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LiDAR & Oblique Solutions

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Overview

- Summary of 2015 Michigan State LiDAR Program
- LiDAR Quality Levels
- Calibration and Accuracy Reporting
- LiDAR Products
  - Classified LAS
  - DSM/DTM
    - Hydro-flattenning
  - Intensity Images
  - Building Footprints

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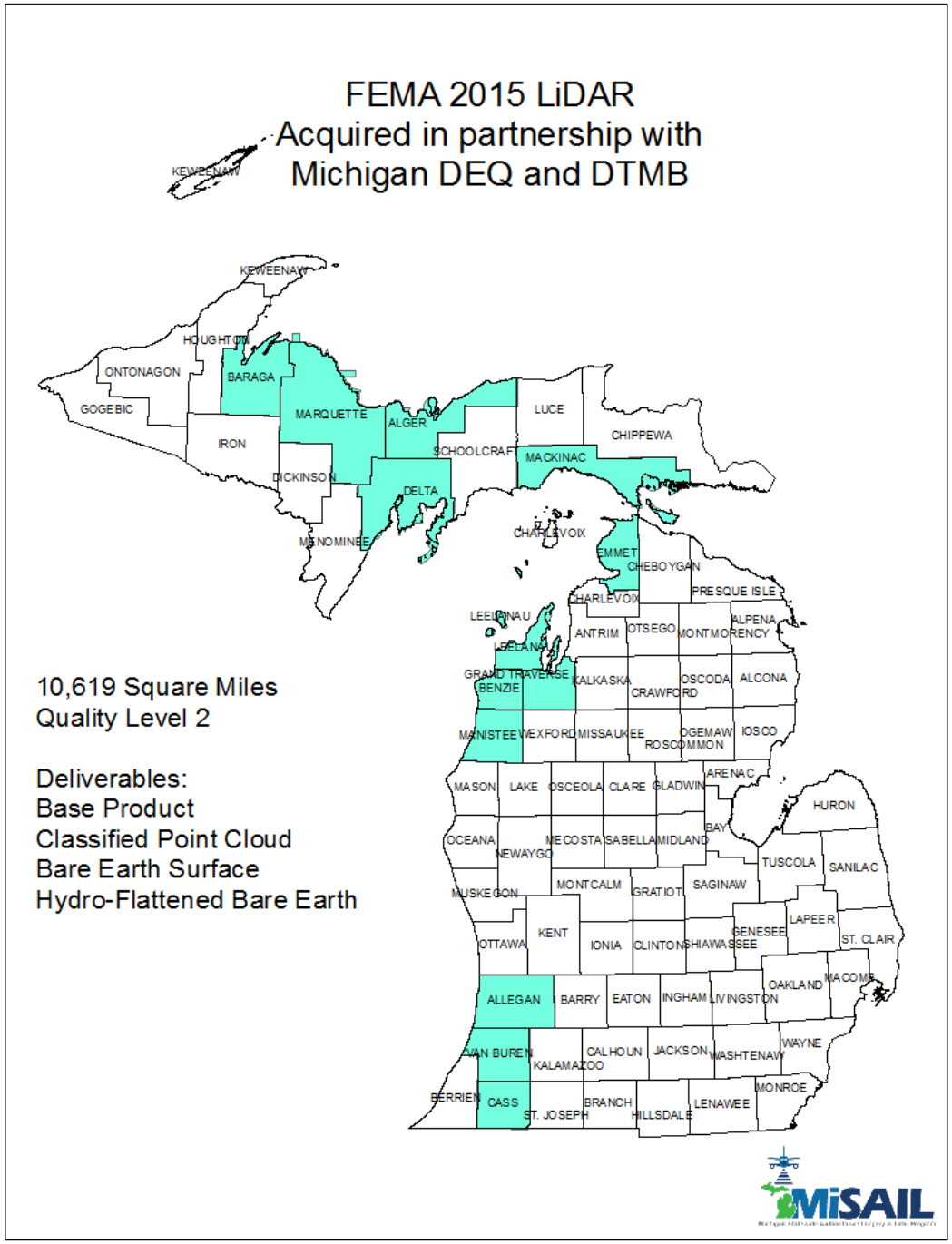
Summary of 2015 Michigan LiDAR program

All the work will be carried out according to the USGS LiDAR Base Specifications Version 1.0 & the FEMA Guidelines



DEM Quality Levels

Quality Levels	Data Source	Horizontal Resolution	Vertical Accuracy	
		Point Density	RMSEz in Open Terrain	Equivalent Contour Accuracy
QL 1	LiDAR	8 points/m²	9.25 cm	1 foot
QL 2	LiDAR	2 points/m²	9.25 cm	1 foot
QL 3	LiDAR	1 – 0.25 points/m²	≤18.5 cm	2 feet
QL 4	Imagery/ LiDAR	1 – 0.04 points/m²	46.3 – 139 cm	5 – 15 feet
QL 5	Imagery/ IFSAR	0.04 points/m²	92.7 – 185 cm	10 – 20 feet

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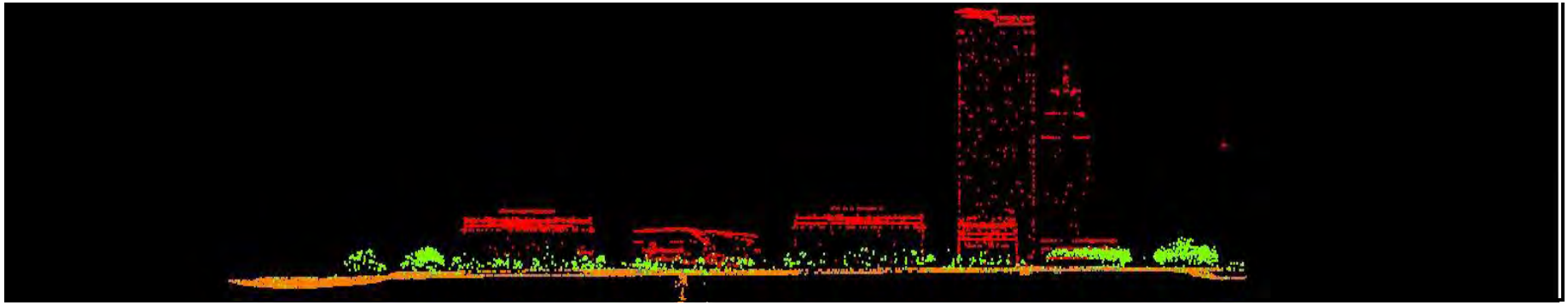
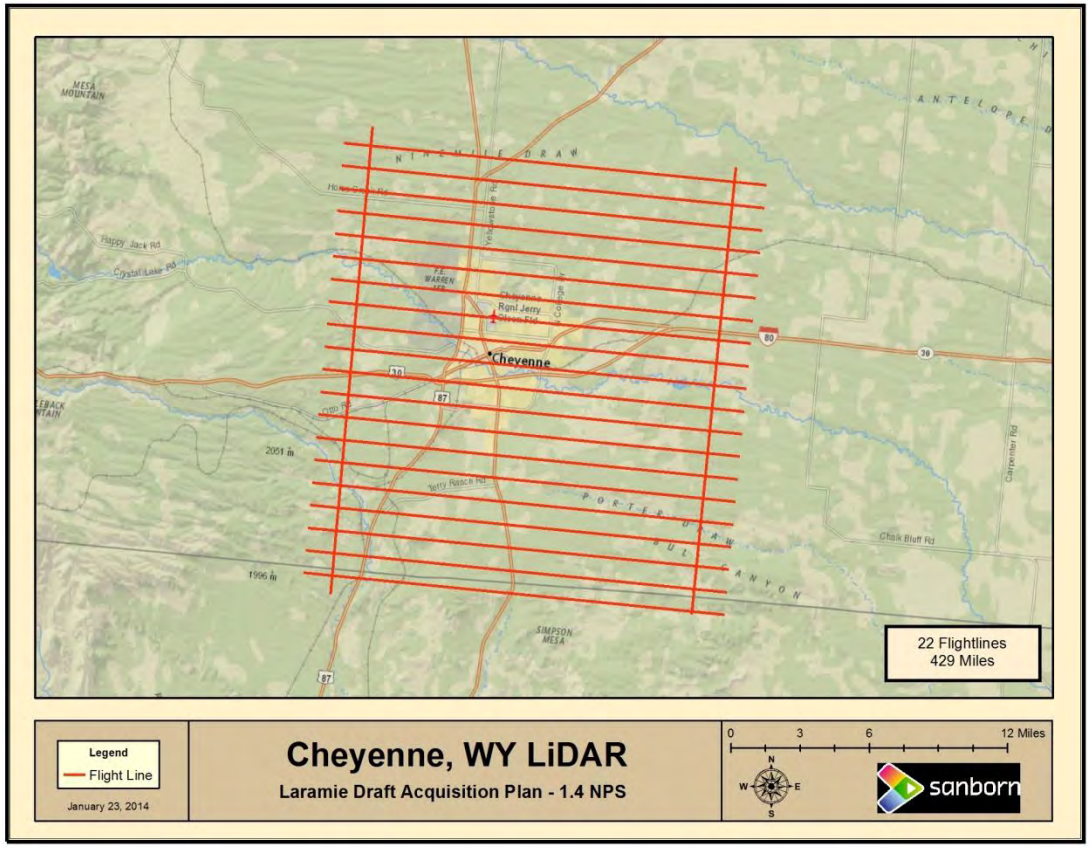
LiDAR Point Density



0.35m NPS (QL-1) → 0.7m NPS (QL-2) → 1.4 m NPS (QL-3)

QL3 1.4 NPS Flight Plan



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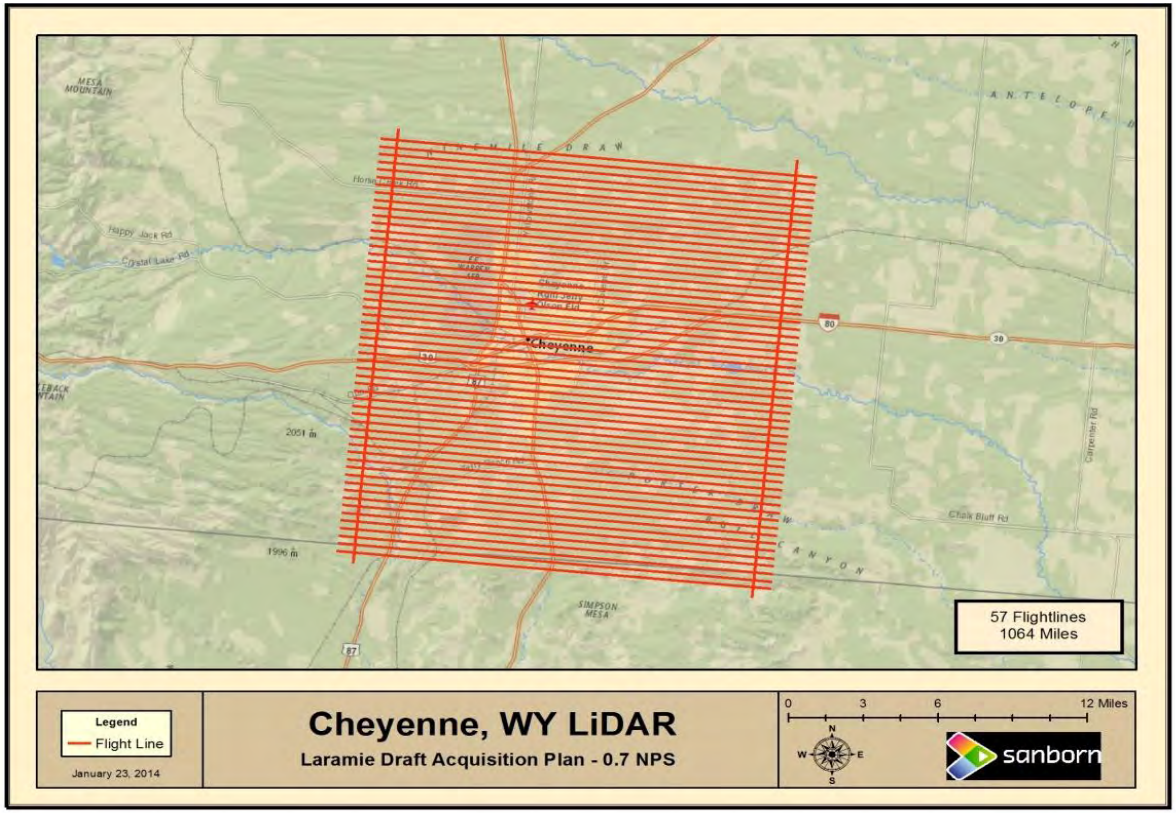
QL2 0.7 NPS Flight Plan



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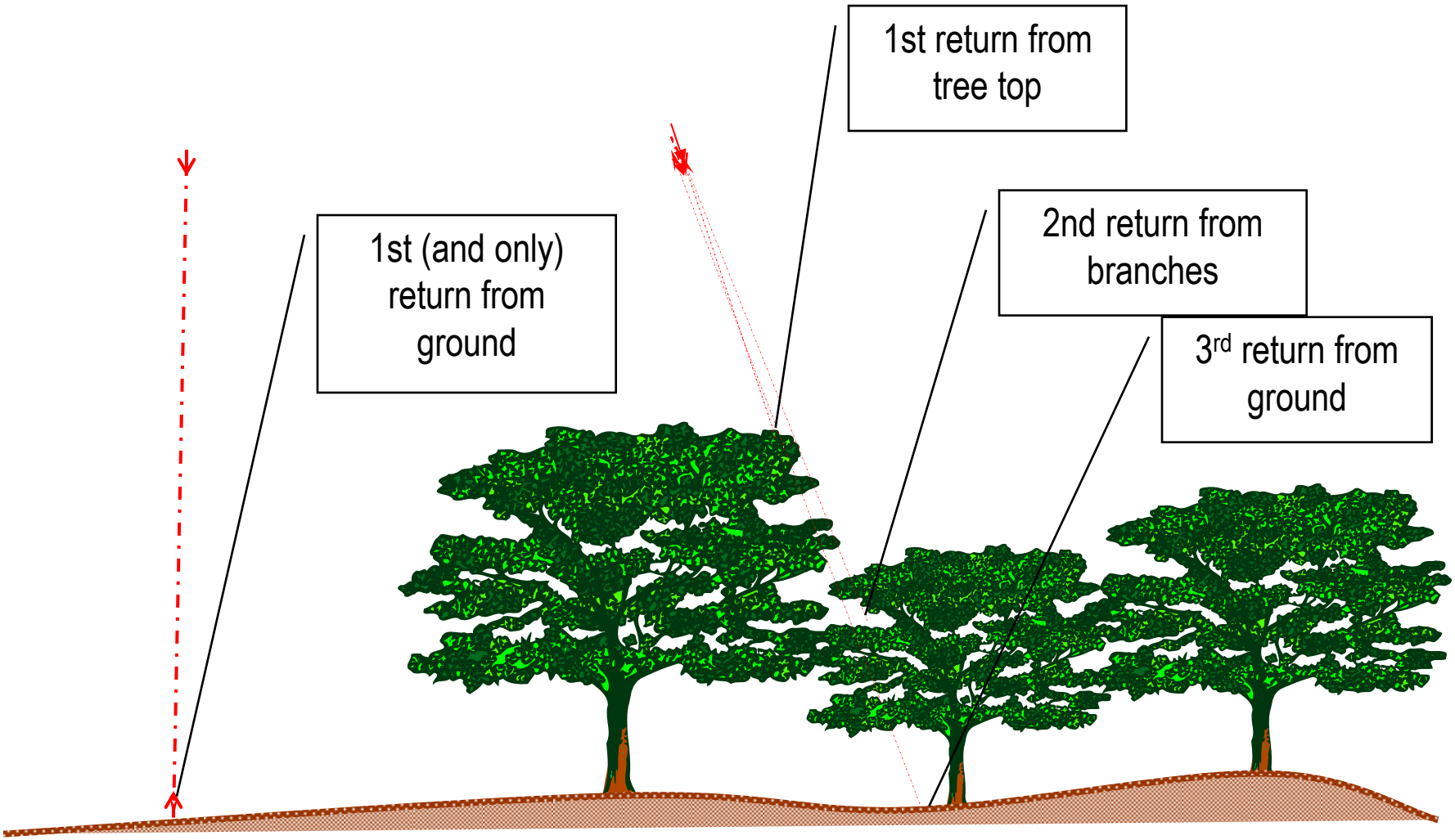
Multiple Return Capability



Provided by Leica Geosystems GIS and Mapping, LLC

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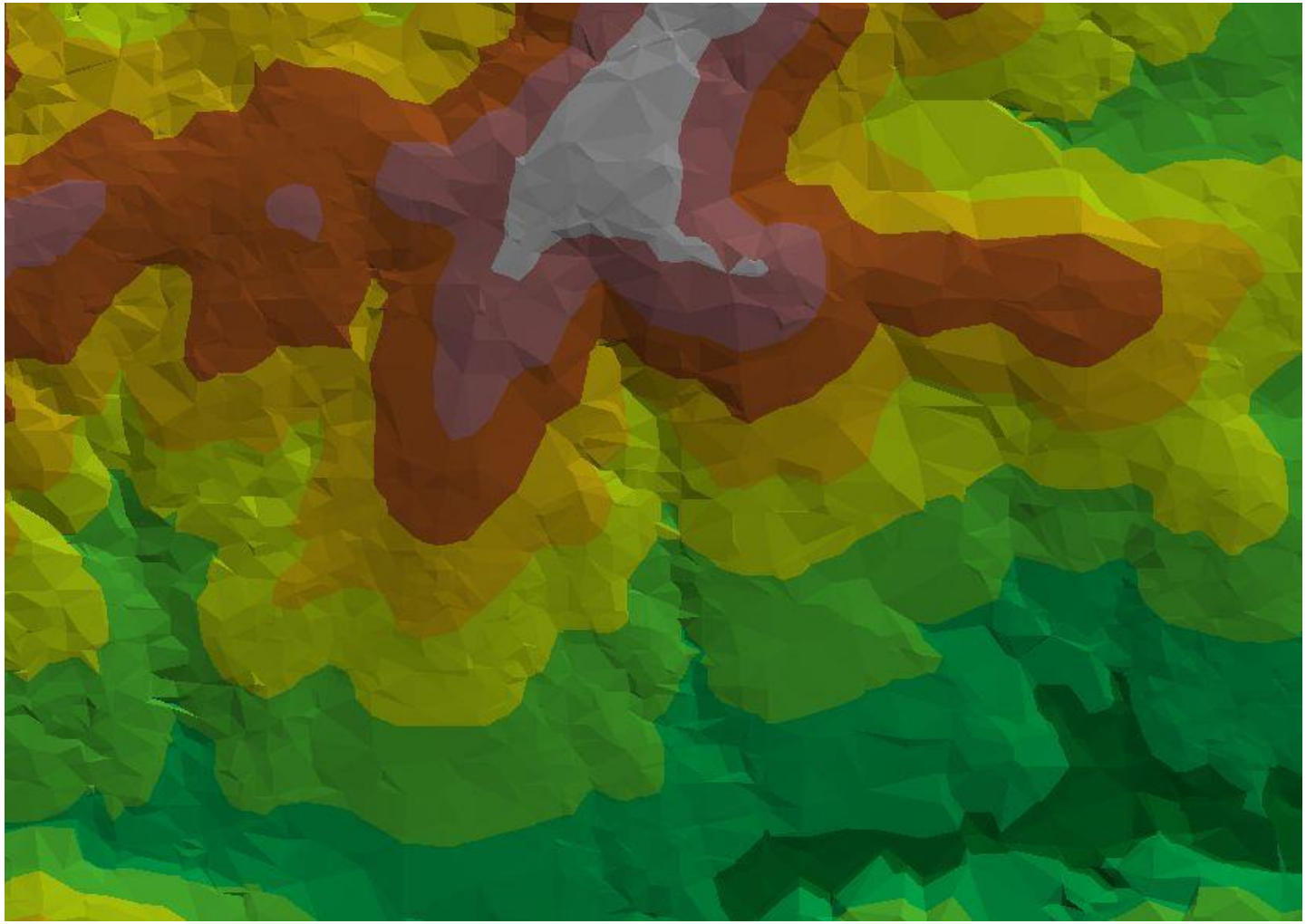
Advantages of the Multiple Return Capability

Advantages of the Multiple Return Capability



Last Return Data Processed to Bare Ground

LiDAR Calibration Overview

- GPS-IMU Processing
- Installation Calibration
- Compute mission calibration parameters using calibration lines
- Final LiDAR Calibration Using TerraMatch
- DZ Ortho process: for relative accuracy
- Control-Point Z Adjustment
- Run FVA, SVA and CVA reports to independently validate and report the accuracy (After Manual Classification and QC).

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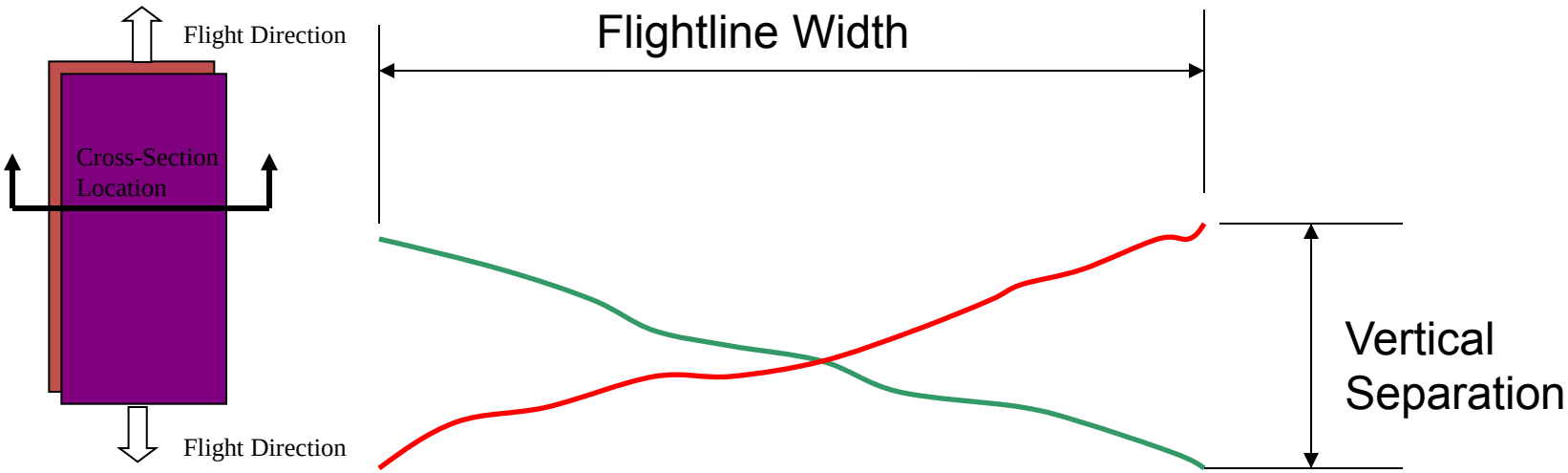
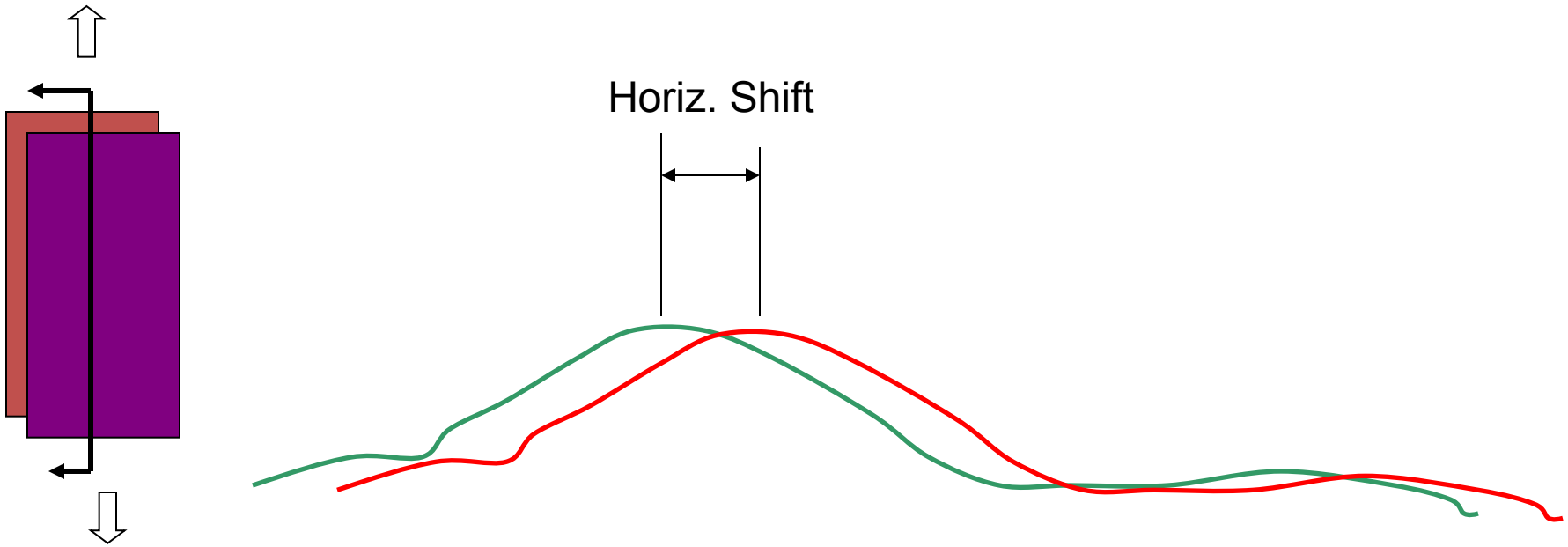
LiDAR Calibration



Roll Correction = atan(Vertical Separation/Flightline Width)

LiDAR Calibration



Pitch Correction = atan((Horiz Shift/2)/Flying Height)

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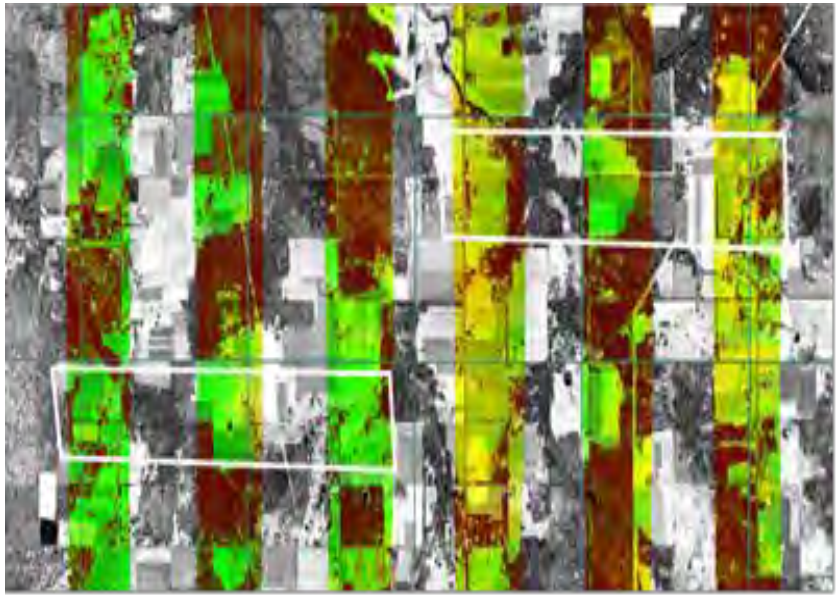
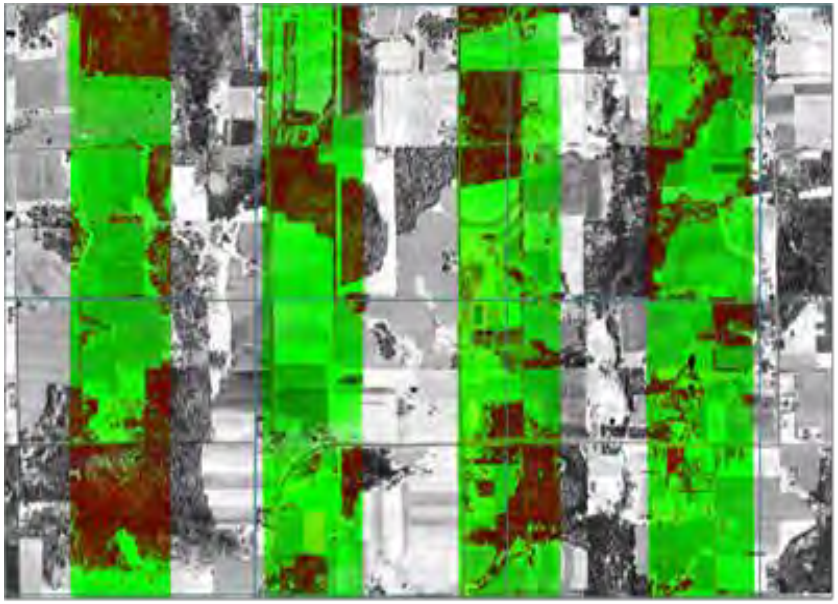
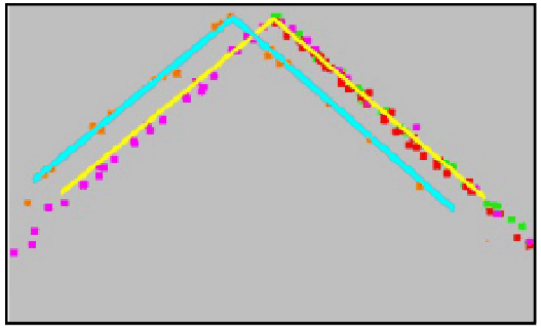
LiDAR Calibration



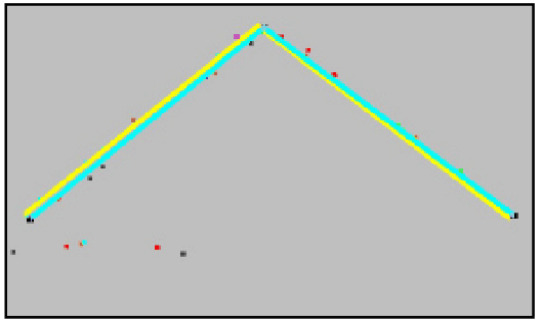
Swath to swath systematic errors are shown. TerraMatch uses the sample tiles to find biases between swaths and correct for them.



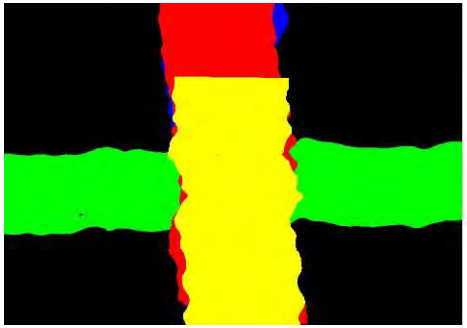
Swath to swath errors are corrected automatically by applying correction file.



Laser points on a building roof show a mismatch between different flight lines



Laser points after matching process.



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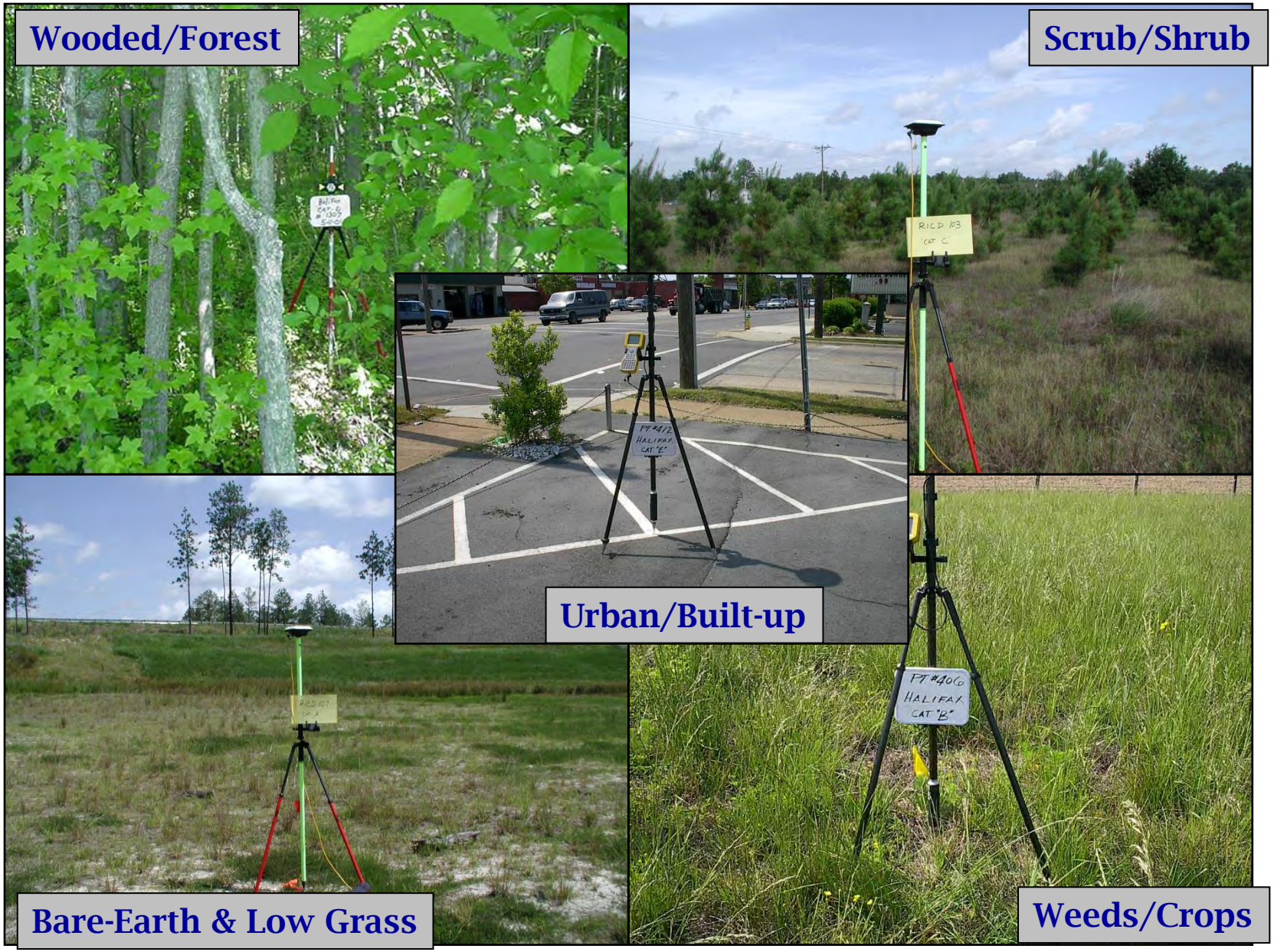
USGS QA/QC for Lidar



New Upcoming Specs

- Accuracy specifications for all Geospatial products including LiDAR will be defined by the new ASPRS Specs **ASPRS_Accuracy_Standards_for_Digital_Geospatial_Data**

- Instead of the FVA and SVA, there will be new terminologies about accuracy assessment in NVA (Non Vegetated areas) and VA (Vegetated Areas) and there accuracies will be called NVVA and VVA

- There are some changes in the LAS Version requirements but software are not ready for that yet.

- There will be a requirement to report horizontal accuracy for LiDAR datasets

- USGS/Dewberry is working on a methodology to report relative accuracy between swaths. That might be a part of the new requirement.

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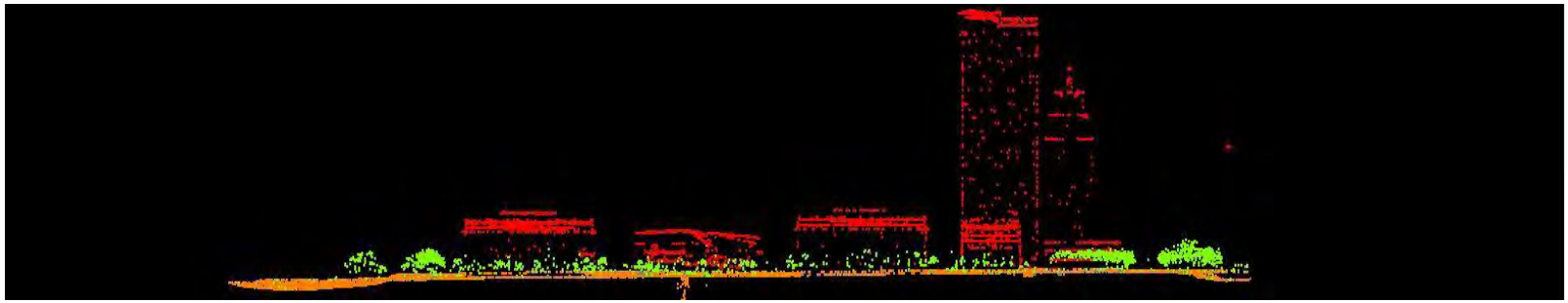
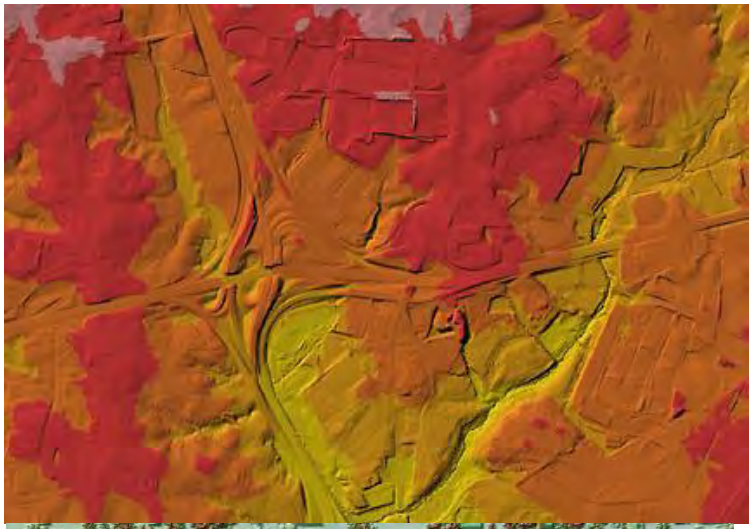
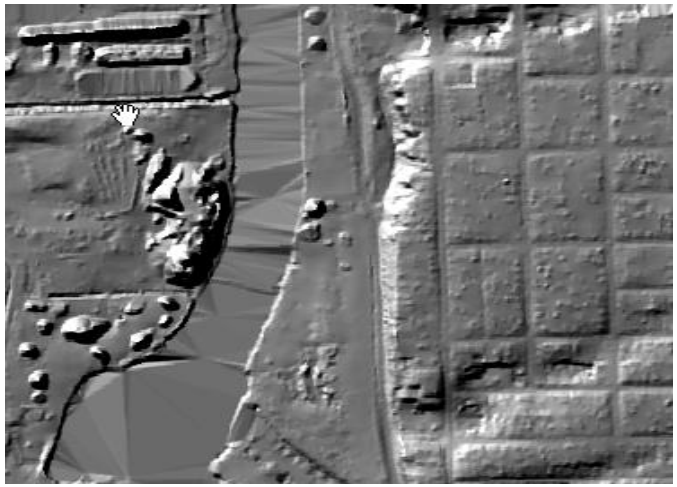
Typical LiDAR Products



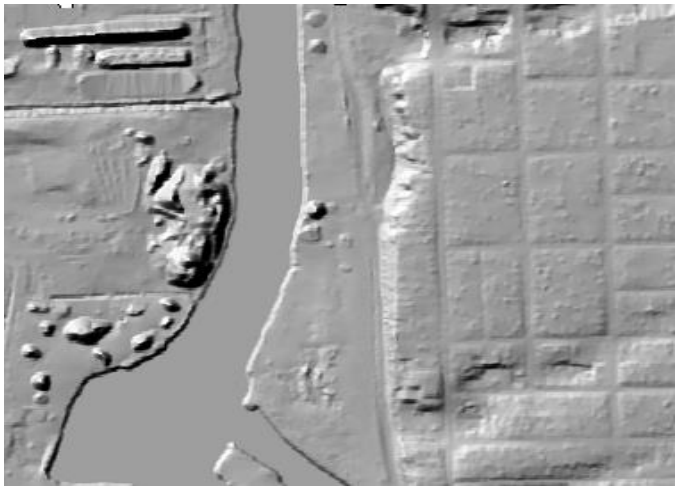


Hydro-Flattening

- The USGS Hydro-flattening/Hydro-Enforcement Specs are
  - Water bodies bigger than 2 Acres are flat
  - River wider than 100 ft are flat bank-to-bank and follow downhill gradient



Lidar only



Hydro-flattened Lidar

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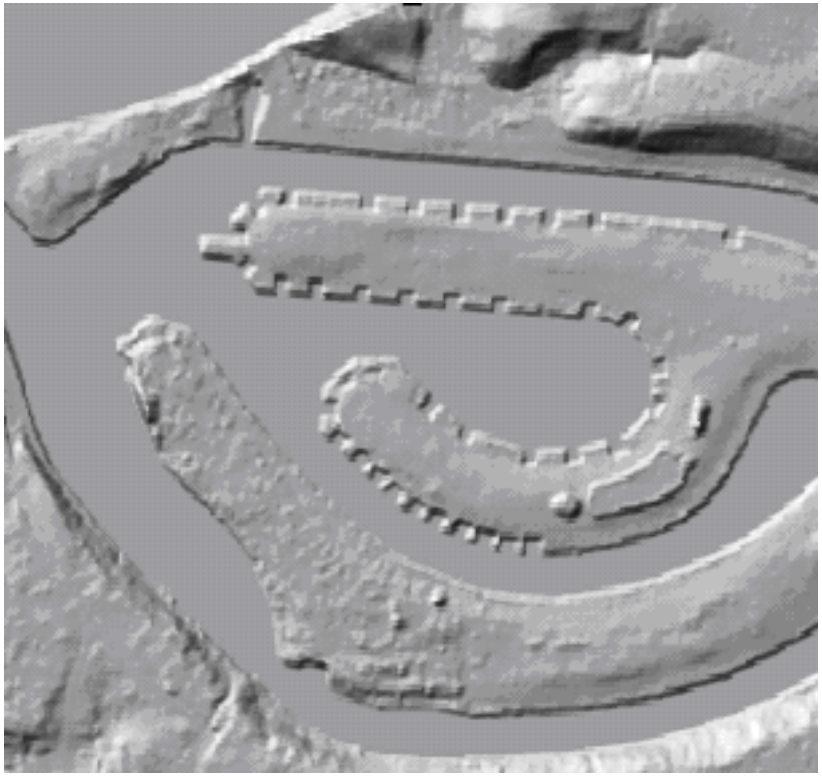
Hydro-Flattening Examples

Lidar only



Hydro-flattened Lidar

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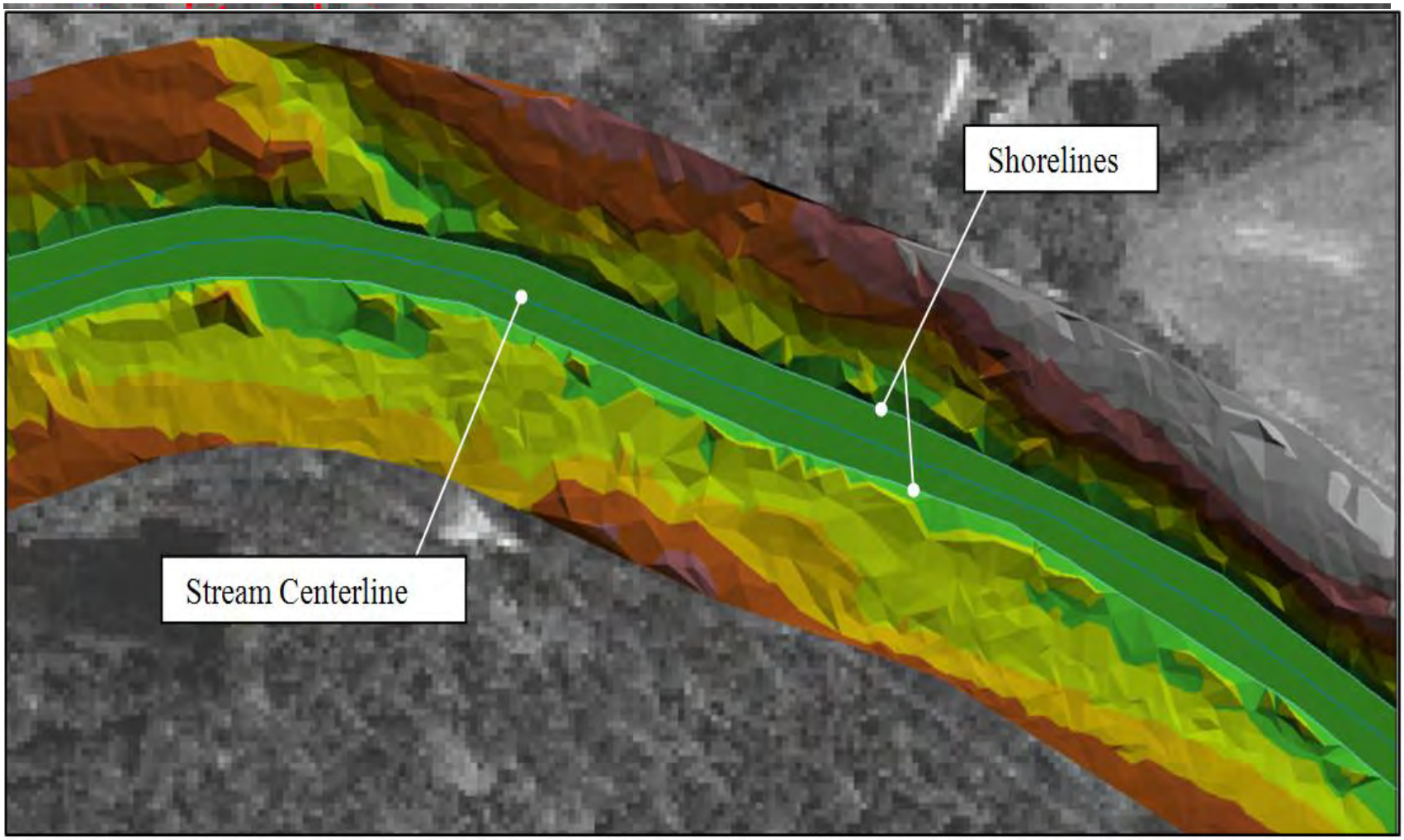
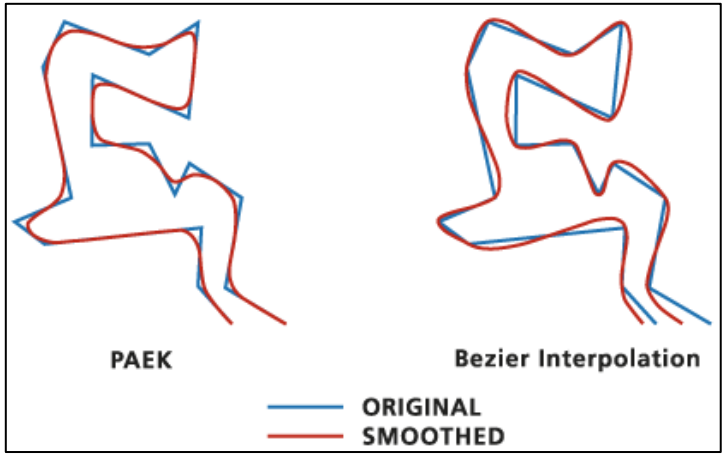
Hydro Enforced Breaklines



Contouring

- Breaklines required to support accuracy (base)
- Additional Breaklines; 'Planimetric Style'
  - All hydrography lines
  - Bridges, buildings
  - Road and parking lot edges rail centerlines "hard" and "soft" breaklines
- Sanborn works closely with customer to determine degree of smoothing



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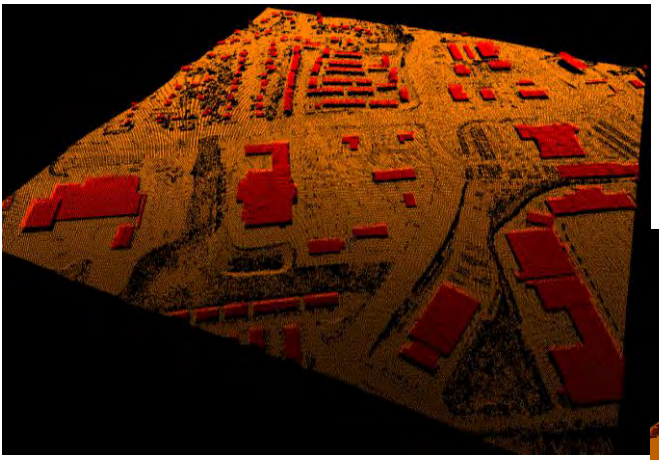
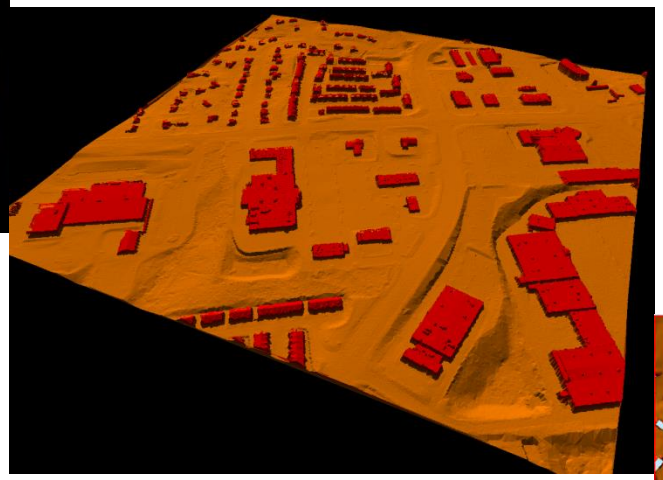
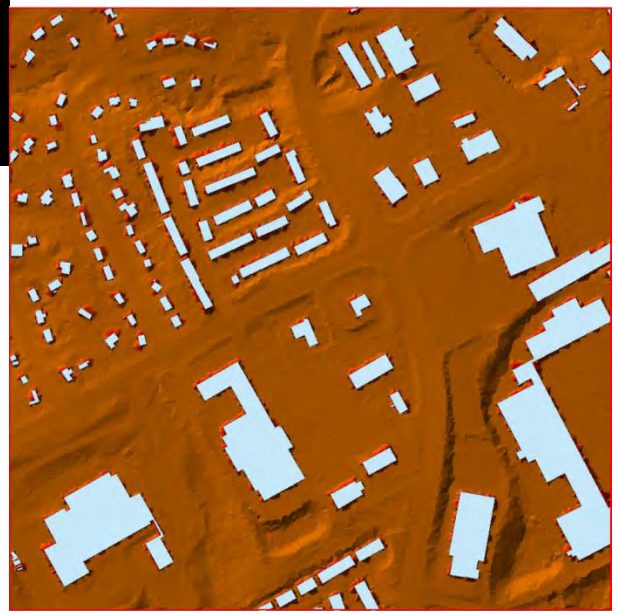
Automated Building Extraction: Example 1







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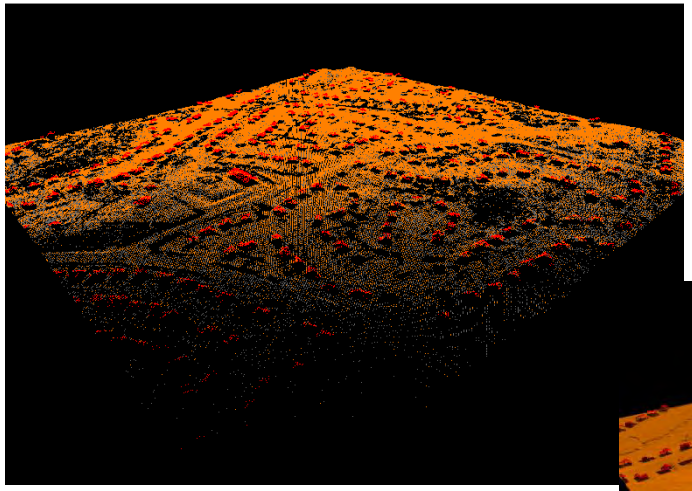
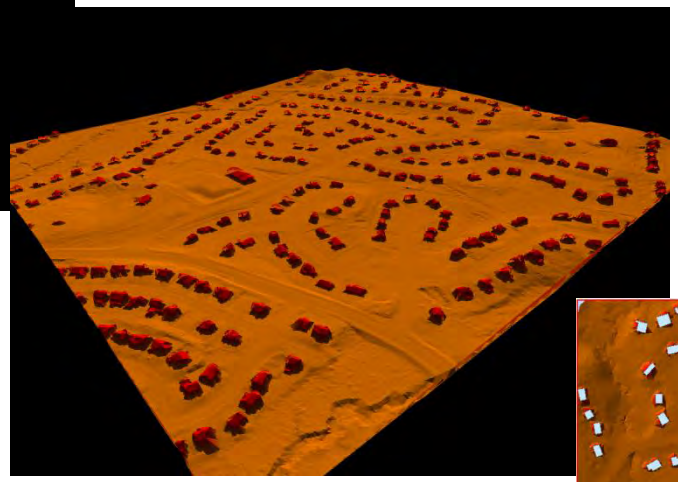
Automated Building Extraction: Example 2





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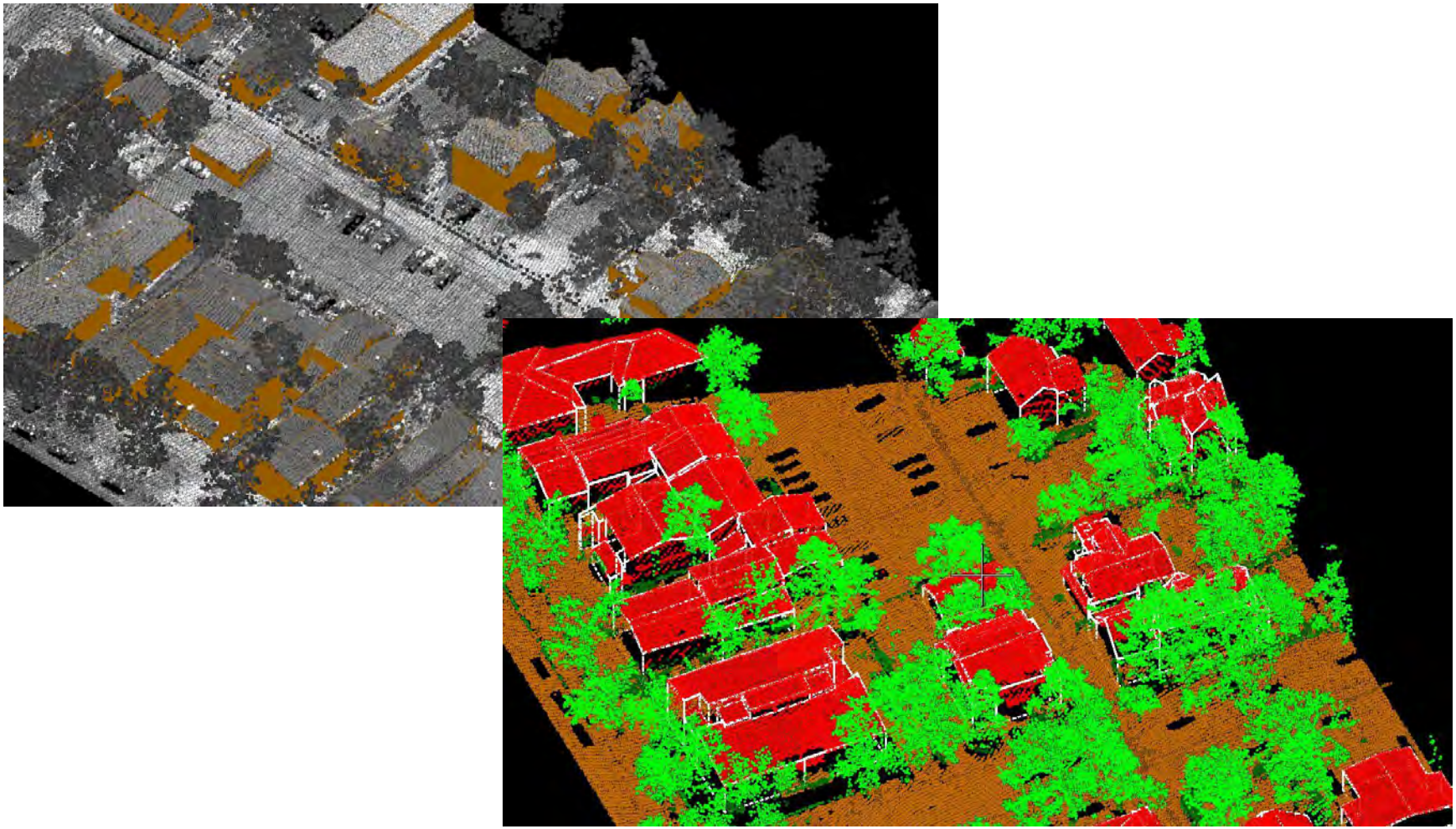
Automated Building Extraction



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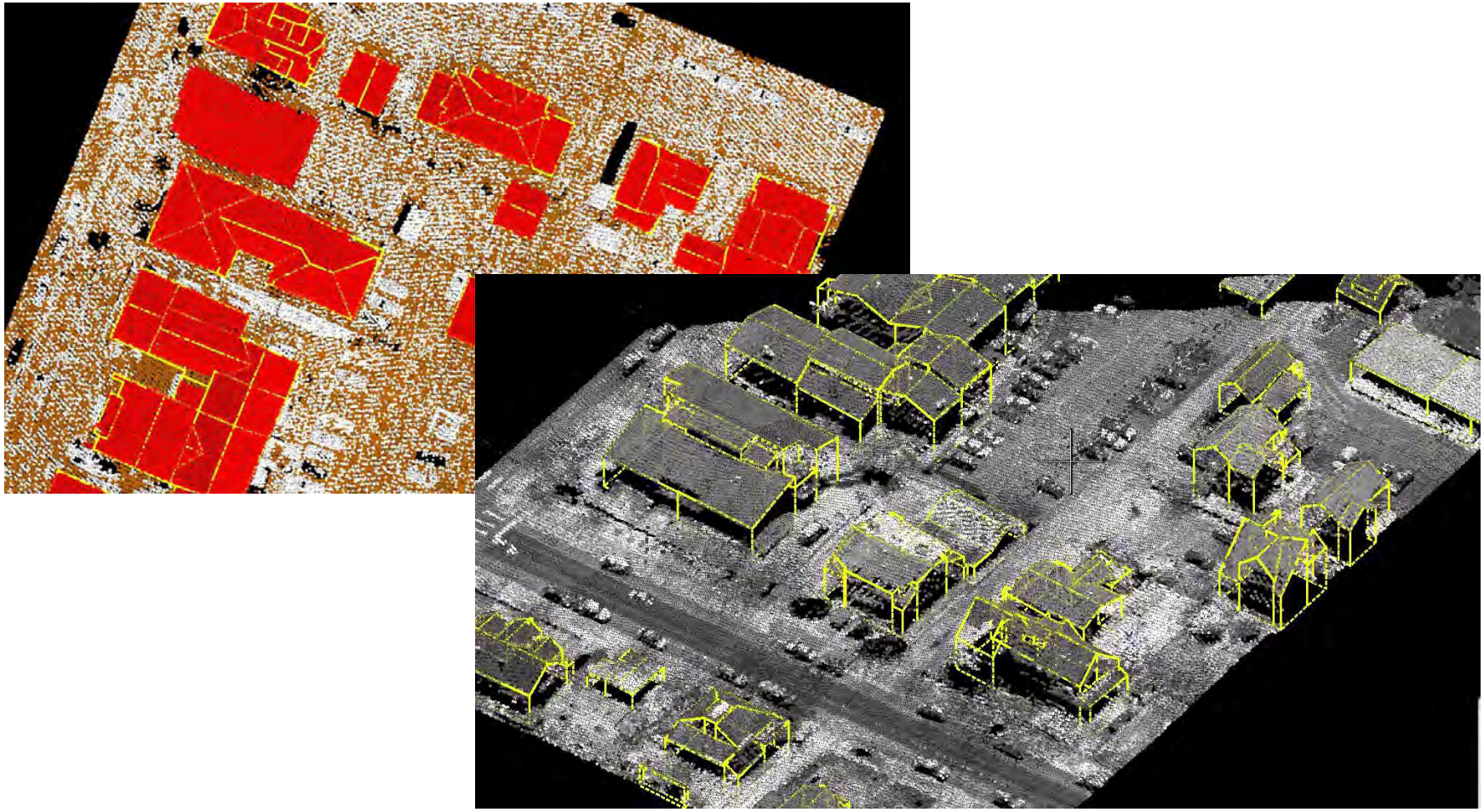
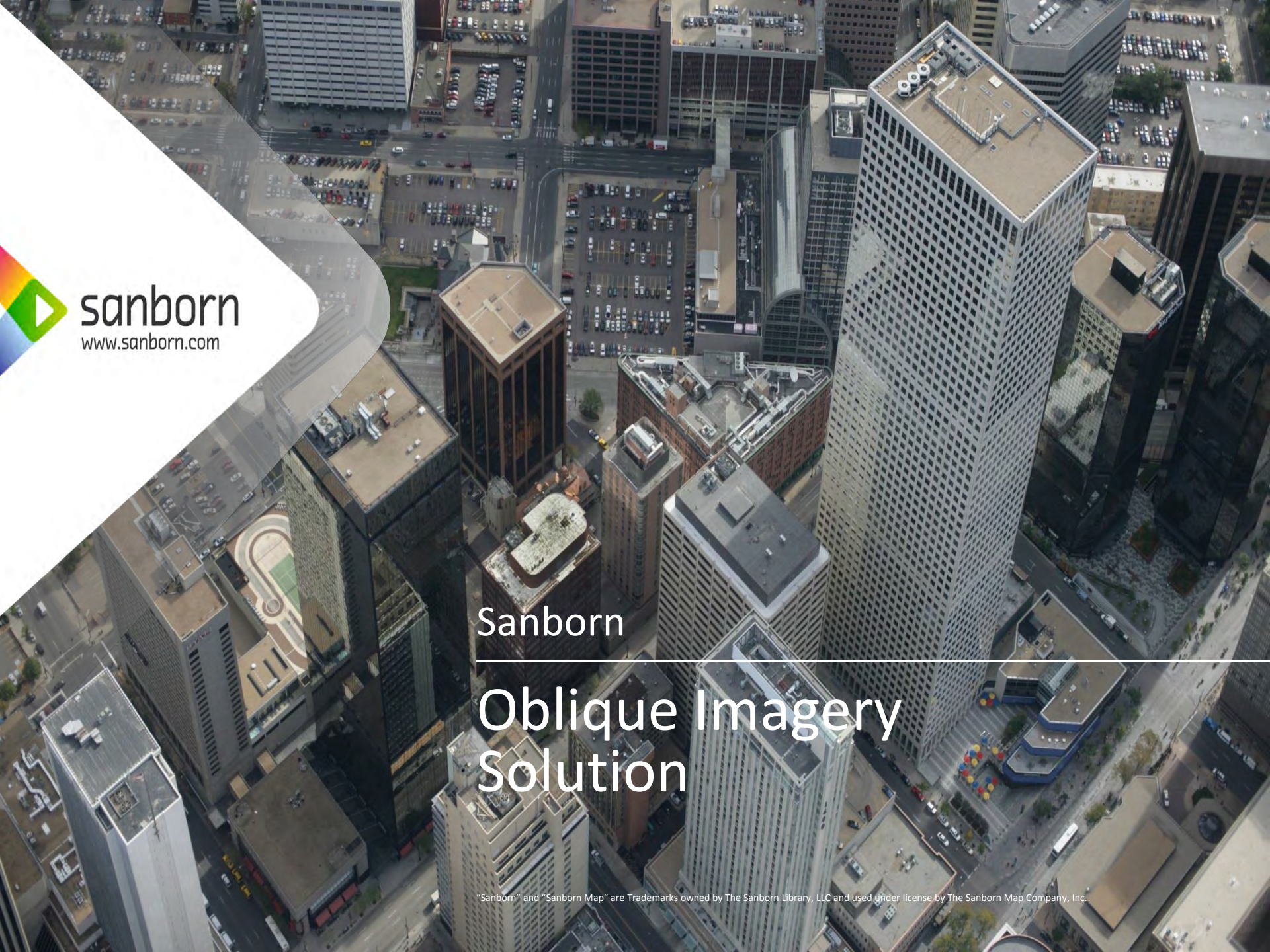
Automated Building Extraction





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Oblique Imagery Solution

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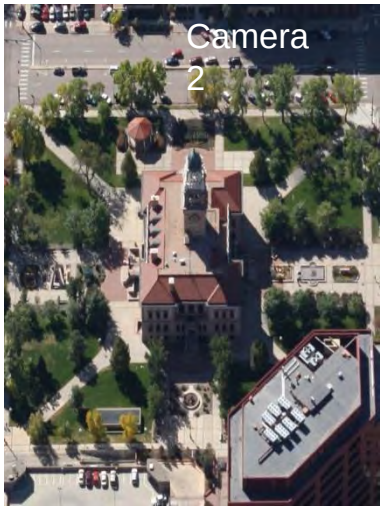
What is Sanborn Oblique Imagery?



The Sanborn Oblique Imagery Solution enables users to see multiple aerial views of any location while providing access to the Oblique Analyst (a browser-based tool) & an Application that runs on ESRI platform that allows users to extract measurements and derive important information from oblique imagery views.

Sanborn has collected, processed and staged more than 20K sq miles (~15 million oblique images) in last 3 years.

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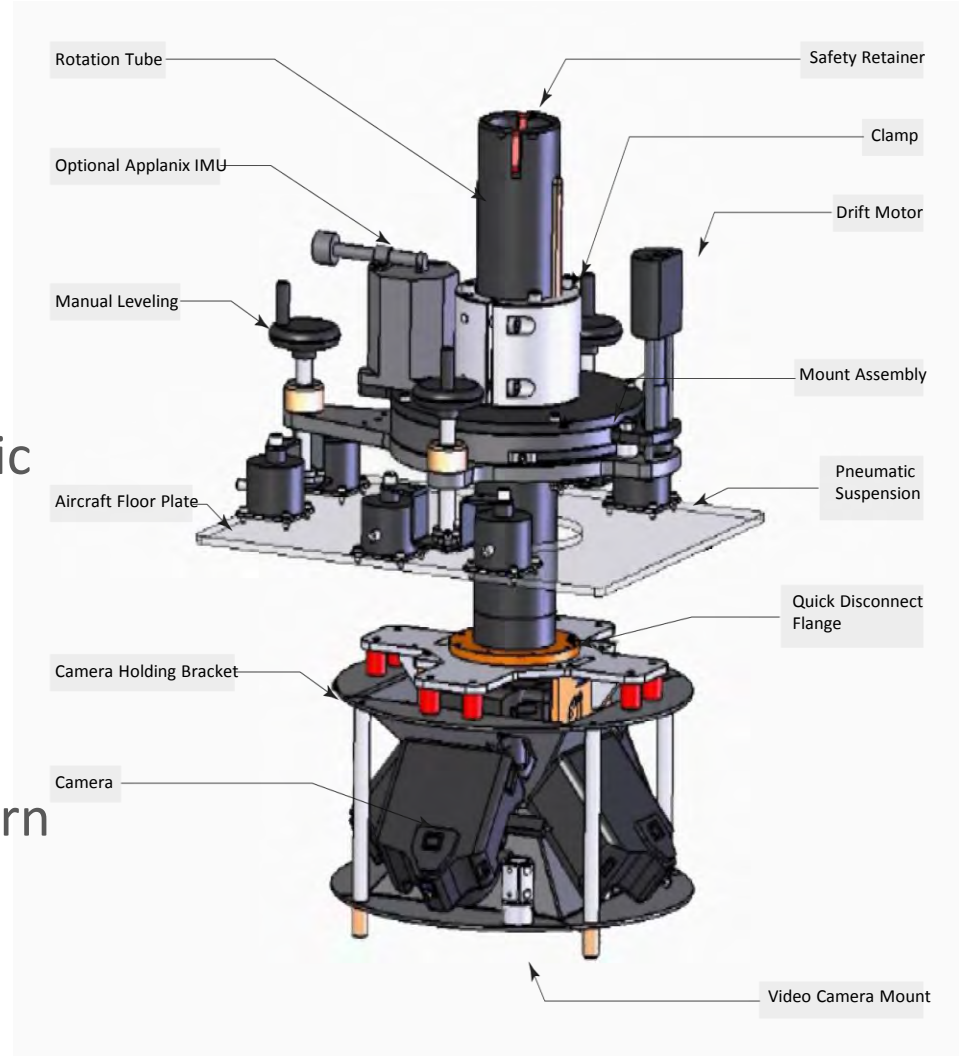
Sensors

Sanborn owns and operates 4 Oblique Camera Systems

In Oblique sensors we use calibrated lenses, photogrammetric camera mounts, and full Aerial Triangulation for generating mapping level accuracies.

In the production workflow Sanborn computes refined exterior and interior orientation parameters using an integrated Nadir and Oblique Bundle block adjustment

A Typical Multi-Camera Oblique Digital Acquisition System



Sanborn | Oblique Imagery Solution

Final, georeferenced imagery is delivered to the end-user in a format that makes it easy to see, analyze, and extract data from effectively.

Sample: 6-inch Oblique
Colorado Springs, CO
Acquired: 2008

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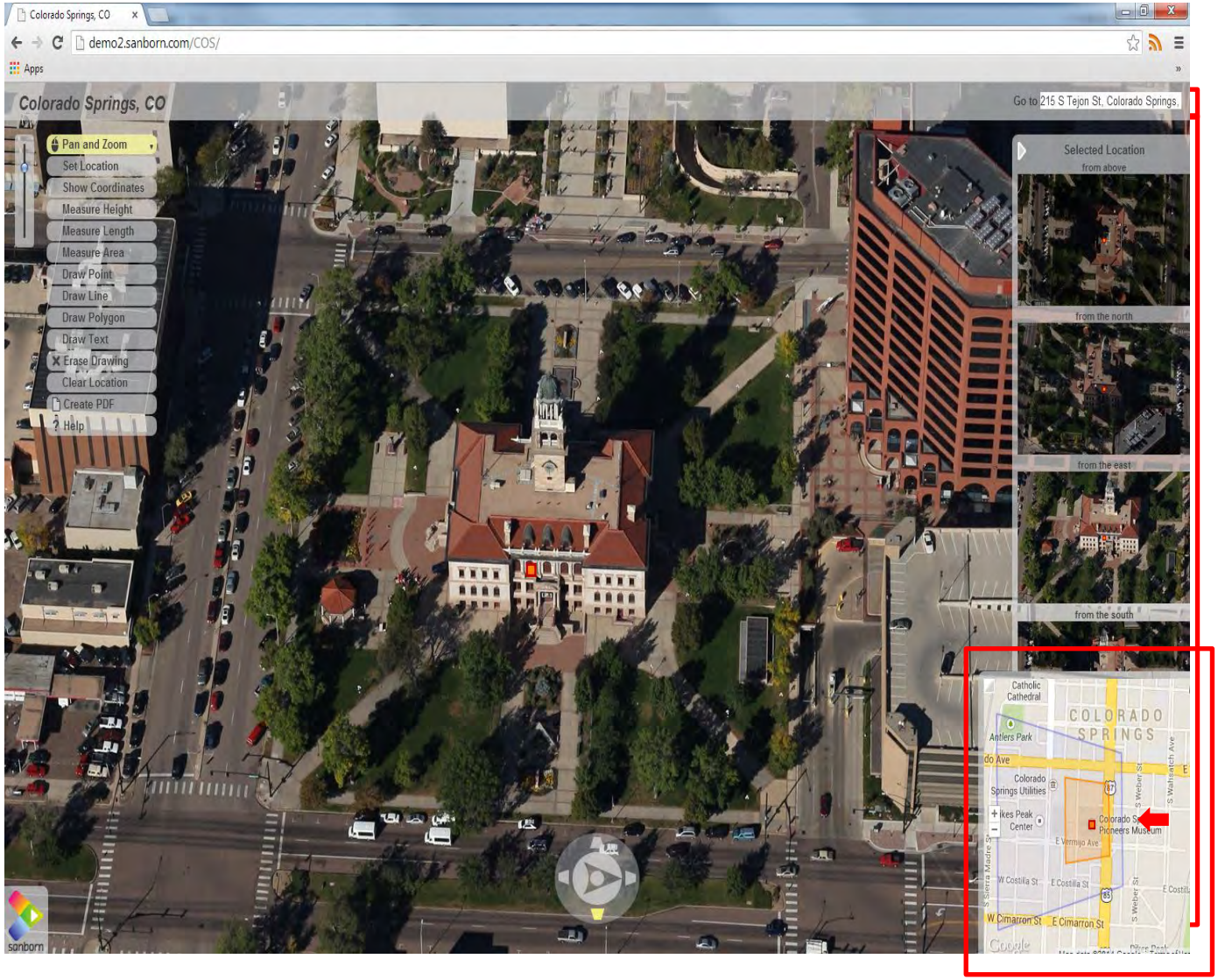
Sanborn Oblique Analyst™

The Oblique Analyst viewer is equipped with tools designed to easily derive information from oblique imagery. In addition, with one click, all annotations, measurements, and drawings in the window can be easily output to PDF for distribution.

Google Map Panel

This panel displays the current location view overlaid on a google map, providing helpful spatial context for the user.



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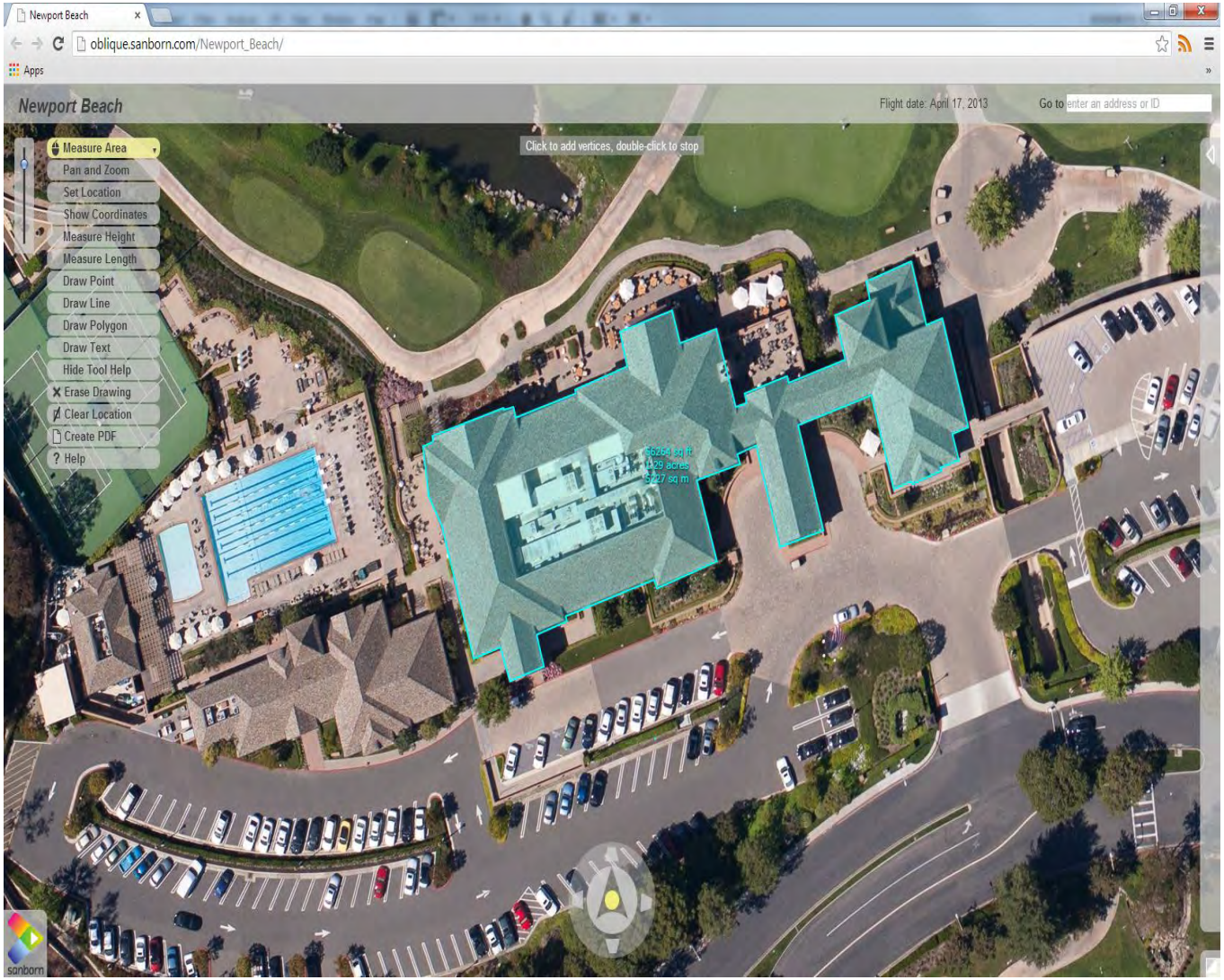
Oblique Analyst Functionality

Measure Area

Measure the surface area of an object in the imagery.



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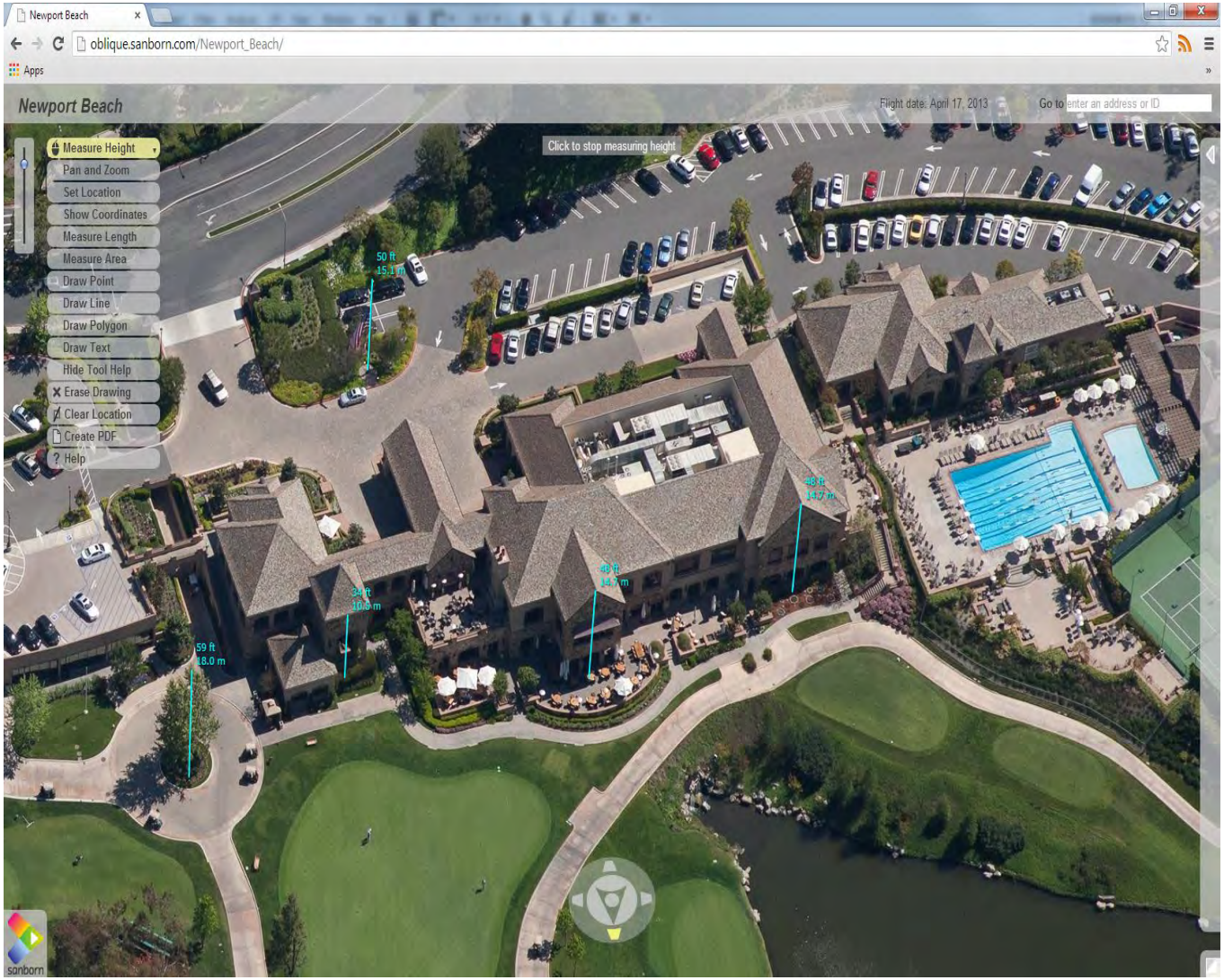
Oblique Analyst Functionality

Measure Height

A featured tool is provided to measure an object's height in the image.



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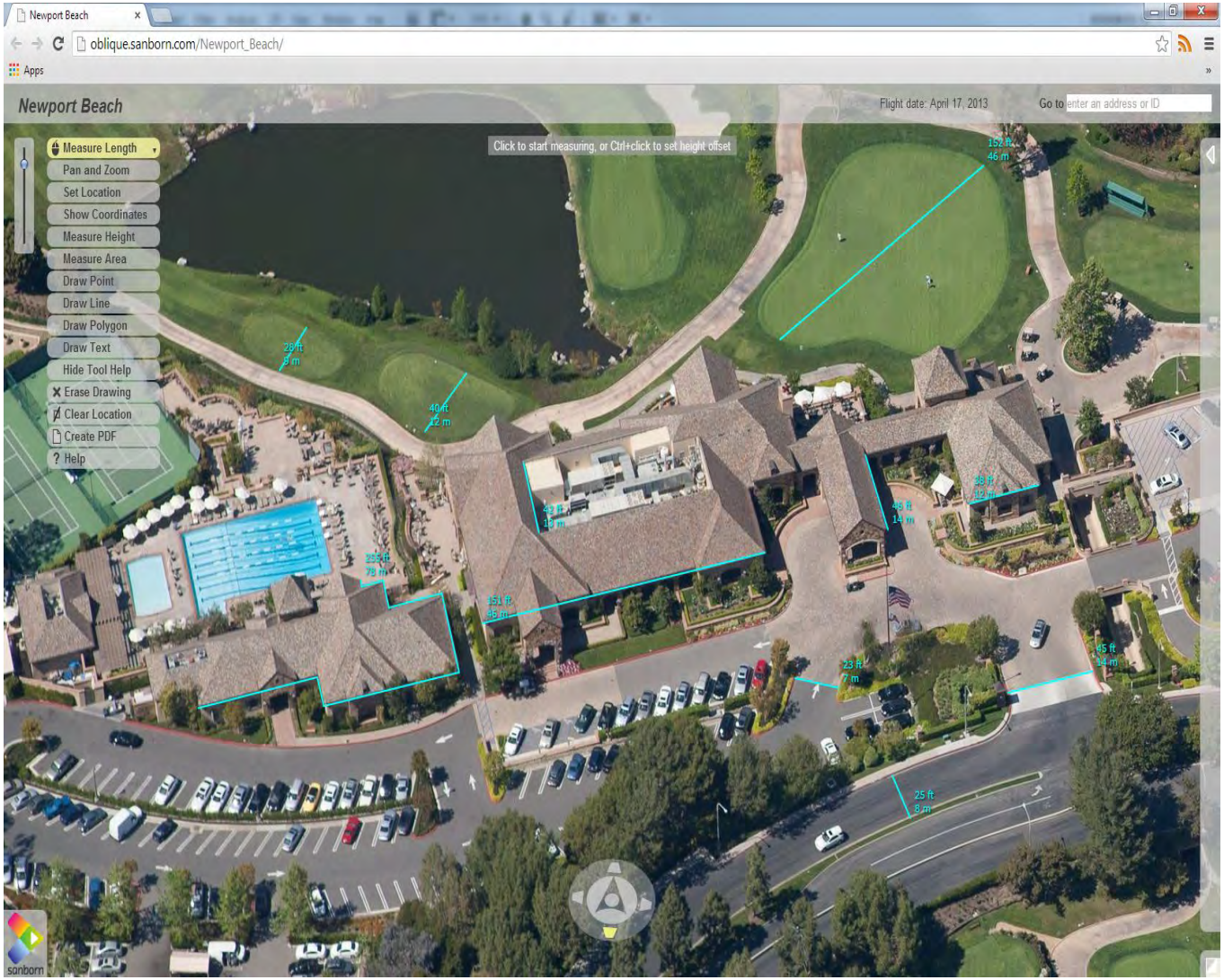
Oblique Analyst Functionality

Measure Length

A tool is provided to measure length along the side of an object in the image.



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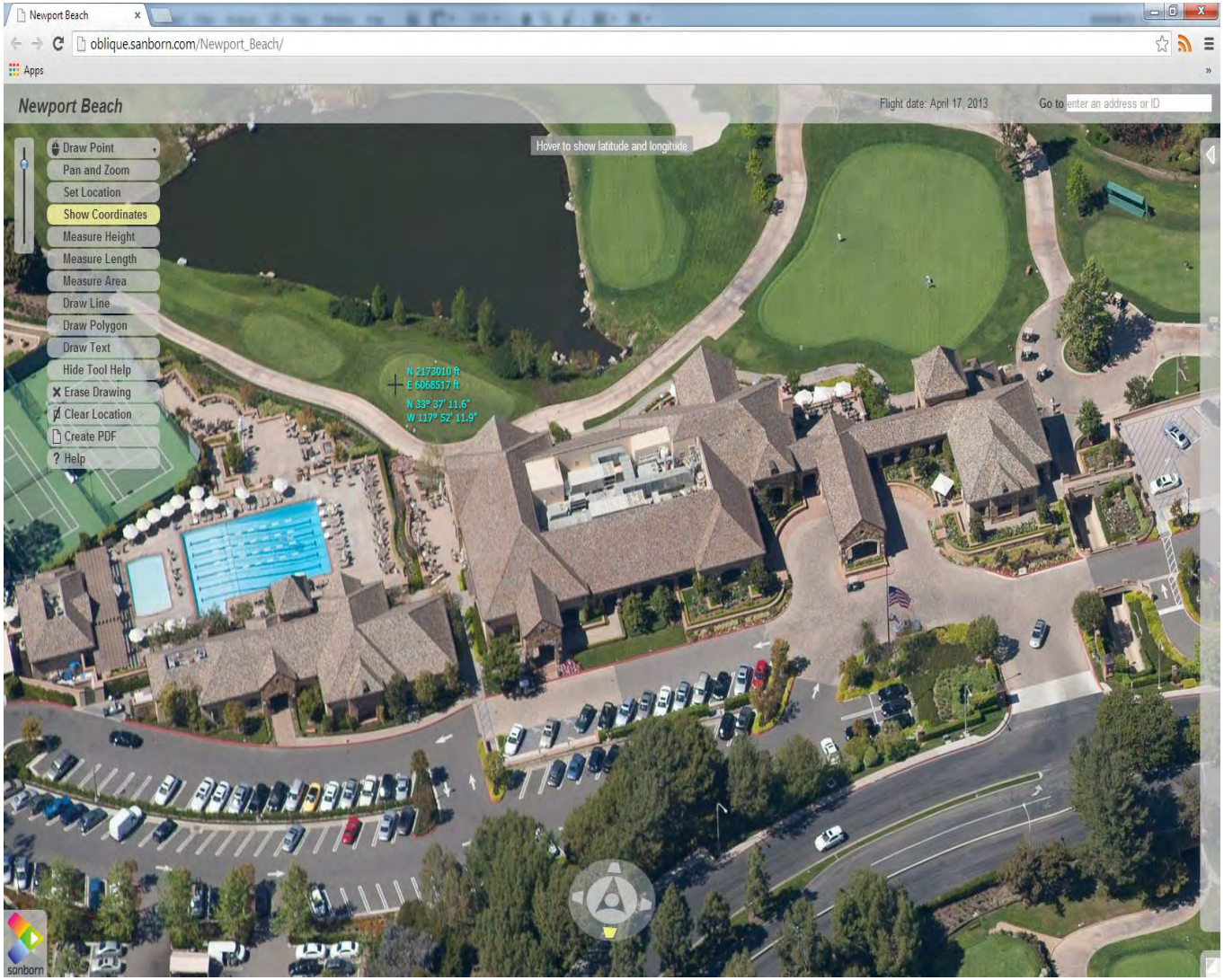
Oblique Analyst Functionality

Show Coordinates



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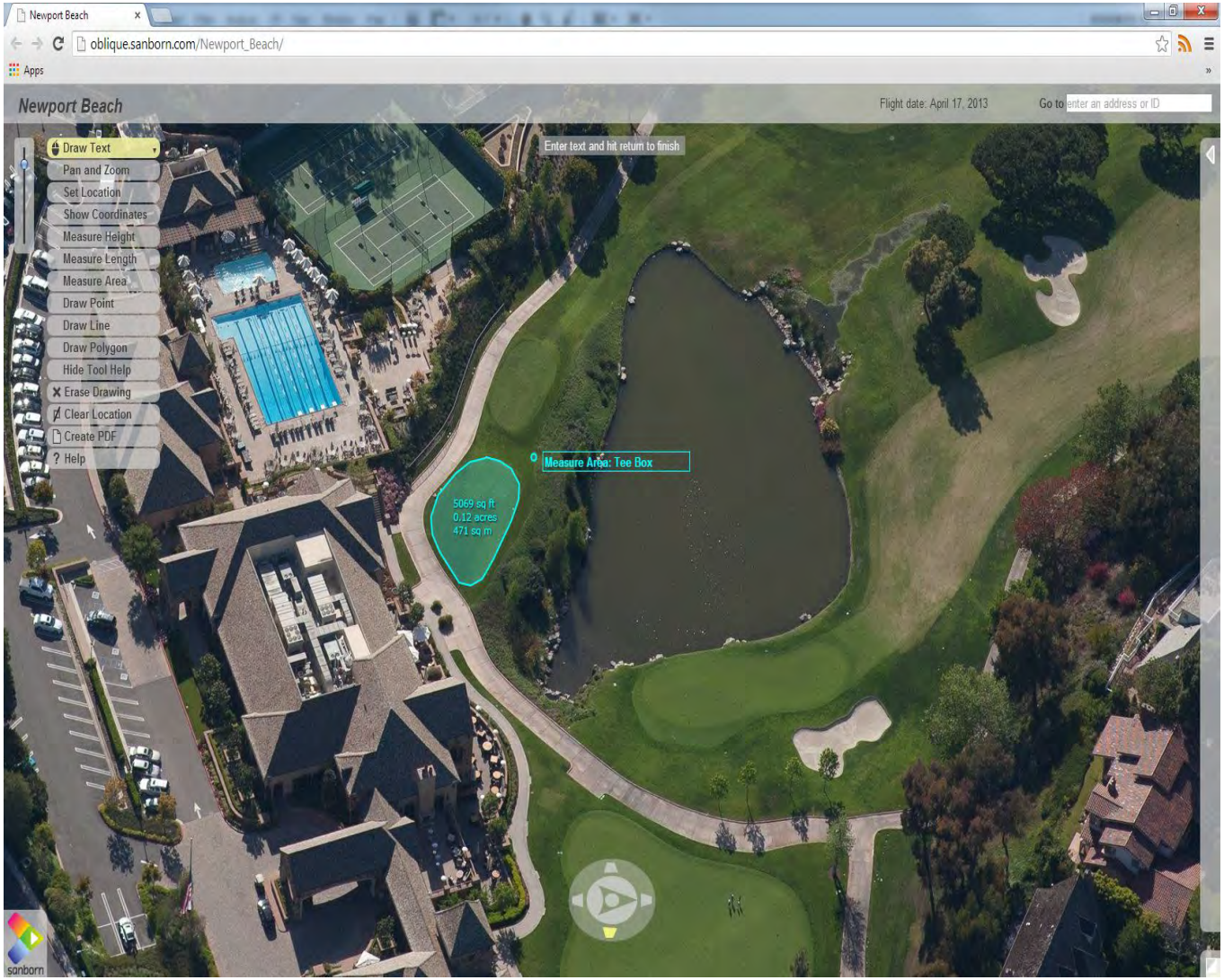
Oblique Analyst Functionality

Drawing and Text Annotation

Create points, lines, polygons, or input text on the image. Create a PDF from the image for easy distribution. Output includes measurements, drawings, and annotations.



8-inch Resolution

Dallas, Texas

3.7-inch Resolution

Dallas, Texas

2.5-inch Resolution

Dallas, Texas

Before and After Comparison

Moore, Oklahoma - Tornado Destruction – 2013

On May 20, 2013, an F5 tornado devastated a swath of the Oklahoma City suburb.
The storm destroyed homes, businesses and severely damaged a hospital and two elementary schools, leaving a trail of destruction in some spots that was as much as 1.3 miles wide and 17 miles long. This imagery depicts the before and after for an isolated area.

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3D Mesh Model

- High-resolution, textured, 3D mesh model made from 2D oblique images.
- End product is a true-3D (as opposed to 2.5D height maps), high-resolution, and photo-textured model

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