AIRBORNE LIDAR REPORT

MAINE STATEWIDE ORTHOIMAGERY PROGRAM

1.5-METER POST SPACING LIDAR

MAINE OFFICE OF INFORMATION TECHNOLOGY

WOOLPERT PROJECT NUMBER: 72248

PREPARED BY: WOOLPERT, INC.

4454 Idea Center Boulevard
Dayton, OH 45430.1500

October 2012

WOOLPERT

DESIGN | GEOSPATIAL | INFRASTRUCTURE

AIRBORNE LIDAR REPORT

MAINE STATEWIDE ORTHOIMAGERY PROGRAM

1.5-METER POST SPACING LIDAR

WOOLPERT PROJECT #72248

For:

State of Maine
Office of Information Technology
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SECTION 1: OVERVIEW

PROJECT NAME: MAINE STATEWIDE LIDAR

WOOLPERT PROJECT #77248

This report contains a comprehensive outline of the airborne LiDAR data acquisition included within the Maine Statewide Orthoimagery Program. Three non-contiguous project areas totaled approximately 2326 square miles. Area 1 is also referred to as Aroostook while Areas 2 & 3 is referred to as Mid-Coastal Cleanup. The LiDAR data was collected and processed to meet a nominal post spacing (NPS) of 1.5 meters. 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 Leica's ALS60 and Optech's Gemini LiDAR Systems in Multi-Pulse mode. The ALS60 and Gemini LiDAR Systems are capable of collecting multiple echoes per pulse with a minimum of a first, last, and one intermediate return. The systems also records information such as the intensity (LiDAR pulse signal strength), timestamp, and scan angle for each return signal. 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):	4.92 ft / 1.5 m
AGL (Above Ground Level) average flying height:	7,800 ft / 2,377 m (Leica ALS60) 6,800 ft / 2,072 m (Optech Gemini)
MSL (Mean Sea Level) average flying height:	Varies by terrain
Average Ground Speed:	150 knots / 172 mph
Field of View (full):	40 degrees
Pulse Rate:	99 kHz (Leica ALS60) 100 kHz (Optech Gemini)
Scan Rate:	38 Hz (Leica ALS60) 32 Hz (Optech Gemini)
Side Lap (Minimum):	25%

LiDAR data was processed and projected in UTM, Zone 19, North American Datum of 1983 (NAD83) in units of meters. The vertical datum used for the project was referenced to NAVD 1988, meters, Geoid09.

Figure 1.1: LiDAR Flight Layout – Maine Statewide Area 1

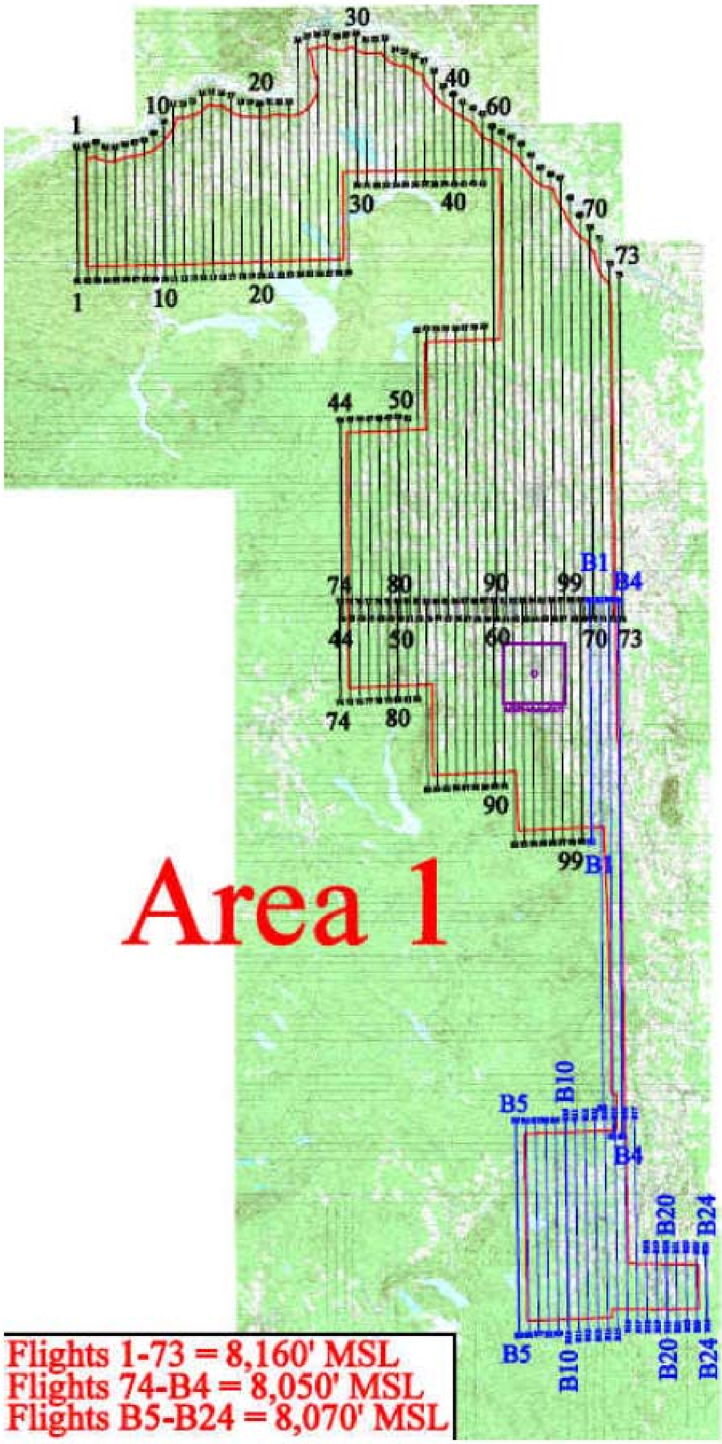
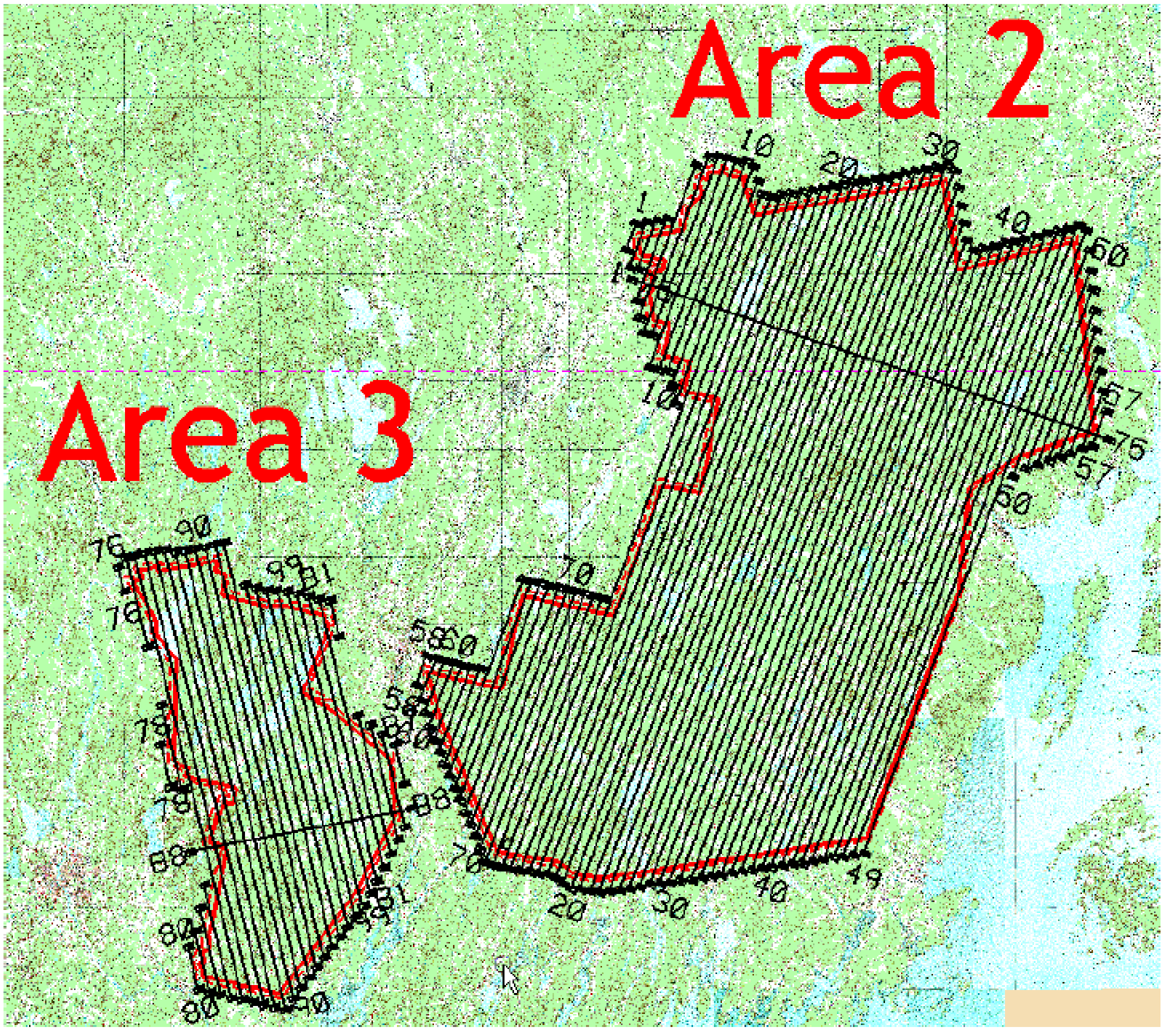


Figure 1.2: LiDAR Flight Layout - Maine Statewide Area 2/3



SECTION 2: ACQUISITION

Woolpert owns and operates all the equipment used for the airborne data collection, ground control, and ABGNSS missions with the exception of NGS CORS stations.

Data was collected with an Optech Gemini LiDAR Sensor (Serial Number 56108) aboard a Cessna 310 (N1107Q) and a Leica ALS60 LiDAR Sensor (Serial Number 6157) aboard a Cessna 404 (N475RC) both operating in Multiple Pulses in Air (MPiA) mode.

Flight navigation is performed using IGI CCNS (Computer Controlled Navigation System). 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.

Woolpert's aerial acquisition team coordinated with the necessary Air Traffic Control and restricted airspace personnel prior to flying to ensure access.

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

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

A base-station unit was mobilized for each 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. All GNSS base station data and point locations were tied together, along with the ground control.

The ALS60 200 kHz Multiple Pulses in Air (MPiA) LiDAR System has the following specifications:

Table 2.1: ALS60 LiDAR System Specifications

Specifications	
Operating Altitude	200 - 6,000 meters
Scan Angle	0 to 75° (variable)
Swath Width	0 to 1.5 X altitude (variable)
Scan Frequency	0 – 100 Hz (variable based on scan angle)
Maximum Pulse Rate	200 kHz
Range Resolution	Better than 1 cm
Elevation Accuracy	8 – 24 cm single shot (one standard deviation)
Horizontal Accuracy	7 – 64 cm (one standard deviation)
Number of Returns per Pulse	4 (first, second, third, last)
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

Table 2.1: ALS60 LiDAR System Specifications	
Specifications	
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

Table 2.2: Optech Gemini LiDAR System Specifications			
Specifications			
Serial numbers	Sensor Head 09SEN258, 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 50 kHz	1/5500 x altitude	< 5 cm up to 500 m < 10 cm up to 1 km < 15 cm up to 2 km < 20 cm up to 3 km < 25 cm up to 4 km
	70 kHz	1/5500 x altitude	< 5 cm up to 500 m < 10 cm up to 1 km < 15 cm up to 2 km
	100 kHz	1/5500 x altitude	< 10 cm up to 500 m < 15 cm up to 1 km < 20 cm up to 2 km
	125 kHz	1/5500 x altitude	< 10 cm up to 500 m < 15 cm up to 1km
	143 kHz	1/5500 x altitude	< 15 cm up to 500 m < 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		
Scan frequency	Variable; maximum 70 Hz		
Scan angle	Variable from 0 to ± 25°, in increments of ±1°		
Scanner Product	Scan Angle x Scan Frequency ≤ 1000		
Roll compensation	5 Hz update rate (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) 50 kHz (maximum AGL 3.0 km) 70 kHz (maximum AGL 2.5 km) 100 kHz (maximum AGL 2.0 km) 125 kHz (maximum AGL 1.6 km) 142 kHz (maximum AGL 1.4 km)		

Table 2.2: Optech Gemini LiDAR System Specifications	
Specifications	
	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 Sensor head: -10 to 35º C (assuming the use of thermal jacket)
Storage Temperature	Control Rack: – 10 º to 50º C 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

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 at the Waterville Airport (WVL) for the airborne GPS support on April 18, 2012 through April 29, 2012. Coordinates: 44°32'00.82170"N, 69°40'45.68492"W, Elipsoid Height 67.641 meters.

Woolpert survey crews were onsite, operating a Global Navigation Satellite System (GNSS) Base Station at Presque Isle Airport (PQI) for the airborne GPS support on May 3, 2012 through May 12, 2012. Coordinates: 46°41'40.66336' (N), 68°02'50.67008" (W), Elipsoid Height 126.259 meters.

The LiDAR data was collected in (18) missions

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.

Table 2.3: Airborne LiDAR Acquisition Flight Summary

Flight Date/Sensor	Lines Flown	Time On/Off Line (UTC)	Time On/Off Line (Local = EDT)
April 18, 2012 Optech Gemini 56108	1-11 (Area 2)	14:34-18:18	10:34 AM – 2:18 PM
April 18, 2012 Optech Gemini 56108	15-22 (Area 2)	18:46-22:30	2:46 PM – 6:30 PM
April 19, 2012 Optech Gemini 56108	23-29 (Area 2)	12:42-16:47	8:42 AM – 12:47 PM
April 19, 2012 Optech Gemini 56108	30-37 (Area 2)	20:13-00:00	4:13 PM – 8:00 PM
April 20, 2012 Optech Gemini 56108	38-49 (Area 2)	14:59-19:58	10:59 AM – 3:58 PM
April 25, 2012 Optech Gemini 56108	50-57 (Area 2)	12:22-14:08	8:22 AM – 10:08 AM
April 25, 2012 Optech Gemini 56108	58-59, 72-74 (Area 2)	18:57-20:27	2:57 PM - 4:27 PM

Table 2.3: Airborne LiDAR Acquisition Flight Summary			
Flight Date/Sensor	**Lines Flown**	**Time On/Off Line (UTC)**	**Time On/Off Line (Local = EDT)**
April 26, 2012 Optech Gemini 56108	29 & 74 reflights (Area 2)	12:52-14:20	8:52 AM – 10:20 AM
April 28, 2012 Optech Gemini 56108	59-72, 75 (Area 2) 99-B7 (Area 3)	17:10-21:38	1:10 PM – 5:38 PM
April 29, 2012 Optech Gemini 56108	89-98 (Area 3)	12:15-14:23	8:11 AM – 11:23 AM
May 3, 2012 Leica ALS60 SH6157	36-73 (Area 1)	19:12–02:27	3:12 PM – 10:27 PM
May 4, 2012 Leica ALS60 SH6157	19-35, 81-99 (Area 1)	12:44-18:36	8:44 AM – 2:36 PM
May 6, 2012 Optech Gemini 56108	74, 76-88, 107 (Area 3)	12:27-15:59	8:27 AM – 11:59 AM
May 6, 2012 Optech Gemini 56108	9-18, 80-81, B5-B10 (Area 1)	11:39-14:46	7:39 AM – 10:46 AM
May 6, 2012 Leica ALS60 SH6157	B1-B5, B12-B29 (Area 1)	18:02-22:47	2:02 PM – 6:47 PM
May 7, 2012 Optech Gemini 56108	B1-18 (Area 1)	15:42-19:40	11:42 AM – 3:40 PM
May 7, 2012 Optech Gemini 56108	B19-B28 (Area 1)	20:05-22:45	4:05 PM – 6:45 PM
May 12, 2012 Optech Gemini 56108	B16 (reflight)	22:27-23:44	6:27 PM – 7:44 PM

SECTION 3: LIDAR DATA PROCESSING

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 survey crew. 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 survey crews were onsite, operating a Global Navigation Satellite System (GNSS) Base Stations at the Lemons Municipal Airport (TUP) and Golden Triangle Regional Airport (GTR) for the airborne GPS support. The GNSS base stations operated during the LiDAR acquisition missions are listed below:

Table 3.1: GNSS Base Stations

Station Name	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height (L1 Phase center) (Meters)
Waterville Airport	N 44° 32' 00.82170"	W 69° 40' 45.68492"	67.641
Presque Isle Airport	N 46° 41' 40.66336"	W 68° 02' 50.67008"	126.259

DATA PROCESSING

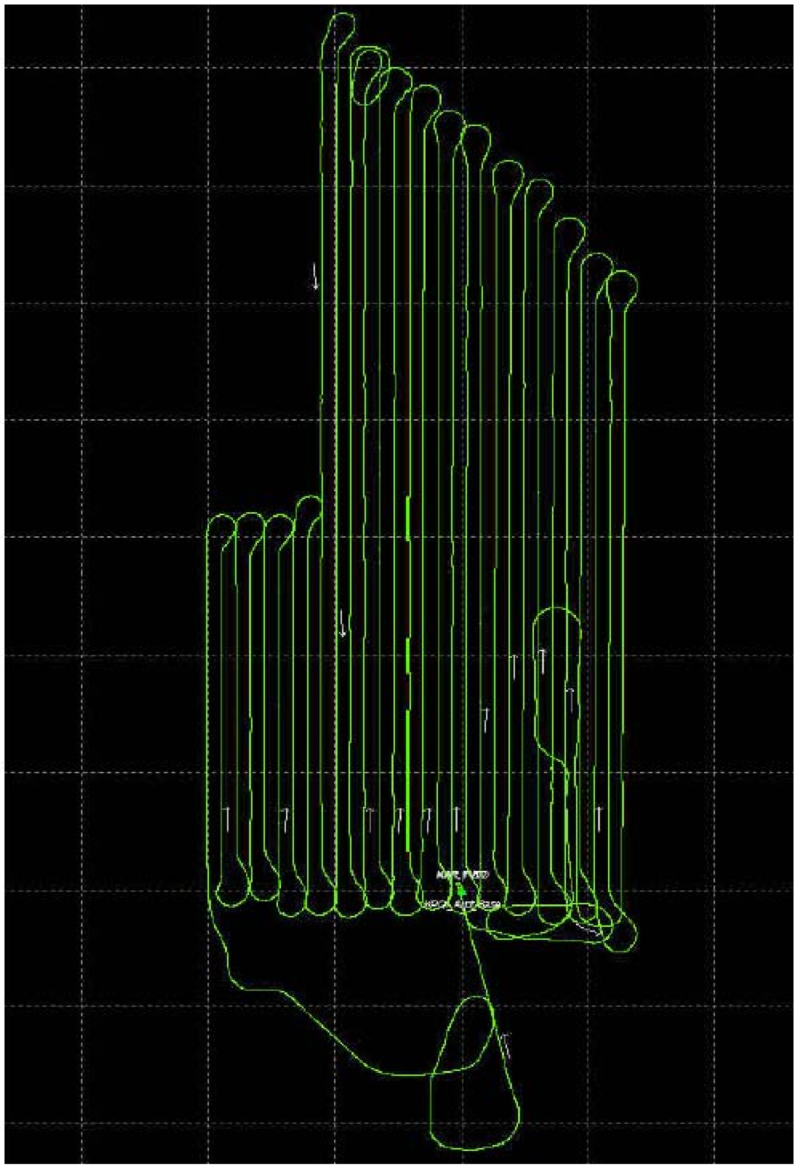
All airborne GNSS and IMU data was post-processed and quality controlled using Applanix 5.3 MMS software. GNSS data was processed at a 1 and 2 Hz data capture rate and the IMU data was processed at 200 Hz.

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. See **Figure 3.1** for the flight trajectory.

Flight Trajectory

Figure 3.1: Flight Trajectory from Day124: N475RC



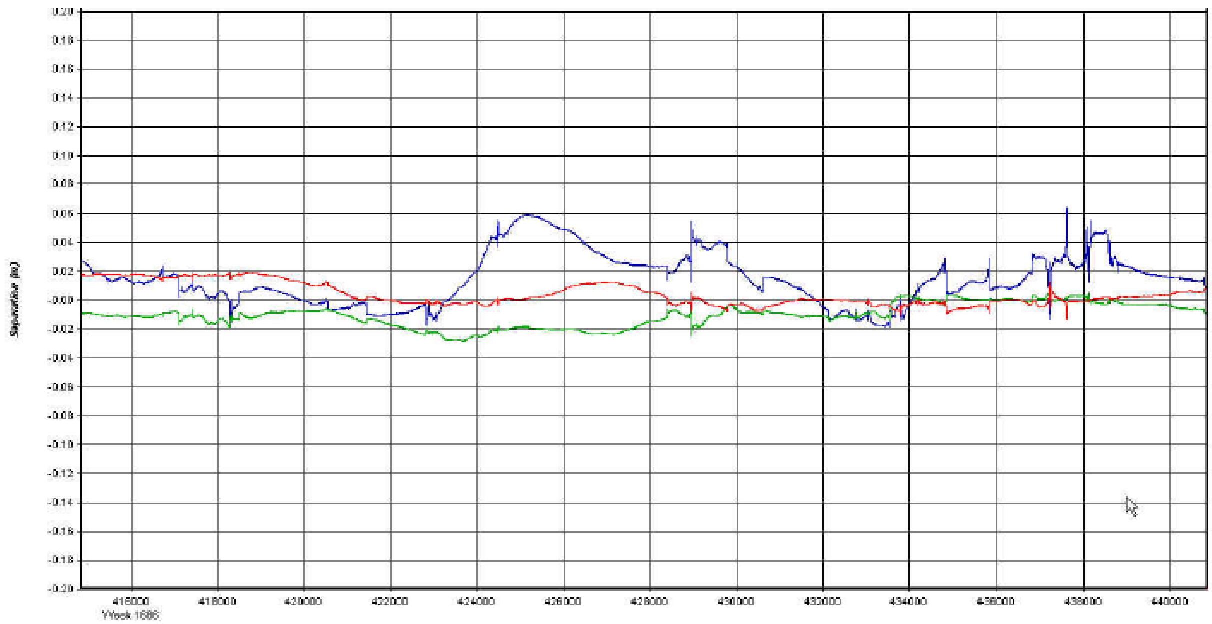
Within the trajectory processing, there are many factors that affect the overall quality, but the most indicative are the Combined Separation, the Estimated Positional Accuracy, and the Positional Dilution of Precision (PDOP).

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. See **Figure 3.2** for the combined separation graph.

Figure 3.2: Representative Graph from Day124 of Combined Separation: N475RC

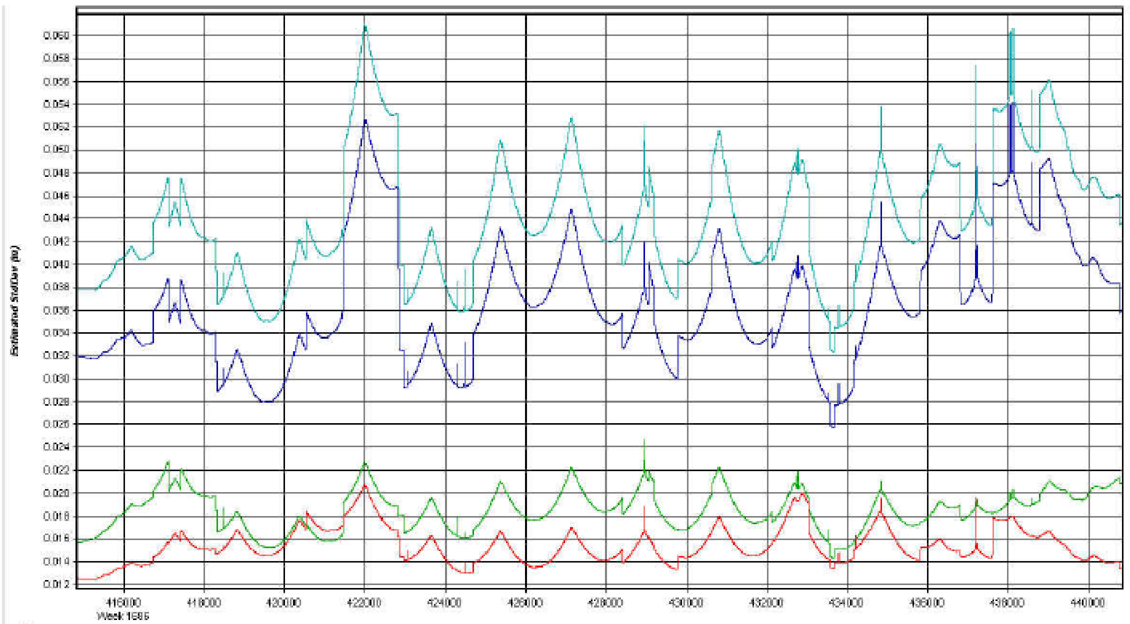


Estimated Positional Accuracy

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.

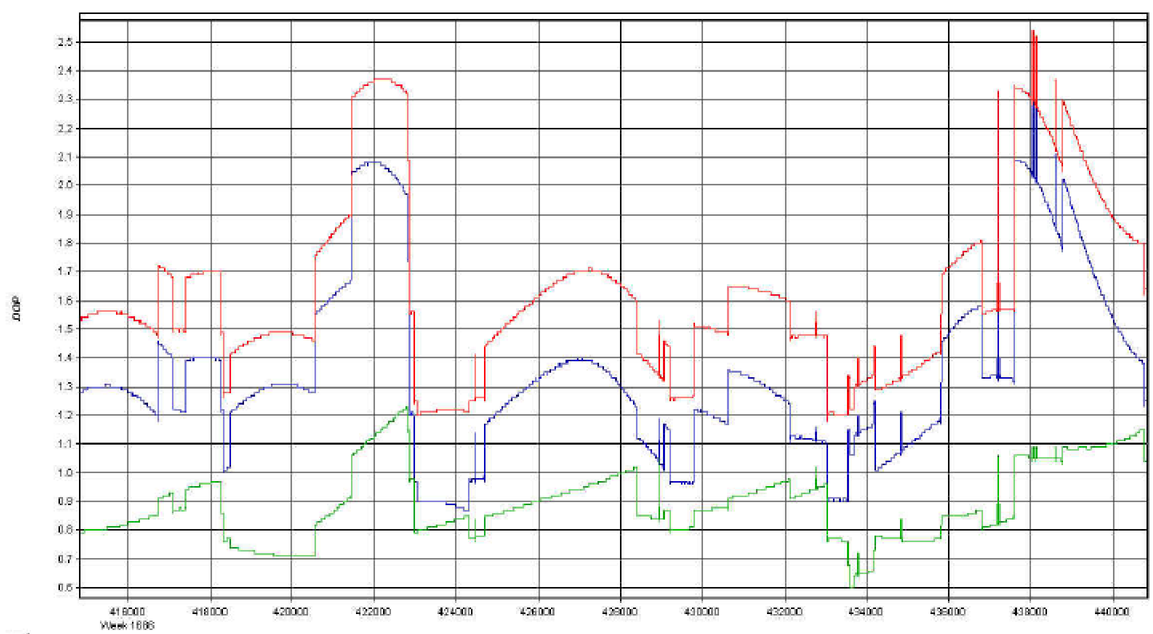
Figure 3.3: Representative Graph from Day124 of Positional Accuracy: N475RC



PDOP

Position Dilution of precision (DOP) is a measure of the quality of the GPS data being received from the satellites. Woolpert's goal is to maintain an average PDOP of 3 or less.

Figure 3.4: Representative Graph from Day124 of PDOP: N475RC



LIDAR PROCESSING APPLICATIONS AND WORK FLOW OVERVIEW

Individual flight lines processed 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. **Software: TerraScan v.12.005, TerraMatch v.12.01, Woolpert Proprietary Software**

Imported calibrated LAS point cloud data into the project tiles. Resulting data were classified as ground and non-ground points with additional filters created to meet the project 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. The LiDAR LAS files for this project have been classified into the Default (Class 1), Ground (Class 2), Noise (Class 7), Water (Class 9), Ignored Ground (Class 10) and Overlap (Class 11) classifications. **Software: TerraScan v.12.005, Microstation v8**

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.12.005, Microstation v8.**

All water bodies greater than two acres and all rivers with a nominal 100 foot width or larger were collected as break lines using 2-d digitizing methods and lidar intensity as a base map. **Software: ESRI v10.0, Microstation v8, TerraScan v.12.005.**

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 feet (100 feet) and greater nominal width. **Software: LP360 v.2011.1.54.1, Microstation v8, ESRI v.10.0, Woolpert Proprietary Software**

SECTION 4: HYDROLOGIC FLATTENING AND FINAL QUALITY CONTROL

HYDROLOGIC FLATTENING OF LIDAR DEM DATA

This task 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, ponds, and islands 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

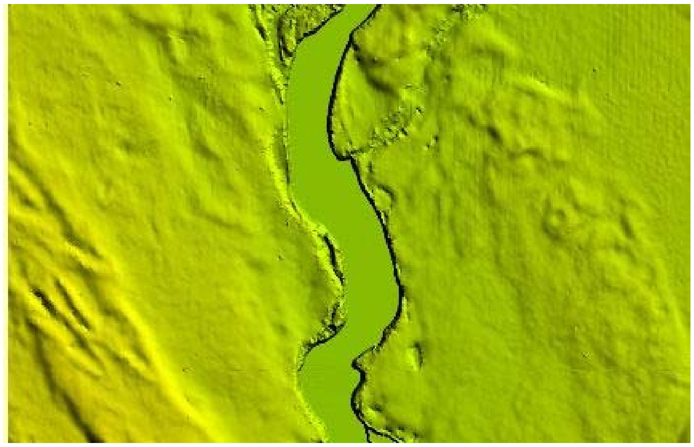
Woolpert utilized the following steps to hydrologically flatten the water bodies and for gradient hydrologic flattening of the double line streams within the existing LiDAR data.

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. Google Earth and Bing Maps were 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. During the collection of linework, the technical staff used a program that displayed the polygon measurement area as a reference to identify lakes larger than 2-acres. 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. . **Figures 4.1** illustrates a good example of 30.5 meters (100 feet) nominal streams identified and defined with hydrologic breaklines.

Figure 4.1



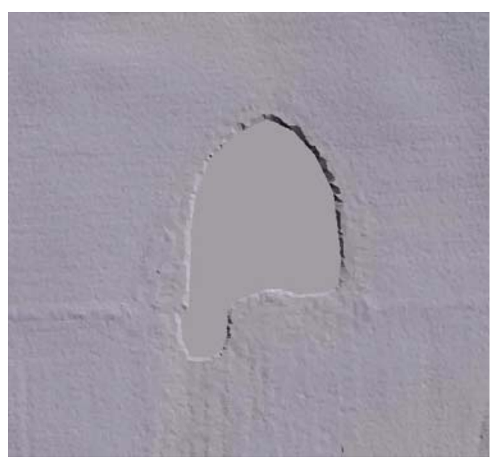
4. All ground points were reclassified from inside the hydrologic feature polygons to water, class nine (9).

5. All ground points were reclassified from within a 1.5 meter (5 foot) 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** 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.

Figure 4.2

Figure 4.3



7. Terrascan was used to add the hydrologic breakline vertices and export the lattice models. The hydrologically flattened DEM data was provided to USGS in ESRI ArcGrid format at a 1-meter cell size. The hydrologic breaklines compiled as part of the flattening process were provided to the State of Maine 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 (100feet) were provided as a PolylineZ file.

DATA QA/QC

Extensive QC processes are used to verify the quality of the hydro flattened DEM. Following the collection of breaklines representing hydro features, all breaklines are reviewed for horizontal placement accuracy, connectivity, relationship to banks, and consistency. These processes are carried out by a combination of visual QA/QC and automated programs.

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 QA/QC points.

Table 5.1: Overall Vertical Accuracy Statistics, Maine Statewide

Average error	-0.001	meters
Minimum error	-0.11	meters
Maximum error	+0.125	meters
Average magnitude	0.050	meters
Root mean square	0.061	meters
Standard deviation	0.058	meters

Table 5.2: QA/QC Analysis, UTM 19N, NAD83, Maine Statewide

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Laser Elevation (meters)	Dz (meters)
1001	411501.345	4913659.787	116.452	116.55	0.098
1002	428174.212	4907963.062	61.458	61.45	-0.008
1003	417782.312	4896200.182	103.183	103.2	0.017
1004	435299.906	4893729.63	88.999	88.95	-0.049
1005	417885.244	4876718	51.839	51.92	0.081
1006	431808.485	4881995.984	48.676	48.62	-0.056
1007	446211.398	4891465.838	33.431	33.44	0.009
1008	466133.185	4948918.465	44.452	44.45	-0.002
1009	491398.12	4951385.538	139.74	139.63	-0.11
1010	503348.31	4931090.003	173.849	173.76	-0.089
1011	488319.987	4908463.613	127.859	127.75	-0.109
1012	466855.572	4890121.744	51.914	52	0.086
1013	468602.982	4922085.953	221.179	221.13	-0.049
1014	441345.436	4902762.13	69.975	70.1	0.125
1015	529984.062	5225064.555	240.449	240.4	-0.049

Table 5.2: QA/QC Analysis, UTM 19N, NAD83, Maine Statewide

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Laser Elevation (meters)	Dz (meters)
1016	571124.196	5229093.823	256.521	256.57	0.049
1017	555869.319	5194005.056	271.666	271.67	0.004
1018	583030.075	5176211.879	197.867	197.84	-0.027
1019	583116.048	5214361.71	218.872	218.85	-0.022
1020	591138.84	5096549.172	187.203	187.18	-0.023
1021	577860.925	5102184.082	196.771	196.81	0.039
1022	585382.694	5115803.326	141.91	141.88	-0.03
1023	577139.14	5152853.917	240.674	240.73	0.056
1024	551058.138	5220294.754	184.548	184.59	0.042
1025	568057.409	5176170.075	178.127	178.11	-0.017

VERTICAL ACCURACY CONCLUSIONS

Tested 0.12 meters fundamental vertical accuracy at 95 percent confidence level in open terrain using RMSE(z) x 1.9600

Based on the analysis of the LiDAR data, the accuracy of the data meets the project requirements.

Approved By:			
Title	Name	Signature	Date
Associate LiDAR Specialist Certified Photogrammetrist #1281	Qian Xiao		September 21, 2012

SECTION 6: FINAL DELIVERABLES

FINAL DELIVERABLES

The Woolpert LiDAR Processing team will deliver the following:

- Raw LiDAR data (point cloud) in LAS v1.2 format files size not to exceed 2 GB
- LiDAR Classified data in LAS v1.2 format
- Hydro Breaklines in Esri 10 shapefile format
- Hydro Flattened DEM derived at 1-meter pixel, delivered in Esri 10 ArcGrid format
- ESRI 10 shapefile of flightlines with acquisition dates
- ESRI 10 shapefile of control points
- ESRI 10 shapefile of tile index
- Each deliverable product will include FGDC metadata
- LiDAR Report – pdf and hard copy

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