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<origin>Photo Science, Inc.</origin>

<pubdate>Unpublished Material</pubdate>

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State of Massachusetts (Classified LAS): LIDAR for the North East â€“ ARRA and LiDAR for the North East Part II. (USGS Contract: G10PC00026, ARRA LIDAR Task Order Numbers) USGS Contract: G10PC00026 Task Order Number: G10PD02143 Task Order Numbers: G10PD01027 (ARRA) and G10PD02143 (non-ARRA)

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<descript>

<abstract>

The LiDAR for the North East Project, funded in large part by the American Recovery and Reinvestment Act (ARRA) of 2009, as well as, other funding sources was designed to help stimulate the U.S. economy and provide for more accurate floodplain mapping in the North East representing the start of a regional LiDAR collection program that served as a test case for a national elevation program. Lead by the United States Geological Survey's (USGS) National Geospatial Program Office and the State of Maine's Office of GIS with active collaboration and participation by other federal, state and local agencies resulted in LiDAR acquisition and processing of over 8,000 sq. miles of (LiDAR) data of a coastal zone spanning six North Eastern states, including Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, and New York. USGS's National Geospatial Technical Operations Center (USGS NGTOC) in Rolla, MO provided project management and quality control oversight for the project which consisted of two Task Orders issued to USGS contractor, GMR Aerial Surveys inc. d/b/a Photo Science (contractor), for task order execution through the use of USGS's Geospatial Products and Services Contract (USGS Contract: G10PC00026). Task Order specifications included state/area specific vertical accuracy, nominal post spacing and tide coordinated acquisition requirements.

Specific to the State of Massachusetts, LiDAR was collected in the Winter and Spring 2011

at a 1 meter or better nominal post spacing (1m GSD) for approximately 2,022

square miles of Massachusetts, while no snow was on the ground and rivers were at or below normal levels.

LiDAR data acquired along the Massachusetts coast line was flown at Daily

Predicted Low Tide Plus or minus 90 minutes. LiDAR was flown, controlled, processed and

classified to meet a bare earth Fundamental Vertical Accuracy (FVA) of 30 cm at a 95%

confidence level, derived according to NSSDA, i.e., based on vRMSE of 15 cm in the

"open terrain" land cover category. Cape Cod (Barnstable County) was flown and processed

to meet a bare earth Fundamental Vertical Accuracy (FVA) of 18.13 cm at a 95% confidence

level, derived according to NSSDA, i.e., based on vRMSE of 9.25 cm in the "open terrain"

land cover category.

In order to post process the LiDAR data to meet task order specifications,

Photo Science subcontractor, The James W. Sewall Company, established a total of 60 control

points that were used to calibrate the LIDAR to known ground locations established throughout

the Massachusetts project area. Additionally, Sewall established twenty (20) quality control

"blind" check points using survey grade, dual frequency GPS receivers throughout the

Massachusetts project area and the contractor supplied the coordinate and elevation

data values for each point to USGS to independently validate theses required vertical

accuracies. These points were not used by the Contractors production team duing any

phase of the project. Massachusetts data was developed based on a horizontal projection/datum

of UTM NAD83 (2007), UTM Zone 19, meters and vertical datum of NAVD1988 (GEOID09), meters.

LiDAR data was delivered in RAW flightline swath format, processed to create Classified

LAS 1.2 Files formatted to 2997 individual 1500m x 1500m tiles, Hydro Flattening Breaklines

in Esri shape file format, and corresponding 1.0 meter gridded Raster DEM Files tiled to

the same 1500m x 1500m schema. LiDAR Data was originally delivered to USGS for quality

control validation under USGS Delivery Lot 7. The lineage (metadata), positional, content

(completeness), attribution, logical consistency, and accuracies of all digital elevation

data produced conform to the specifications stipulated in USGS Task Orders G10PD01027 (ARRA)

and G10PD02143 (non-ARRA) and the U.S. Geological Survey National Geospatial Program Base

LiDAR Specification, Version 12.

</abstract>

<purpose>

Classified LAS files are used to show the manually reviewed bare earth surface. This allows the user to create Intensity Images,

Breaklines and Raster DEM.

</purpose>

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None. However, users should be aware that temporal changes may have occurred since

this data set was collected and that some parts of this data may no longer represent actual

surface conditions. Users should not use this data for critical applications without a full

awareness of it's limitations. Acknowledgement of the U.S. Geological Survey would be

appreciated for products derived from these data.

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<datacred>Photo Science, Inc. flew the LiDAR and processed the data. Northrop Grumman/3001 helped with the acquisition of the LiDAR data.</datacred>

<native>MicroStation Version 8; TerraScan Version 11; ALS Post Processor 2.70 Build#15; TerraModeler Version 11;

GeoCue Version 7.0.34.5; Optech DashMAP 5.1000; Windows XP Operating System</native>

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<pubdate>Unpublished Material</pubdate>

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State of Massachusetts (Raster DEM): LIDAR for the North East â€“ ARRA and LiDAR for the North East Part II. (USGS Contract: G10PC00026, ARRA LIDAR Task Order Numbers) USGS Contract: G10PC00026 Task Order Number: G10PD02143 Task Order Numbers: G10PD01027 (ARRA) and G10PD02143 (non-ARRA)

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State of Massachusetts (Hydro Breaklines): LIDAR for the North East â€“ ARRA and LiDAR for the North East Part II. (USGS Contract: G10PC00026, ARRA LIDAR Task Order Numbers) USGS Contract: G10PC00026 Task Order Number: G10PD02143 Task Order Numbers: G10PD01027 (ARRA) and G10PD02143 (non-ARRA)

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State of Massachusetts: LIDAR for the North East â€“ ARRA and LiDAR for the North East Part II. (USGS Contract: G10PC00026, ARRA LIDAR Task Order Numbers) USGS Contract: G10PC00026 Task Order Number: G10PD02143 Task Order Numbers: G10PD01027 (ARRA) and G10PD02143 (non-ARRA)

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<attraccr>The project area required LiDAR to be collected on 1.0 meter GSD or better

and processed to meet a bare earth vertical accuracy of 15.0 centimeters RMSEz or better with

the exception of Cape Cod (Barnstable County) which was flown and processed to meet a bare earth

vertical accuracy of 9.25cm centimeters RMSEz or better.

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<logic>Classified LAS files were tested by Photo Science for both vertical and horizontal accuracy.

All data is seamless from one tile to the next, no gaps or no data areas.</logic>

<complete>Datasets contain complete coverage of tiles.</complete>

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<vertaccr>Classified LAS files were tested by Photo Science for both vertical and horizontal

accuracy. All data is seamless from one tile to the next, no gaps or no data areas.

The vertical unit of the data file is in decimal meters with 2-decimal point precision.

The reported RMSEz value was determined using the calibration control points, and not the Blind Control. The calibration control

points are the same points that were used to remove any bias in the dataset before bare earth editing.

The listed RMSEz value shown below was calculated from the ground (ASPRS Class 2) data in the final Classified LAS file.

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<srccontr>Control points are uses as a known elevation to adjust the LiDAR data to the surface.</srccontr>

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<srccontr>LiDAR points were used to produce the deliverables.</srccontr>

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Control Process: James W. Sewall Company was contracted by Photo Science, Inc. to

locate a total of 60calibration control used in the post processing of the LiDAR data as well as 20 quality assurance check points for the state of Massachusetts. The points

were located on relatively flat terrain on surfaces that generally consisted of grass,

gravel or bare earth. See Final Survey Reports for additional collection parameters and methodologies.

Applanix software was used in the post processing of the

airborne GPS and inertial data that is critical to the positioning and

orientation of the sensor during all flights. POSPac MMS provides

the smoothed best estimate of trajectory (SBET) that is necessary

for Optech's post processor to develop the point cloud from the

LiDAR missions. The point cloud is the mathematical three dimensional

collection of all returns from all laser pulses as determined from

the aerial mission. At this point this data is ready for analysis,

classification, and filtering to generate a bare earth surface model

in which the above ground features are removed from the data set.

The point cloud was manipulated within the Optech software; GeoCue,

TerraScan, and TerraModeler software was used for the automated

data classification, manual cleanup, and bare earth generation from

this data. Project specific macros were used to classify the ground

and to remove the side overlap between parallel flight lines.

All data was manually reviewed and any remaining artifacts removed

using functionality provided by TerraScan and TerraModeler.

All ground (ASPRS Class 2) LiDAR data inside of the Lake Pond and Double Line Drain hydro flattening

breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality.

A buffer of 1 meter was also used around each hydro flattened feature to classify these ground (ASPRS Class 2)

points to ignored ground (ASPRS Class 10). All Lake Pond Island and Double Line Drain Island features were

checked to ensure that the ground (ASPRS Class 2) were reclassified to the correct classification after the

automated classification was completed.

A new class has been added to the dataset to represent the bare water of the ocean

areas collected throughout the project area. ASPRS Class 14 is being used to represent the bare water

ocean surface. While attempts were made to remove all extraneous features above the surface

of the water, there may be above surface features classified to this class. Some islands below the required

collection specifications have been classified to this class as well. This class was also used

during the creation of the ERDAS Imagine Raster DEM files. The Ocean Shoreline and Ocean Island

breaklines were used to complete the automated classification of these classes within the final LAS files.

All overlap data was processed through automated functionality provided by

TerraScan to classify the overlapping flight line data to approved classes by USGS. The overlap data was

classified to Class 17 (USGS Overlap Default), Class 18 (USGS Overlap Ground), Class 25 (USGS Overlap Water),

and Class 30 (USGS Overlap Bare Water). These classes were created through automated processes only

and were not verified for classification accuracy. Due to software limitations within TerraScan, these classes were used to

trip the Withheld bit within various software packages. These processes were reviewed and accepted by USGS through

multiple conference calls and pilot study areas.

Data was then run through additional macros to ensure deliverable classification

levels matching the ASPRS LAS Version 1.2 Classification structure. GeoCue functionality was then

used to ensure correct LAS Versioning. In-house software was used as a final

QA/QC check to provide LAS Analysis of the delivered tiles. QA/QC checks were performed on a per tile

level to verify final classification metrics and full LAS header information.

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<eadetcit>All deliverables meet specifications in contract. LAS Files meet ASPRS and USGS Classification Standards.</eadetcit>

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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>

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<cntper>Michael Shillenn</cntper>

</cntorgp>

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<addrtype>mailing and physical address</addrtype>

<address>523 Wellington Way, Suite 375</address>

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