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<abstract>Terrapoint and LMSI collected LiDAR for over 2,572 square miles in Northumberland, Lancaster, Middlesex, King and Queen, Matthews, Gloucester, James City, Williamsburg, Surry, Isle of Wight, and Suffolk Counties in Virginia. The nominal pulse spacing for this project was no greater than 0.7 meters. This project was collected with a sensor which collects waveform data and provides an intensity value for each discrete pulse extracted from the waveform. GPS Week Time, Intensity, Flightline and echo number attributes were provided for each LiDAR point. Dewberry used proprietary procedures to classify the LAS according to USGS ARRA specifications: 1-Unclassified, 2-Ground, 7-Noise, 9-Water, 10-Ignored Ground due to breakline proximity. Dewberry produced 3D breaklines and combined these with the final LiDAR data to produce seamless hydro flattened DEMs and first return DSMs for the 3,199 tiles (5000 ft x 5000 ft) that cover the project area.</abstract>

<purpose>The purpose of this LiDAR data was to produce high accuracy 3D elevation products, including tiled LiDAR in LAS 1.2 format, 3D breaklines, and 5 ft cell size hydro flattened Digital Elevation Models (DEMs) and 5 ft cell size Digital Surface Models (DSMs).</purpose>

<supplinf>A complete description of this dataset is available in the Final Project Report submitted to the USGS.</supplinf>

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<useconst>This data was produced for the USGS according to specific project requirements. This information is provided "as is". Further documentation of this data can be obtained by contacting: USGS/NGTOC, 1400 Independence Road, Rolla, MO 65401. Telephone (573) 308-3587.</useconst>

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<cntinfo>

<cntorgp>

<cntorg>USGS</cntorg>

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<cntpos>USGS NGTOC</cntpos>

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<addrtype>mailing and physical address</addrtype>

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<city>Rolla</city>

<state>MO</state>

<postal>65401</postal>

<country>USA</country>

</cntaddr>

<cntvoice>(573) 308-3587</cntvoice>

<cntemail>pemmett@usgs.gov</cntemail>

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<dataqual>

<logic>Data covers the tile scheme provided for the project area.</logic>

<complete>A visual qualitative assessment was performed to ensure data completeness and bare earth data cleanliness. No void or missing data, the bare earth surface is of good quality and data passes vertical accuracy specifications.</complete>

<posacc>

<horizpa>

<horizpar>Lidar source compiled to meet 3.5 foot horizontal accuracy.</horizpar>

<qhorizpa>

<horizpav>3.5 feet</horizpav>

<horizpae>Dewberry does not perform independent horizontal accuracy testing on the LiDAR. LiDAR vendors perform calibrations on the LiDAR sensor and compare data to adjoing flight lines to ensure LiDAR meets the 3.5 ft horizontal accuracy standard at the 95% confidence level. Please see the final project report delivered to the USGS for more details.</horizpae>

</qhorizpa>

</horizpa>

<vertacc>

<vertaccr>The vertical accuracy of the LiDAR was tested by Dewberry with 105 independent survey checkpoints. The survey checkpoints were evenly distributed throughout the project area and were located in areas of either urban or open terrain.

All checkpoints were used to compute the Fundamental Vertical Accuracy (FVA). Project specifications required a FVA of 1.20 ft (36.2 cm) based on a RMSEz (0.60 ft/18.5 cm) x 1.9600. All checkpoints were used to compute the Consolidated Vertical Accuracy (CVA). Project specifications required a CVA of 1.20 ft (36.2 cm) based on the 95th percentile.</vertaccr>

<qvertpa>

<vertaccv>0.73 feet</vertaccv>

<vertacce>Based on the vertical accuracy testing conducted by Dewberry, using NSSDA and FEMA methodology, vertical accuracy at the 95% confidence level (called Accuracyz) is computed by the formula RMSEz x 1.9600. The dataset for the USGS Eleven County Virginia LiDAR project satisfies the criteria:

Lidar dataset tested 0.75 ft vertical accuracy at 95% confidence level in open and urban terrain, based on RMSEz (0.38 ft) x 1.9600.

Based on the vertical accuracy testing conducted by Dewberry, using NDEP and ASPRS methodology, consolidated vertical accuracy at the 95% confidence level is computed using the 95th percentile method. The dataset for the USGS Eleven County Virginia LiDAR project satisfies the criteria:

Lidar dataset tested 0.73 ft vertical accuracy at 95% confidence level in all land cover categories combined (urban and open terrain).</vertacce>

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<procdesc>Data for the Eleven County Virginia LiDAR project was acquired by both Terrapoint and LMSI.

Three Optech ALTM 3100EA LiDAR systems were utilized to collect the data. The three aircraft used for the survey were Piper Navaho, registrations C-FVTL (Terrapoint) and C-FVYW (Terrapoint) with an endurance of approximately 6 hours and a Piper Turbo Aztec registration N40204 (LMSI) with an endurance of approximately 7 hours.

Fifty-four (54) flight missions resulting in 477 production lines were required to obtain data over the entire project area. A combination of Sokkia GSR 2600 and NovAtel DL-4+ dual-frequency GPS receivers were used to support the airborne operations of this survey and to establish the GPS control network. Five existing published survey monuments and two newly surveyed points were used as base stations for all missions. Forty-eight (48) additional points were established by LMSI and used for quality control and calibration of the data.

Airborne GPS kinematic data was processed on-site using GrafNav kinematic On-The-Fly (OTF) software. Flights were flown with a minimum of 6 satellites in view (13o above the horizon) and with a PDOP of better than 3. Distances from base station to aircraft were kept to a maximum of 24km.

The initial step of calibration is to verify availability and status of all needed GPS and Laser data against field notes and compile any data if not complete. Subsequently the mission points are output using Optech's Dashmap, initially with default values from Optech or the last mission calibrated for system. The initial point generation for each mission calibration is verified within Microstation/Terrascan for calibration errors. If a calibration error greater than specification is observed within the mission, the roll pitch and scanner scale corrections that need to be applied are calculated. The missions with the new calibration values are regenerated and validated internally once again to ensure quality. All missions are validated against the adjoining missions for relative vertical biases and collected GPS kinematic validation points for absolute vertical accuracy purposes. On a project level, a supplementary coverage check is carried out, to ensure no data voids unreported by Field Operations are present.</procdesc>

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<srcused>Inertial Measurement Unit</srcused>

<procdate>201005</procdate>

<srcprod>Calibrated LiDAR Point Cloud LAS 1.2 format</srcprod>

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<cntorgp>

<cntorg>Terrapoint USA (TP) /LMSI</cntorg>

</cntorgp>

<cntaddr>

<addrtype>mailing and physical address</addrtype>

<address>TP-251216 Grogan's Park Drive/LMSI-118 South Oak Street</address>

<city>TP-The Woodlands/LMSI-Raymond</city>

<state>TP-TX/LMSI-MS</state>

<postal>TP-77380/LMSI-39154</postal>

<country>USA</country>

</cntaddr>

<cntvoice>TP-1-877-999-7687/LMSI-1-601-857-0796</cntvoice>

<cntfax>TP-1-281-296-0869/LMSI-1-601-857-4181</cntfax>

<hours>Monday to Friday, 8 - 5, CST</hours>

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<procstep>

<procdesc>Dewberry utilizes a variety of software suites for inventory management, classification, and data processing. All LiDAR related processes begin by importing the data into the GeoCue task management software. GeoCue allows the data to retain its delivered tiling scheme (5000 ft by 5000 ft). The tiled data is then opened in Terrascan where Dewberry uses proprietary ground classification routines to remove any non-ground points and generate an accurate ground surface. The ground routine consists of three main parameters (building size, iteration angle, and iteration distance); by adjusting these parameters and running several iterations of this routine an initial ground surface is developed. The building size parameter sets a roaming window size. Each tile is loaded with neighboring points from adjacent tiles and the routine classifies the data section by section based on this roaming window size. The second most important parameter is the maximum terrain angle, which sets the highest allowed terrain angle within the model. Once the ground routine has been completed a manual quality control routine is done using hillshades, cross-sections, and profiles within the Terrasolid software suite. After this QC step, a peer review and supervisor manual inspection is completed on a percentage of the classified tiles based on the project size and variability of the terrain. After the ground classification corrections were completed, the dataset was processed through a water classification routine that utilizes breaklines compiled by Dewberry to automatically classify hydrographic features. The water classification routine selects ground points within the breakline polygons and automatically classifies them as class 9, water. During this water classification routine, points which are in close proximity (3 ft) to the hydrographic features are moved to class 10, an ignored ground. In addition to classes 1, 2, 9, and 10, there is a Class 7, noise points. This class was only used if needed when points could manually be identified as low/high points.

The fully classified dataset is then processed through Dewberry's comprehensive quality control program.

The data was classified as follows:

Class 1 = Unclassified. This class includes vegetation, buildings, noise etc.

Class 2 = Ground

Class 7= Noise

Class 9 = Water

Class 10= Ignored Ground

The LAS header information was verified to contain the following:

Class (Integer)

GPS Week Time (0.0001 seconds)

Easting (0.01 foot)

Northing (0.01 foot)

Elevation (0.01 foot)

Echo Number (Integer 1 to 4)

Echo (Integer 1 to 4)

Intensity (8 bit integer)

Flight Line (Integer)

Scan Angle (Integer degree)</procdesc>

<srcused>Calibrated LiDAR Point Cloud LAS 1.2 format</srcused>

<procdate>201010</procdate>

<srcprod>Final LiDAR datasets with USGS-ARRA classifications</srcprod>

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<cntinfo>

<cntperp>

<cntorg>Dewberry - Geospatial Services Group</cntorg>

<cntper>Brian Mayfield</cntper>

</cntperp>

<cntpos>Project Manager</cntpos>

<cntaddr>

<addrtype>mailing and physical address</addrtype>

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<city>Tampa</city>

<state>FL</state>

<postal>33602</postal>

<country>USA</country>

</cntaddr>

<cntvoice>813.421.8628</cntvoice>

<cntfax>813.225.1385</cntfax>

<cntemail>bmayfield@dewberry.com</cntemail>

<hours>8:00 - 5:00 EST</hours>

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arising out of the use of these data even if the USGS has been advised of the

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<distliab> Translation of files to formats other than those described here is the sole responsibility

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these data, installation, fitness of the data for a particular purpose, its use, or

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<address>U.S. Geological Survey</address>

<address>EROS Data Center</address>

<address>47914 252nd Street</address>

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<country>US</country>

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<cntvoice>1-800-252-4547</cntvoice>

<cnttdd>1-605-594-6933</cnttdd>

<cntfax>1-605-594-6589</cntfax>

<cntemail>custserv@usgs.gov</cntemail>

<hours>Monday through Friday 8:00 AM to 4:00 PM (Central Time)</hours>

<cntinst> The above is the contact information for EROS Data Center in

Sioux Falls, SD. this is the digital data storage and distribution

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<cntorgp>

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<cntper>Patrick Emmett</cntper>

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