9	4445080.06	9.87	0.11
4027	556929	4452273.74	46.79	0.13

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
4028	534863.9	4445218.26	23.94	0.08

ACCURACY CONCLUSIONS

Tall Weeds and Crops Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.167 meters supplemental vertical accuracy at the 95th percentile, tested against the DEM. Tall Weeds and Crops Errors larger than 95th percentile include:

- Point 4001, Easting 561912.82, Northing 4541882.33, Z-Error 0.31 meters
- Point 4024, Easting 559801.06, Northing 4472909.07, Z-Error 0.18 meters

Table 5.5: Quality Check Point Analysis, Brushlands and Trees, UTM 18N, NAD83, NAVD88 GEOID12A, New Jersey CMGP Sandy Lidar

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
5001	561833	4541926.64	108.11	0.26
5002	577585.8	4543734.86	126.8	0.06
5003	589660.2	4529479.89	119.76	0.11
5005	557566.5	4524711.48	52.41	0.05
5005A	568983.9	4518457.9	53.31	0.17
5005B	567900.5	4516937.99	41.04	0.25
5006	579162.9	4524864.1	1.83	0.17
5007	579607.7	4513598.11	0.46	0.17
5015	579903.9	4507075.06	2.75	0.02
5016	575927.2	4503079.23	4.27	0.11
5019	549237.5	4501617.97	102.07	0.07
5019A	540230.3	4513740.1	184.76	0.04
5020	547208.1	4488582.25	29.45	0.1
5021	534817.4	4467723.72	34.12	0.01
5022	546352.5	4461543.88	34.33	0.13

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
5023	550075.6	4474783.74	39.19	0.14
5024	561094	4471628	33.65	0.05
5025	573663.1	4464733.95	25.7	0.05
5026	576318.1	4444434.44	20.18	0.07
5027	559075.7	4452424.97	34.99	0.07
5028	544438.9	4445867.99	42.39	0.15

ACCURACY CONCLUSIONS

Brushlands and Trees Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.25 meters supplemental vertical accuracy at the 95th percentile, tested against the DEM. Brushlands and Trees Errors larger than 95th percentile include:

- Point 5001, Easting 561832.98, Northing 4541926.64, Z-Error 0.26 meters

Table 5.6: Quality Check Point Analysis, Forested and Fully Grown, UTM 18N, NAD83, NAVD88 GEOID12A, New Jersey CMGP Sandy Lidar

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
6001	561843.7	4541936.42	108.44	0.13
6001A	561856.6	4541930.01	109.4	0.24
6002	577463.8	4543781.34	126.49	0.08
6002A	577452	4543774.99	126.69	0.05
6003	589679.8	4529458.05	118.16	0.11
6003A	589665.8	4529426.57	119.12	0.08
6005	568256	4517438.02	34.79	0.02
6005A	568227.9	4517469.33	34.77	0.12
6006	579101.1	4524966.74	3.17	0.11
6006A	579101.8	4524972.45	4.19	0.05
6007	579103.5	4513199.5	2.74	0.08

Point ID	Easting (UTM meters)	Northing (UTM meters)	DEM Elevation (meters)	Abs. Dz (meters)
6007A	579120	4513192.7	1.74	0.02
6015	579905.4	4507043.21	3.25	0.12
6015A	579908.6	4507050.87	3.13	0.07
6018	540209.8	4514156.72	182.94	0.03
6018A	540195.9	4514165.39	185.62	0.03
6019	549245.8	4501647.34	102.98	0.01
6019A	549257.8	4501628.35	99.53	0.02
6020	547183.5	4488615.29	29.37	0
6020A	547189.5	4488637.36	29.98	0.27
6021	534845.1	4467775.29	33.91	0.07
6021A	534847.5	4467790.12	33.8	0.03
6022	546400	4461540.61	34.14	0.1
6022A	546412.5	4461536.74	34.1	0.18
6023	550061	4474739.61	38.93	0.14
6023A	550054.2	4474725.64	38.7	0.06
6024	559795.1	4472606.08	23.54	0.11
6024A	559760.8	4472619.37	24.11	0.08
6025	573732.7	4464753.98	26.91	0.12
6025A	573740.3	4464732.25	27.02	0.09
6026	575092	4445492.11	16.53	0.01
6026A	575066.4	4445510.94	16.11	0.1
6027	559150	4452439.1	33.33	0.05
6027A	559162.7	4452433.61	33.02	0.05
6028	542160.7	4446239.16	34.99	0.09
6028A	542137.2	4446256.4	34.72	0

ACCURACY CONCLUSIONS

Forested and Fully Grown Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.195 meters supplemental vertical accuracy at the 95th percentile, tested against the DEM. Forested and Fully Grown Errors larger than 95th percentile include:

- Point 6001A, Easting 561856.55, Northing 4541930.01, Z-Error 0.24 meters
- Point 6020A, Easting 547189.48, Northing 4488637.36, Z-Error 0.27 meters

CONSOLIDATED VERTICAL ACCURACY ASSESSMENT

ACCURACY CONCLUSIONS

Consolidated Vertical Accuracy (CVA) Tested 0.175 meters consolidated vertical accuracy at the 95th percentile level, tested against the DEM. Consolidated errors larger than 95th percentile include:

- Point 4001, Easting 561912.82, Northing 4541882.33, Z-Error 0.31 meters
- Point 4024, Easting 559801.06, Northing 4472909.07, Z-Error 0.18 meters
- Point 5001, Easting 561832.98, Northing 4541926.64, Z-Error 0.26 meters
- Point 5005B, Easting 567900.45, Northing 4516937.99, Z-Error 0.25 meters
- Point 6001A, Easting 561856.55, Northing 4541930.01, Z-Error 0.24 meters
- Point 6020A, Easting 547189.48, Northing 4488637.36, Z-Error 0.27 meters

Approved By:			
Title	Name	Signature	Date
Associate LiDAR Specialist Certified Photogrammetrist #1281	Qian Xiao		October 2014

SECTION 6: FLIGHT LOGS

FLIGHT LOGS

Flight logs for the project are shown on the following pages.

Woolpert

Leica LIDAR					
	9/21/2014	AM	73666		NY-NJ-----8 LINES
SIMMONS		N475SC	5000.9	18:00:00	22:00:00	WOOLPERT P/N
PILOT		SENSOR TYPE		LAUNCH START TIME		
SWAIN		AUS-710R	5005.5	22:00:00	5:00:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud	Departing	KTTN
calm	10	clr						Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	120
				Gain - Fine/Down	12	Multi	X	B	100

Air Speed	AGL	MSL	Waveform Used				Waveform Mode		Pre-Trigger Dist.
150 kts	7500 Ft	Ft	Yes		No	X	@ NS		Ft

Line #	Dir.	Line Start Time	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 5-Turns Before Mission Yes No
B25	NE	22:23:00	22:31:00	21:13:00				
B24	SW	22:33:00	22:40:00	0:00:00				FAST AT START OF LINE-RED PARACHU
B23	NE	22:43:00	22:51:00	0:00:00				
B22	SW	22:54:00	23:03:00	0:00:00				
B20	NE	23:04:00	23:15:00	0:00:00				
B21	SW	23:18:00	23:20:00	0:00:00				
B19	SW	23:25:00	23:37:00	0:00:00				
B18	NE	23:40:00	23:51:00	0:00:00				
B17	SW	23:53:00	0:04:00	0:00:00				
B16	NE	0:08:00	0:19:00	0:00:00				
B15	SW	0:21:00	0:33:00	0:00:00				
B14	NE	0:36:00	0:47:00	0:00:00				
B13	SW	0:50:00	1:01:00	0:00:00				
B12	NE	1:04:00	1:16:00	0:00:00				
B11	SW	1:19:00	1:32:00	0:00:00				EARLY ABORT DUE TO ATC (RESTRICTE
B10	NE	1:33:00	1:46:00	0:00:00				
B09	SW	1:48:00	2:01:00	0:00:00				EARLY ABORT DUE TO ATC (RESTRICTE
B08	NE	2:04:00	2:16:00	0:00:00				LATE START DUE TO ATC (RESTRICTED
B07	SW	2:19:00	2:32:00	0:00:00				EARLY ABORT DUE TO ATC (RESTRICTE
				0:00:00				
				0:00:00				
				0:00:00				
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				0:00:00				
↑ Times entered are Zulu / GMT ↑				Page	1			Verify 5-Turns After Mission Yes No

Additional Comments:

Drive #

97

Woolpert

Leica LIDAR	3/21/2014	80	73666/73734	1	NJ_NY Post Sandy

GALAMBOS	N115SD	2461.3	6:21:00	22:21:00	WOOLPERT PIA
LaROCQUE	ALS-7177	2464.0	8:14:00	0:14:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	[illegible]	Departing	KTTN
310 11 g15	10	Clear		11	-7	30.00		Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	x	B	170

Air Speed		AGL		MSL		Waveform Used				Waveform Mode	Pre-Trigger Dist.	
150	kts	7500	Ft	7500	Ft	Yes		No	x	@ NS		Ft

Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments	
Test	n/a	22:06:17	22:06:30	n/a	n/a	n/a	n/a	GPS Began Logging At:	21:45:25
⇓ Times entered are Zulu / GMT ⇓								Verify 5-Turns Before Mission Yes X No	
51B	N	22:20:40	22:27:14	0:00:00	17	0.6	1.3	TAKEOFF:2156Z/5:56L/ Mode 360	
50B	S	22:30:16	22:38:22	0:00:00	17	0.6	1.1		
49B	N	22:41:40	22:49:18	0:00:00	19	0.6	1.1		
48B	S	22:52:47	23:01:15	0:00:00	19	0.6	1		
47B	N	23:04:45	23:13:23	0:00:00	19	0.6	1		
46B	S	23:16:29	23:25:32	0:00:00	17	0.7	1.1		
45B	N	23:29:00	23:37:55	0:00:00	18	0.6	1		
44B	S	23:40:42	23:49:30	0:00:00	19	0.6	1		
43B	N	23:52:37	0:01:31	0:00:00	18	0.6	1.2		
42B	S	0:04:11	0:13:33	0:00:00	17	0.7	1.2		
				0:00:00				Landing: 00:32z/8:32L	
				0:00:00				Static: 00:37:50	
				0:00:00					
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				0:00:00					
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⇑ Times entered are Zulu / GMT ⇑				Page		1		Verify 5-Turns After Mission Yes x No	

Additional Comments:	Drive #
	783516

Woolpert

Leica LIDAR				
3/22/2014	81	73666		NY-NJ ——— 8 LINES

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SIMMONS	N475RC	5005.5	10:40:00	14:40:00	WOOLPERT PVN
SWAIN	ALS-70[illegible]	5007.2	12:50:00	16:50:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud	Departing	KTTN
calm	10	clr					HAZE	Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	120
				Gain - Fine/Down	12	Multi	x	B	100

Air Speed		AGL		MSL		Waveform Used				Waveform Mode	Pre-Trigger Dist.
150	Kts	7500	Ft		Ft	Yes		No	x	@ MS	Ft

Line #	Dir.	Line Start Time	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 5-Turns Before Mission Yes No
B6	NE	15:01:00	15:14:00	6:47:00				MANUAL START DUE TO ATC (RESTRIC
B5	SW	15:17:00	15:30:00	0:00:00				EARLY ABORT DUE TO ATC (RESTRICTE
B4	NE	15:33:00	15:45:00	0:00:00				LATE START DUE TO ATC (RESTRICTED A
B3	SW	15:49:00	16:02:00	0:00:00				EARLY ABORT DUE TO ATC (RESTRICTE
B66-B02	NE	16:05:00	16:15:00	0:00:00				LATE START DUE TO ATC (RESTRICTED A
B1	SW	16:18:00	16:22:00	0:00:00				ABORT DUE TO TDC ERROR & CLOUDS
				0:00:00				
				0:00:00				
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↑ Times entered are Zulu / GMT ↑			Page		1			Verify 5-Turns After Mission Yes No

Additional Comments:

Drive #

Woolpert

Leica LIDAR					
	9/22/2014	81	75866/73714	1	NJ_NY Port Sandy

Operator	Aircraft		Lead In/Out Time		Base
GALAMBOS	N111SD	2464.0	10:23:00	14:23:00	WOOLPERT PIN
Pilot	Sensor Type				
LaROCQUE	AUS-7177	2467.1	12:44:00	18:44:00	9:10 AM

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud		
calm	10	Clear		6	-1	29.82		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Air Speed	AGL		MSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.
150	Kts	7500	Ft	7500	Ft	Yes		No	X	@	NS	Ft

Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments	
Test	n/a	14:15:17	14:15:27	n/a	n/a	n/a	n/a	GPS Began Logging At:	13:51:40
↑ Times entered are Zulu / GMT ↑								Verify 2 Turns Before Mission	Yes X No
42B	N	14:22:35	14:31:44	0:00:00	17	0.6	1.1	TAKEOFF: 1358Z/9:58L	
41B	S	14:35:02	14:43:40	0:00:00	18	0.6	1.1		
40B	N	14:46:19	14:54:31	0:00:00	17	0.6	1.1		
39B	S	14:57:13	15:05:44	0:00:00	16	0.7	1.2		
38B	N	15:08:22	15:16:25	0:00:00	17	0.6	1		
37B	S	15:19:37	15:28:22	0:00:00	17	0.7	1.1		
36B	N	15:30:50	15:38:52	0:00:00	16	0.7	1.2		
35B	S	15:41:53	15:50:49	0:00:00	17	0.7	1.2		
34B	N	15:53:23	16:01:54	0:00:00	16	0.7	1.2		
33B	S	16:05:08	16:14:06	0:00:00	16	0.7	1.1		
32B	N	16:16:52	16:25:21	0:00:00	18	0.6	1.1		
31B	S	16:28:51	16:37:23	0:00:00	18	0.6	1.1		
30B	N	16:40:44	16:42:58	0:00:00	16	0.7	1.1	REFLY DUE TO CLOUDS	
				0:00:00					
				0:00:00				Landing: 16:56Z/12:56L	
				0:00:00				Static: 16:59:30Z	
				0:00:00					
				0:00:00					
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes X No

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR	3/22/2014	81	73846/73734	1	NJ_NY Post Sandy

GALAMBOS	N111SD	2467.1	4:05:00	20:05:00	WOOLPERT PVN
LaROCQUE	ALS-7177	2468.5	4:56:00	20:56:00	9:10 AM

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud	Departing	KTTN
300 18 g26	10	Clear		18	-1	29.78		Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	x	B	170

Air Speed		AGL		MSL		Waveform Used				Waveform Mode	Pre-Trigger Dist.
150	Kts	7500	Ft	7500	Ft	Yes		No	X	@ MS	Ft

Line #	Dir.	Line Start Time	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:	19:45:30
↓ Times entered are Zulu / GMT ↓								Verify 5-Turns Before Mission	Yes X No
308	N	20:04:54	20:12:28	0:00:00	17	0.6	1.1	TAKEOFF: 1952z/3:52L	
298	S	20:14:45	20:15:00	0:00:00	18	0.6	1.1	Flight "B"	
298	S	20:18:08	20:26:04	0:00:00	17	0.6	1.3	OFFLINE-reflight	
288	N	20:29:02	20:36:22	0:00:00	16	0.7	1.2		
278	S	20:39:05	20:46:19	0:00:00	17	0.6	1		
268	N	20:48:51	20:55:45	0:00:00	17	0.6	1.4		
				0:00:00				Landing: 2118Z/5:18L	
				0:00:00				Static: 21:21:20	
				0:00:00					
				0:00:00					
				0:00:00					
				0:00:00					
				0:00:00					
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↑ Times entered are Zulu / GMT ↑			Page		1			Verify 5-Turns After Mission	Yes x No

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR					
	9/24/2014	83	73866/73714	1	NJ_NY Post Sandy

Operator	Aircraft		Flight #	Flight #	Project Name		
GALAMBOS	N111SD		2469.1	9:13:00	13:19:00	WOOLPERT P/N	
Pilot	Sensor Type						
LeROCQUE	ALS-7177		2471.0	10:40:00	14:40:00	9:10 AM	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud	Departing	KTTN
130 8	10	clear		-6	-7	3026		Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Nir Speed	AGL		MSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.	
150	Kts	7500	Ft	7500	Ft	Yes		No	X	@	NS	Ft

Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments	
Text	n/a			n/a	n/a	n/a	n/a	GPS Began Logging At:	12:53:00
↑ Times entered are Zulu / GMT ↑								Verify 5-Turns Before Mission	Yes: X No:
52B	N	13:12:57	13:14:28	0:00:00	17	0.6	1.1	Takeoff: 13:01Z/9:01l	
53B	S	13:19:39	13:22:06	0:00:00	18	0.6	1.2	SMALL THIN CLOUD END OF LINE	
54B	N	13:24:49	13:27:50	0:00:00	17	0.6	1.1		
55B	S	13:30:33	13:33:42	0:00:00	16	0.7	1.2		
56B	N	13:36:15	13:39:42	0:00:00	17	0.6	1		
57B	S	13:42:47	13:46:23	0:00:00	19	0.6	1.1		
58B	N	13:49:39	13:53:07	0:00:00	19	0.6	1.1		
59B	S	14:00:56	14:01:18	0:00:00	19	0.6	1.1	Too fast	
60B	N	14:04:04	14:04:53	0:00:00	18	0.6	1.2		
61B	S	14:08:19	14:09:26	0:00:00	18	0.6	1.2		
62B	N	14:11:29	14:12:58	0:00:00	18	0.6	1.2		
63B	S	14:15:39	14:13:44	0:00:00	18	0.6	1.2	MISSED LINE	
63B	S	14:20:25	14:22:06	0:00:00	18	0.6	1.2		
64B	N	14:24:50	14:27:36	0:00:00	18	0.6	1.2		
65B	S	14:30:15	14:33:17	0:00:00	18	0.6	1.2	Landing: 14:52Z/10:52l	
66B	N	14:36:23	14:40:06	0:00:00	18	0.7	1.3	Static: 14:53:35	
				0:00:00					
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes: X No:

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR					
	9/24/2014	83	75866/73714	1	NJ_NY Port Sandy
Operator	Aircraft				
GALAMBOS	N111SD	2471.0	6:38:00	22:38:00	WOOLPERT P/N
Pilot	Sensor Type				
LeROCQUE	AUS-7177	2472.3	7:27:00	23:27:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud		
280-310 8g16	10	clear		8	-17	3012		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Nr Speed	AGL		MSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.	
150	kts	7500	Ft	7500	Ft	Yes		No	X	@	NS	Ft

Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments	
Test	n/a	22:33:15	22:33:30	n/a	n/a	n/a	n/a	GPS Began Logging At:	22:13:30
		↑ Times entered are Zulu / GMT ↑						Verify 2 Turns Before Mission	Yes X No
3B	N	22:38:28	22:40:30	0:00:00	20	0.6	1.1	Takeoff: 2218Z/6:18L	
4B	S	22:43:01	22:45:30	0:00:00	18	0.6	1.2	Southern End near restricted area	
5B	N	22:48:21	22:50:21	0:00:00	17	0.6	1.1	Southern 5 mi. near restrctd area	
6B	S	22:53:17	22:55:09	0:00:00	16	0.7	1.2	Southern 5 mi. near restrctd area	
7B	N	22:58:42	22:00:47	0:00:00	17	0.6	1	Southern 5 mi. near restrctd area	
8B	S	23:-04:10	23:06:49	0:00:00	19	0.6	1.1	Southern 5 mi. near restrctd area	
9B	N	23:09:41	23:11:38	0:00:00	19	0.6	1.1	Southern 5 mi. near restrctd area	
10B	S	23:15:48	23:16:58	0:00:00	19	0.6	1.1	Southern 5 mi. near restrctd area	
11B	N	23:19:46	23:21:45	0:00:00	18	0.6	1.2	Southern 3 mi. near restrctd area	
10B	S	23:24:17	23:27:19	0:00:00	18	0.6	1.2		
				0:00:00					
				0:00:00				Mission 2	
				0:00:00					
				0:00:00					
				0:00:00				Landing 2239z	
				0:00:00				Static: 22:42:43	
				0:00:00					
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes X No

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	3/26/2014	85	73666	1	NY-NJ ——A LINES

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SIMMONS	N475RC	5012.7	19:40:00	23:40:00	WOOLPERT PVN
SWAIN	ALS-70	5015.7	23:00:00	3:00:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud	Departing	KTTN
							HAZE	Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	120
				Gain - Fine/Down	12	Multi	x	B	100

Air Speed	AGL	MSL	Waveform Used	Waveform Mode	Pre-Trigger Dist.
150	7500 Ft	Ft	x	@ MS	Ft

Line #	Dir.	Line Start Time	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 5-Turns Before Mission Yes No
A41	NE	0:11:00	0:21:00	0:56:00				
A40	SW	0:23:00	0:33:00	0:00:00				
A39	NE	0:35:00	0:47:00	0:00:00				
A38	SW	0:49:00	0:59:00	0:00:00				
A37	NE	1:03:00	1:15:00	0:00:00				
A36	SW	1:18:00	1:30:00	0:00:00				
A35	NE	1:33:00	1:47:00	0:00:00				
A34	SW	1:49:00	2:02:00	0:00:00				
A33	NE	2:05:00	2:19:00	0:00:00				
A32	SW	2:22:00	2:35:00	0:00:00				
				0:00:00				
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				0:00:00				
↑ Times entered are Zulu / GMT ↑			Page	1				Verify 5-Turns After Mission Yes No

Additional Comments: Tail winds on south bound runs; Wind kept shifting, so the speed fluctuated from fast to slow at times.

Drive # 112

Woolpert

Leica LIDAR					
	9/26/2014	83	73666/73714	1	NJ_NY Post Sandy
Operator	Aircraft		Flight Start Time	Flight Start Time Actual	Area
GALAMBOS	N111SD	2472.3	12:30:00	16:30:00	WOOLPERT P/N
Pilot	Sensor Type		Flight End Time	Job End Time	PIC
LeROCQUE	AUS-7177	2474.4	2:10:00	18:10:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud		
340 22 31	10	clear		1	-15	2993		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Nr Speed	AGL		MSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.	
150	kts	7500	Ft	7500	Ft	Yes		No	X	@	NS	Ft

Line #	Dir.	Line Start Time	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:	16:10:30
↑ Times entered are Zulu / GMT ↑								Verify 5-Turns Before Mission	Yes X No
1B	N	16:30:45	16:39:05	0:00:00	17	0.7	1.3	Takeoff: 16:18Z/12:18	
96A	S	16:45:58	16:53:50	0:00:00	17	0.7	1.3	CLOUD 9 MILES INTO IT	
97A	N	16:56:52	17:05:07	0:00:00	16	0.8	1.4	CLOUD 13 MILES INTO IT	
98A	S	17:08:31	17:15:58	0:00:00	16	0.7	1.2		
99A	N	17:19:19	17:27:26	0:00:00	16	0.7	1.2		
73A	S	17:32:28	17:34:05	0:00:00	14	0.8	1.4		
95A	S	17:35:15	17:37:00	0:00:00	14	0.8	1.4		
94A	N	17:39:55	17:41:26	0:00:00	14	0.8	1.4		
72A	N	17:00:00	17:44:05	0:00:00	14	0.8	1.4		
93A	S	17:47:50	17:49:04	0:00:00	14	0.8	1.4		
92A	N	17:52:02	17:52:56	0:00:00	14	0.8	1.4		
68A	SW	18:05:01	18:06:26	0:00:00	14	0.8	1.4		
69A	NE	18:10:05	18:10:09	0:00:00	14	0.8	1.4	CLOUDS	
				0:00:00					
				0:00:00				Landing: 1824Z	
				0:00:00				Static: 18:26:15	
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes X No

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR					
	9/26/2014	83	75866/75714	1	NJ_NY Post Sandy

Operator	Aircraft		Flight #	Lidar Start Time	Lidar End Time	Base
GALAMBOS	N111SD	2472.3	12:30:00	18:30:00	WOOLPERT PIN
Pilot	Sensor Type	Lidar End Time	Lidar End Time	Data End Time	POC
LeROCQUE	ALS-7177	2474.4	2:10:00	18:10:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud	Departing	KTTN
340 22 31	10	clear		1	-15	2993		Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
				Gain - Course/Up	6	Single		A	180
32	41.6	239	100	Gain - Fine/Down	12	Multi	X	B	170

Nr Speed	AGL		BSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.	
150	7500	Ft	7500	Ft	Yes		No	X	@	NS		Ft

Line #	Dir.	Line Start Time	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:	16:10:30
↑ Times entered are Zulu / GMT ↑								Verify 2 Turns Before Mission	Yes X No
1B	N	16:30:45	16:39:05	0:00:00	17	0.7	1.3	Takeoff: 16:18Z/12:18	
96A	S	16:45:58	16:53:50	0:00:00	17	0.7	1.3	CLOUD 9 MILES INTO IT	
97A	N	16:56:52	17:05:07	0:00:00	16	0.8	1.4	CLOUD 13 MILES INTO IT	
98A	S	17:08:31	17:15:58	0:00:00	16	0.7	1.2		
99A	N	17:19:19	17:27:26	0:00:00	16	0.7	1.2		
73A	S	17:32:28	17:34:05	0:00:00	14	0.8	1.4		
95A	S	17:35:15	17:37:00	0:00:00	14	0.8	1.4		
94A	N	17:39:55	17:41:26	0:00:00	14	0.8	1.4		
72A	N	17:00:00	17:44:05	0:00:00	14	0.8	1.4		
93A	S	17:47:50	17:49:04	0:00:00	14	0.8	1.4		
92A	N	17:52:02	17:52:56	0:00:00	14	0.8	1.4		
68A	SW	18:05:01	18:06:26	0:00:00	14	0.8	1.4		
69A	NE	18:10:05	18:10:09	0:00:00	14	0.8	1.4	CLOUDS	
				0:00:00					
				0:00:00				Landing: 1824Z	
				0:00:00				Static: 18:26:15	
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes X No

Additional Comments:

Drive #: 783516

Woolpert

Leica LIDAR					
	3/27/2014	IM	73666	1	NY-NJ ——A LINES

SIMMONS	N475NC	5015.7	9:10:00	13:10:00	WOOLPERT PIR
SWAIN	AUS-7108	5022.8	16:45:00	20:40:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud		
330 @ 08	10 SM	CLR		-4	-15	3042		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Coarse/Up	5	Single		A	120
				Gain - Fine/Down	12	Multi	X	B	100

Nr Speed	AGL	MSL	Waveform Used				Waveform Mode	Pre-Trigger Dist.
150 Kts	7500 Ft	Ft	Yes		No	X	@ NS	Ft

Line #	Dir.	Line Start Time	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 5-Turns Before Mission: Yes / No
A31	NE	13:52:00	14:06:00	4:30:00				
A30	SW	14:08:00	14:22:00	0:00:00				
A29	NE	14:24:00	14:37:00	0:00:00				
A28	SW	14:40:00	14:54:00	0:00:00				
A27	NE	14:56:00	15:10:00	0:00:00				
A26	SW	15:13:00	15:28:00	0:00:00				
A25	NE	15:30:00	15:45:00	0:00:00				
A24	SW	15:49:00	16:01:00	0:00:00				
A23	NE	16:04:00	16:16:00	0:00:00				
A22	SW	16:19:00	16:31:00	0:00:00				
A21	SW	16:34:00	16:46:00	0:00:00				
A20	NE	16:48:00	17:01:00	0:00:00				
A19	SW	17:03:00	17:16:00	0:00:00				
A52	NE	17:23:00	17:32:00	0:00:00				
A53	SW	17:35:00	17:43:00	0:00:00				
A54	NE	17:46:00	17:53:00	0:00:00				
A55	SW	17:56:00	17:59:00	0:00:00				
A56	NE	18:02:00	18:05:00	0:00:00				
A61	SW	18:08:00	18:10:00	0:00:00				
A18	NE	18:21:00	18:25:00	0:00:00				
A17	SW	18:29:00	18:34:00	0:00:00				
A16	NE	18:36:00	18:40:00	0:00:00				
A15	SW	18:43:00	18:47:00	0:00:00				
A13	NE	18:50:00	18:53:00	0:00:00				
A12	SW	18:56:00	18:59:00	0:00:00				
A11	NE	19:02:00	19:06:00	0:00:00				
A10	SW	19:08:00	19:12:00	0:00:00				
A9	NE	19:15:00	19:18:00	0:00:00				
A6	SW	19:21:00	19:25:00	0:00:00				
A5	NE	19:28:00	19:32:00	0:00:00				
A4	SW	19:35:00	19:39:00	0:00:00				
↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission: Yes / No

Additional Comments:

Tail winds on south bound runs; Wind kept shifting, so the speed fluctuated from fast to slow at times.

Drive #

Woolpert

Leica LIDAR					
	9/27/2014	86	75846/75714	1	NJ_NY Port Sandy

Operator	Aircraft		Lidar Start Time		Base
GALAMBOS	N111SD	2477.4	10:41:00	14:41:00	WOOLPERT PIN
Pilot	Sensor Type		Lidar End Time		PIC
LeROCQUE	AUS-7177	2479.2	11:54:00	15:56:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud		
270 6	10	clear		-3	-15	3043		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Air Speed	AGL		MSL		Waveform Used				Waveform Mode		Pre-Trigger Dist.
150	7500	Ft	7500	Ft	Yes		No	X	@	NS	Ft

Line #	Dir.	Line Start Time	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:	14:18:12
		↑ Times entered are Zulu / GMT ↑						Verify 5-Turns Before Mission Start: Y	N
86	N	14:41:33	14:48:44	0:00:00	16	0.8	1.3	takeoff: 1425z	
87	S	14:51:54	14:58:34	0:00:00	16	0.8	1.3	"A" Block	
88	N	15:01:30	15:08:21	0:00:00	16	0.8	1.3		
89	S	15:11:25	15:17:54	0:00:00	16	0.8	1.3		
90	N	15:20:56	15:27:27	0:00:00	16	0.7	1.2		
91	S	15:30:33	15:37:07	0:00:00	14	0.8	1.4		
14	N	15:46:50	15:50:02	0:00:00	14	0.8	1.4		
13	S	15:53:08	15:54:02	0:00:00	18	0.6	1	TDC data acquiring does not finish	
				0:00:00				successfully	
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				0:00:00					
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				0:00:00				Landing: 16:16z	
				0:00:00				Static: 16:19:14	
				0:00:00					
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↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission: Yes	X	No	

Additional Comments:	Drive #
	783516

Woolpert

Leica LIDAR					
	4/1/2014	81	73666	1	NY-NJ ——— B & C LINES

SIMMONS	N475YC	5022.8	12:45:00	4:45:00	WOOLPERT P/A
PILOT					
SWAN	AUS-710R	5029.0	7:20:00	11:20:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fog/Cloud		
360 @ 05	10 SM	CLR		6	-2	3009		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	120
				Gain - Fine/Down	12	Multi	X	B	100

Air Speed	AGL	MSL	Waveform Used				Waveform Mode	Pre-Trigger Dist.
150 kts	7500 Ft	Ft	Yes		No	X	@ NS	Ft

Line #	Dir.	Line Start Time	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 2 Turns Before Mission Start: Yes / No
C45	S	5:14:00	5:15:00	10:38:00				
C44	N	5:18:00	5:20:00	0:00:00				
C43	S	5:23:00	5:24:00	0:00:00				
C42	N	5:29:00	5:37:00	0:00:00				
C34	N	5:43:00	5:48:00	0:00:00				
C35	S	5:51:00	5:56:00	0:00:00				
C36	N	5:58:00	6:04:00	0:00:00				
C37	S	6:06:00	6:11:00	0:00:00				
C38	N	6:14:00	6:17:00	0:00:00				
C39	S	6:19:00	6:22:00	0:00:00				
C41	E	6:26:00	6:28:00	0:00:00				
C40	W	6:31:00	6:33:00	0:00:00				
B89	W	6:40:00	6:43:00	0:00:00				
B88	W	6:48:00	6:50:00	0:00:00				
B87	SW	6:54:00	6:55:00	0:00:00				
B86	NW	6:59:00	7:00:00	0:00:00				
B85	SW	7:04:00	7:05:00	0:00:00				
B84	NW	7:09:00	7:10:00	0:00:00				
B83	NW	7:14:00	7:16:00	0:00:00				
C22	NW	7:21:00	7:22:00	0:00:00				
B81	SE	7:25:00	7:27:00	0:00:00				
B82	NW	7:32:00	7:34:00	0:00:00				
B78	SW	7:37:00	7:39:00	0:00:00				
B79	SE	7:42:00	7:45:00	0:00:00				
B80	E	7:50:00	7:51:00	0:00:00				
C21	E	7:57:00	8:00:00	0:00:00				
C20	E	8:07:00	8:09:00	0:00:00				
C19	NE	8:13:00	8:16:00	0:00:00				
C18	N	8:21:00	8:24:00	0:00:00				
C17	S	8:28:00	8:30:00	0:00:00				
C14	N	8:34:00	8:35:00	0:00:00				
↑ Times entered are Zulu / GMT ↑				Page	1			Verify 5-Turns After Mission: Yes / No

Additional Comments: Drive #

Tail winds on south bound runs; Wind kept shifting, so the speed fluctuated from fast to slow at times..

Woolpert

Leica LIDAR					
	9/11/2014	90	73666/73714	1	NJ_NY Port Sandy
Operator	Aircraft		Flight #	Flight #	Project Name
DALAMBOS	N111SD		2480.1	7:53:00	23:53:00 WOOLPERT PIN
PIC	Sensor Type		Local Start Time	Local End Time	Data End Time PIC
LeROCQUE	ALS-7177		2494.5	11:55:00	3:53:00

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud	Departing	KTTN
350 9	10	clear		12	-1	30.01		Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Nr Speed	AGL	BSL	Waveform Used				Waveform Mode		Pre-Trigger Dist.
150 Kts	7500 Ft	7500 Ft	Yes		Adj	X	@ NS		Ft

Line #	Dir.	Line Start Time	Line End Time	Time On Line	SV's	HDOP	PDOP	Line Notes/Comments	
Text	n/a			n/a	n/a	n/a	n/a	GPS Began Logging At:	23:36:00
↑ Times entered are Zulu / GMT ↑								Verify 5-Turns Before Mission	Yes X No
56B	N	23:53:18		0:00:00	19	0.7	1.2	Takeoff: 23:43z TDC ERROR	
56B	N	0:11:04	0:14:38	0:00:00	20	0.7	1.2	Overbase : 00:06:00 rebooted	
57B	S	0:17:18	0:18:23	0:00:00	19	0.7	1.2	TOO FAST	
57B	S	0:23:00	0:27:24	0:00:00	18	0.7	1.2		
66B	S	0:30:24	0:33:50	0:00:00	17	0.7	1.1	FLYING LOW DUE TO ATC	
31B	N	0:40:31	0:44:30	0:00:00	19	0.7	1.2		
53A	N	0:53:39	1:02:19	0:00:00	18	0.7	1.1		
52A	S	1:05:01	1:13:12	0:00:00	18	0.7	1.1	DROPUTS DUE TO WATER	
45A	N	1:16:25	1:25:33	0:00:00	18	0.7	1.1	SATS DROPED FROM 18 TO 4	
44A	S	1:28:32	1:36:58	0:00:00	18	0.7	1.1	WE HAD CHANGED CABLES	
43A	N	1:40:21	1:49:38	0:00:00	18	0.7	1.1		
42A	S	1:52:37	2:00:29	0:00:00	17	0.8	1.2		
80	NE	2:09:04	2:17:14	0:00:00	16	0.7	1.3		
79	SW	2:20:00	2:27:45	0:00:00	19	0.6	1		
78	NE	2:30:55	2:40:16	0:00:00	20	0.6	1		
76	SW	2:41:54	2:49:46	0:00:00	19	0.6	1		
75	NE	2:52:52	2:59:50	0:00:00	18	0.6	1.1		
74	SW	3:02:35	3:03:40	0:00:00	18	0.7	1.4		
73	SW	3:07:29	3:09:05	0:00:00	18	0.7	1.4		
72	NE	3:12:35	3:13:36	0:00:00	18	0.7	1.4		
71	SW	3:18:09	3:19:06	0:00:00	18	0.7	1.4	ALTITUDE: 7834	
70	NE	3:22:21	3:23:51	0:00:00	18	0.7	1.4	ALTITUDE: 7834	
69	SW	3:26:39	3:28:02	0:00:00	19	0.8	1.3	ALTITUDE: 7834	
9	NE	3:38:02	3:41:36	0:00:00	18	0.7	1.4		
8	SW	3:44:35	3:48:01	0:00:00	17	0.7	1.2		
7	NE	3:51:33	3:55:15	0:00:00	17	0.7	1.2		
				0:00:00				LANDING: 04:16Z	
				0:00:00				STATIC:04:18:00	
				0:00:00					
				0:00:00					
				0:00:00					
↑ Times entered are Zulu / GMT ↑				Page		1		Verify 5-Turns After Mission	Yes X No

Additional Comments:

Drive #

783516

WOOLPERT FLIGHT LOG SHEET #1

Leica ALS-70	MM/DD/YYYY: 4/6/2014	Day of Year: 96	Mission Name / Job #: 74257

Operator	Aircraft	Hobbs Start	Local Start Time	Zulu Start Time
Annen	N475BC X / N404CP / N7078F / N475CP / N1107Q	5035.6	6:24	10:24
Pilot	**Sensor**	**Hobbs End**	**Local End Time**	**Zulu End Time**
Albers	SH-7177 / SH_6157 / SH-7186 X	5042.2	16:14	20:14

Passengers	Using or Relying on GCPS	GPS Base #1	Operator	Annen	PID	ICTTN
	Yes ☐ No ☒	GPS Base #2	Operator	NYCI	PID	DI0446

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud	Departing ICAO / Arriving ICAO
320/9	10	Clr	0	34f	21f	30.17		

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	GAIN: Course/Up ___ Fine/Down ___	MODE: Single ☐ Multi ☐ 2+2 ☐ 4+3 ☐
32	41.6	239	100		

Air Speed	AGL	MSL	Threshold	Waveform Mode	Pre-Trigger Dist.
150 Kts	7500 Ft	7500 Ft	/	@ NS	Ft

Line #	Dir.	Line Start Time	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 ☐
C42	N	10:57:00	11:04:00					New York
C43	S	11:09:00	11:10:00					
C44	N	11:12:00	11:14:00					
C45	S	11:16:00	11:18:00					
C4	E	11:33:00	11:37:00					
B67	S	11:43:00	11:50:00					
B68	N	11:53:00	12:02:00					
B69	S	12:05:00	14:14:00					
A42	S	12:16:00	12:25:00					
A43	N	12:28:00	12:37:00					
A44	S	12:39:00	12:48:00					
A45	N	12:51:00	13:00:00					
A77	N	13:11:00	13:20:00					
								Long Island
23	E	13:31:00	13:47:00					
24	W	13:49:00	14:05:00					
25	E	14:07:00	14:22:00					
26	W	14:25:00	14:40:00					
27	E	14:42:00	14:57:00					
28	W	15:00:00	15:16:00					
29	E	15:18:00	15:34:00					
30	W	15:37:00	15:53:00					
31	E	15:56:00	16:12:00					MANUAL START UL001
32	W	16:14:00	16:31:00					
31	E	16:34:00	16:35:00					GAP FILL
C2	W	16:41:00	16:44:00					NEW YORK
C3	E	16:46:00	16:49:00					
		† Times entered are Zulu / GMT †		0:00:00	Total Time On Line			Verify S-Turns After Mission Yes ☐ No ☐

Additional Comments: Drive #

Woolpert

Leica LIDAR

Mission Date	Day of Year	Project #	Flight #	Project Name
4/19/2014	109	73714	1	NY_NJ_Post-Hurricane_Sandy

Operator	Aircraft	HOBBS Start	Local Start Time	UTC Start Time	Base
GALAMBOS	N111SD	2542.5	2:34:00	18:34:00	WOOLPERT PIN

Pilot	Sensor Type	HOBBS End	Local End Time	UTC End Time	PDI
LaROCQUE	ALS-7177	2544.6	4:09:00	20:09:00	new pin 1:45 start

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud		
010 11g19	10	clear		18	-6	3024		Departing	KTTN
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Coarse/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	X	B	170

Air Speed		AGL		MSL		Waveform Used				Waveform Mode	Pre-Trigger Dist.
150	Kts	7500	Ft	7500	Ft	Yes		No	X	@ NS	Ft

Line #	Dir.	Line Start Time	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:	18:10:52
		↓ Times entered are Zulu / GMT ↓						Verify S-Turns Before Mission Yes X No	
A96	SW	18:34:08	18:41:42	0:00:00	16	0.7	1.5	T/O: 18:17Z	
A97	NE	18:44:13	18:52:24	0:00:00	16	0.7	1.5		
A98	SW	18:55:01	19:02:49	0:00:00	16	0.7	1.5		
A99	NE	19:05:57	19:13:57	0:00:00	18	0.6	1.1		
C5	NE	19:21:57	19:25:36	0:00:00	17	0.6	1.3		
C6	SW	19:28:28	19:32:24	0:00:00	18	0.6	1.1	OFFLINE	
C7	NW	19:34:29	19:36:38	0:00:00	18	0.6	1.1		
C8	SE	19:39:08	19:41:01	0:00:00	17	0.6	1.1		
C9	NW	19:43:48	19:45:50	0:00:00	17	0.6	1.1		
C10	SE	19:48:25	19:50:15	0:00:00	17	0.6	1.1		
C6	NE	19:52:59	19:56:51	0:00:00	17	0.6	1.1		
C34	S	20:05:37	20:09:35	0:00:00	18	0.6	1.2		
				0:00:00				Landing: 20:26z	
				0:00:00				Static: 20:27:17	
				0:00:00					
				0:00:00					
				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 #

783516

Woolpert

Leica LIDAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	4/11/2014	11114	73846/73734	1	NJ_NY Post Sandy

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GALAMBOS	N111SD	2553.0	6:29:00	22:29:00	WOOLPERT PIN
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LaROCQUE	ALS-7177	2555.3	7:03:00	23:03:00	

Wind Dir/Speed	Visibility	Ceiling	Cloud Cover %	Temp	Dew Point	Pressure	Haze/Fire/Cloud		
250 3	10	clear		9	-3	29.95		Departing	KHYA
								Arriving	KTTN

Scan Angle (FOV)	Scan Frequency (Hz)	Pulse Rate (kHz)	Laser Power %	Fixed Gain		Mode		Threshold Values	
32	41.6	239	100	Gain - Course/Up	6	Single		A	180
				Gain - Fine/Down	12	Multi	x	B	170

Air Speed		AGL		MSL		Waveform Used				Waveform Mode	Pre-Trigger Dist.	
150	[illegible]	7500	Ft	7500	Ft	Yes		No	X	@ NS		Ft

Line #	Dir.	Line Start Time	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:	22:08:53
↓ Times entered are Zulu / GMT ↓								Verify 5-Turns Before Mission Yes X No	
				0:00:00				6:20-10:20PM TIDES	
				0:00:00				8:20 LOW TIDE	
				0:00:00				ARR TTN: 2554.3	
				0:00:00				takeoff:22:15z	
874	NE	22:29:11	22:36:38	0:00:00	18	0.7	1.1		
875	SW	22:39:32	22:46:42	0:00:00	20	0.6	1		
876	NE	22:49:19	22:56:58	0:00:00	18	0.7	1.2		
877	SW	22:58:49	23:02:42	0:00:00	18	0.7	1.3		
				0:00:00				landing ttn:23:16z	
				0:00:00				Static:	
				0:00:00					
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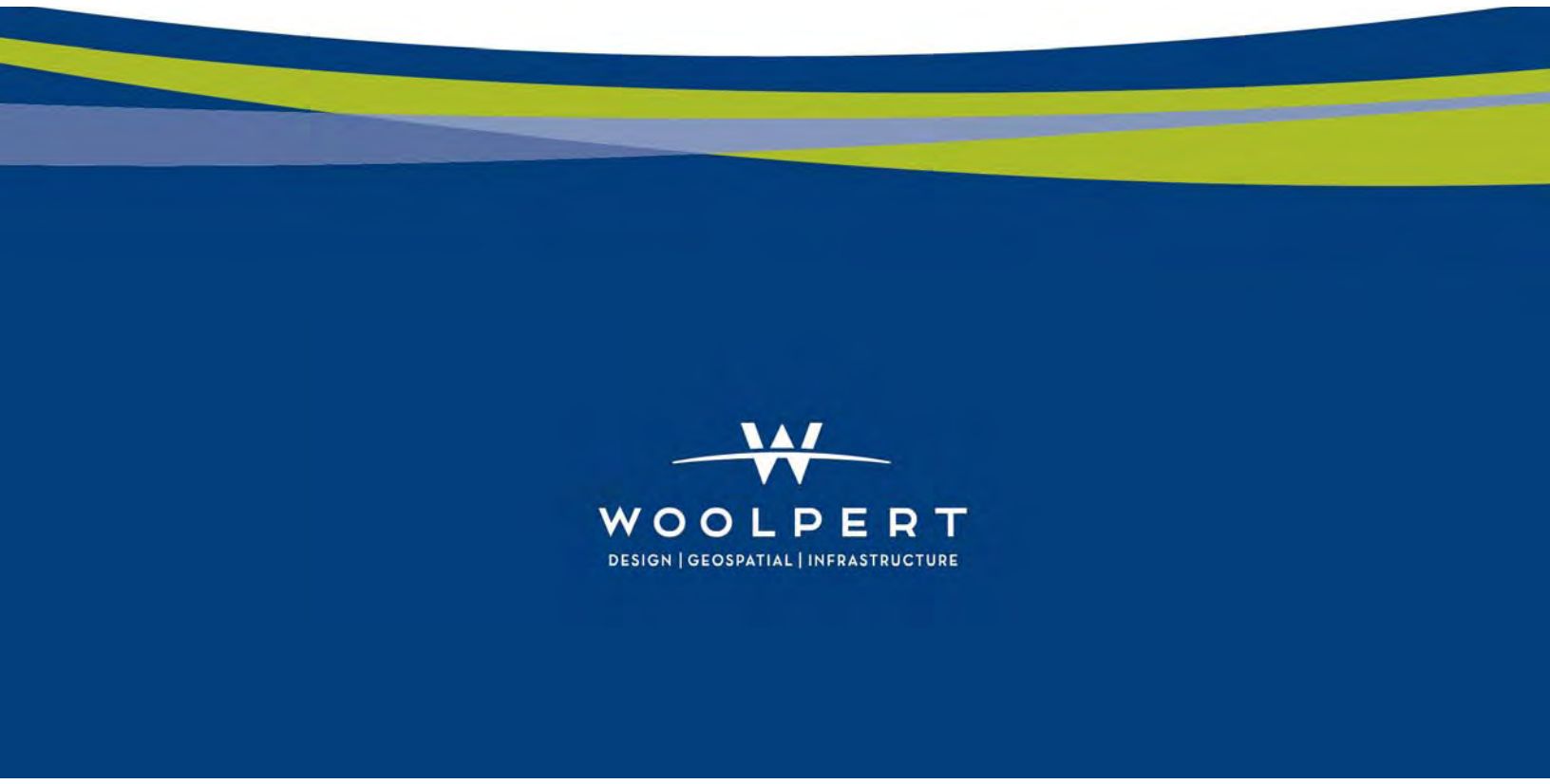
Additional Comments:	Drive #
	783516

SECTION 7: FINAL DELIVERABLES

FINAL DELIVERABLES

The final lidar deliverables are listed below.

- LAS v1.2 classified point cloud
- LAS v1.2 raw unclassified point cloud flight line strips no greater than 2GB. Long swaths greater than 2GB will be split into segments)
- Hydrologically flattened Polygon z and Polyline z shapefiles
- Hydrologically flattened bare earth 1-meter DEM in ERDAS .IMG format
- 8-bit gray scale intensity images
- Tile layout and data extent provided as ESRI shapefile
- Control points provided as ESRI shapefile
- FGDC compliant metadata per product in XML format
- Lidar processing report in pdf format
- Survey report in pdf format


WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE