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CRCOG CAPITOL REGION COUNCIL OF GOVERNMENTS

Working together for a better region.

Capitol Region Council of Governments

2016 CT Statewide GIS Data Acquisition and Services

February 19, 2016 10:00 am

Presented by: Shawn Benham, PMP
Project Manager

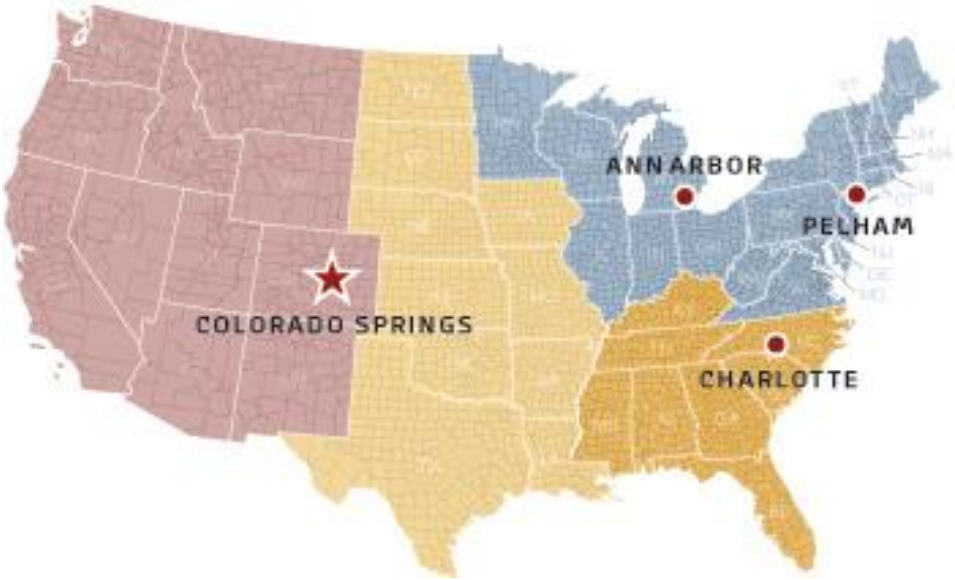
Brad Arshat, CP, EIT
Director, Strategic Accounts

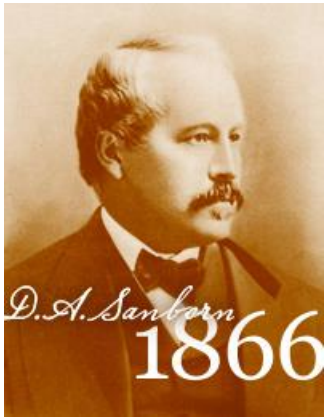
Agenda

1. Welcome & Introductions
2. Base Project Details
3. Buy-up Options
4. Contact information & Ordering
5. Questions?

Sanborn Company Overview

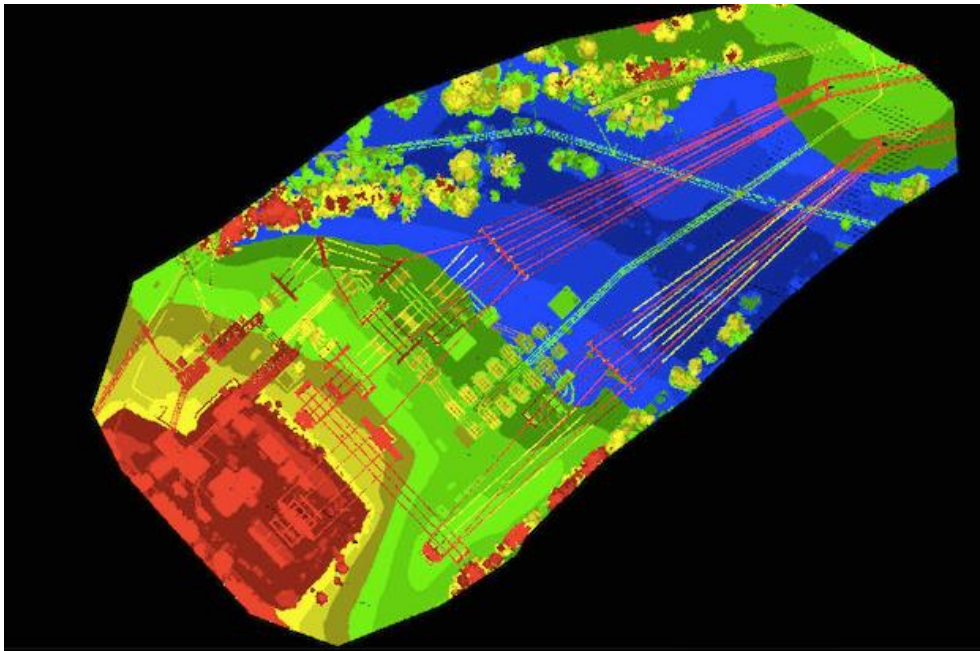
- Founded in 1866
  - Current Ownership – CEO & The Daily Mail
- Full service geospatial solution provider
  - Authentic and Accurate
- 125 employees in 4 offices nationwide
- An ISO 9001:2008 certified, quality-oriented company and culture





Long History with Geospatial Services

- Ground Survey *since 1866*
- Aerial Survey *since 1966*
- Digital Photogrammetric Mapping *since 1979*
- Digital Terrain Modeling *since 1984*
- First Successful Commercial Ortho *production system in the U.S. in 1988*
- LiDAR *collection and production since 1998*
- Digital Aerial Imagery *sensors since 2004*
- Mobile and Ground LiDAR *since 2010*
- Oblique Imagery *since 2012*
- Drone Programs *since 2013*



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CRCOG Program Overview

- 1-Year contract Sanborn / CRCOG
- Total Project Area ~ 5,100 mi² including 1/4 mile buffer
- Imagery: Orthos (4 band) @ 3” GSD
- LiDAR: USGS Base Spec v1.2 QL2
- Contours: 1-foot
- Range of buy-up options

- Spring, snow-free, leaf off collect
- Tide coordinated acquisition
- Building lean & shadow mitigation
- Geo-referencing - CT State Plane, NAD83, NAVD88, USFT
- Metadata, Reports, etc.
- Final delivery by end of 2016
- CRCOG has full & sole data rights

Horizontal Accuracy – Orthoimagery

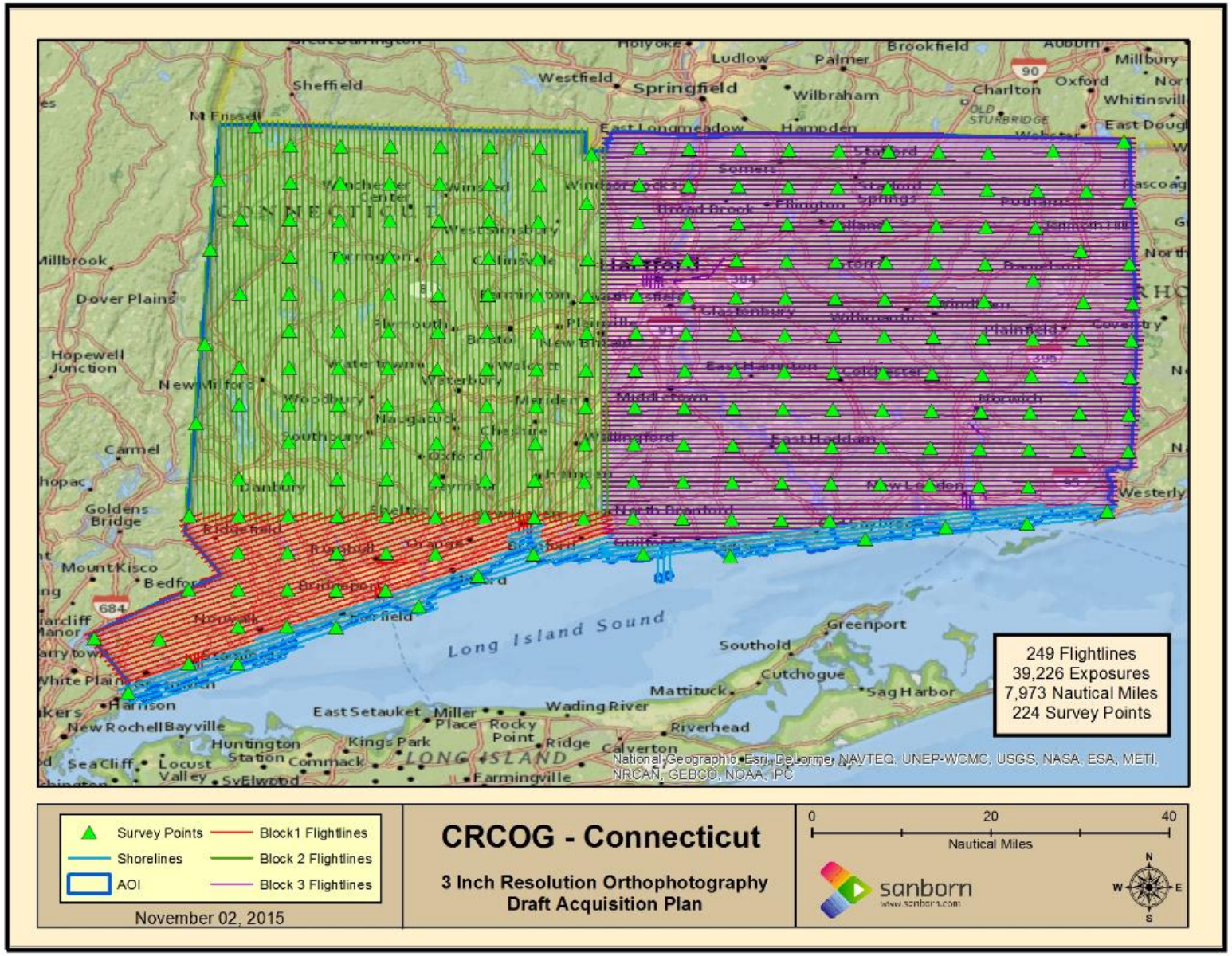
Per ASPRS Positional Accuracy Standards for Digital Geospatial Data (V1.0 - Nov. 2014)

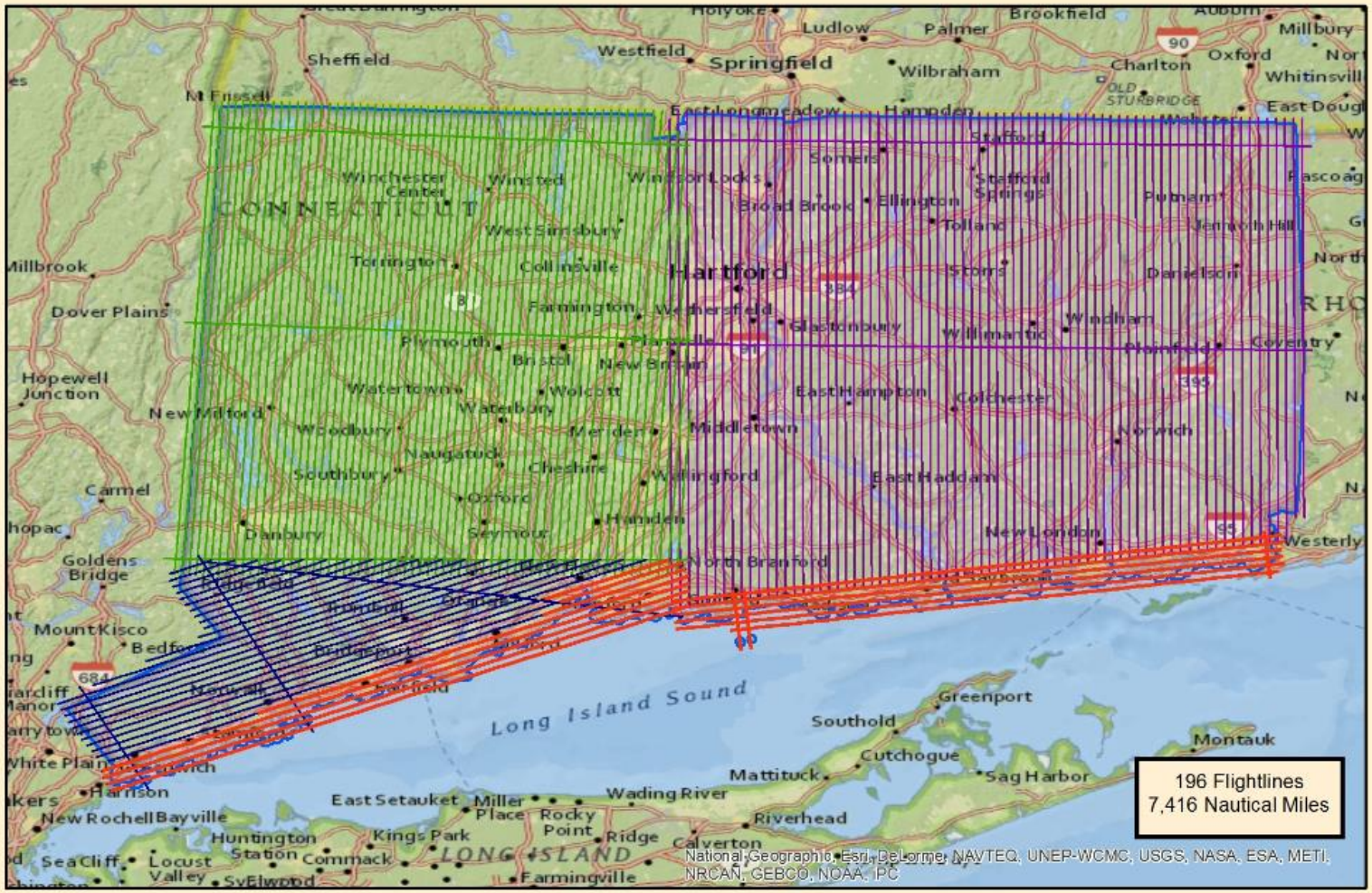
Horizontal Accuracy Class	RMSEx and RMSEy (cm)	RMSEr (cm)	Horizontal Accuracy at 95% Confidence Level (cm)
15 cm	***≤15***	***≤21.2***	***≤36.7***

USGS QL2 LiDAR Vertical Accuracy Requirements

Per USGS LiDAR Base Specification Version 1.2

Absolute Accuracy	
RMSEZ (non-vegetated) (cm)	***≤ 10.0***
NVA at 95-percent confidence level (cm)	***≤ 19.6***
VVA at 95-percent confidence level (cm)	***≤ 29.4***





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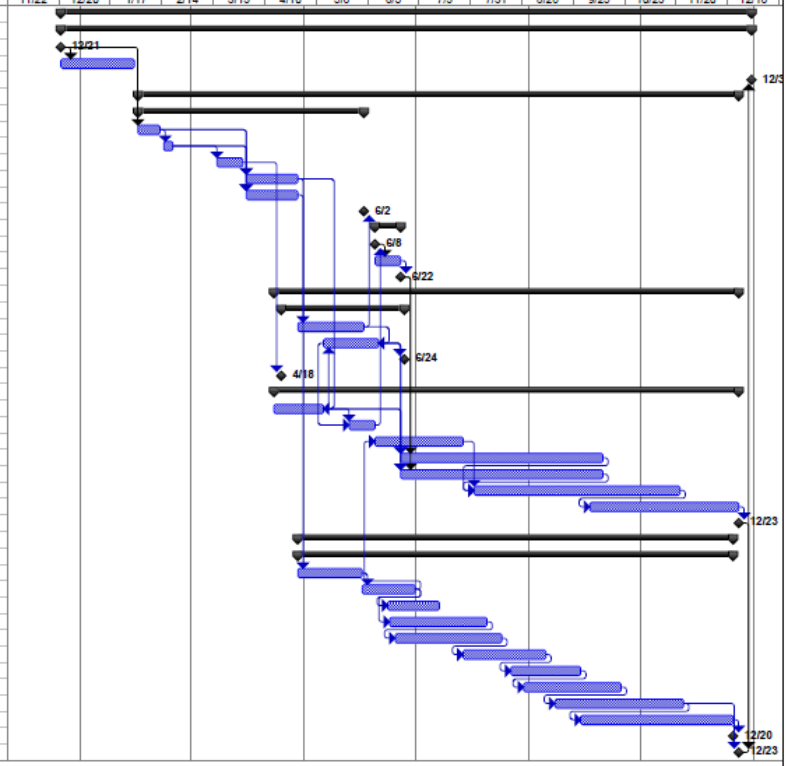
Project Schedule

Draft Schedule

CRCOG - Spring 2016 Statewide GIS Data Acquistion and Services

ID	Task Name	Start	Finish	Duration
1	**CRCOG - Spring 2016 GIS Data Acquisition and Services**	**Mon 12/21/15**	**Fri 12/30/16**	**270 days**
2	**Project Execution / Milestones**	**Mon 12/21/15**	**Fri 12/30/16**	**270 days**
3	Project Kickoff Meeting	Mon 12/21/15	Mon 12/21/15	0 days
4	Produce Project Work Plan	Mon 12/21/15	Fri 1/29/16	30 days
5	Project Closeout	Fri 12/30/16	Fri 12/30/16	0 days
6	**Production Timeline**	**Mon 2/1/16**	**Fri 12/23/16**	**235 days**
7	**Acquisition**	**Mon 2/1/16**	**Thu 6/2/16**	**89 days**
8	Acquisition Planning	Mon 2/1/16	Fri 2/12/16	10 days
9	Review/Approve Flight & Control Plans	Mon 2/15/16	Fri 2/19/16	5 days
10	Panel/Survey Ground Control	Tue 3/15/16	Mon 3/28/16	10 days
11	Image Acquisition Window (weather permitting)	Thu 3/31/16	Wed 4/27/16	20 days
12	LIDAR Acquisition Window (weather permitting)	Thu 3/31/16	Wed 4/27/16	20 days
13	Deliver Acquisition Reports/Documents	Thu 6/2/16	Thu 6/2/16	0 days
14	**Pilot Deliveries**	**Wed 6/8/16**	**Wed 6/22/16**	**10 days**
15	Deliver Pilot (LIDAR, DEM, Orthoimagery, Contours)	Wed 6/8/16	Wed 6/8/16	0 days
16	CRCOG Pilot Review - (LIDAR, DEM, Orthoimagery, Contours)	Thu 6/9/16	Wed 6/22/16	10 days
17	Approve Pilot (LIDAR, DEM, Orthoimagery, Contours)	Wed 6/22/16	Wed 6/22/16	0 days
18	**3-in Orthoimagery**	**Fri 4/15/16**	**Fri 12/23/16**	**181 days**
19	**Aerotriangulation (AT)**	**Mon 4/18/16**	**Fri 6/24/16**	**49 days**
20	GPS/IMU Data Processing	Thu 4/28/16	Thu 6/2/16	26 days
21	Produce AT Solution	Thu 5/12/16	Fri 6/10/16	22 days
22	Deliver AT Report, Raw Imagery, and Associated Files	Fri 6/24/16	Fri 6/24/16	0 days
23	Deliver Ground Control Report and Associated Files	Mon 4/18/16	Mon 4/18/16	0 days
24	**DEM, Orthoimagery, Contours**	**Fri 4/15/16**	**Fri 12/23/16**	**181 days**
25	Process Aerial Imagery	Fri 4/15/16	Wed 5/11/16	19 days
26	Produce Pilot (DEM, Orthoimagery, Contours)	Thu 5/26/16	Wed 6/8/16	10 days
27	Generate/Classify LIDAR Digital Terrain Model	Thu 6/9/16	Tue 7/26/16	34 days
28	Process Orthoimagery	Thu 6/23/16	Mon 10/10/16	78 days
29	Process Contours	Thu 6/23/16	Mon 10/10/16	78 days
30	Delivery of Orthos/Contours by Block	Tue 8/2/16	Mon 11/21/16	80 days
31	QC/Corrections/Edits (If Required)	Tue 10/4/16	Fri 12/23/16	59 days
32	Final Orthoimagery Mosaic & Contour Delivery Complete	Fri 12/23/16	Fri 12/23/16	0 days
33	**QL2 LIDAR Production**	**Thu 4/28/16**	**Tue 12/20/16**	**169 days**
34	**LIDAR Processing**	**Thu 4/28/16**	**Tue 12/20/16**	**169 days**
35	Data Calibration and Adjustment	Thu 4/28/16	Wed 6/1/16	25 days
36	LIDAR Classification	Thu 6/2/16	Thu 6/30/16	21 days
37	Edit/QC LAS data	Thu 6/16/16	Wed 7/13/16	20 days
38	Compile Breaklines	Fri 6/17/16	Mon 8/8/16	37 days
39	QC Compiled Data	Mon 6/20/16	Tue 8/16/16	42 days
40	Breakline Editing	Wed 7/27/16	Fri 9/9/16	33 days
41	Produce Hydro Flattened DEM	Mon 8/22/16	Wed 9/28/16	28 days
42	LIDAR Product Finalization	Mon 8/29/16	Thu 10/20/16	39 days
43	LIDAR Deliveries by Block	Thu 9/15/16	Wed 11/23/16	50 days
44	QC/Corrections/Edits (If Required)	Thu 9/29/16	Tue 12/20/16	59 days
45	Final LIDAR Delivery Complete	Tue 12/20/16	Tue 12/20/16	0 days
46	**Final Reports, Metadata, Ancillary Data Delivery**	Fri 12/23/16	Fri 12/23/16	1 day



Date: Tue 11/3/15 | Task | Milestone | Summary

Page 1

Final production schedule is subject to revision pending finalization of provisional products and deliverable extents.
Acquistion window is dependent on ground and weather conditions in the project area.

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Base Ortho Product

- Statewide coverage
- 3-inch resolution
- 4 band (R,G,B,NIR)
- 1,250’ by 1,250’ tiles
- GeoTIFF and MrSID tiles
- MrSID mosaics for each Town
- Hosting by UConn
- No cost to CRCOG’s CT partner agencies

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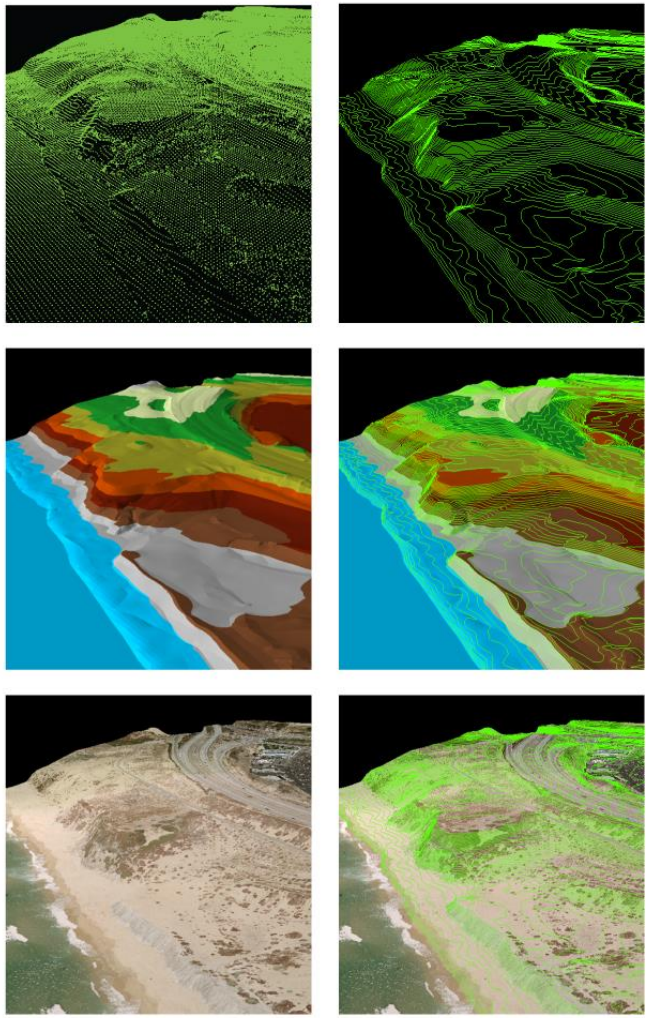
Base LiDAR Product



- Statewide coverage
- USGS LBS V1.2 QL2 – 2 points per square meter
- Ground/non-ground classification
- Hydro-flattened
- Bare earth DEM
- 1-foot & 5-foot contours
- Intensity images
- Hosting by UConn
- No cost to CRCOG's CT partner agencies

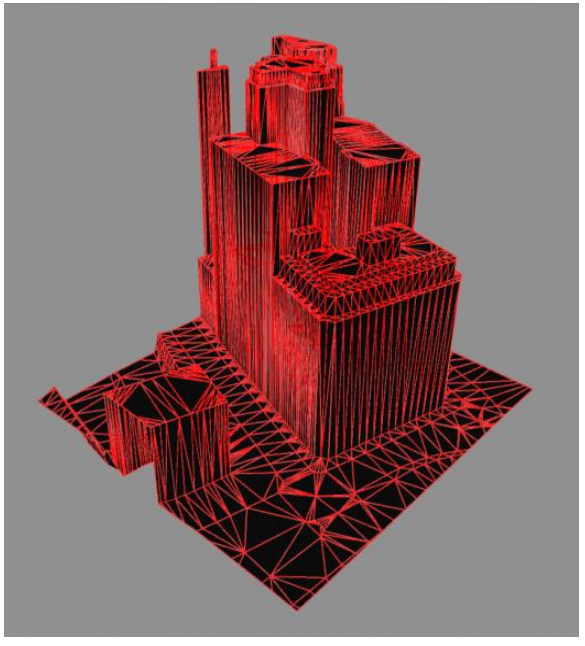
Summary of Base LiDAR Data Deliverables	
Deliverable	**Description**
Raw Point Cloud	▪ LAS V1.4 format ▪ ASCII format
Classified point cloud	▪ LAS V1.4 format ▪ ASCII format ▪ Classification per USGS LBS V1.2
Bare Earth DEM	▪ 1-meter cell size ▪ Delivery in GeoTIFF format ▪ Delivery in Esri Raster format ▪ Hydro-flattened surface per LBS V1.2
Hydro Breaklines	▪ Esri Geodatabase format
Contours (1-foot and 5-foot)	▪ Esri Geodatabase format
Intensity Images	▪ Tiled delivery ▪ 8-bit grey scale GeoTIFF

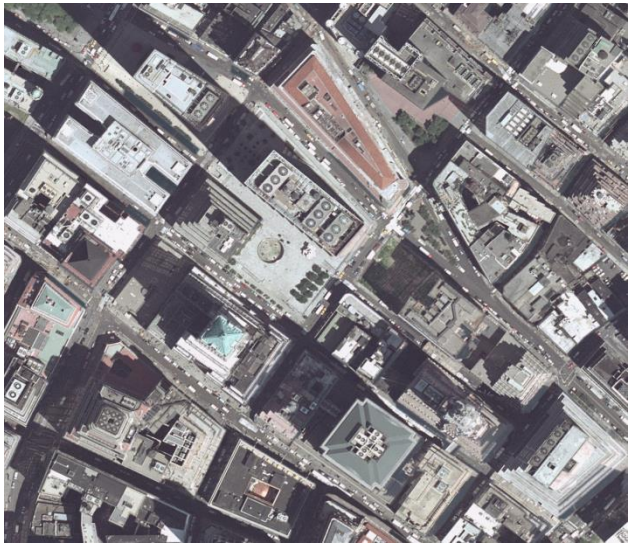
Buy-up Overview

- Each agency contracts independently with Sanborn for buy-ups:
  - True orthophotography
  - QL1 LiDAR
  - Oblique Imagery
  - Planimetric data
  - LiDAR derivatives
    - digital surface model
    - enhanced classification of point cloud
    - hydro conditioning & enforcement
  - Building extraction from LiDAR
  - 3D building models
  - Others

True Orthophotography

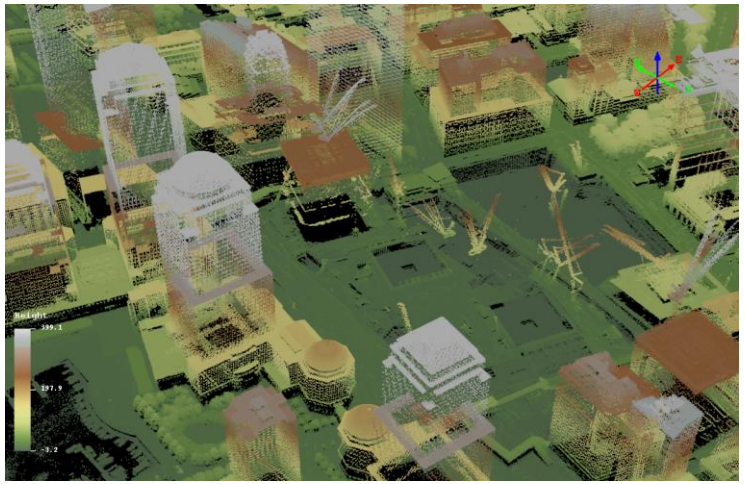
- A consideration in urban cores with tall buildings
- Orthorectifies buildings, not just the terrain surface – removes all "building lean".
- In addition to putting each building in true map position, it helps expose otherwise hidden "urban canyons".
- Requires supplemental high-overlap imagery, and high sun-angle acquisition time
- Sanborn must be informed prior to airborne data acquisition proceeding for this option
- Cost is $2,225 per square mile





QL-1 LiDAR Upgrade

- Point density is 8 pts/m² instead of 2 pts/m² at QL-2
- Per USGS LBS v1.2 – LiDAR point accuracy is the same at QL1 & QL2
- Typically used for specialized applications where enhanced surface definition is needed – detailed structure modeling, vegetation canopy, geological faults, powerline detection, etc.
- Sanborn must be informed prior to airborne data acquisition proceeding for this option



Upgrade to QL-1 LiDAR		
Area	**Cost**	**Unit**
Up to 10 sq miles	$ 8,362.42	Fixed fee/minimum
11 - 19	$ 836.24	per square mile
20 - 49	$ 494.29	per square mile
50 - 249	$ 263.99	per square mile
250-499	$ 202.91	per square mile

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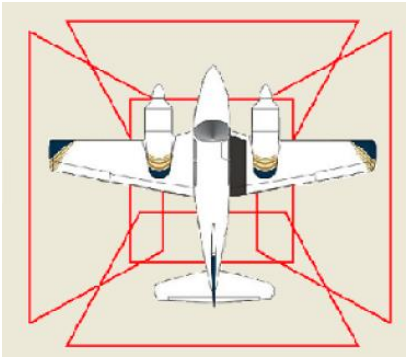
Sanborn Oblique Imagery

- Full-color imagery provides complete 5-view coverage your chosen project area
  - 4 oblique views (45 degrees) + 1 vertical
- Sanborn's offering successfully deployed in the marketplace for 4 years
- Available resolutions from 2 inches to 12 inches+
- Licensed product, but:
  - No usage, sharing or deployment restrictions
  - No "per seat" costs
  - Right to use never expires
- Two methods to view oblique imagery – Sanborn's browser based viewer/analyst or ArcGIS desktop extension
- This is a custom flight mobilization



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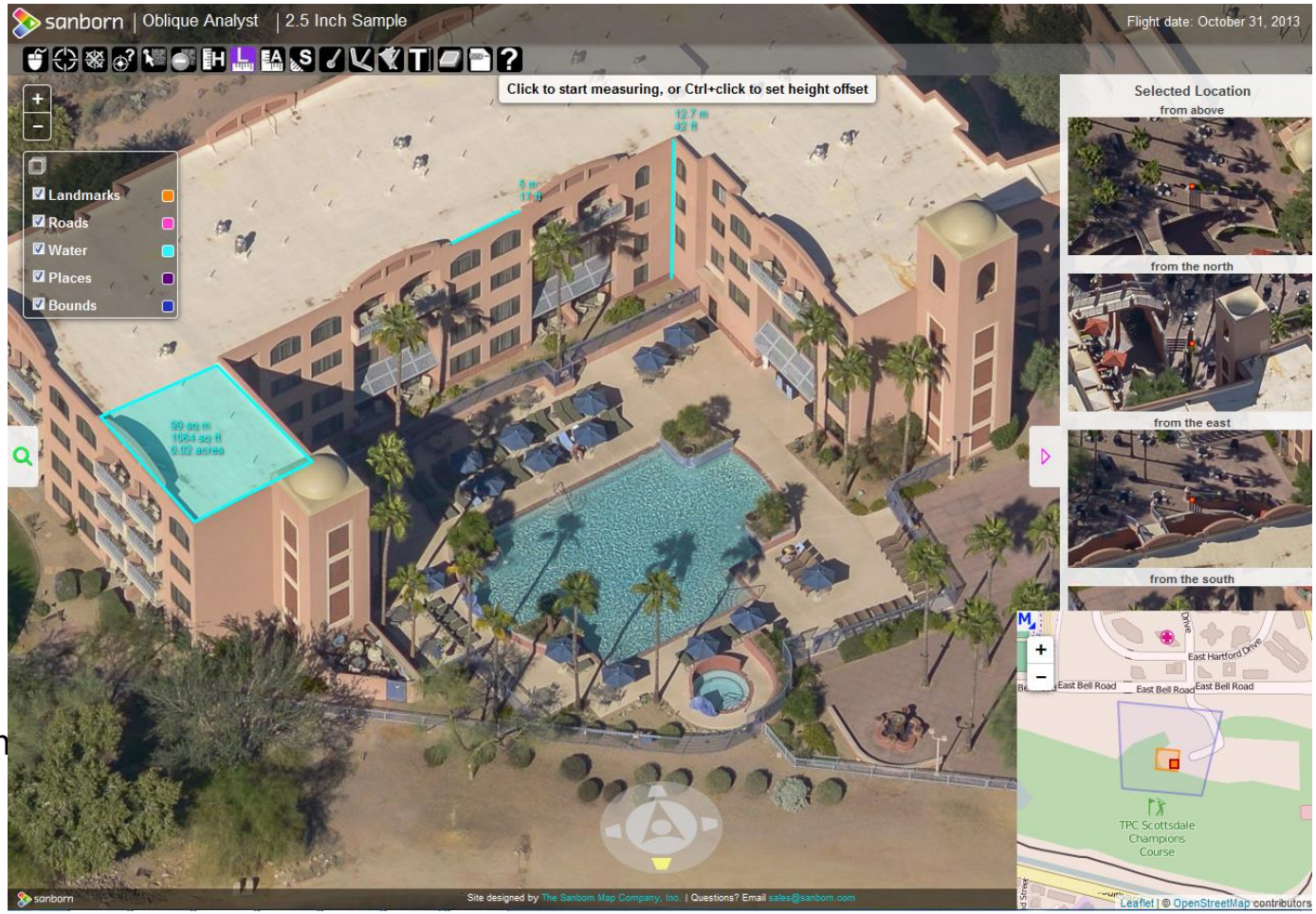
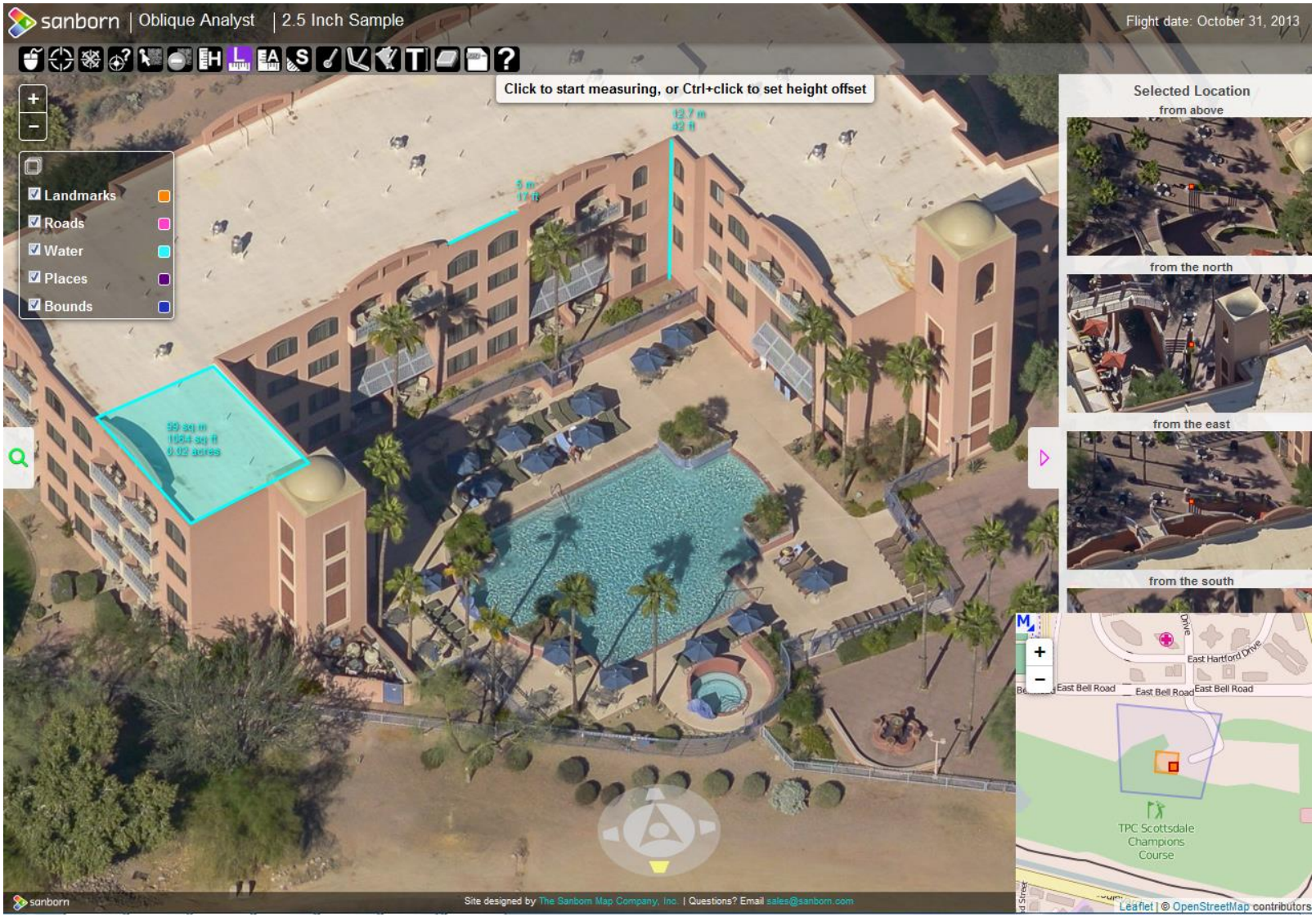
Sanborn Oblique Analyst®

Capabilities include:

- Search by address
- Search by Parcel ID Number
- Pan, zoom
- Set a location
- Show coordinates
- Measure Height
- Measure Length
- Measure Area
- Measure Slope
- Draw (add) Point
- Draw (add) Line
- Draw (add) Polygon
- Draw (add) Text
- Erase Drawings
- Clear Location
- Create PDF
- Ingest shapefiles
- Help Documentation



- Can be integrated with CAMA and E911 CAD systems
- Custom services such as change detection, data hosting, are also available



Sanborn Oblique Analyst® Demo Links:

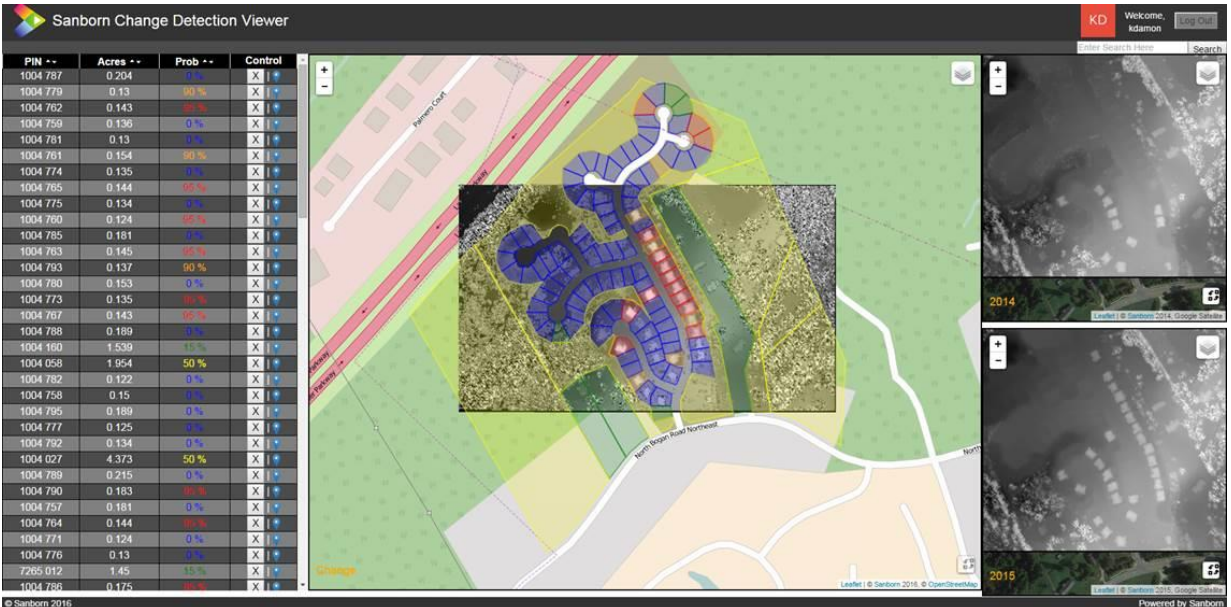
https://oblique.sanborn.com/25sample_new/

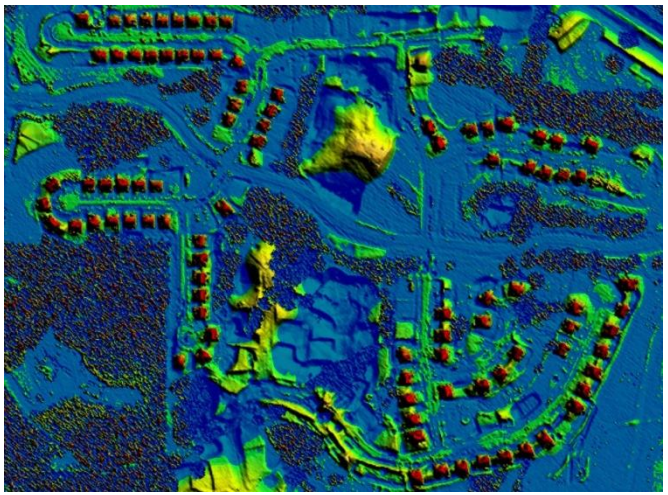
https://oblique.sanborn.com/4sample_new/

https://oblique.sanborn.com/6sample_new/

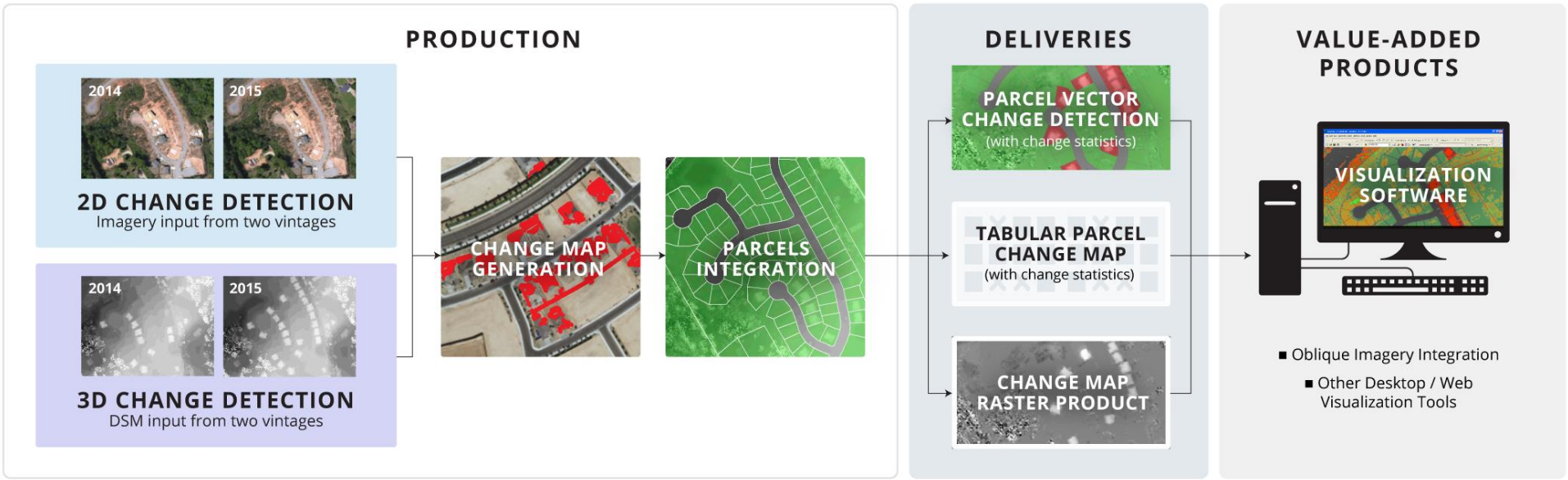
Data Maintenance

- Update Mapping
- Change Detection
- Database Integration
- Ongoing and live update capable
- Full reporting





Change Detection Process



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Oblique Imagery Chart Pricing Based on Contiguous Area								
Resolution	Square Miles	Up to 10 sq miles (Fixed cost - Includes Mobilization)	11 to 19 (Add Mob)	20 - 49 (Add Mob)	50 - 249 (Add Mob)	250-499 (Add Mob)	500-999 (Add Mob)	1000+ (Add Mob)
3"	Georeferenced Vertical	$ 10,880.00	$ 1,088.00	$ 675.00	$ 525.00	$ 400.00	$ 385.00	$ 370.00
	Ortho Vertical (Option)	$ 3,720.00	$ 372.00	$ 274.00	$ 193.00	$ 126.00	$ 117.00	$ 107.00
4"	Georeferenced Vertical	$ 9,590.00	$ 959.00	$ 595.00	$ 425.00	$ 350.00	$ 325.00	$ 310.00
	Ortho Vertical (Option)	$ 2,580.00	$ 258.00	$ 180.00	$ 121.00	$ 75.00	$ 68.00	$ 62.00
6"	Georeferenced Vertical	$ 8,450.00	$ 845.00	$ 475.00	$ 375.00	$ 305.00	$ 250.00	$ 235.00
	Ortho Vertical (Option)	$ 1,670.00	$ 167.00	$ 107.00	$ 67.00	$ 37.00	$ 32.00	$ 29.00
9"	Georeferenced Vertical	$ 8,350.00	$ 835.00	$ 460.00	$ 325.00	$ 250.00	$ 150.00	$ 120.00
	Ortho Vertical (Option)	$ 910.00	$ 91.00	$ 50.00	$ 30.00	$ 20.00	$ 15.00	$ 13.00
12"	Georeferenced Vertical	$ 8,200.00	$ 820.00	$ 440.00	$ 300.00	$ 225.00	$ 125.00	$ 95.00
	Ortho Vertical (Option)	$ 740.00	$ 74.00	$ 38.00	$ 21.00	$ 13.00	$ 9.00	$ 8.00

1) Mobilization is $10,000, and is paid only once per flight season and can be divided among an unlimited number of participants.
2) Areas under 10 square miles are fixed fee, and include the cost of the flight mobilization.
3) Contiguous blocks need not respect political boundaries for pricing.
4) Imagery delivery includes ArcGIS plug-in at no additional cost. Browser-baser viewer/analyst app is optional.
5) If orthorectified vertical images are desired, the cost must be added to the cost for the default georeferenced vertical imagery.
6) Sanborn Oblique Analyst® cost is $14,000. Optional maintenance is $2,900 per year starting in Year 2.
7) Option data hosting is $500 per month.

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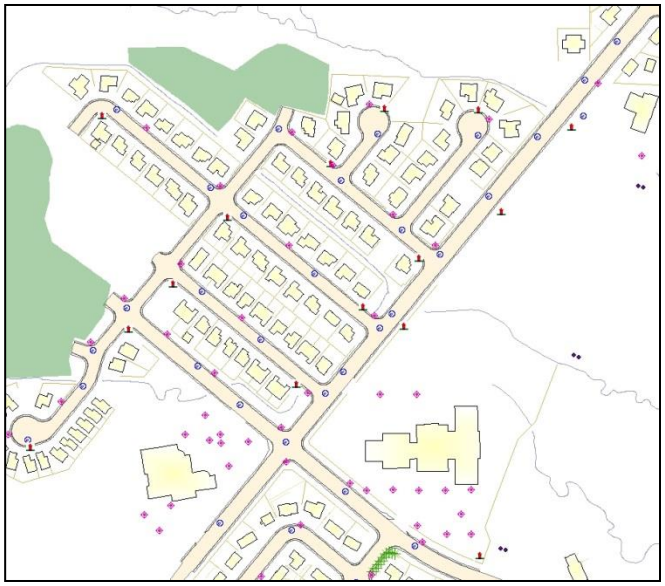
Planimetric Mapping



- Vector mapping of visible features
- Fully customizable data sets – can be complete mapping or selected features only, e.g. buildings
- Formatted to your database design specifications
- All feature data extraction performed using stereo-photogrammetric techniques – no “heads up digitizing” from orthos
- Engineering design accuracy: 6-inches RMSE
- GIS or CAD data formats, 2D or 3D
- Old data sets are often cheaper to replace than to update
  - Searching for changes takes a lot of time
  - Specs of legacy data are often unknown
- Pricing is highly scope and feature density dependent – custom quotes will be provided

<u>Pricing</u>

- Setup/Minimum: $2,500
- Buildings only: $0.41/ea
- Range can vary from <$1,500 to >$4,100/mi²
- Data set required by typical town will run in the $2,600 to $2,900/mi² range
- Please request custom quote

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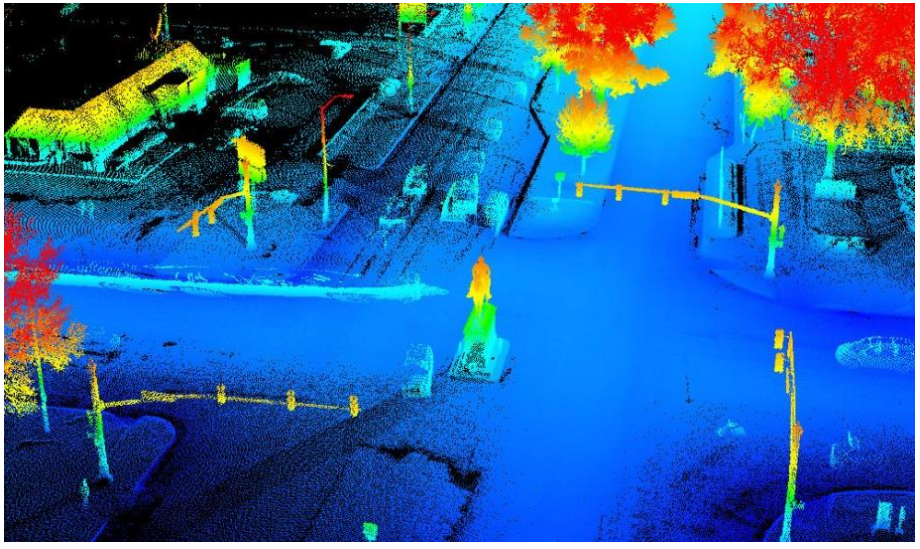
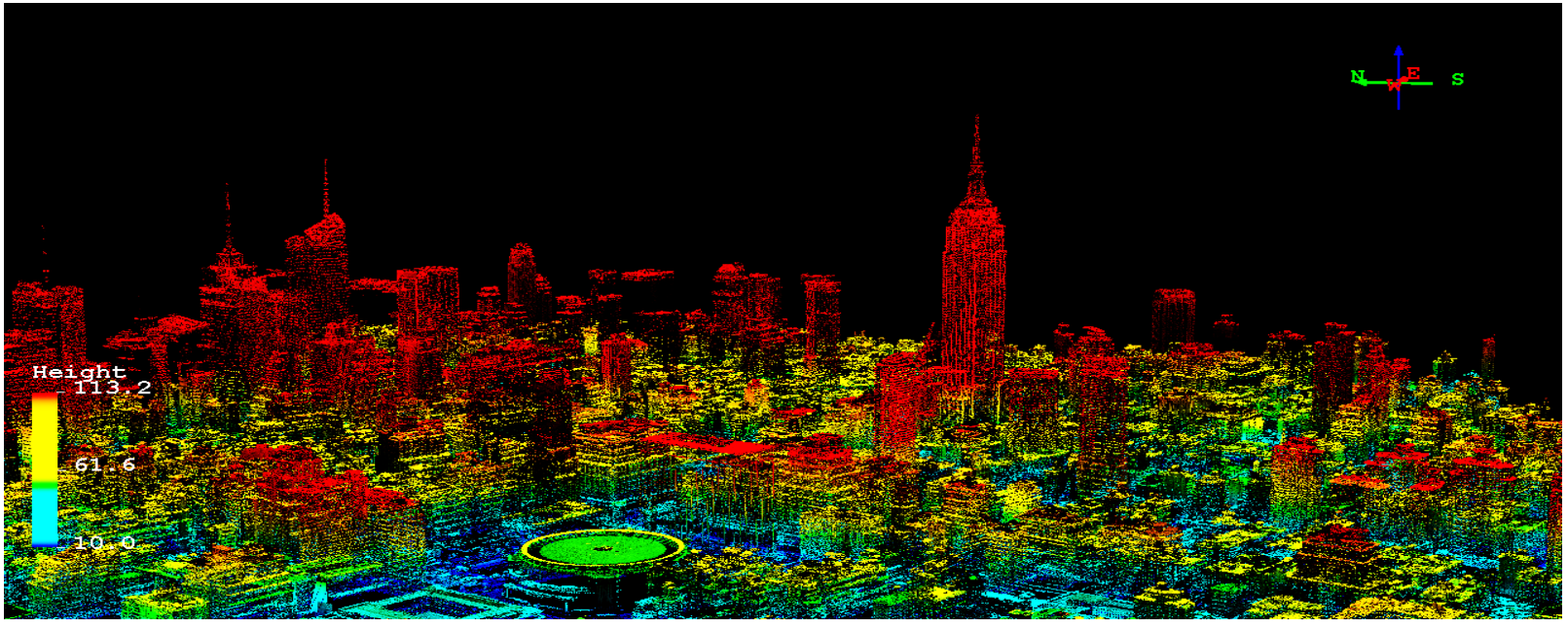
LiDAR Digital Surface Model (DSM)



- A DSM represents the first return or first strike of all LiDAR points
- Includes all above ground features, as well as unobstructed terrain
- Line of site analysis, wireless signal propagation, airport obstruction studies
- Cost is $700 + $2/mi²



Enhanced LiDAR Point Cloud Classification

- The classification process discriminates raw LiDAR points into defined categories
- The objective for USGS LBS v1.2 and the CRCOG program is mainly to separate ground points from non-ground points
- Custom, enhanced classification schemes can discriminate buildings, vegetation, etc.
- Cost is function of complexity of classification scheme and feature density.

USGS LBS v1.2 Classification Requirement	
Class 1	Processed but unclassified
Class 2	Bare earth
Class 7	Low noise
Class 9	Water
Class 10	Ignored ground
Class 17	Bridge decks
Class 18	High noise

Sample Enhanced Classification Scheme	
Class 1	Processed but unclassified
Class 2	Bare earth
Class 3	Low Vegetation
Class 4	Medium Vegetation
Class 5	High Vegetation
Class 6	Building
Class 7	Low noise
Class 9	Ignored ground
Class 17	Bridge decks
Class 18	High noise

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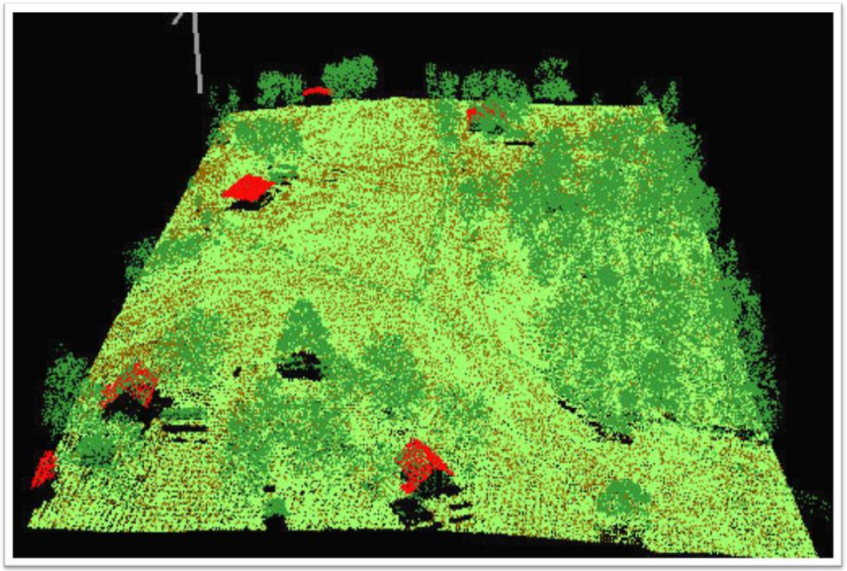
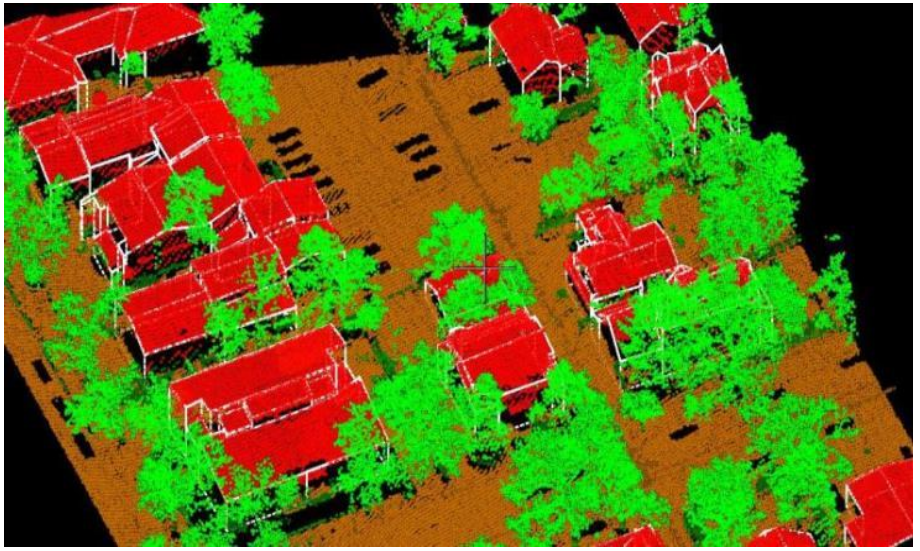
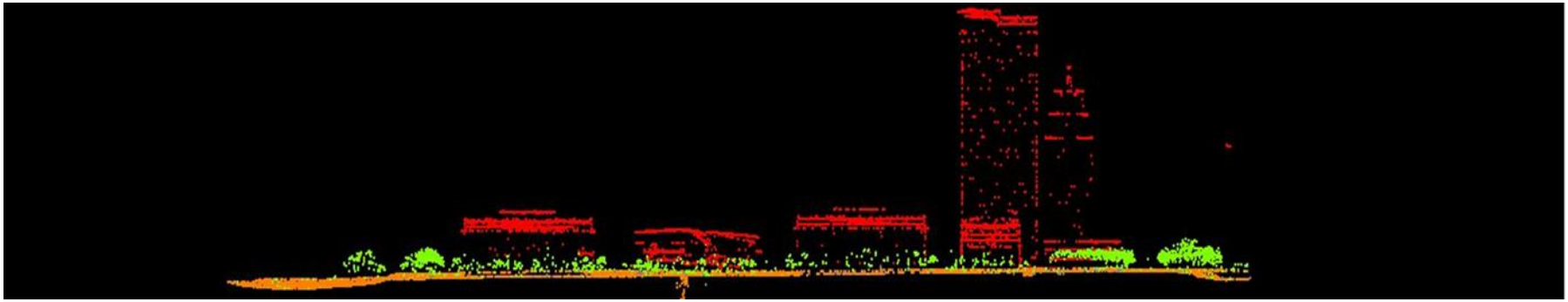
Enhanced LiDAR Point Cloud Classification

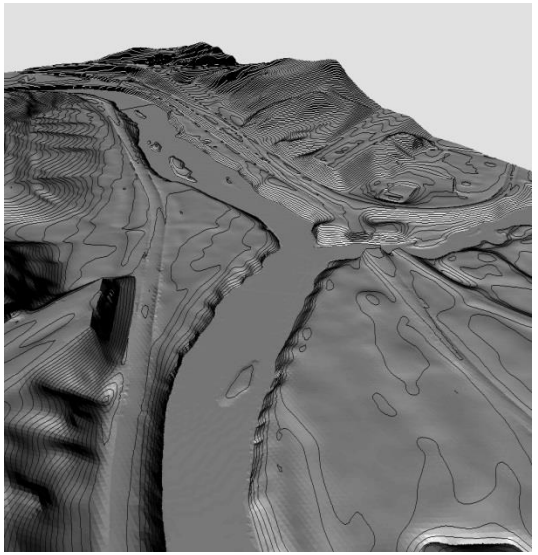


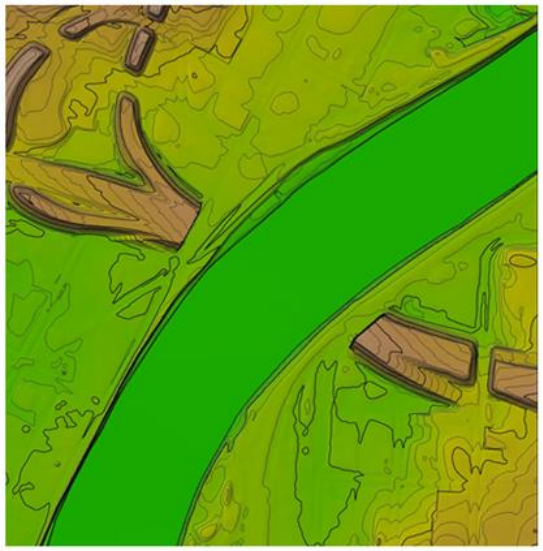




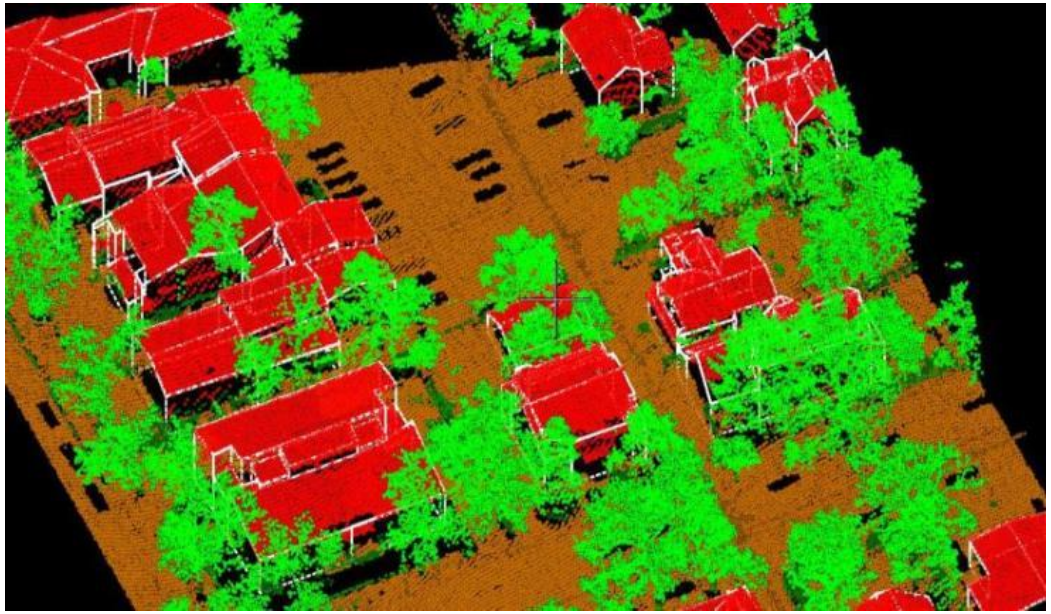
LiDAR Hydro Conditioning and Enforcement

- Hydro Conditioning and Enforcement produce hydrologic, not topographic surfaces, and:
  - Are used for hydrological modeling, not topographic mapping
  - Are NOT a goal or requirement of USGS LBS v1.2
- Hydro Conditioning:
  - Ensures that the flow of water is continuous across the entire terrain surface, whether water flow is in a stream channel or not
  - Includes removal of all spurious sinks or pits in the terrain surface
- Hydro Enforcement
  - Applies to mapped drainage features such as lakes, streams, and culverts, not the overall terrain surface
  - Similar to hydro-flattened surface, but includes the removal of terrain over culverts, and other obstructions to hydrologic continuity, and additional breakline enhancement to ensure accurate flow modeling
- Cost is $7.36 per square mile

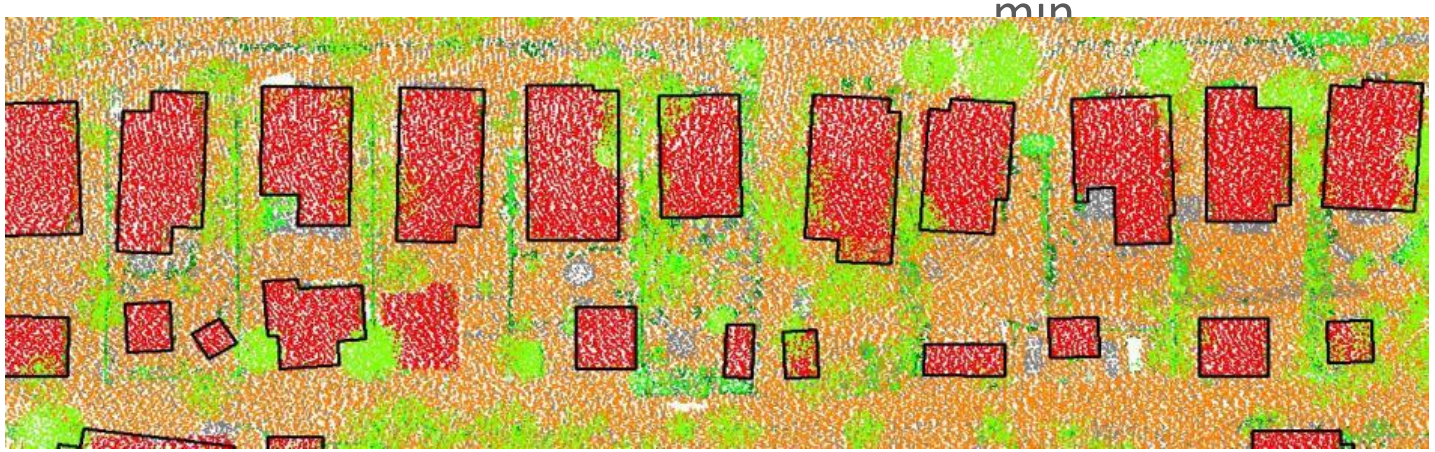




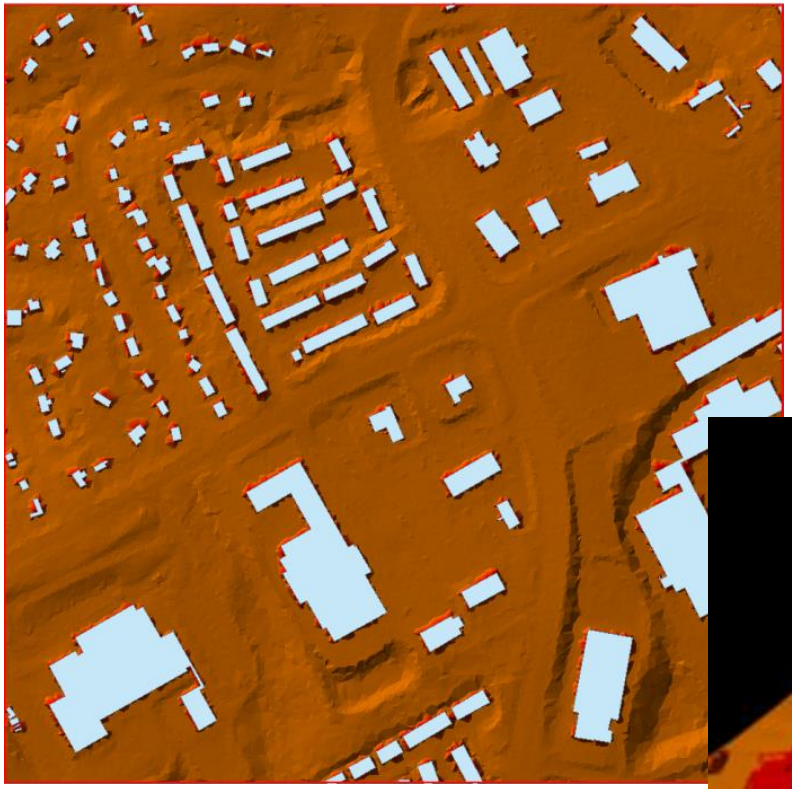
Building Extraction from LiDAR

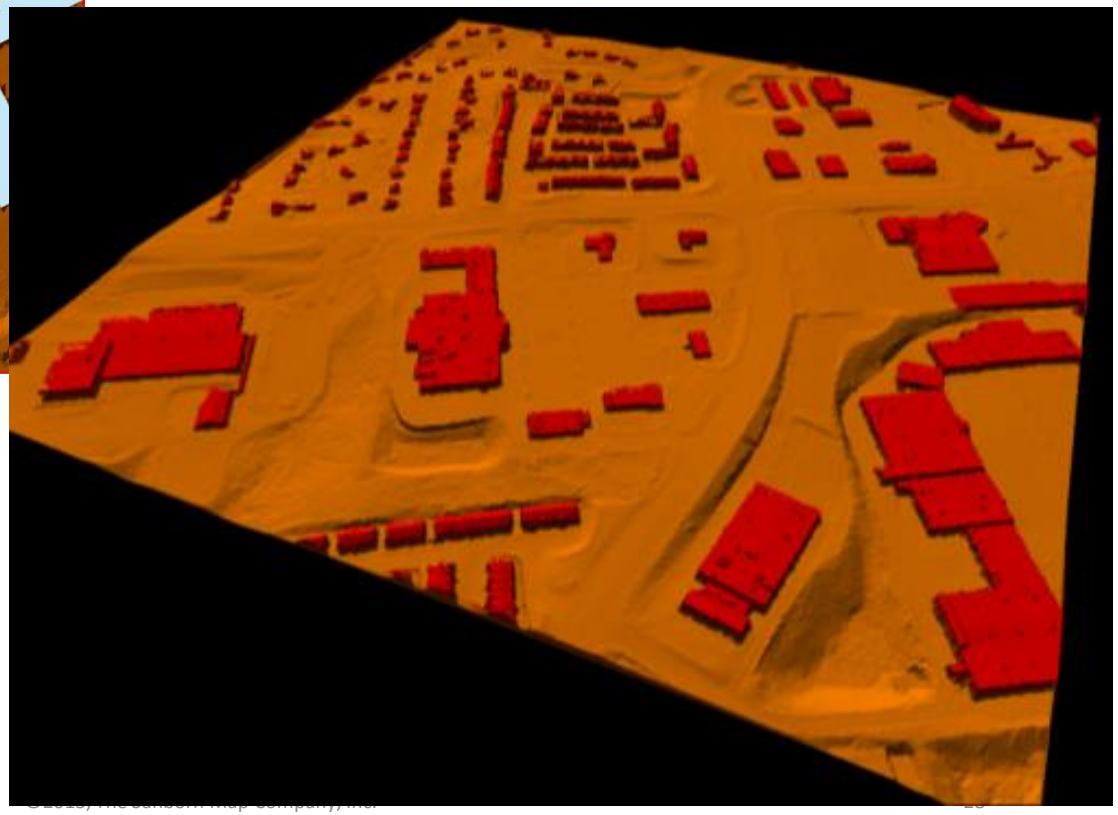


- Can be 2D outlines or 3D wire frames
- Rapid and cost effective compared to imagery-based stereo photogrammetric or heads-up digitizing techniques
- Semi-automated process
- 80-90% geometric accuracy
- GIS and CAD formats
- Cost is $0.16/building, $2,500 min



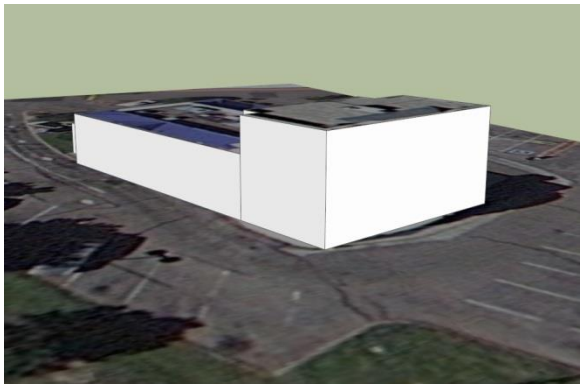
Building Extraction from LiDAR



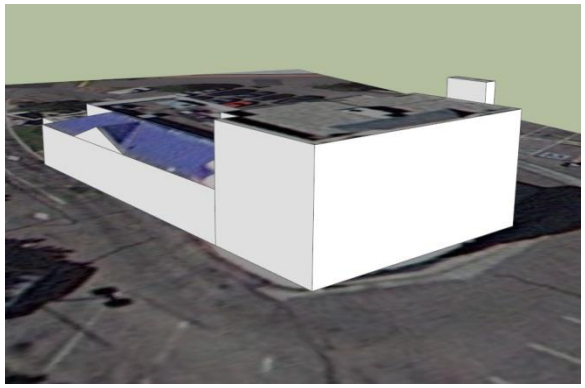


3D Building Models

Untextured Geometry



LOD1



LOD2

LOD3

Wide range of deliverable formats, including SketchUp (SKP), Collada (DAE), CityGML (XML), or TerraExplorerPro (XPL2)

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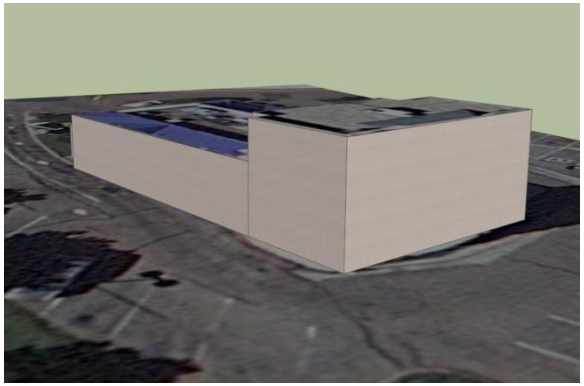
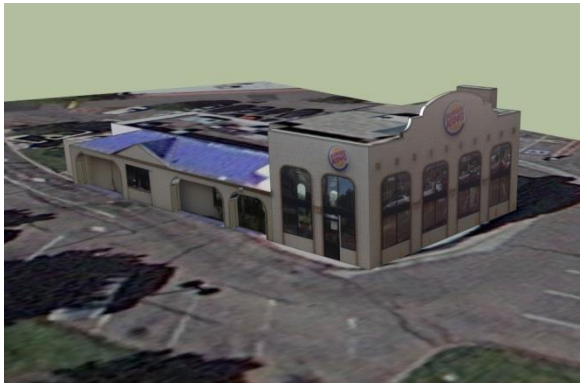
3D Building Models

Textured Geometry

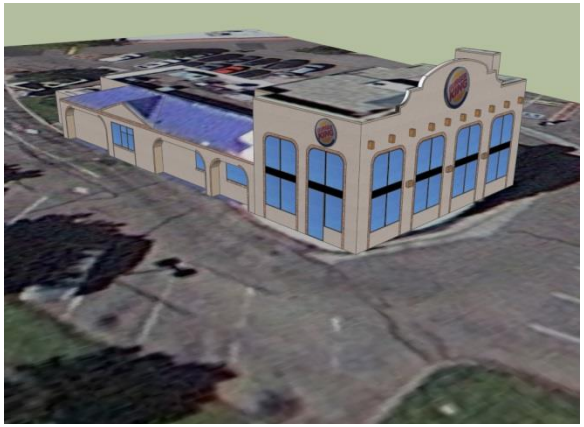


LOD1 – Representative texture

LOD2 – Photo-realistic texture



LOD3 – Photo-realistic texture



LOD3 – Sanborn GeoFeature Modeling™

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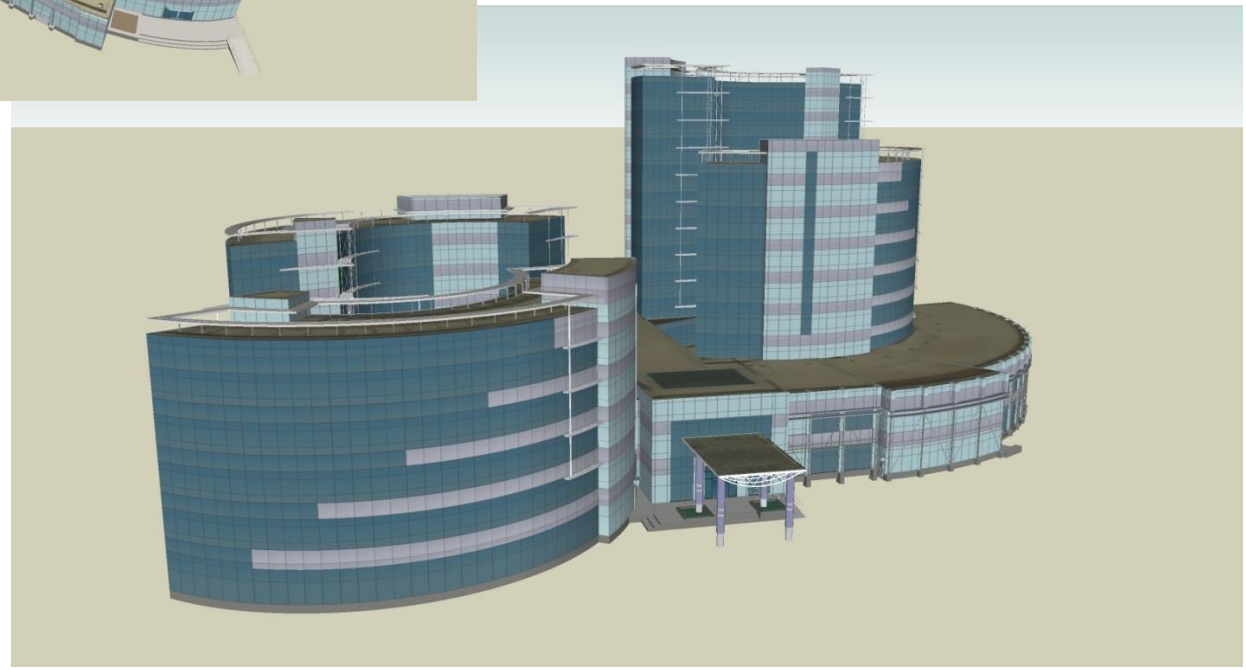
3D Buildings Models

Full architectural geometric detailing

Texturing from oblique aerial or terrestrial photography



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Contact Information

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Email: sbenham@sanborn.com

Brad Arshat (Sanborn)

Price Quotations, Technical Information, Contracts Liaison

Cell: 443-603-7725

Email: barshat@sanborn.com

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Price Quotations, Ordering, Contracting

1 - Contact Brad Arshat (Sanborn)

Email: barshat@sanborn.com

Cell: 443-603-7725

2 - Define Area of Interest and Scope of Work

- Shapefile for boundary or tile grids are preferred
- Sanborn will provide any needed technical information, price quotation

3 – Purchase Order or Contract

- Can use agency or Sanborn contract
- Acquisition-dependent buy-ups must be confirmed no later than xx/xx/16
- Other buy-ups can be ordered any time

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Thank you for your time!

Successful Project History

Proven Project Management

ISO Certified Production Processes

Robust Software and IT Infrastructure

State of the Art Sensor Technology

Highly Qualified Human Resources

Acquisition and Production Experience