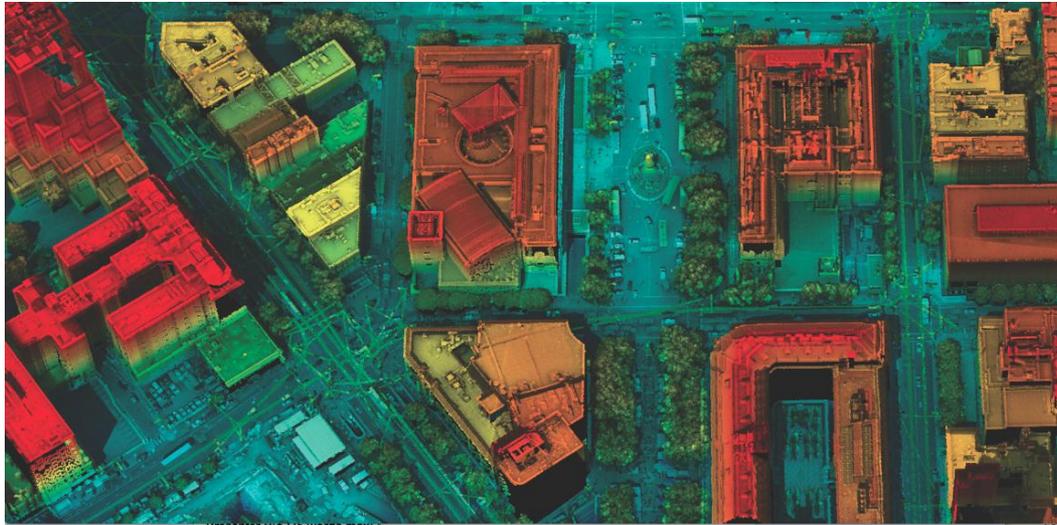


**quantum**  
SPATIAL

Case Study: rapid IA  
damage assessments



JACIE 2014



# The Power of 3



the future is quantum





## DHS awarded four (4) contracts in 2013



Geospatial Management Office  
Department of Homeland Security

### Remote Sensing Contracts

Aerial Imagery for Incident Management

Airborne imagery and elevation data are essential inputs for the accurate characterization of current conditions in an area of interest. Though many requirements for imagery can be fulfilled through the use of commercial satellite platforms, airborne imagery supports the development of imagery at much greater resolution and offers an increased level of flexibility through the ability to synchronize collection with favorable weather conditions.



Joplin, Missouri Tornadoes (May 2011)

The ability to compare imagery before and after an incident is an invaluable tool that supports response and rescue operations, damage assessment and debris removal missions, and for directing support of essential services to citizens. Access to current imagery is also necessary to support missions that include situational awareness, law enforcement, facilities management, security planning and maritime domain awareness.

#### Benefits

The remote sensing contracts are designed specifically for use by all missions and offices within the Department through their internal contracting offices. However, the primary user of these contracts is expected to be FEMA and market research conducted in the development of these contracts also identified requirements from CBP, Secret Service and NPPD. DHS Components may issue orders directly against these contracts, once their internal contracting staff completes requisite orientation and training on use of these contract vehicles. Training and tools are available through the DHS Office of Procurement Operations and the OCIO Geospatial Management Office.

Requires RAPID DELIVERY of 2 days or less



Geospatial Management Office  
Department of Homeland Security

## Remote Sensing Contracts

Aerial Imagery for Incident Management

These contracts have been tailored to satisfy the unique requirements of DHS missions that include but are not limited to the following:

- Direct access to the contracts by any DHS component, mission or field office.
- Rapid delivery (2 days or less<sup>2</sup>) of processed imagery or lidar elevation information in the event of an emergency.
- Web services delivery available through the DHS Geospatial Information Infrastructure.
- Access to specialized services that include feature extraction and product generation
- Access to GMO technical support to provide technical assistance and tools to use the contracts easily and efficiently.

DHS Components will fund their individual requirements for remote sensing services; however, the OCIO GMO will fund an ongoing task for periodic reporting on the operational status and capabilities of the Contractor's aircraft. The GMO will also fund and manage an annual readiness test for each contractor to confirm their capacity and ability to support sudden incidents and to deliver imagery rapidly in the event of an emergency.



[http://www.dhs.gov/sites/default/files/publications/Remote\\_Sensing\\_Information\\_0.pdf](http://www.dhs.gov/sites/default/files/publications/Remote_Sensing_Information_0.pdf)

## **Aerial Remote Sensing to Support Incident Management and Homeland Security (Remote Sensing)**

The U.S. Department of Homeland Security (DHS), Office of Procurement Operations (OPO), Enterprise Acquisitions Division (EAD) has awarded four Indefinite Delivery, Indefinite Quantity (IDIQ) contracts for Aerial Remote Sensing to Support Incident Management and Homeland Security (Remote Sensing) missions throughout the Department. The Remote Sensing Contracts will be available throughout DHS. Specifically, the services will consist of readiness reporting, deployment exercises, vertical and oblique aerial image acquisition, Light Detection and Ranging (LiDAR), photogrammetric data processing, and electronic dissemination of imagery data for DHS.

Awards were made to the following companies:

<b>Contract Awards</b>	
<b>Aero-Metric, Inc.</b> 4020 Technology Parkway Sheboygan, WI 53083  <b>Contract #:</b> HSHQDC-13-D-RS001	<b>Dewberry Consultants LLC</b> 8401 Arlington Boulevard Fairfax, VA 22031-4666  <b>Contract #:</b> HSHQDC-13-D- RS003
<b>BAE Systems</b> 124 Gaither Drive, Suite 100 Mt. Laurel, NJ 08054  <b>Contract #:</b> HSHQDC-13-D- RS002	<b>GMR Aerial Surveys, Inc. dba Photo Science</b> 523 Wellington Way Lexington, KY 40503  <b>Contract #:</b> HSHQDC-13-D- RS004

Please contact [DHSRemoteSensing@hq.dhs.gov](mailto:DHSRemoteSensing@hq.dhs.gov) for additional information.



# Requires constant reporting of aerial assets

HOME ▾ Quantum Spatial Asset Location MODIFY M

Details | Basemap | Share | Print | Measure | Find address or place

Legend

**QSIAssets**

- QSI Assets

**QSI Assets: N441CJ (Conquest)**

AIRCRAFTID	N441CJ (Conquest)
AIRPORTID	OJC
FLIGHT_CREW	Jones / Cox
GROUND_CREW	
AIRCRAFT_TYPE	
SENSOR	DMC-161
ASSIGNMENTS	2014 Lee's Summit Recovery Park Mapping Fly on 3/31/14

Zoom to



## Granbury, TX tornado on May 18, 2013

- Acquired imagery w DMC next morning
- Posted CIR orthos on web < 24 hrs
- Stood up web site with a 'slider tool' to allow rapid before / after viewing for public



### Granbury, Texas Before and After the Tornado

Use the swipe tool to compare aerial views before and after the tornado of May 18, 2013.

A GEOINT Briefing

POWERED BY

Sources: Left, AeroMetric, Inc.; Right, Esri's World Imagery basemap.

- 1
- 2
- 3

#### Granbury Texas

On 18 May 2013, the Ranchos Brazos Subdivision in Granbury Texas was in the path of an EF-4 Tornado. On Thursday it was reported that at least six people were killed and dozens were injured.





[http://gis.aerometric.net/geoint/events/2013/tornado/us\\_tx\\_granbury\\_20130518/stage/index\\_live.html](http://gis.aerometric.net/geoint/events/2013/tornado/us_tx_granbury_20130518/stage/index_live.html)

gis.aerometric.net/geoint/events/2013/tornado/us\_tx\_granbury\_20130518/stage/index\_live.html

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1 2 3

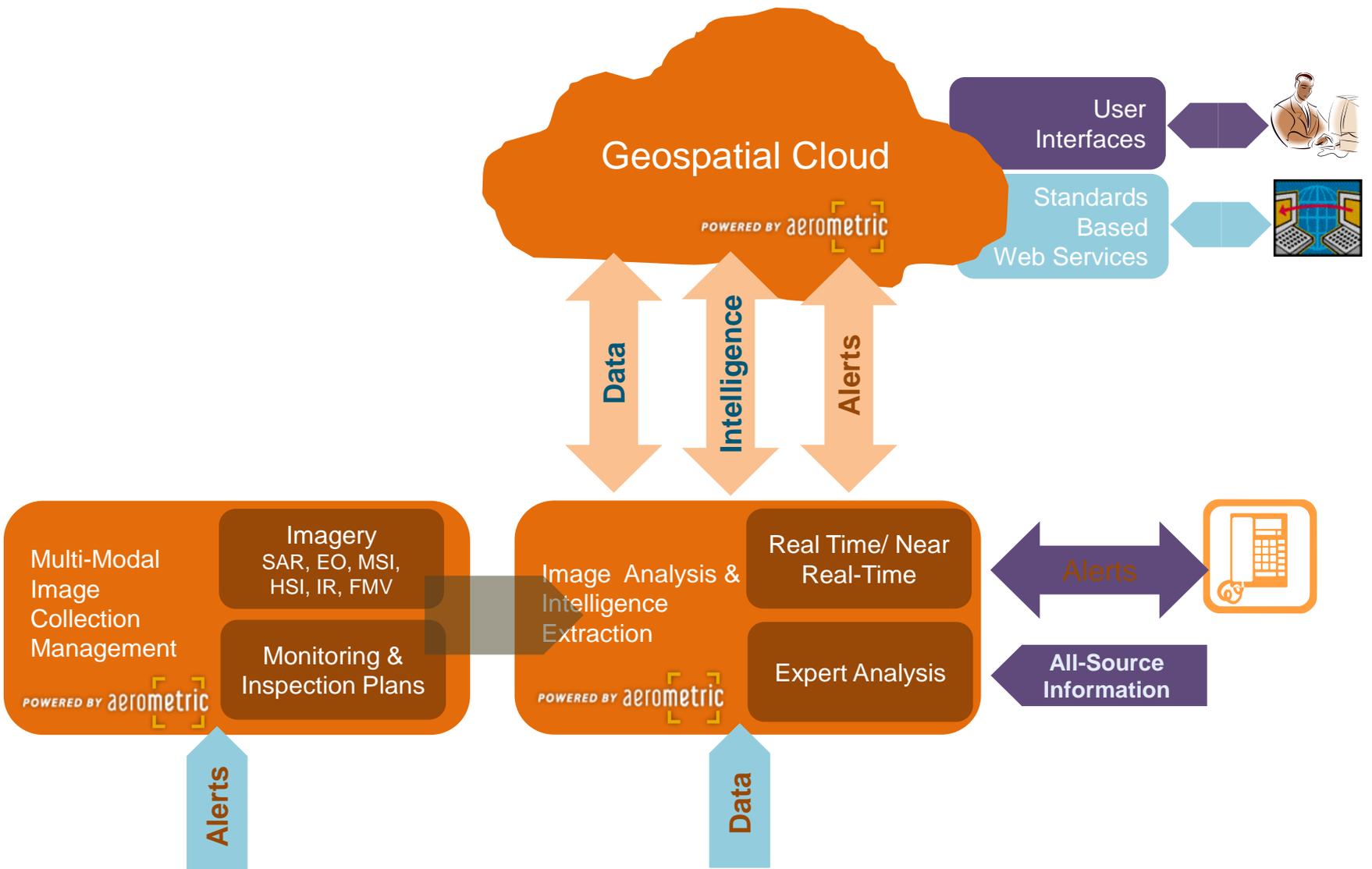
POWERED BY 

Sources: Left, [Aerometric, Inc.](#); Right, Esri's [World Imagery](#) basemap.

#### Ranchos Brazos Subdivision Damage

This zoomed in view of the color infra-red imagery shows the total destruction caused by the tornado.







## June 2013 FEMA exercise in FL

- Each contractor assigned approx. 100 sq. mi.
- All four contractors completed in < 48 hrs.

Then Moore, OK tornado happened

And an

After action briefing by FEMA in DC to contractors

The take way

‘what is really needed is rapid IA damage assessments’



# Currently IA's are done manually



## Appendix FEMA Damage Classification

Damage	Observed Damage	Roof Covering	Roof Diaphragm	Collapsed Walls	Other Considerations
Limited	Generally superficial damage to solid structures (loos of tiles or roof shingles); some mobile homes and light structures damaged or displaced	Up to 20%	None	None	Gutters and/or awning; loss of vinyl or metal siding
Moderate	Solid structures sustain exterior damage (e.g., missing roofs or roof segments); some mobile homes and light structures are destroyed, many are damaged or displaced.	Greater and 20%	Up to 20%	None	Collapse of chimney; garage doors collapse inward; failure of porch or carport. Mobile homes could be partially off foundation.
Extensive	Some solid structures are destroyed; most sustain exterior and interior damage (roofs missing, interior walls exposed); most mobile homes and light structures are destroyed.		Greater than 20%	Some exterior walls are collapsed.	Mobile homes could be completely off foundation – if appears to be repairable.
Catastrophic	Most solid and all light or mobile structures are destroyed.			Majority of the exterior walls are collapsed.	





# IA's primarily done using obliques

Elaine Mahoney  
NOAA  
2.24.2014

## Superstorm Sandy: Pre-storm conditions datasets

- Hurricane Sandy Rapid Response Imagery



# CAP is the primary supplier of oblique's to FEMA

## Sandy Response

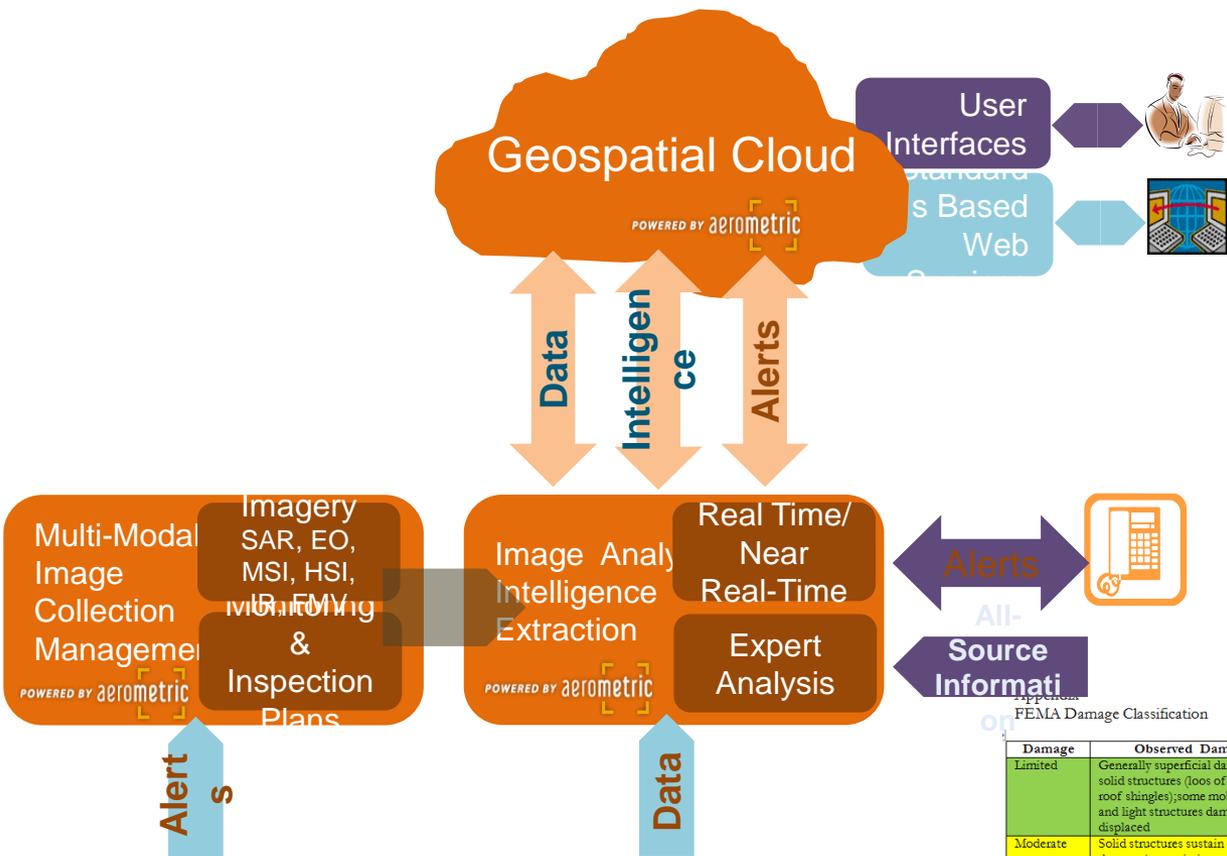
- CAP Flights
  - Oblique, geo-tagged aerial of most impacted areas
  - Used surge model to prioritize flights
  - In air within 24 hours of storm
  - Over 157,000 geo-tagged images captured
  - Over 650 sorties flown
  - Over 250 personnel, including headquarters staff, were in support



FEMA



# Why can't we deliver IA's w our Orthos < 48 hrs ?



FEMA Damage Classification

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ArcGIS - My Map

Details Add Basemap

Save Share Print Measure

Change Symbols

Specify what symbols to use to draw the layer. Help

Use: Unique Symbols

To show: Damage

Colors:

OPTIONS APPLY

- Catastrophic
- Dummy Point
- Extensive
- Limited
- Moderate



TX damage points export 20140121 (107 features, 0 selected)

FID	Damage
-----	--------



ArcGIS - My Map x  
www.arcgis.com/home/webmap/viewer.html?useExisting=1

ArcGIS My Map

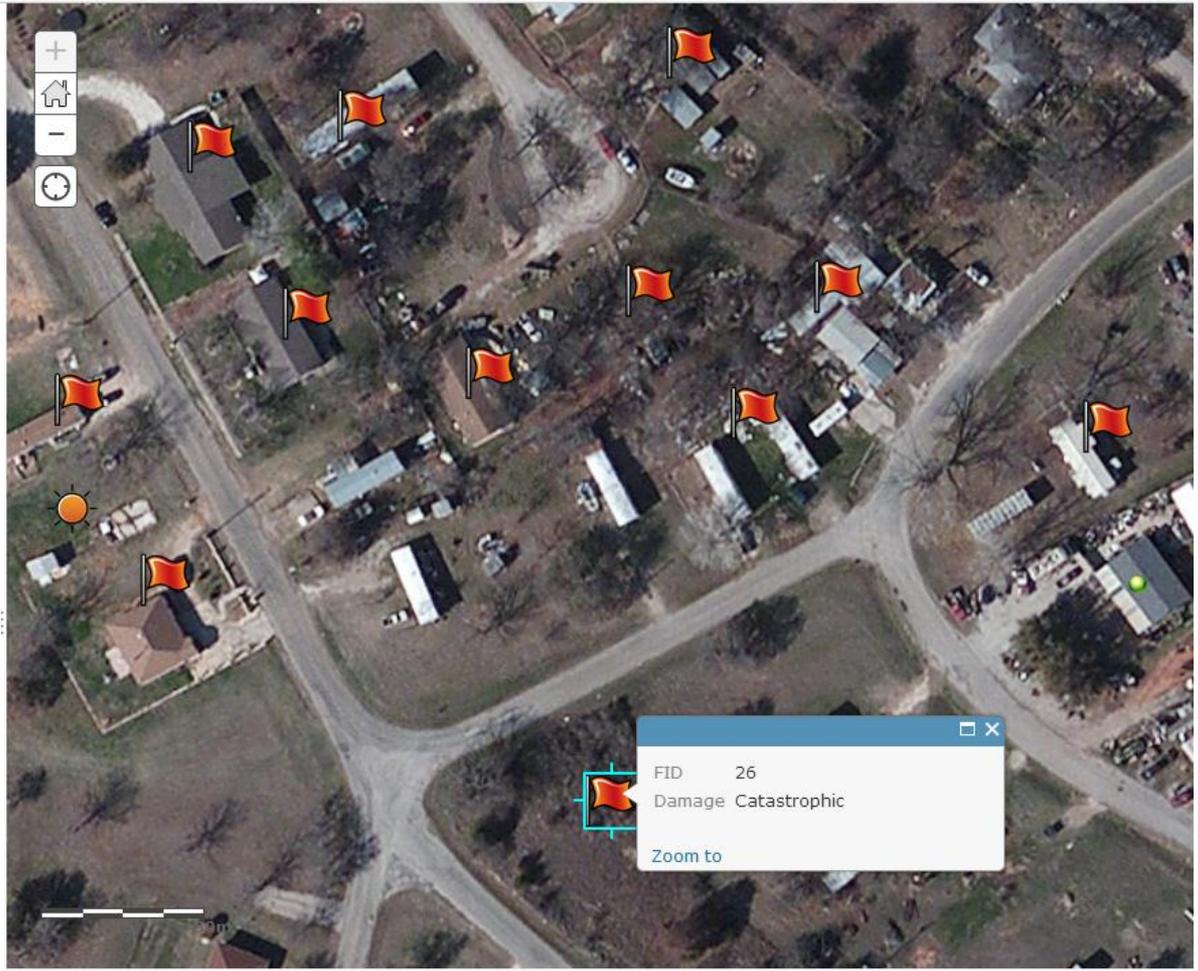
Details Add Basemap Save Sha

About Content Legend

Legend

TX\_damage\_points\_export\_20140121

- Catastrophic
- Dummy Point
- Extensive
- Limited
- Moderate



FID 26  
Damage Catastrophic  
Zoom to



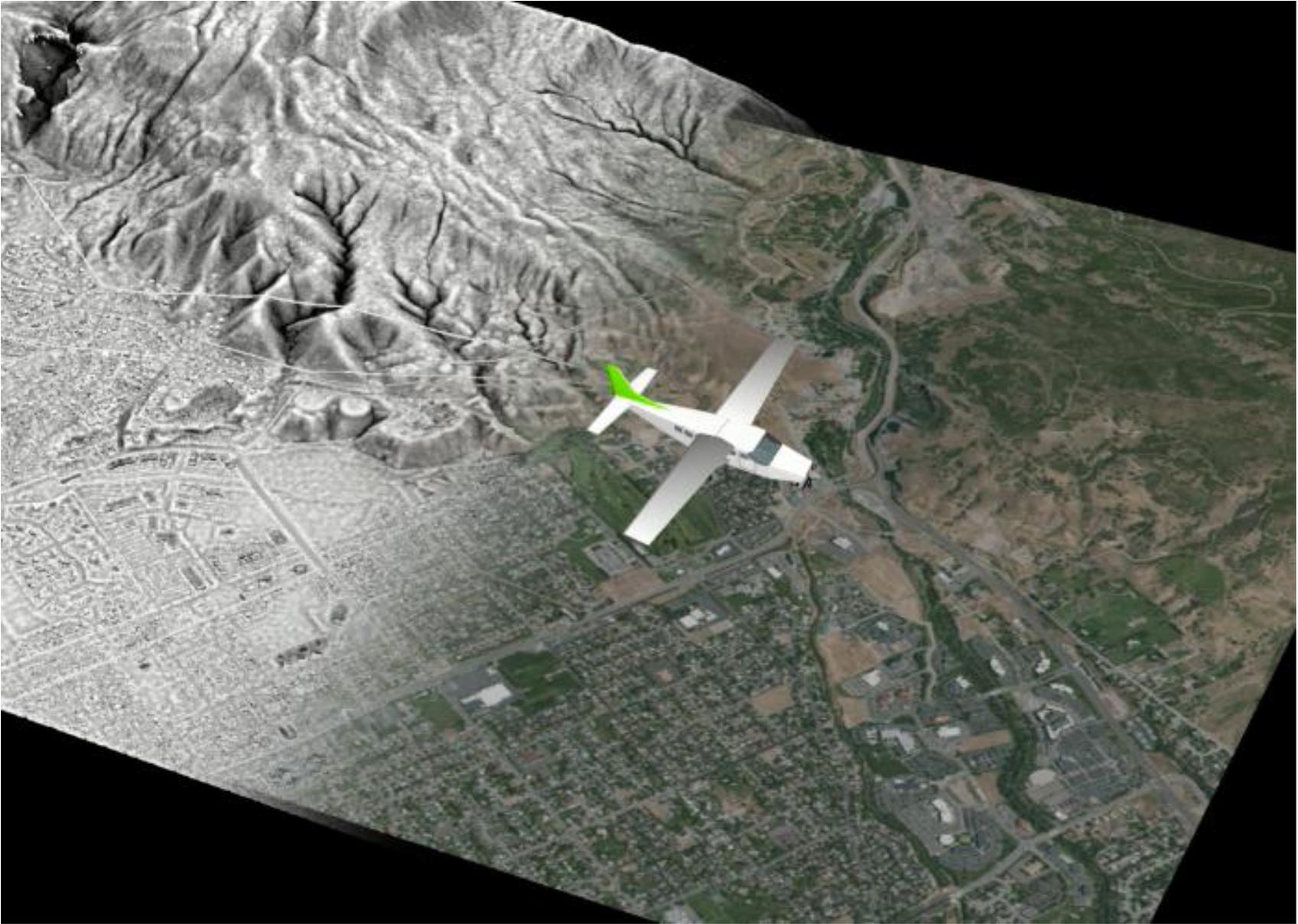
# The Power of 3

first joint BD meeting in September 2013



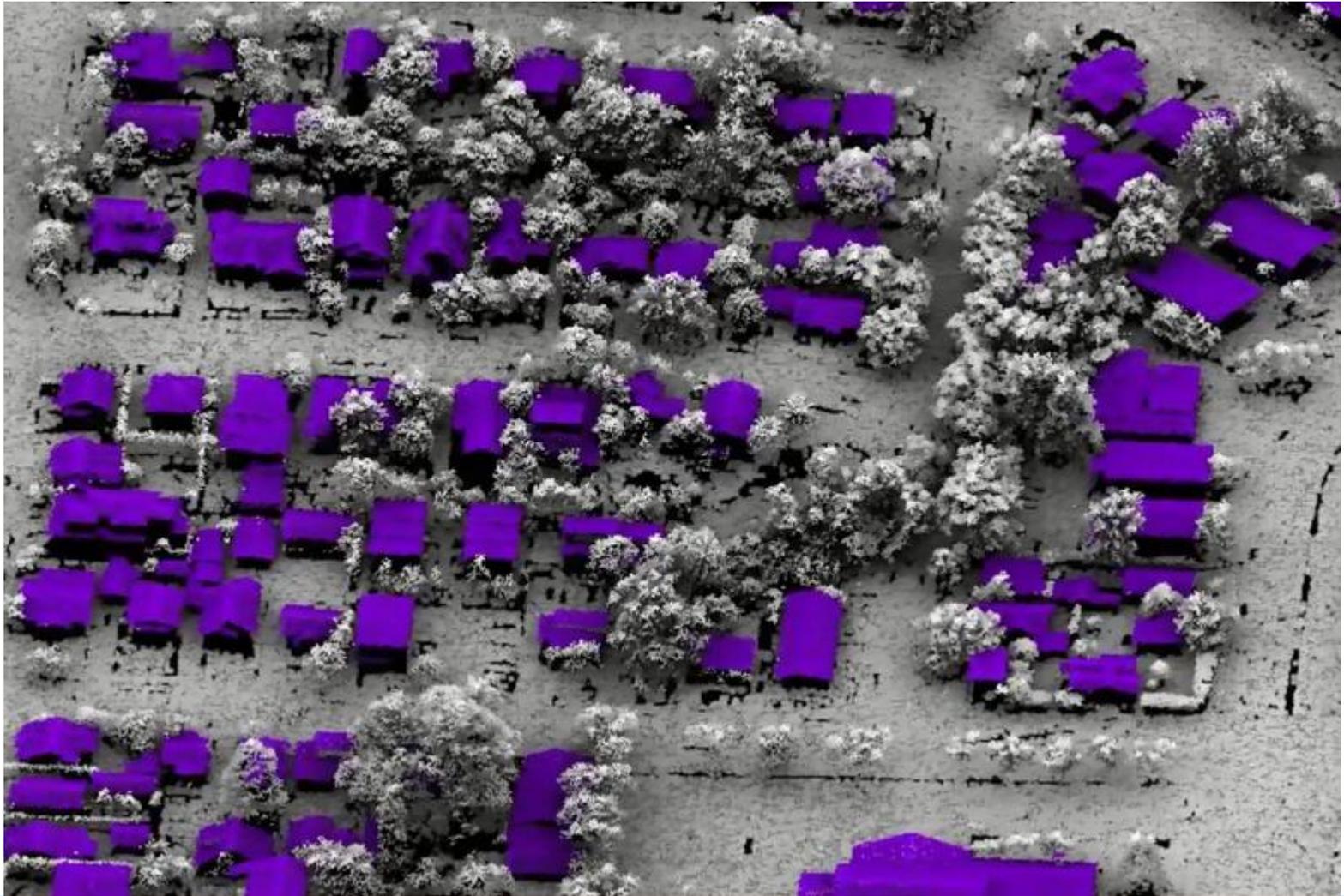
the future is quantum





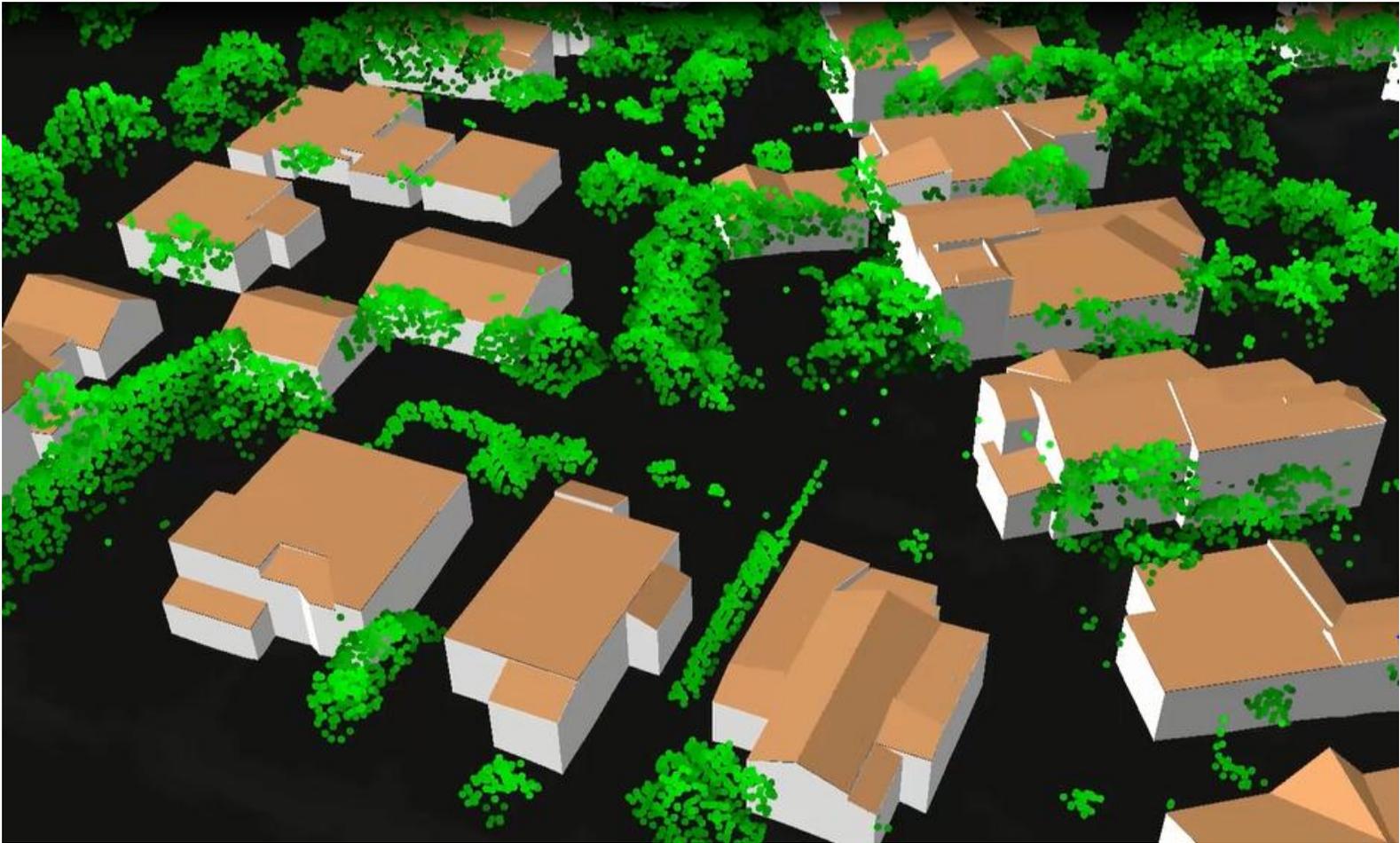


# LiDAR derived buildings





# LiDAR derived buildings

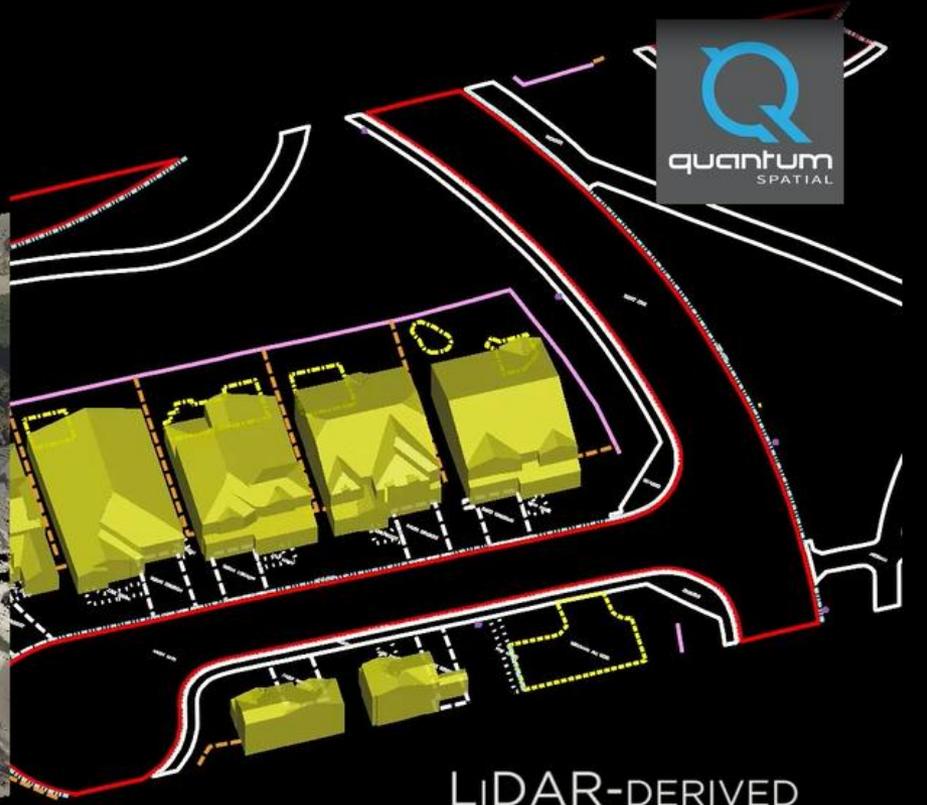




# Automated feature extraction from LiDAR

QS\_infrastructurebuildings

TRUE COLOR  
LIDAR POINT CLOUD



LIDAR-DERIVED  
PLANIMETRIC VECTORS





# Extracted features in Google earth

QS\_infrastructurebuildings





2014 Q Labs Applied that automation to airfield's

- Obstruction identification
- Reporting tools
- Google earth based viewing
- Automation
- Automation
- Automation
- Color coded obstructions



# Fully automated vertical obstructions





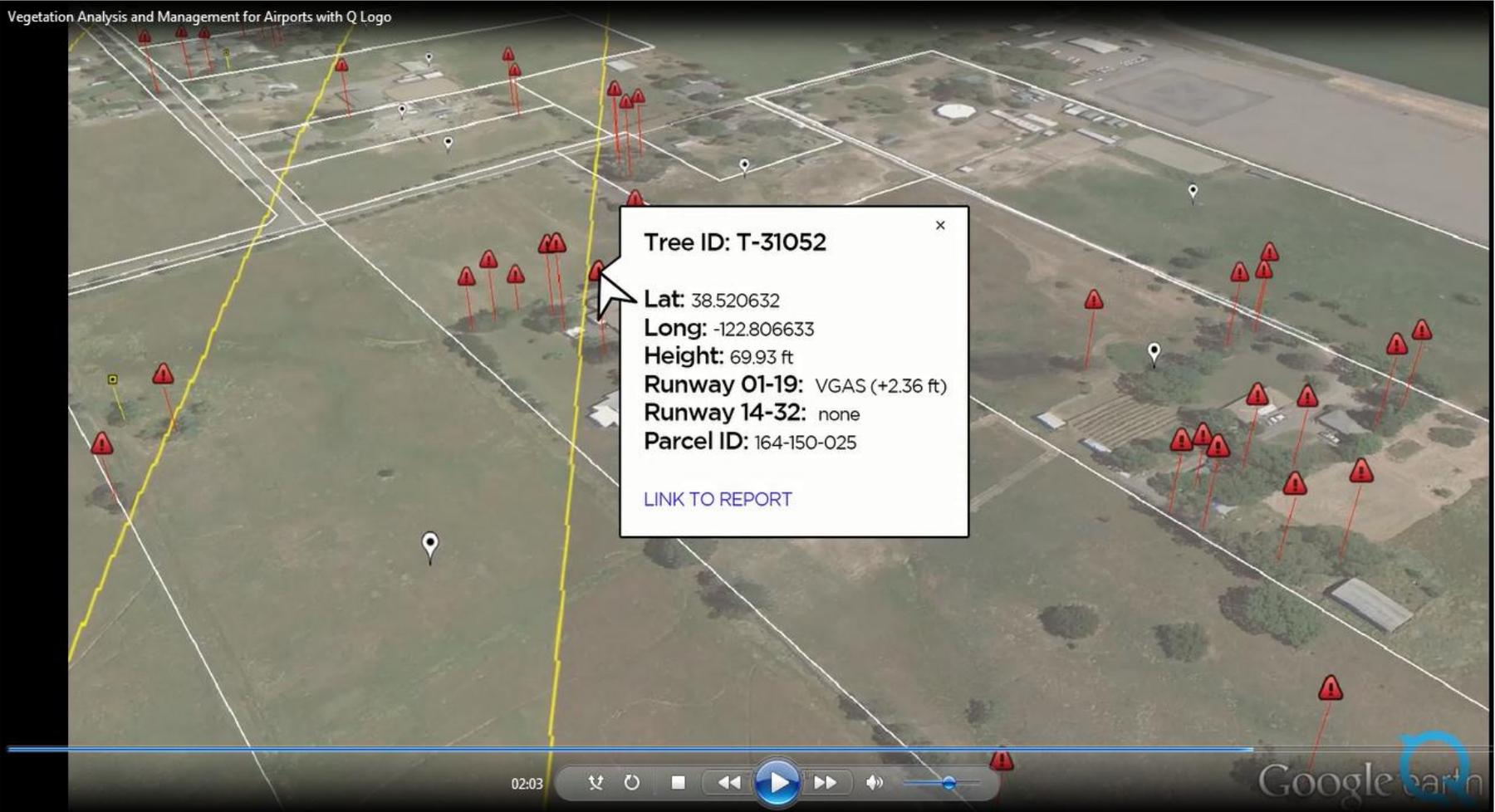
# Fully automated vertical obstructions

Vegetation Analysis and Management for Airports with Q Logo





# Output to cloud based viewers





Hypothesis : obstructions & damage are very similar

- Build upon algorithms already working for vertical obstructions & building shapes
- Use pattern analysis already working in I&I analysis
- Implement change analysis –before/after

We can fully automate damage assessments using a 4 pt. IA classification?



# LiDAR for Emergency Response

- Not oblique imagery
- Day or night time collection of LiDAR
- Less restricted by atmospheric conditions
- LiDAR is more valuable data set than oblique images



# NOAA is entering the oblique game now

ngs.woc.noaa.gov/storms/obliquedemo/

Florida Oblique Test Imagery About Contact Download

Search Address

The screenshot displays the NOAA Florida Oblique Test Imagery web application. The browser address bar shows the URL `ngs.woc.noaa.gov/storms/obliquedemo/`. The page header includes the NOAA logo, the title "Florida Oblique Test Imagery", and navigation links for "About", "Contact", and "Download". A search bar labeled "Search Address" is located in the top right. The main content area is split into two panels. The left panel is a map of the St. Pete Beach area, showing streets like Boca Ciega, South Pasadena, Gulfport, Broadwater, Bayway, and Tierra Verde. A red oblique imagery strip is overlaid on the map, covering the coastline from Boca Ciega to Tierra Verde. A tooltip is visible over the strip, displaying "Image ID: S24175789" and a link to the full resolution image. The right panel is a high-resolution aerial view of the same area, showing buildings, a beach, and the oblique imagery strip's coverage.

The image features a large, stylized blue 'Q' that frames the central text. The 'Q' is composed of a thick blue line that curves around the text, with a small tail at the bottom right. The background is white, and the bottom edge has a dark grey pattern of small 'Q's.

# quantum

SPATIAL

Scott Perkins

Phone 913-221-3512

[sperkins@quantumspatial.com](mailto:sperkins@quantumspatial.com)