NOAA's mission to collect Emergency Response Imagery

NGS Webinar Series

July 9, 2015

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Chief, NGS Remote Sensing Division

Overview

- Division Background
  - Programs, Platforms, Sensors
- Emergency Response Overview
  - Background
  - Delivery by NOAA, USGS, & FEMA
  - Examples of Response
    - Tornadoes and Hurricanes
    - Oblique imagery
  - Coordination Discussion

Background

- U.S. Department of Commerce
  - National Oceanic Atmospheric Administration (NOAA)
    - National Ocean Service
      - National Geodetic Survey
        - Remote Sensing Division

- Primary programs
  - Coastal Mapping Program
  - Aeronautical Survey Program
  - Emergency Response

NOAA's Coastal Mapping Program

- NOAA nautical charts
- Other important applications:
  - Used in defining the United States' territorial limits
  - Coastal resource management
  - Storm surge and coastal flooding modeling
  - GIS analysis
  - Benthic habitat mapping
  - Many more…
  - http://www.ngs.noaa.gov/NSDE/

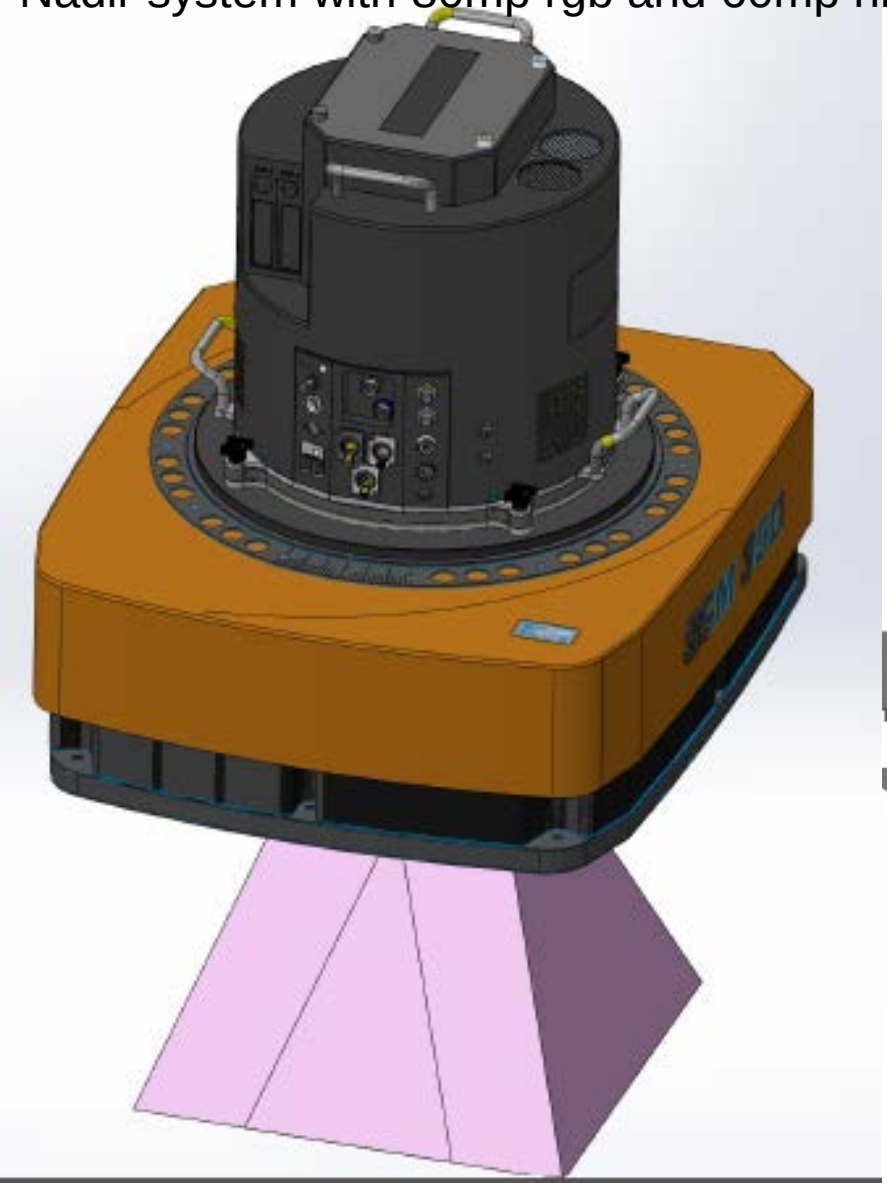
Platforms

NOAA King Air 350ER

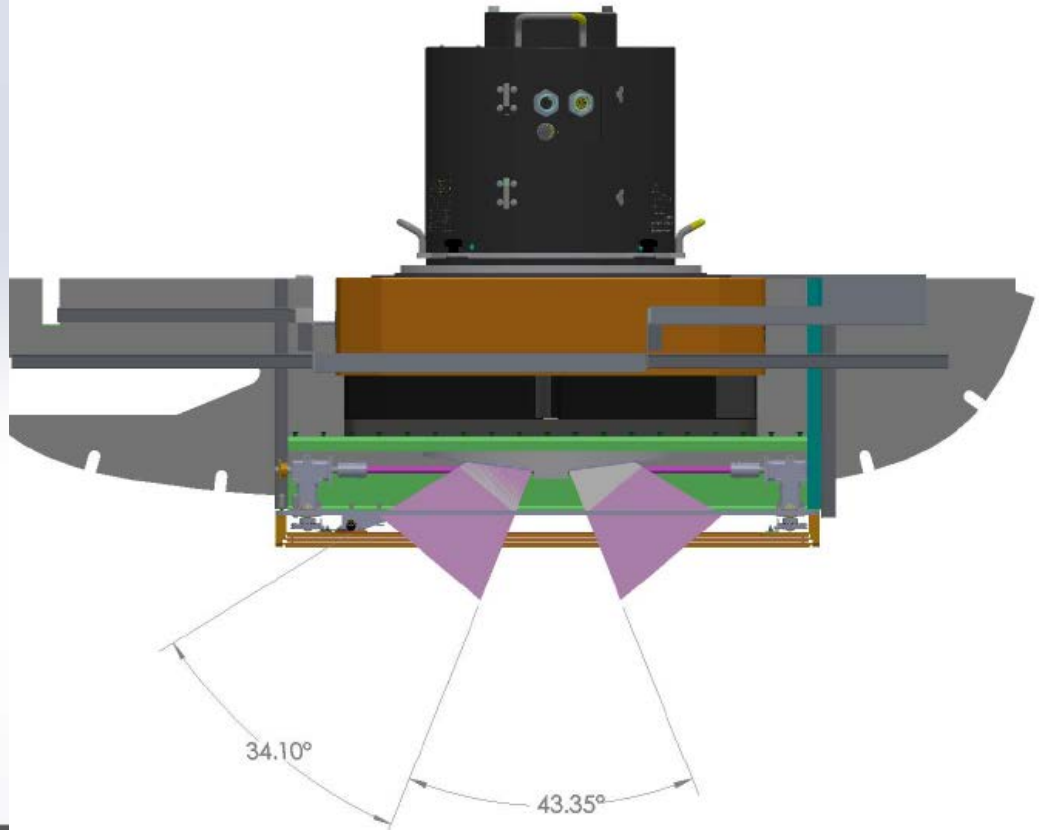
NOAA Otter DHC-6

Sensors

Nadir system with 80mp rgb and 60mp nir

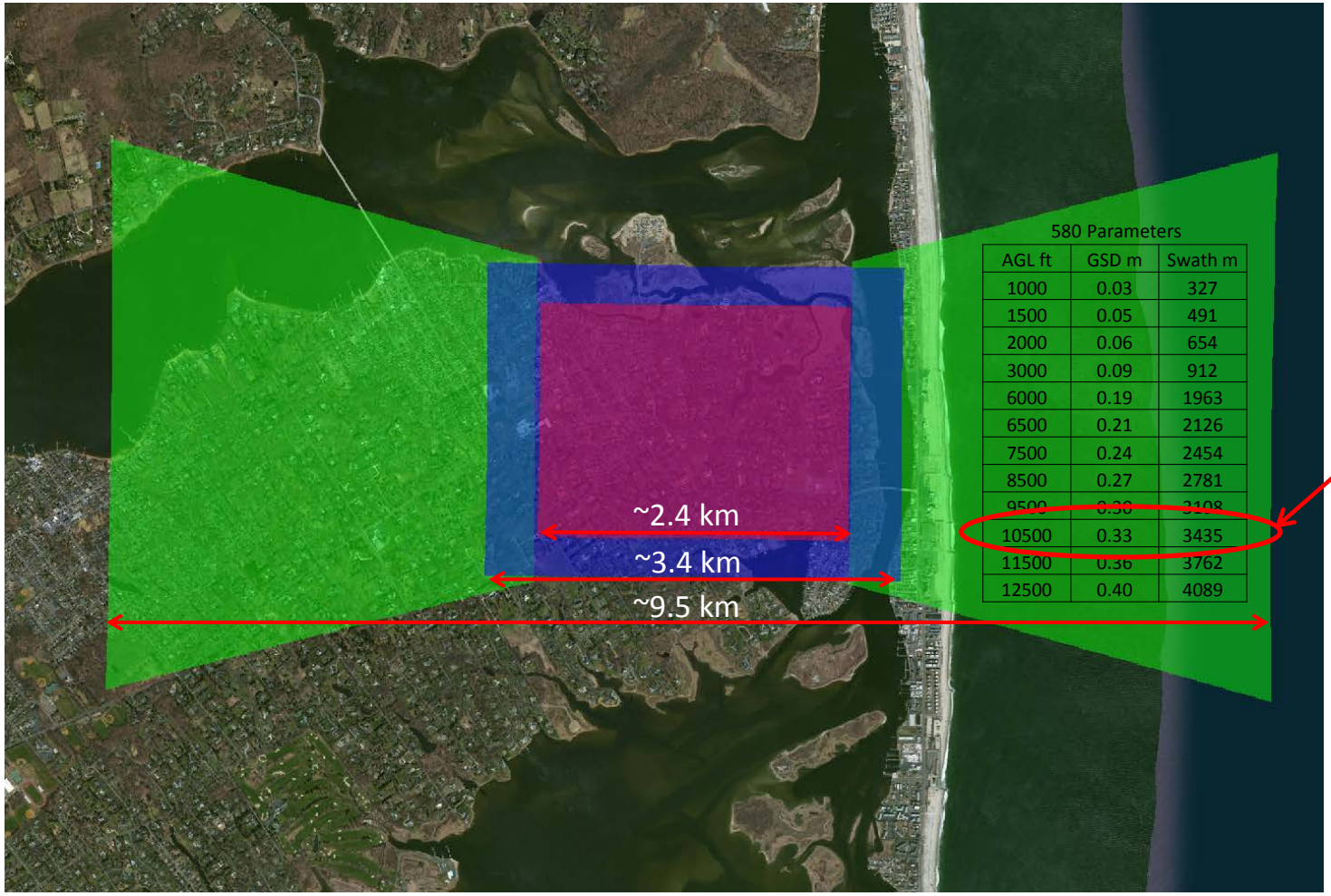


Oblique system with two 39mp rgb




DSS
SSM 350
DSS
DIGITAL SENSOR SYSTEM
SSM 270

Camera Resolution and GSD



580 Parameters

AGL ft	GSD m	Swath m
1000	0.03	327
1500	0.05	491
2000	0.06	654
3000	0.09	912
6000	0.19	1963
6500	0.21	2126
7500	0.24	2454
8500	0.27	2781
9500	0.30	3108
10500	0.33	3435
11500	0.36	3762
12500	0.40	4089

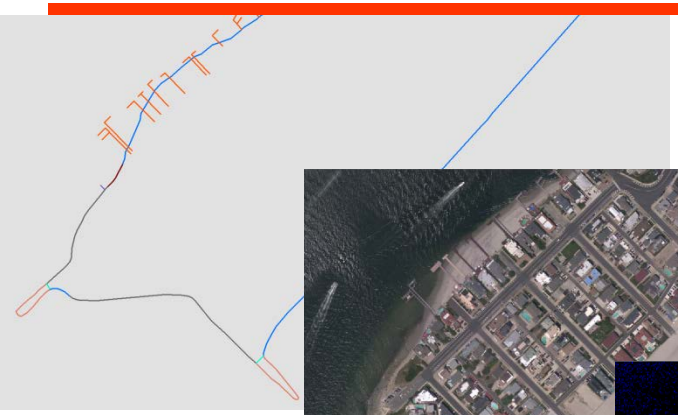
King Air typical flying height

Coverage at 10,500 ft for 439 (Old System) (Red), 580 (Blue) and 539 Oblique (Green)

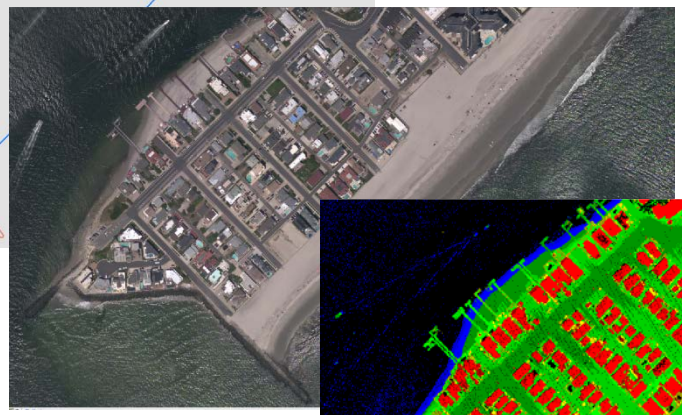
Example image of nadir and oblique imagery

Riegl VQ-880G Topobathy Lidar

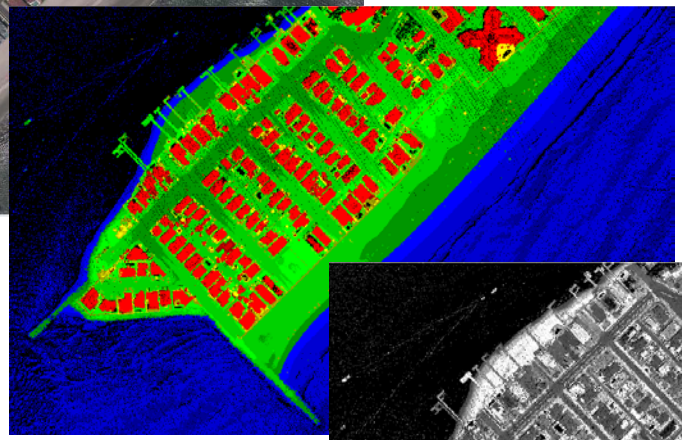
NGS IOCM Products/Deliverables from Topobathy Lidar



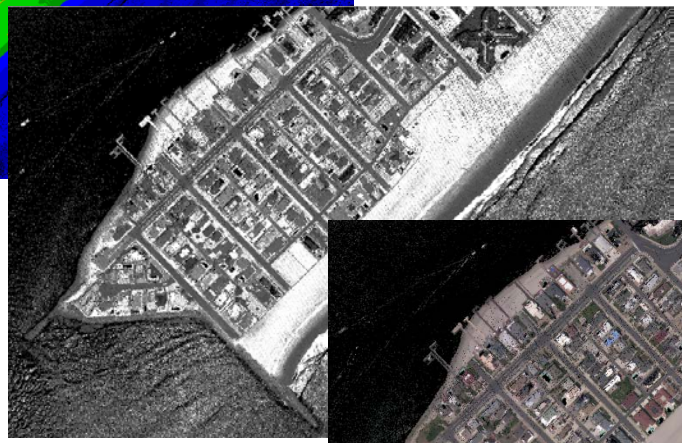
Shoreline



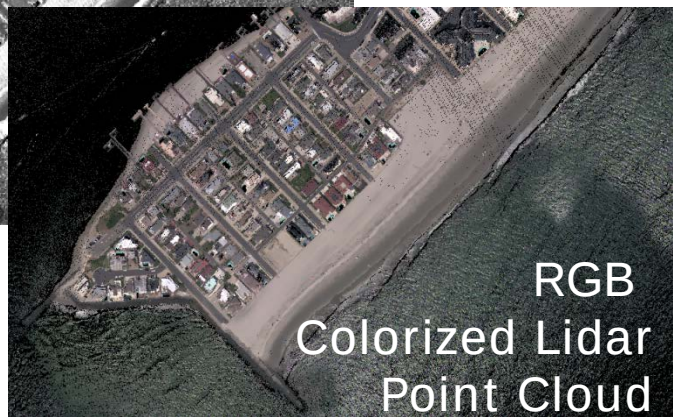
Ortho Mosaic Imagery



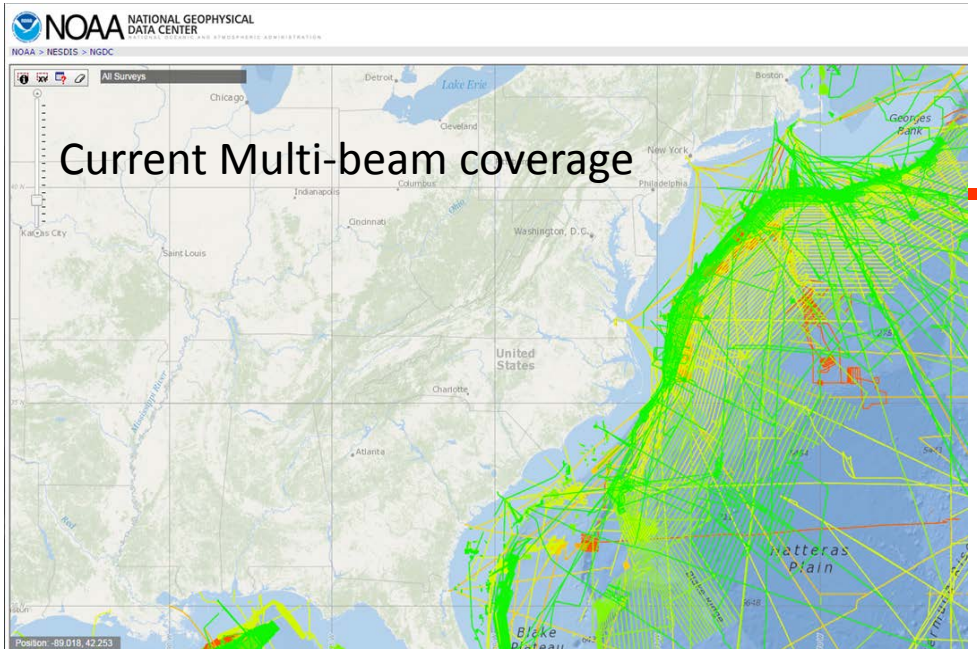
Lidar Point Cloud (elevation)



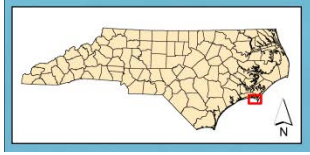
Lidar Point Cloud (intensity)



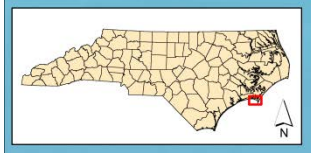
RGB Colorized Lidar Point Cloud



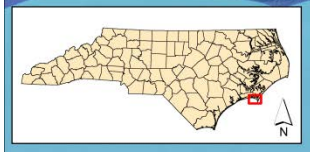
NOAA NGDC integrated dataset, 10m
1869-2010



USACE (JALBTCX) Topobathy LiDAR, 2m
2010



Topobathy LiDAR, 1m
2014



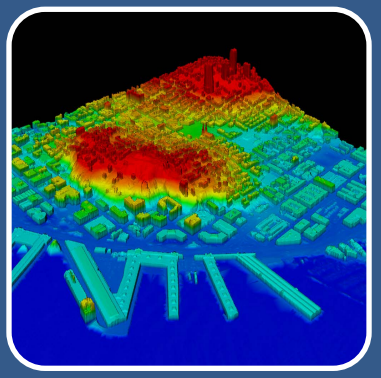
Emergency Response Imagery

- Remotely sensed data is acquired to support NOAA's requirements as well as other emergency response requirements (Mission Essential Activity MEA #3 under Primary Mission Essential Function DOC-2)
- NOAA maintains this capability to meet its own requirements as well as to provide tools, technology, and expertise we have gained to other government entities and the private sector.
- The remotely sensed data collected is disseminated to federal, state, and local government agencies as well as the general public to facilitate support efforts. The data is collected, processed, and disseminated in GIS ready formats by NOAA.

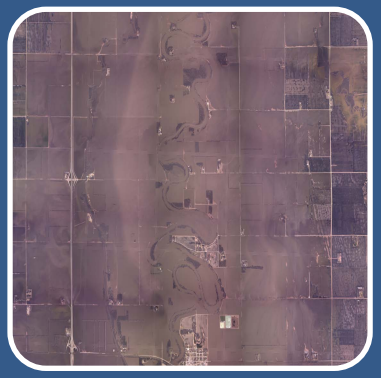
Recent Projects

9/11 Recovery Efforts

Hurricanes: Isabel (2003), Ivan, Jeanne (2004), Dennis, Katrina, Ophelia, Rita, Wilma (2005), Ernesto (2006), Humberto (2007), Gustav, Ike (2008), Earl (2009), Irene (2011), Isaac, Sandy (2012), Arthur (2014).



Lidar Acquisition to support 133 city effort.



Other response: Nor'Easter (2009), North Dakota Flooding (2011), DWH (2010,2011, 2012), Haiti Earthquake (2010), Red River Flooding (2008, 2011), AL and MO tornadoes (2011), IL tornadoes (2015)

storms.ngs.noaa.gov

Emergency Response Imagery

National Geodetic Survey

NGS Home | About NGS | Data & Imagery | Tools | Surveys | Science & Education | Search

The imagery posted on this site was acquired by the NOAA Remote Sensing Division to support NOAA national security and emergency response requirements. In addition, it will be used for ongoing research efforts for testing and developing standards for airborne digital imagery.

Navigation

National Geodetic Survey

Contact Us

Content and Technical Issues

Comments and Policy Issues

Emergency Response Imagery:

Hurricane Arthur (2014)

Hurricane Sandy (2012): **Web Map Interface** **Mobile Web App**

Hurricane Isaac (2012): **Web Map Interface**

Hurricane Irene (2011): **Web Map Interface** **HTML Interface**

Joplin, MO Tornado (2011)

Tuscaloosa, AL Tornado (2011)

North Dakota Flooding (2011)

Hurricane Earl (2010): **Web Map Interface** **HTML Interface**

Nor'Easter Nov09 (2009)

Hurricane Ike (2008)

Hurricane Gustav (2008)

Hurricane Humberto (2007)

Tropical Storm Ernesto (2006)

Hurricane Wilma (2005)

Hurricane Rita (2005)

Hurricane Ophelia (2005)

Hurricane Katrina (2005)

Hurricane Dennis (2005)

Hurricane Ivan (2004)

Hurricane Jeanne (2004)

Hurricane Isabel (2003)

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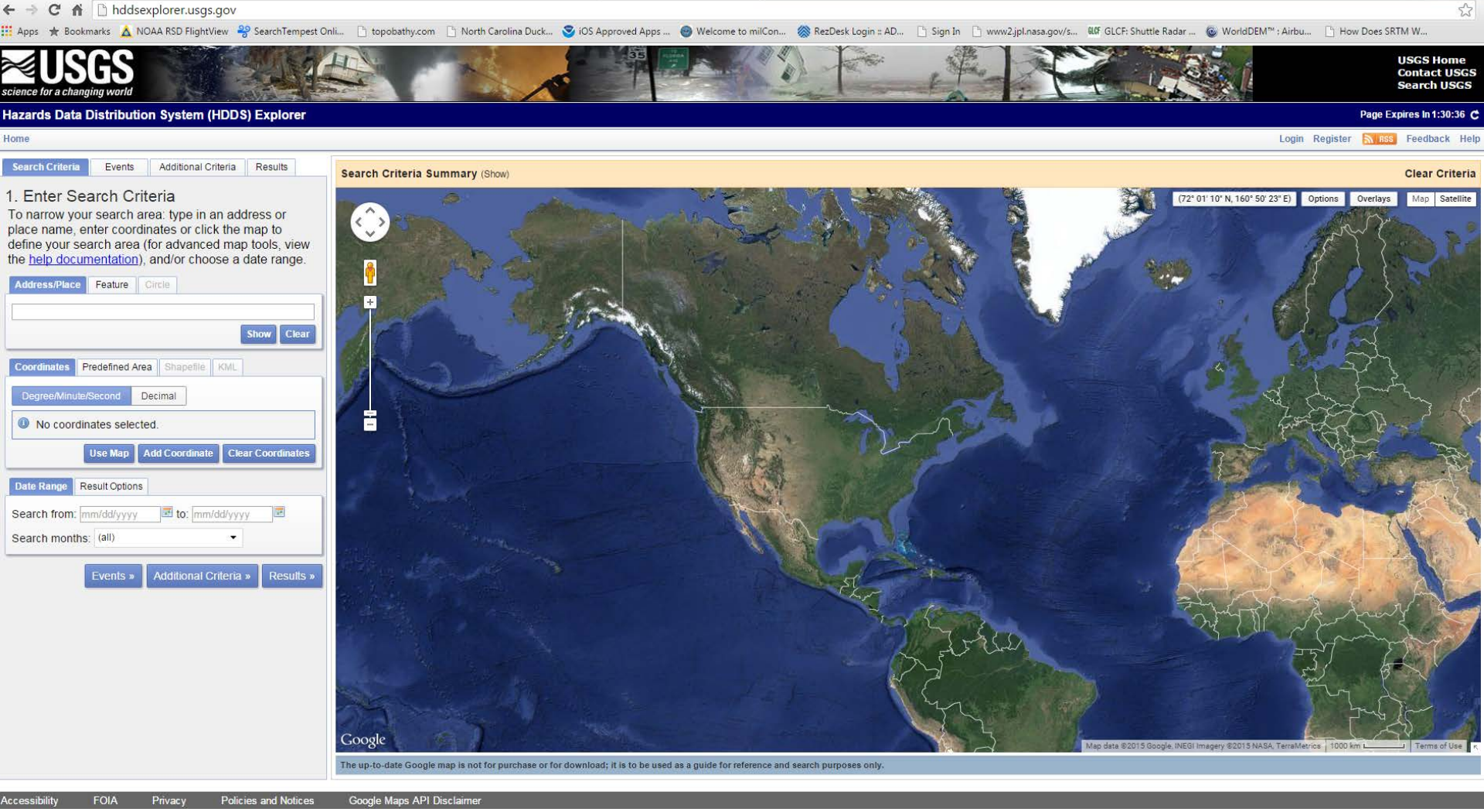
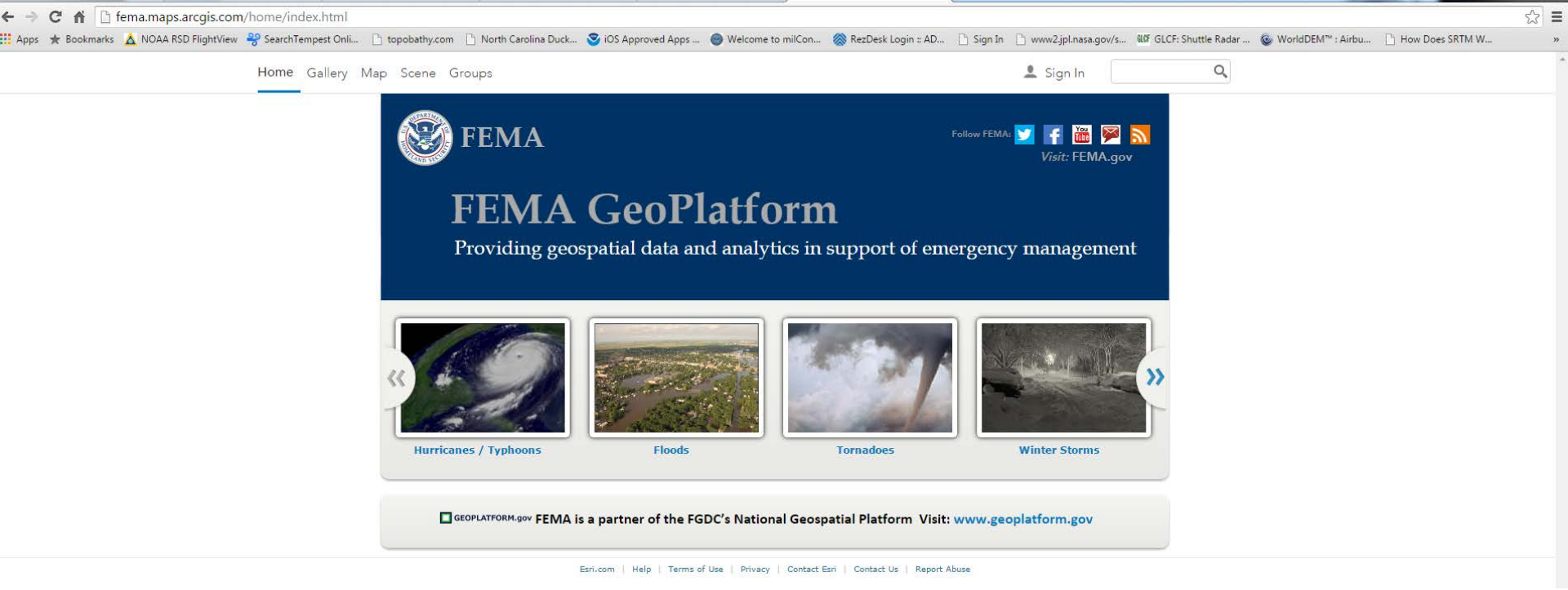


NOAA data in the USGS viewer:

http://hddsexplorer.usgs.gov/



- NOAA data in the FEMA viewer:
- http://fema.maps.arcgis.com/
- NOAA data as download:
- https://content.femadata.com/NationalDisasters/NOAA_Imagery/download/

Tuscaloosa/Birmingham April 2011

Tuscaloosa/Birmingham April 2011

Tuscaloosa/Birmingham April 2011

EXAMPLE 1 (Pre-event)
Damage Assessment Conducted Using FEMA's 4-Level Damage Scale

FEMA Damage Classification

Damage Level		Observed Damages
General Damage Classifications		
LD	Limited Damage	Generally superficial damage to solid structures (e.g., loss of tiles or roof shingles); some mobile homes and light structures are damaged or displaced.
MD	Moderate Damage	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.
ED	Extensive Damage	Some solid structures are destroyed; most sustain exterior and interior damage (roofs missing, interior walls exposed); most mobile homes and light structures are destroyed.
CD	Catastrophic Damage	Most solid and all light or mobile home structures destroyed.

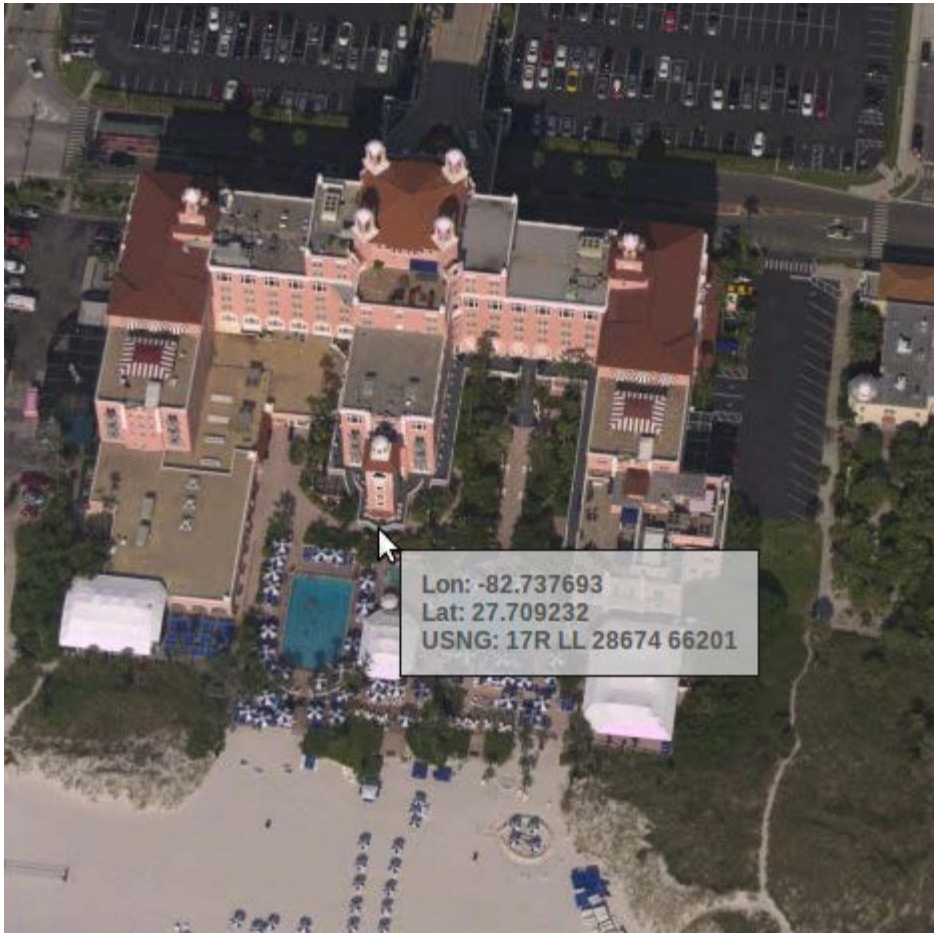
EXAMPLE 1 (Post-event) Damage Assessment Conducted Using FEMA's 4-Level Damage Scale

FEMA Damage Classification

Damage Level		Observed Damages
General Damage Classifications		
LD	Limited Damage	Generally superficial damage to solid structures (e.g., loss of tiles or roof shingles); some mobile homes and light structures are damaged or displaced.
MD	Moderate Damage	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.
ED	Extensive Damage	Some solid structures are destroyed; most sustain exterior and interior damage (roofs missing, interior walls exposed); most mobile homes and light structures are destroyed.
CD	Catastrophic Damage	Most solid and all light or mobile home structures destroyed.

ER Mission Profile(s) for Oblique Imagery

- 1500ft-3500ft (450-1067 m) AGL
- 60 mm lens
- Average GSD ~0.05 m - ~0.15m
- Individual Images with embedded GCP's
- Small, fast *and* geo-referenced
  - JPEG compression
  - Pyramids
  - GeoTiff
- Enhanced flexibility
- Multiple perspectives
- Drag and drop in ESRI
- In browser coordinate display
  - Lat/Lon and USNG



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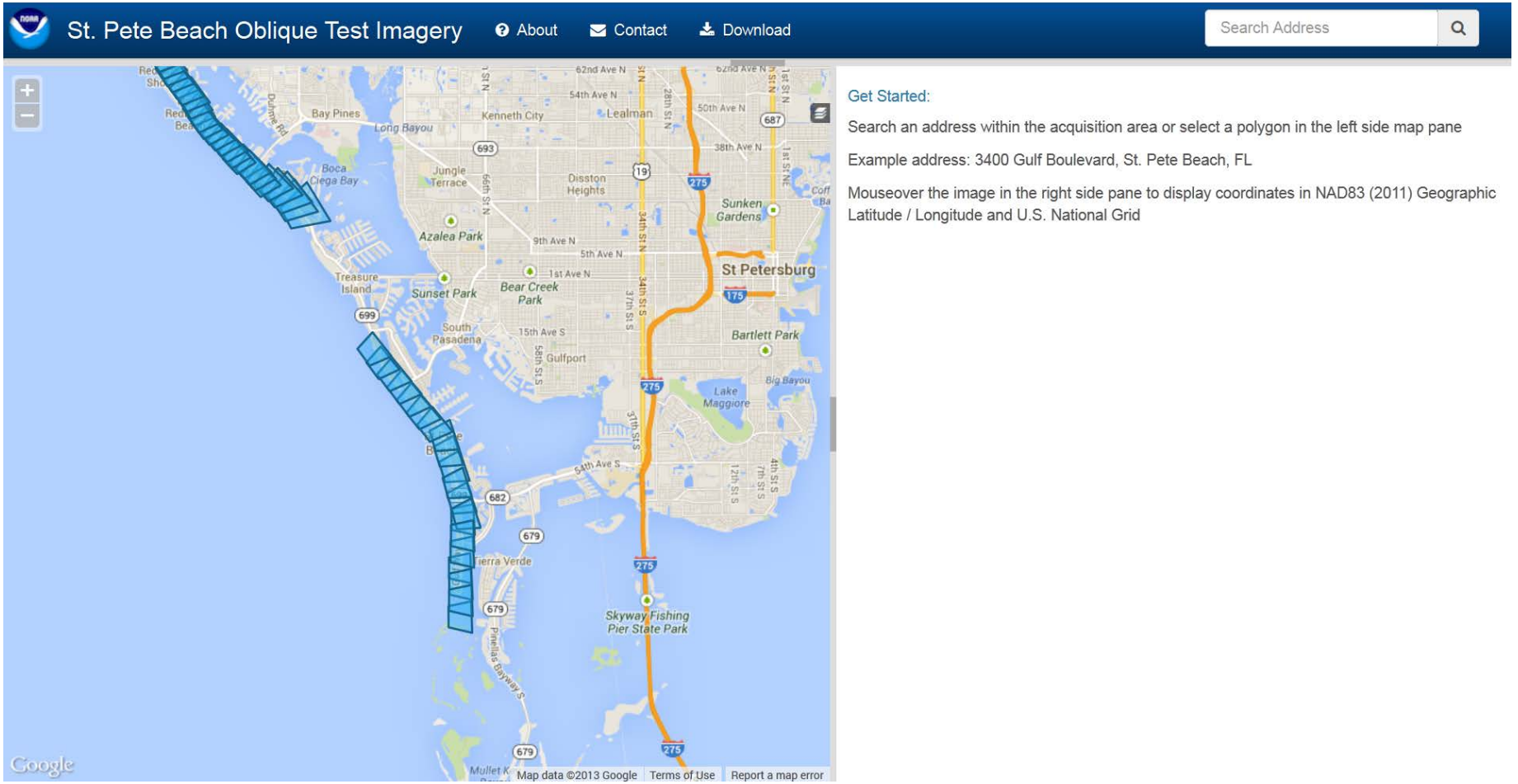

http://storms.ngs.noaa.gov/storms/obliquedemo/

http://storms.ngs.noaa.gov/storms/hx14Test/oblique

http://storms.ngs.noaa.gov/storms/hx14Test

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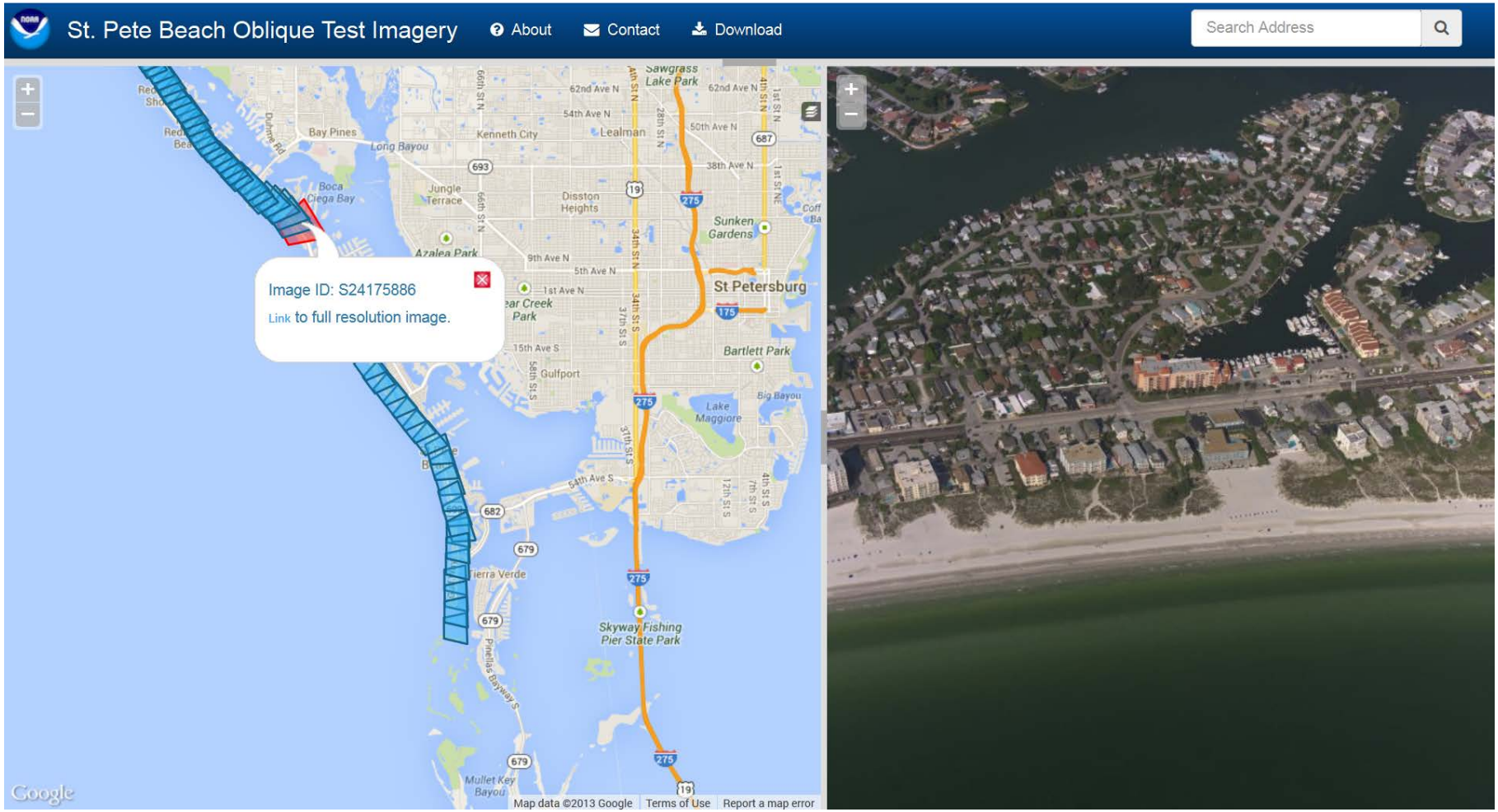

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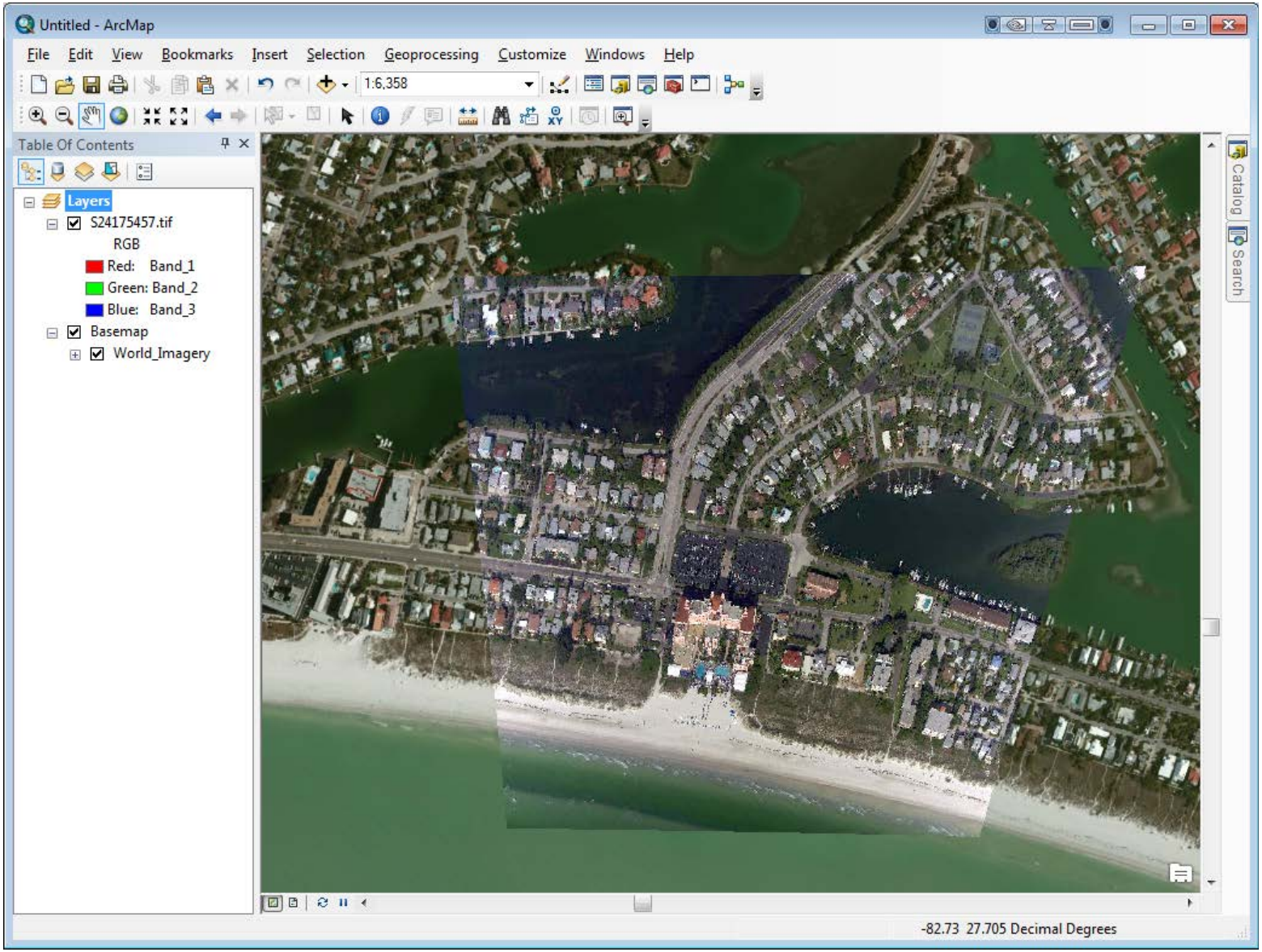
ESRI ArcMap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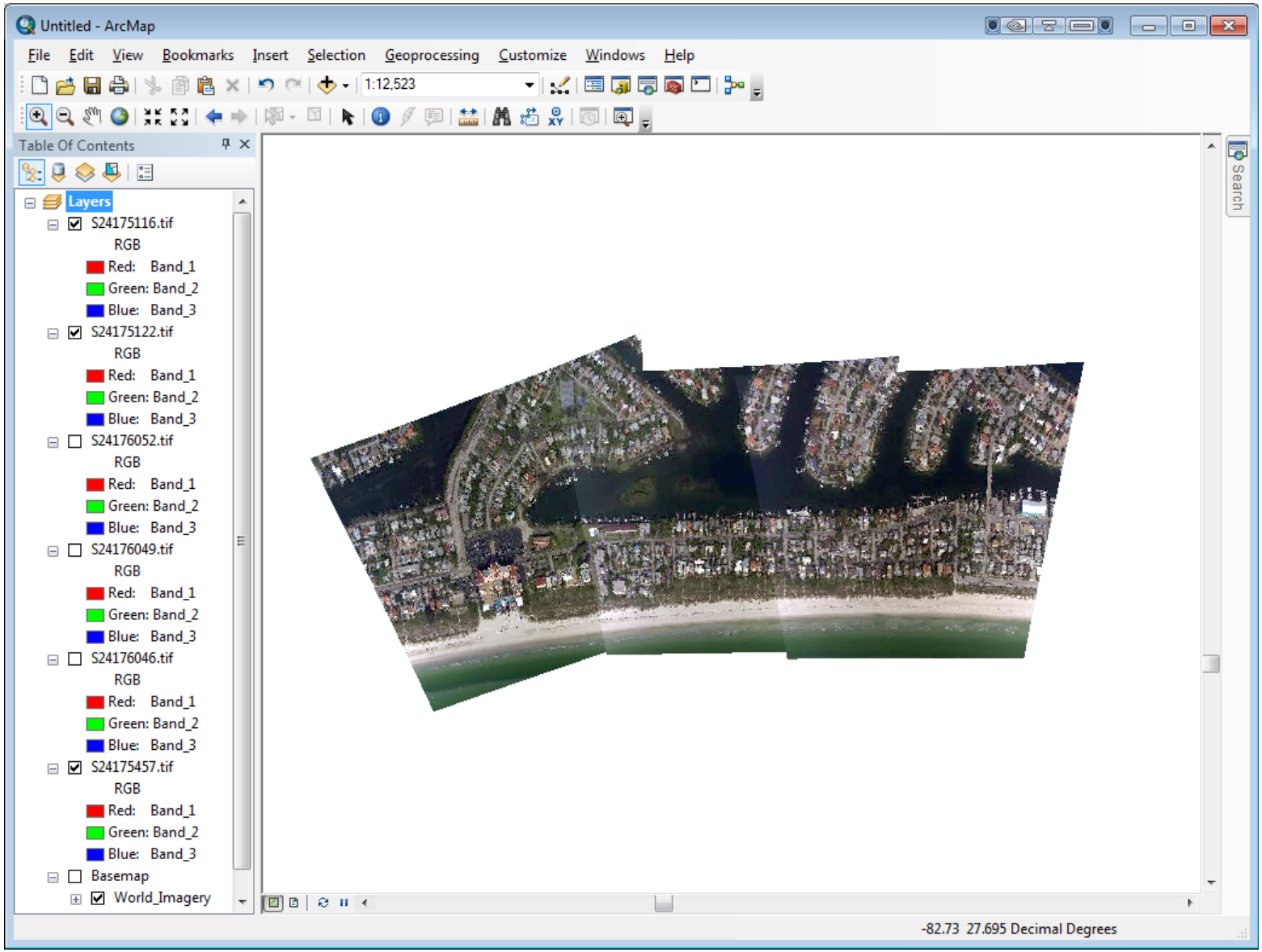
Blue: Band_3
Basemap
World_Imagery
Catalog
Search
-82.73 27.705 Decimal Degrees

ESRI ArcMap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World_Imagery
Search
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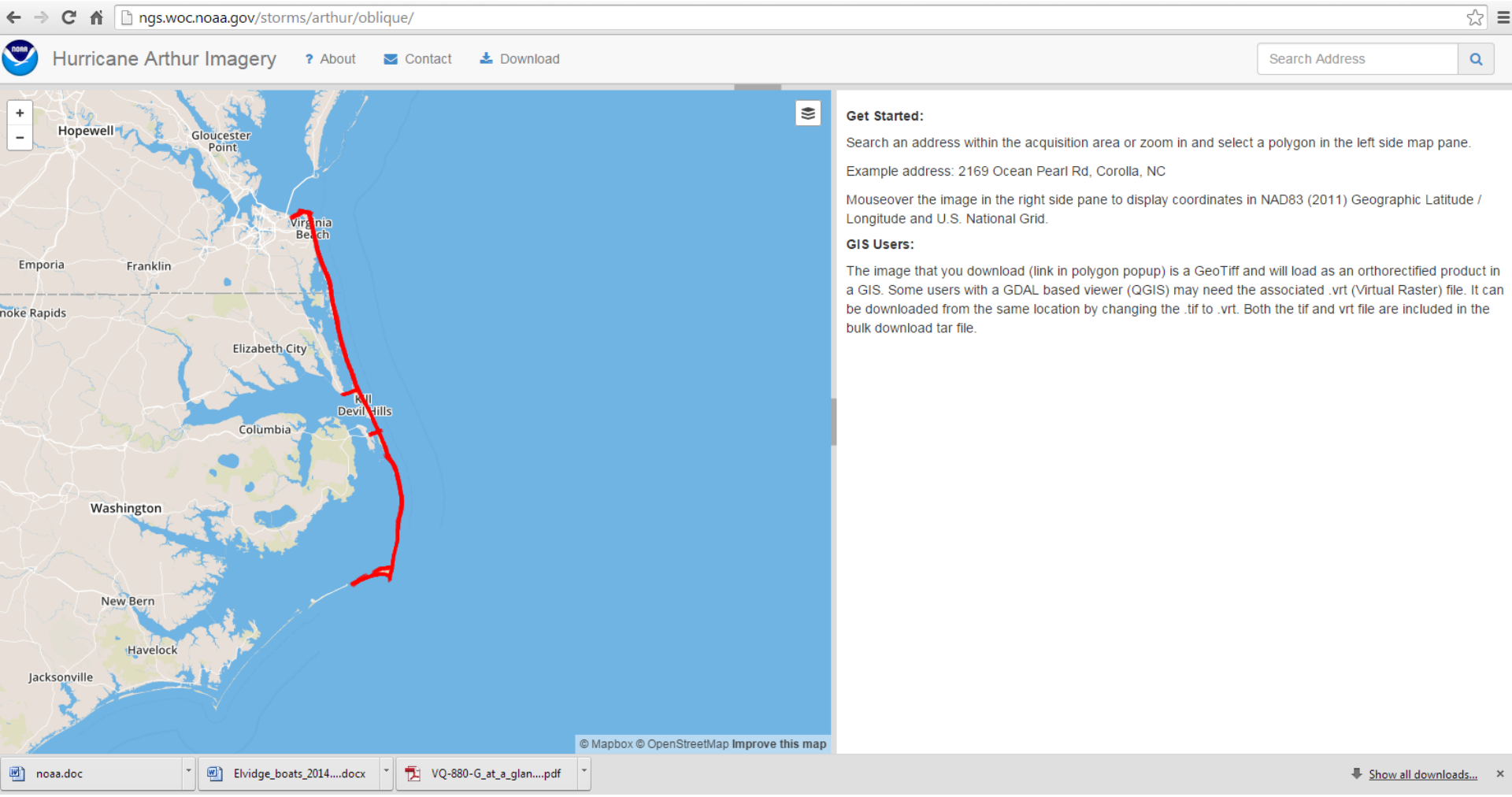
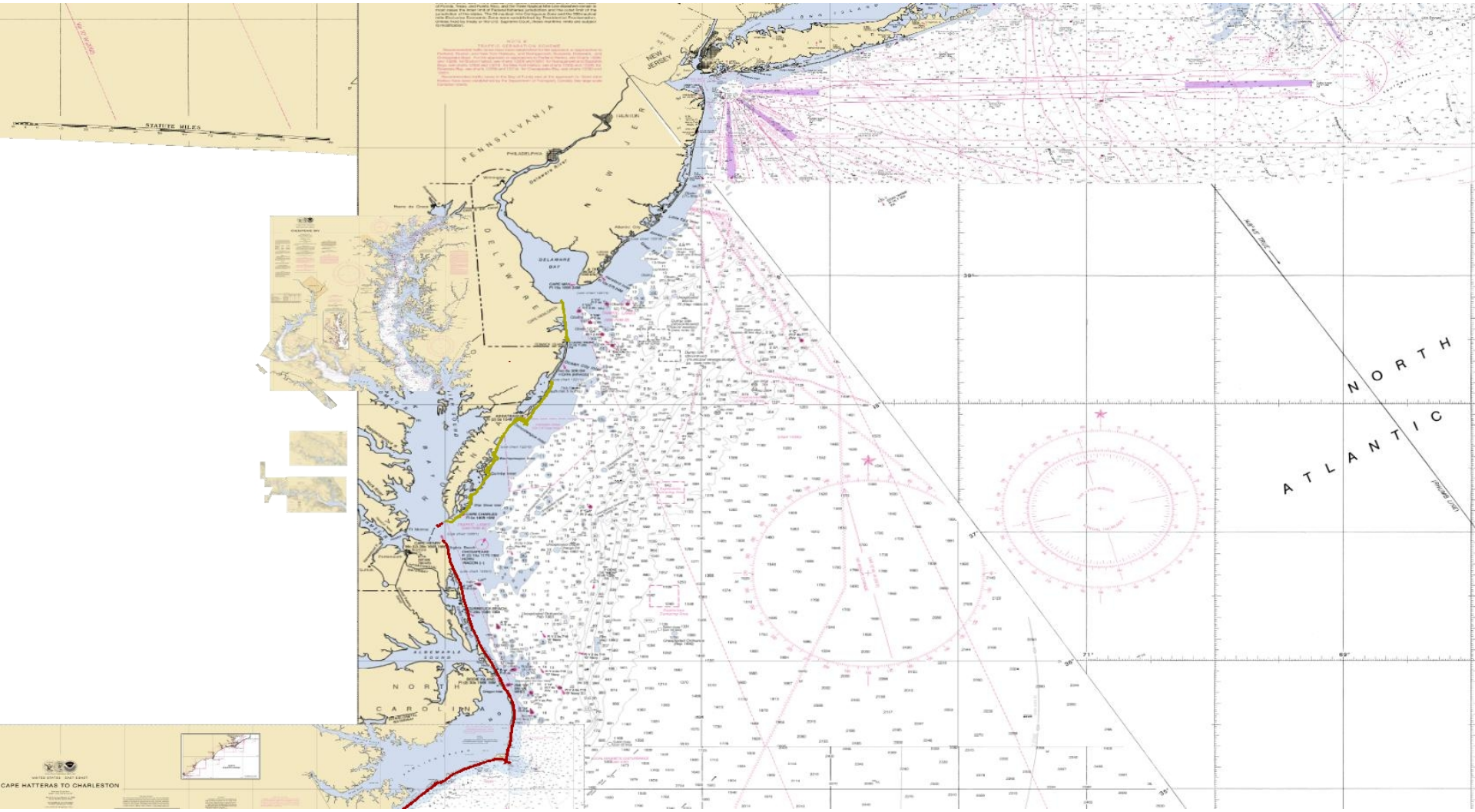
Hx Arthur Response

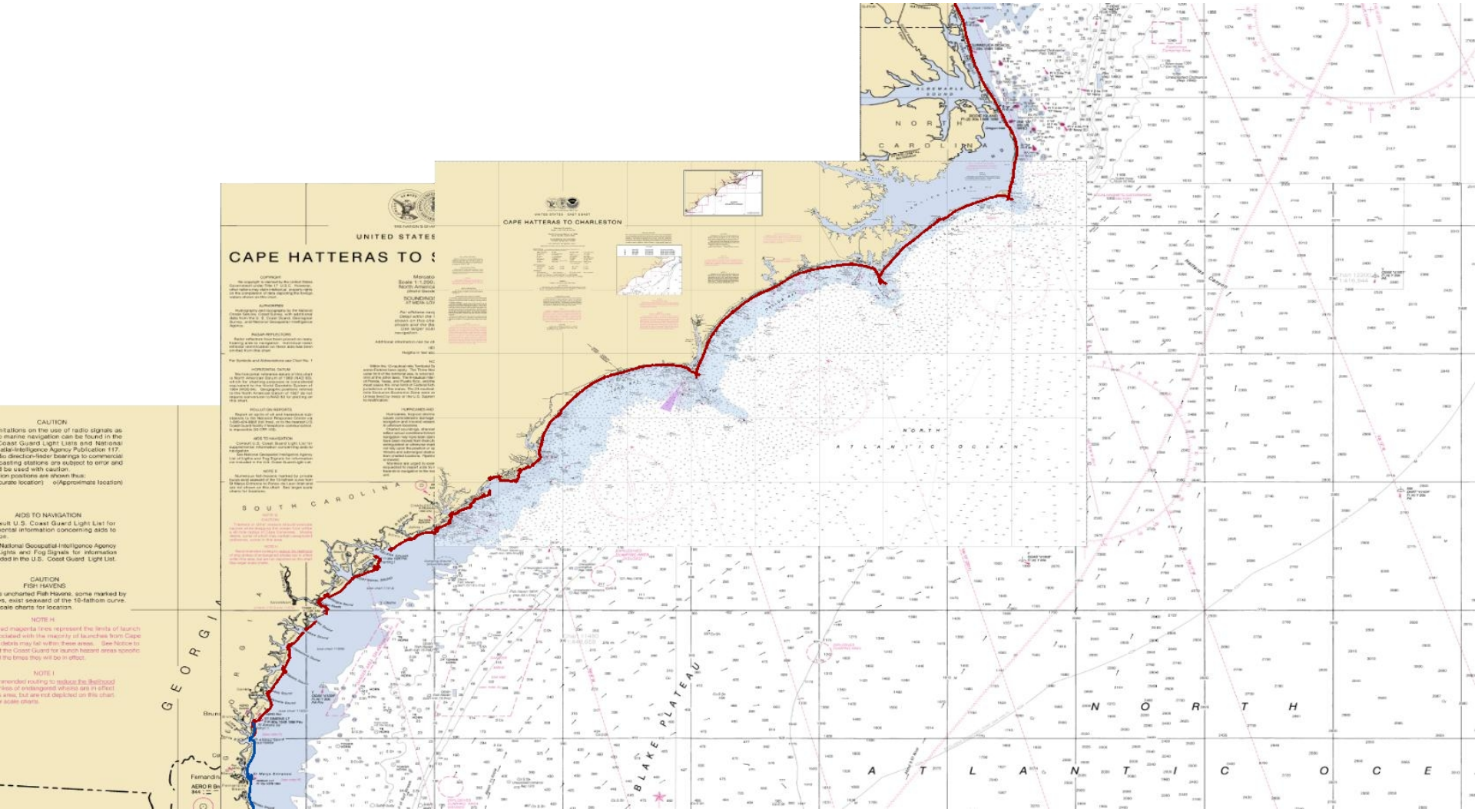


http://ngs.woc.noaa.gov/storms/arthur/oblique/

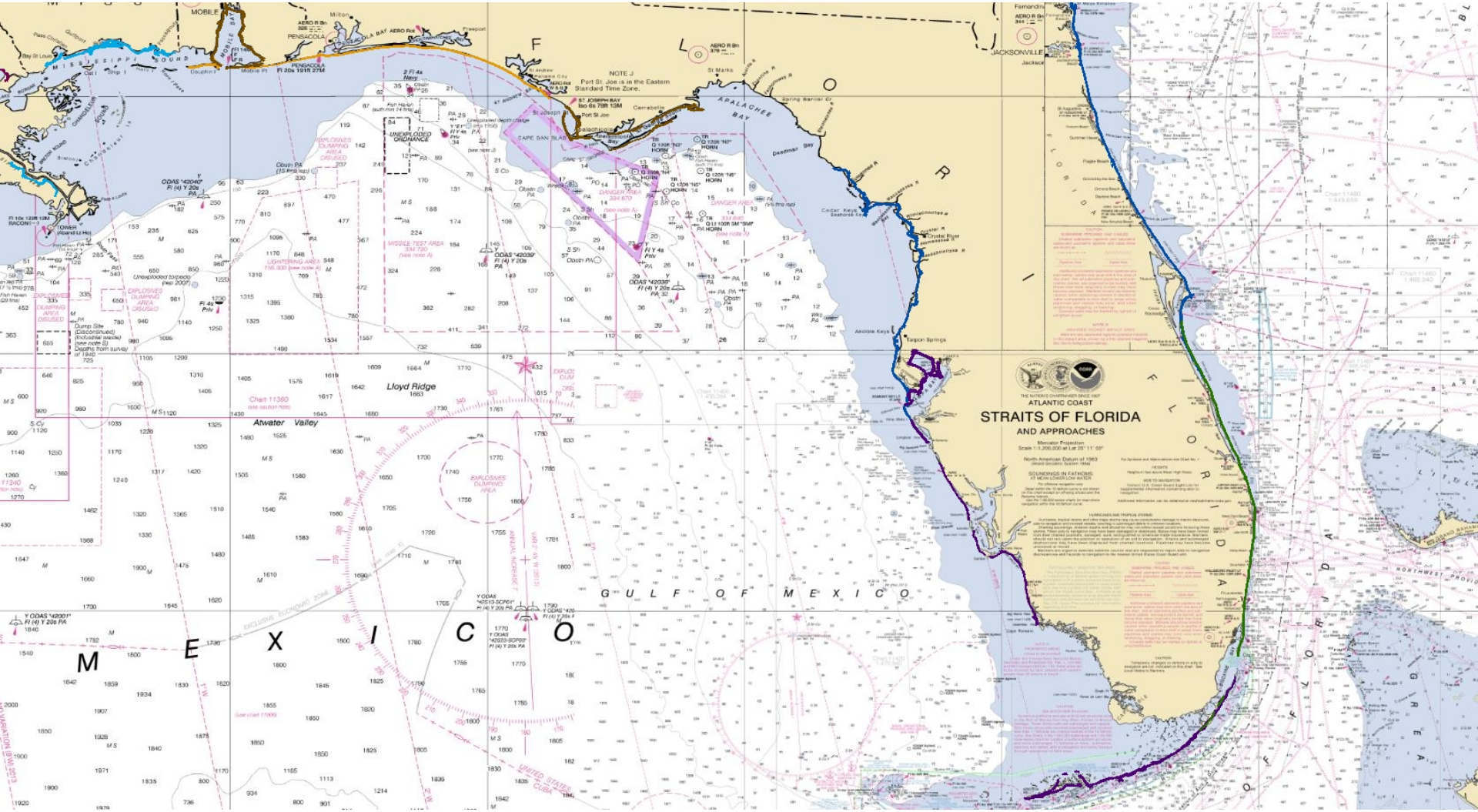
Pre-event oblique imagery



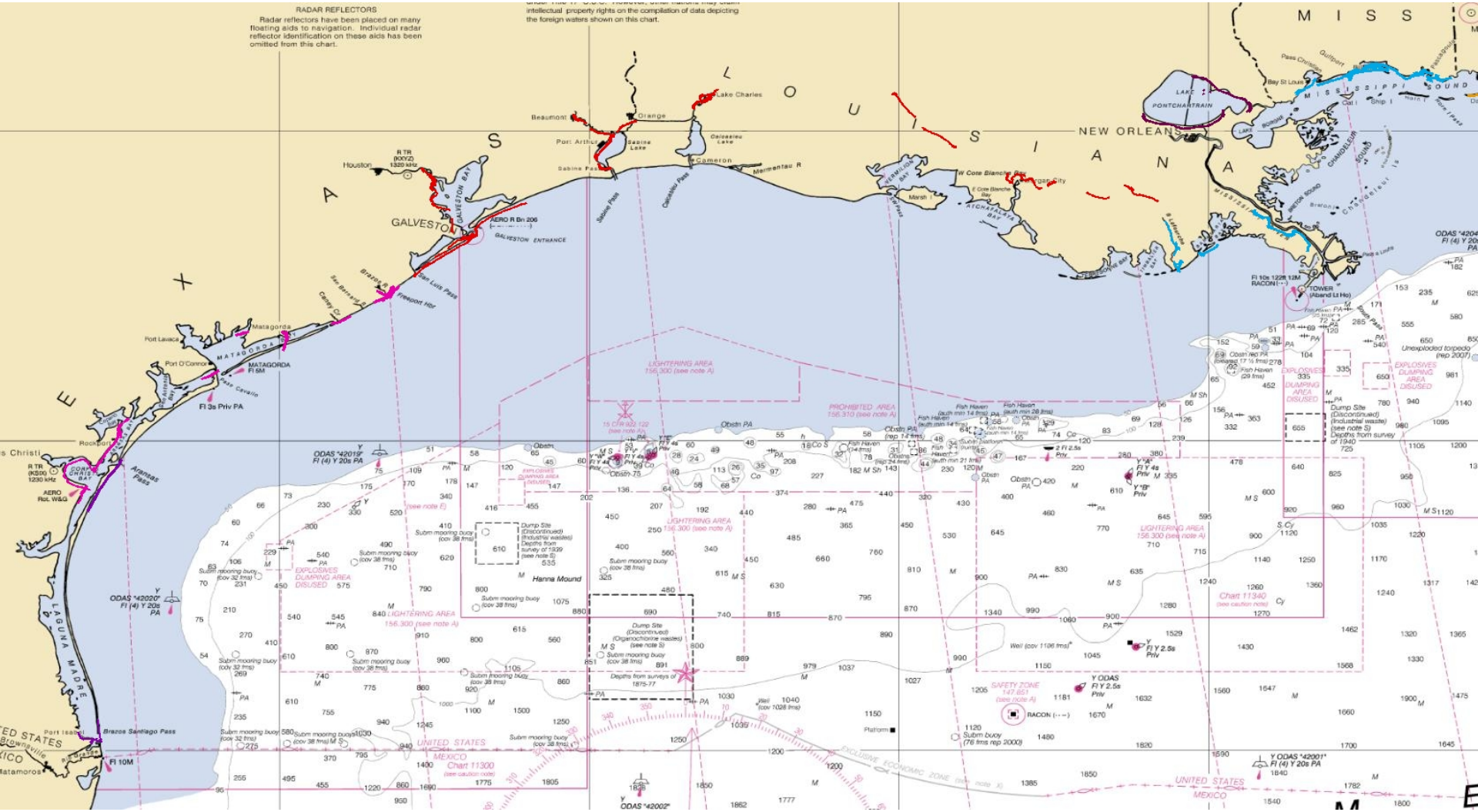
Pre-event oblique imagery



Pre-event oblique imagery



Pre-event oblique imagery



Pre-event planning/operations

Days Out	
-8/-5	*Event of National Significance/Impact to NOAA Mission(s) (Charting, Weather, CZM, Facilities, Trust Resources)*
-4	*Approval by Director, NGS*
-4/-3	*Preplanned flight lines developed/updated (if a known event, Hx, or developed if not).*
-4/-3	*Disseminated to FEMA RS coordinator* and other partners (States,USGS, USACE, FEMA) for coordination/additions*
-3/-2	*Prepositioning of assets and personnel*
-2/0	*Refinement of Requirements*
0/+?	*Daily updates on collections and intentions*

NOAA HX Sandy Response Plan

Response Strategy

Preplanned flight lines for damage assessment imagery were developed and shared with interagency partners through FEMA coordination that include state and local representation as well as used modeled impacts of storm surge and damage from the FEMA Modeling Task Force (MOTF).

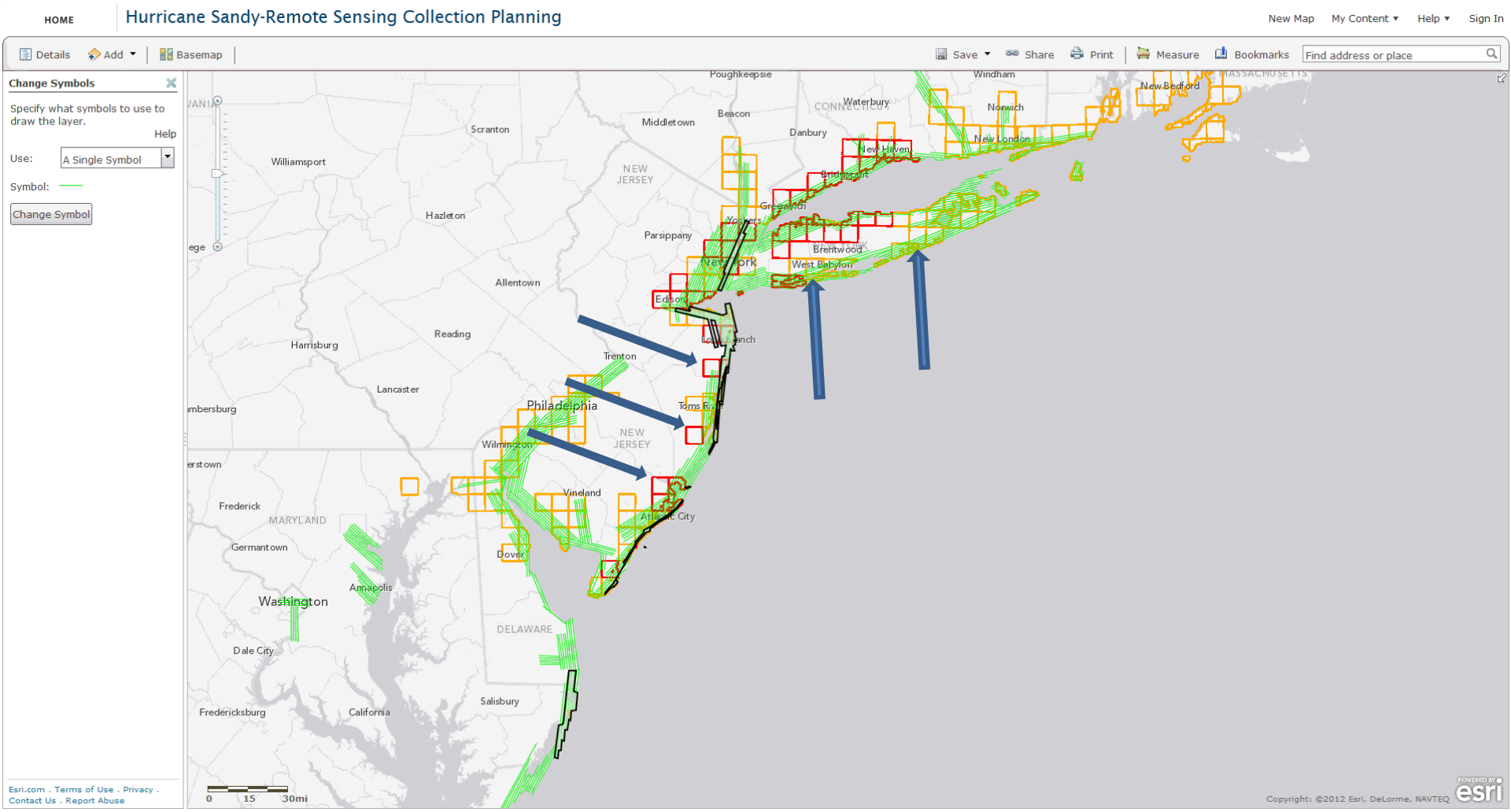
Requirements of Response

The flight lines cover areas of known and potential impacts to navigation, critical infrastructure including those with potential HAZMAT issues, coastal zone management concerns, and overlapping requirements of federal partners including FEMA, USCG, USACE, NGA, and USGS.

Priorities

Priorities are centered on the major ports and waterways supporting the Marine Transportation System; known or projected severe impacts to coastlines and critical infrastructure (New Jersey/New York), areas of severe flooding impacting coastal communities

NOAA planned flight lines and collected data overlaid on MOTF Risk Matrix And Priority setting for 1-2 Nov



Black outline = data collected Green lines = planned collection Blue Boxes = priority areas for 1-2 Nov

HOME

Hurricane Sandy-Remote Sensing Collection Planning

New Map | My Content | Help | Sign In

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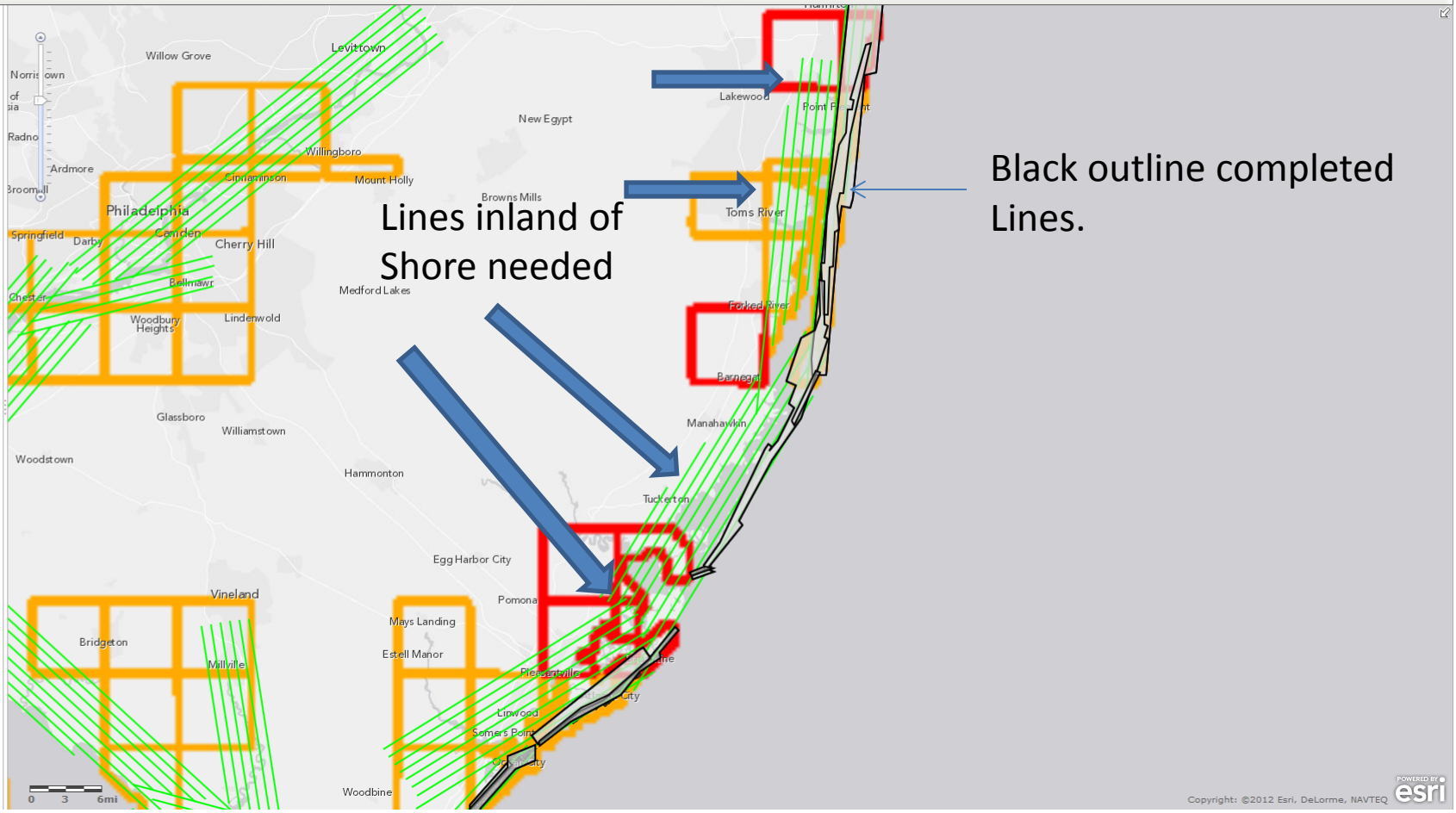
Contents

- sandy ngs rsd
- 20121101 ngs rsd
- 20121031 ngs rsd
- EAARL-B post-Sandy
- NGTOC post-Sandy lidar
- sandy dss flt lines
- Sandy Images
- Collected CAP Imagery
- CT CAP
- Remote Sensing Plans
- NOAA 20121031
- Sandy Surge Extent
- MOTF Risk Matrix
- Light Gray Canvas



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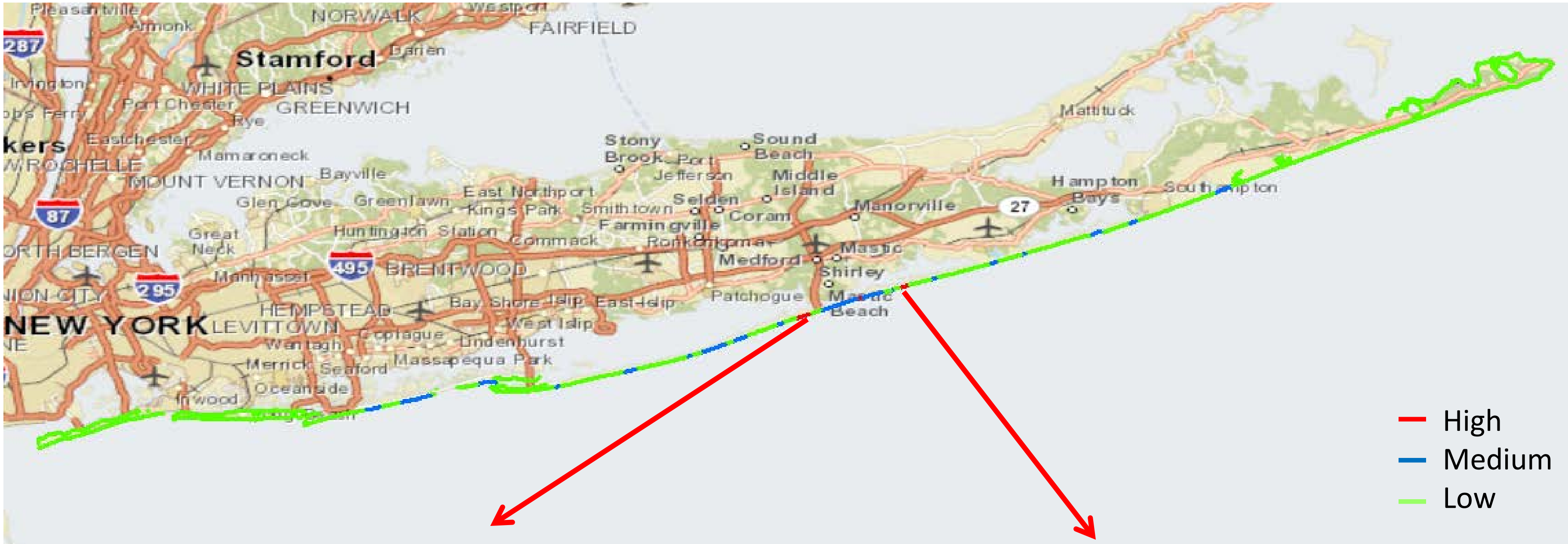
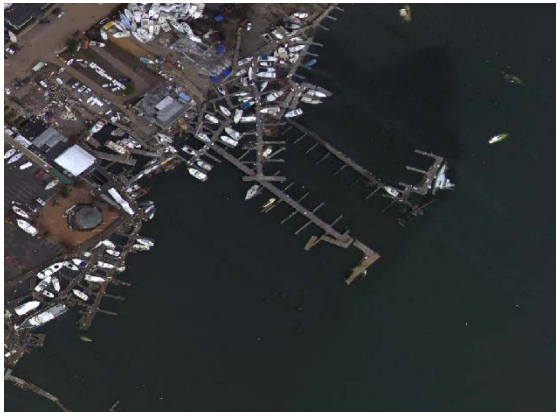
Significant Shoreline Changes (Long Island)

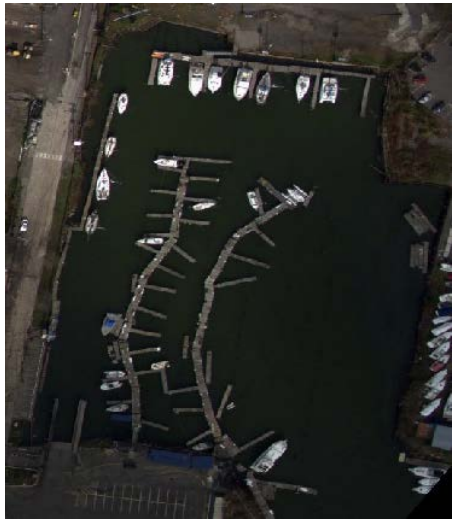


Shoreline Changes (New Jersey)

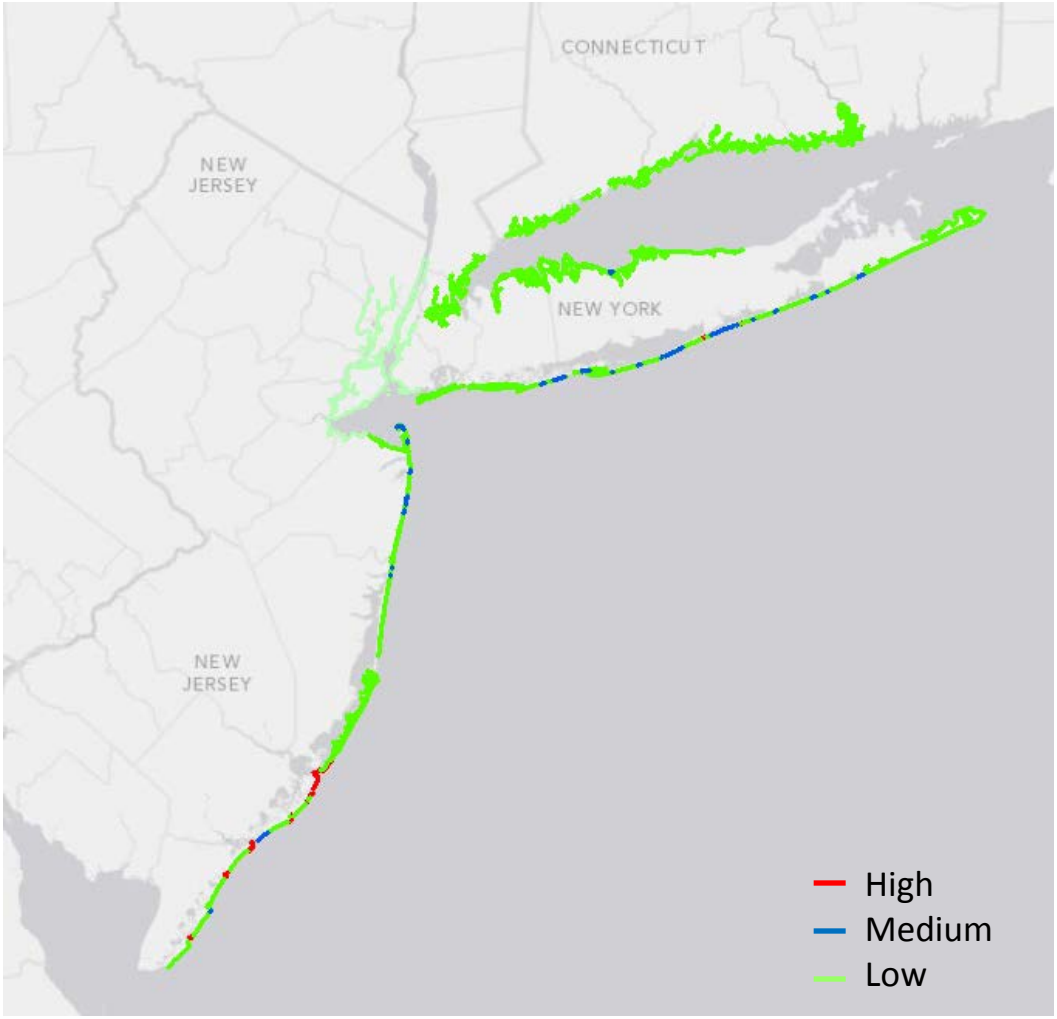
Port Infrastructure Changes

27 Destroyed Features
(Piers, Bulkheads)

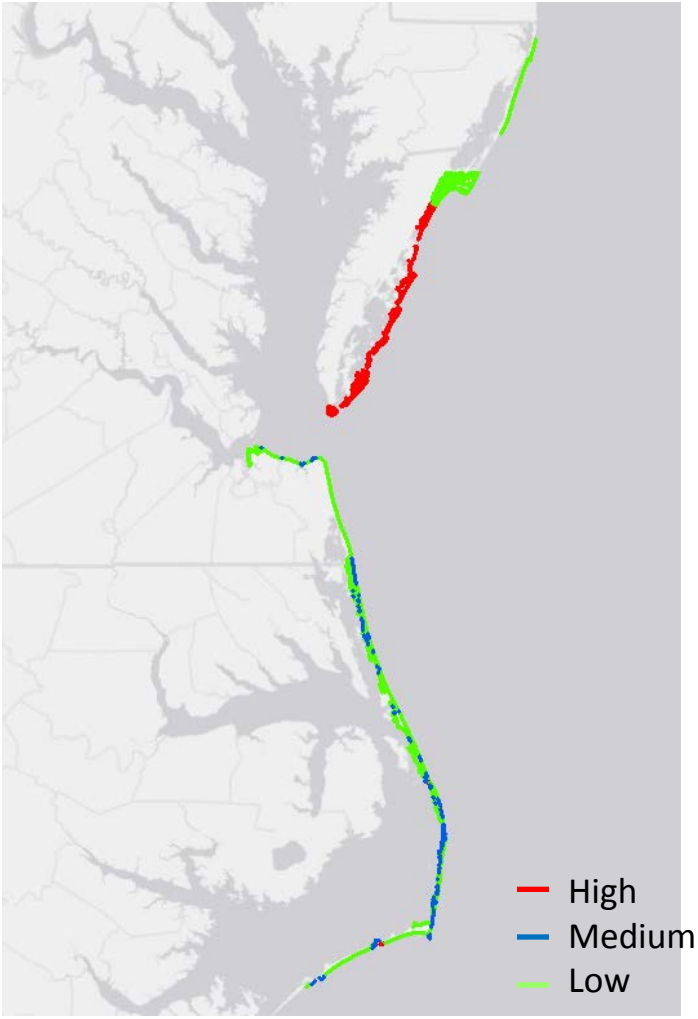




Priority Areas of Shoreline Changes

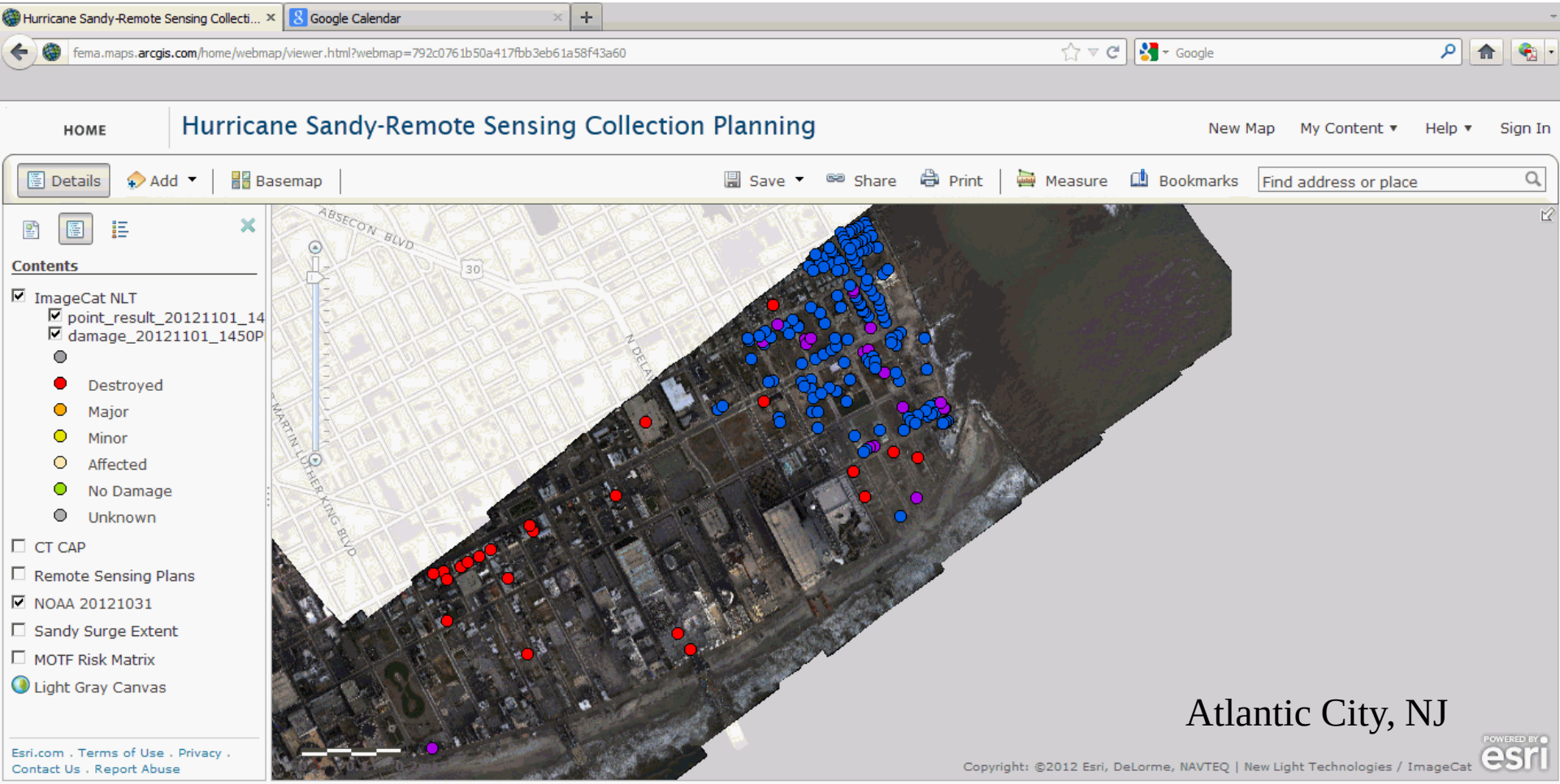


Connecticut to New Jersey



Maryland to North Carolina

FEMA use of NOAA Imagery for Damage Assessment of Individual Homes



Over 147,000 individual structural assessments were conducted using imagery and inundation information.

NOAA Hx Sandy response outcomes

- ***Primary users and coordination***
  - ***FEMA, NJ/NY EMA, NJ/NY DOT, USGS, USACE, DHS, USCG, NGA, Google, ESRI, Insurance industry, academia***
- ***By the numbers***
  - ***12,000 images over 3000 miles of impacted shoreline***
  - ***24 flights, 91.2 flight hours, 7 days***
  - ***Imagery delivered 4-8 hours after landing***
  - ***Supported 147,000 individual structural assessments***
  - ***Visitors 1,145,390, 856 million hits; 12.2 terabytes downloaded***
  - ***storms.ngs.noaa.gov***

Coordination recommendations

- ***NOAA activities through your NOAA CZM contacts, NOAA regional reps, directly with NGS.***
- ***Larger events including above through your State EMAs, DOTs, etc. to FEMA at the JFO.***
  - ***Requires educating now on the importance of the data***
  - ***Find out who the FEMA RS and GIS lead are for your JFO***
- ***Other federal agency contacts USGS Liaisons, USACE Districts, NSGIC, etc.***
- ***Provide feed back on plans and indicate any intentions of collecting similar data within your state.***
- ***Response efforts are from limited resources and every event is different.***