



NGS Coastal Mapping Program

Shoreline and Nearshore Bathymetry

Mike Aslaksen
Chief, Remote Sensing Division
National Geodetic Survey



National Oceanic and Atmospheric Administration

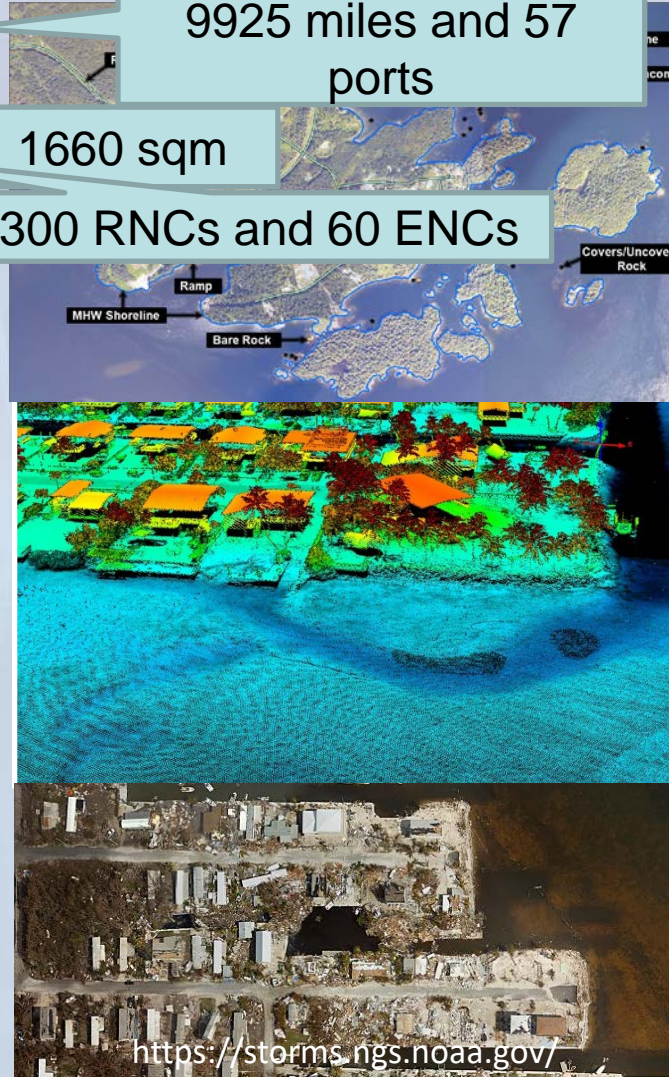
Outline

- **Background**
- **Products**
 - **Topobathy lidar**
 - **Coastal Imagery**
 - **Shoreline**
 - **Geographic Cells (GCs)**
 - **Continuously Updated Shoreline Product (CUSP)**
 - **Coastal Oblique Imagery**
 - **Emergency Response Imagery**
 - **Supplemental**
- **Questions**



NOAA's Coastal Mapping Program

- Define the National Shoreline and nearshore elevation data
- 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
- Coastal Intelligence and Resiliency...
- Emergency Response



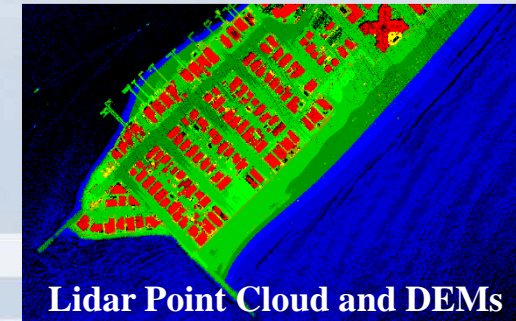
Shoreline

<https://www.ngs.noaa.gov/NSDE/>



Ortho Mosaic Imagery

<https://coast.noaa.gov/digitalcoast/>

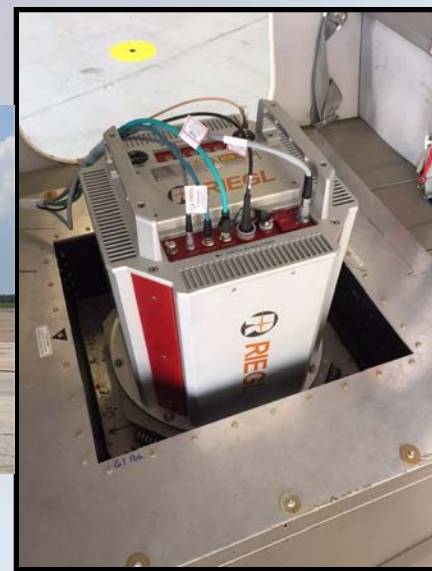


Lidar Point Cloud and DEMs

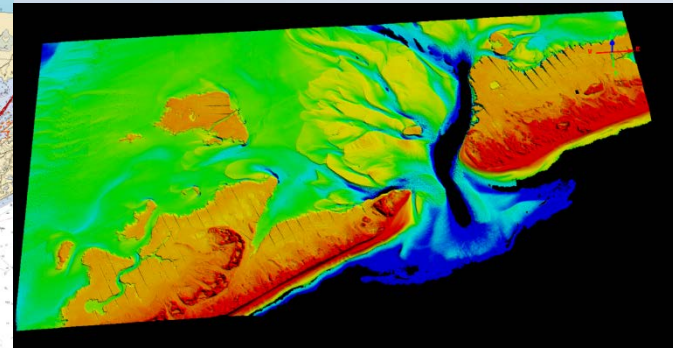
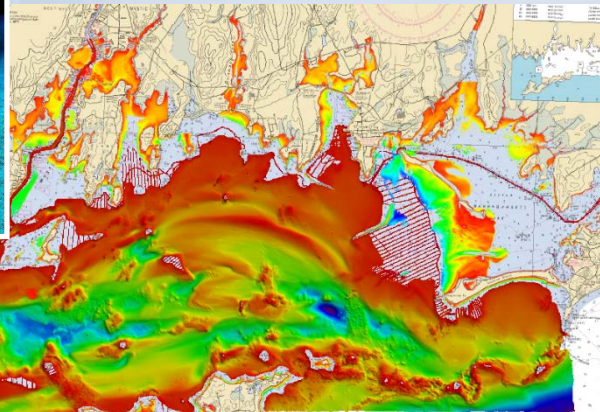
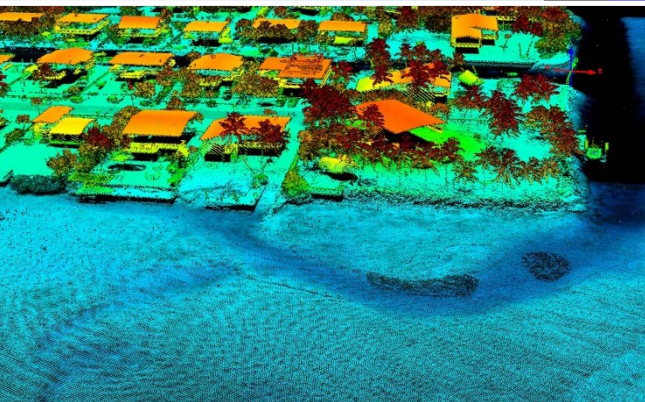
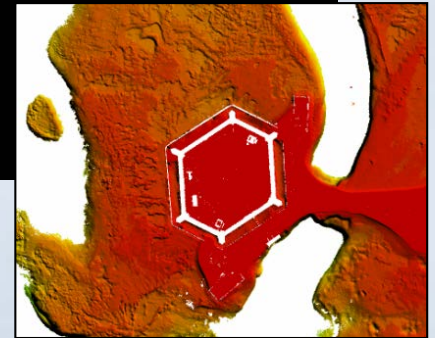
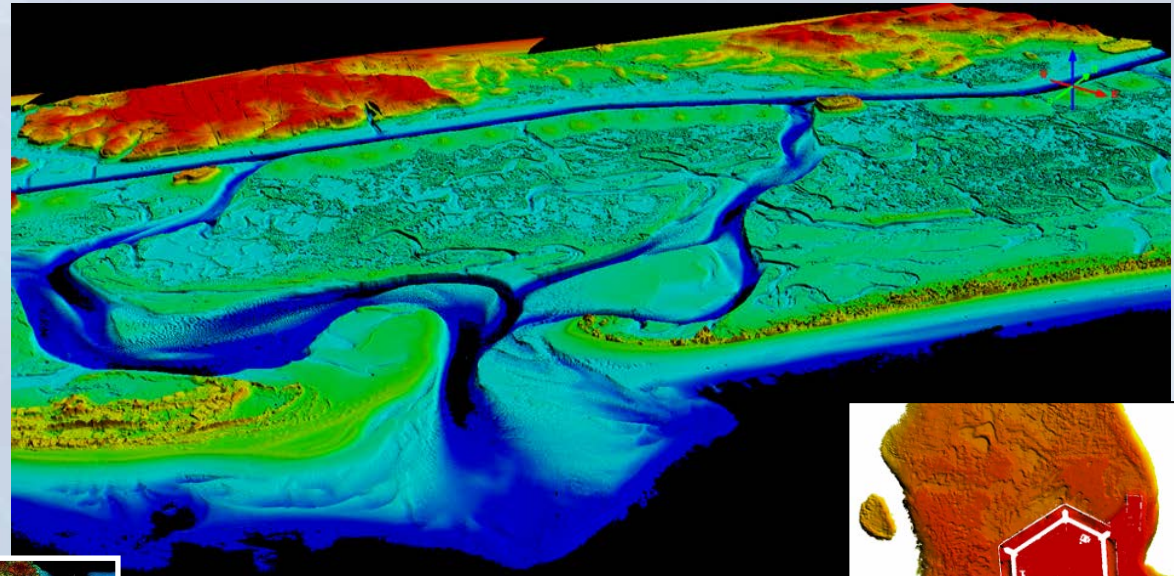
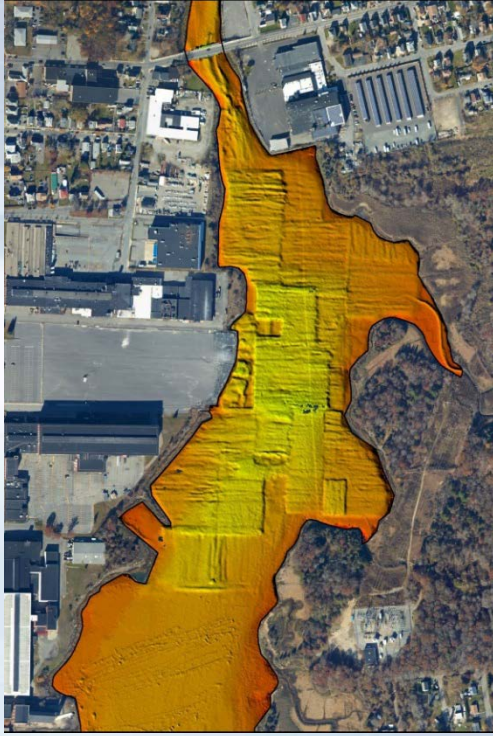


How do we do it?

- **NOAA and contract aircraft**
- **Trimble DSS580 Dual Cam & DSS500 Dual Oblique Cam**
 - RGB & NIR cameras (NIR in DSS580 only)
 - 35cm GSD at 10,500' flying height
 - In-flight image processing
- **RIEGL LIDARs**
 - Topographic LIDAR (LMS-Q680i)
 - Topobathymetric System (VQ-880G)
- **Satellite Imagery**
- **Private sector contracts**
 - Shoreline Mapping IDIQ contract
 - 3 Prime contractors(Quantum Spatial, Dewberry, Fugro)
 - Re-compete planned for fall 2018



RSD's Topobathy lidar data



National Oceanic and Atmospheric Administration

NOAA Digital Coast



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IMAGERY LAND COVER ELEVATION

HELP SHARE

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2014 NOAA NGS Topobathy Lidar: Intracoastal Waterway (FL)

NOAA National Geodetic Survey
2,284,850,654 Pts

Add to Cart

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Topographic Lidar data acquired in support of NOAA's Integrated Ocean and Coastal Mapping Initiative or emergency response.

Also available as a [bulk download](#).



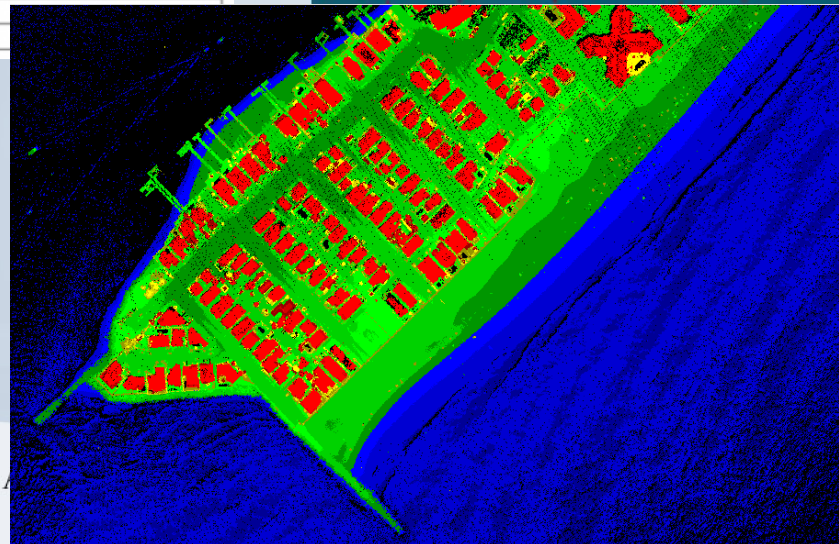
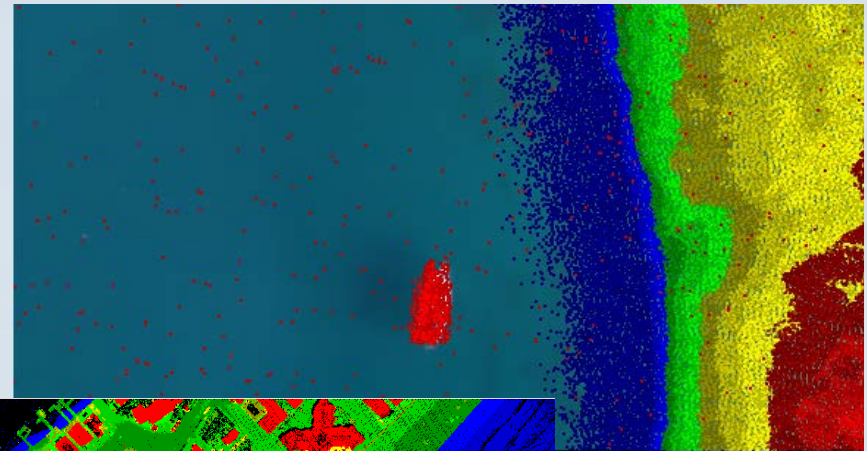
National Oceanic and Atmospheric Administration

Lidar Data Formats

Topobathy lidar classified point-cloud data in ASPRS standard LAS 1.2 format, and topobathy DEMs (1-meter) in IMG format are provided to NOAA's Digital Coast website for distribution to the public.

ASPRS Standard LIDAR Point Classes

<i>Classification Value (bits 0:4)</i>	<i>Meaning</i>
0	Created, never classified
1	Unclassified ¹
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point (mass point)
9	Water
10	<i>Reserved for ASPRS Definition</i>
11	<i>Reserved for ASPRS Definition</i>
12	Overlap Points ²
13-31	<i>Reserved for ASPRS Definition</i>



NOAA Digital Coast



DATA ACCESS VIEWER

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Choose a Data Type to Explore

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Land Cover



DATA ACCESS VIEWER

IMAGERY

LAND COVER

ELEVATION

HELP

SHARE



Search By Address, Lat/Lon or E



← Return to Results

2014 Key West (FL) NOAA NGS DSS Infrared 8 Bit Imagery

NOAA National Geodetic Survey
851.62 MB

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This dataset contains ortho-rectified mosaic tiles, created as a product from the NOAA Integrated Ocean and Coastal Mapping (IOCM) initiative by the National Geodetic Survey (NGS) to increase support for multiple uses of the data.

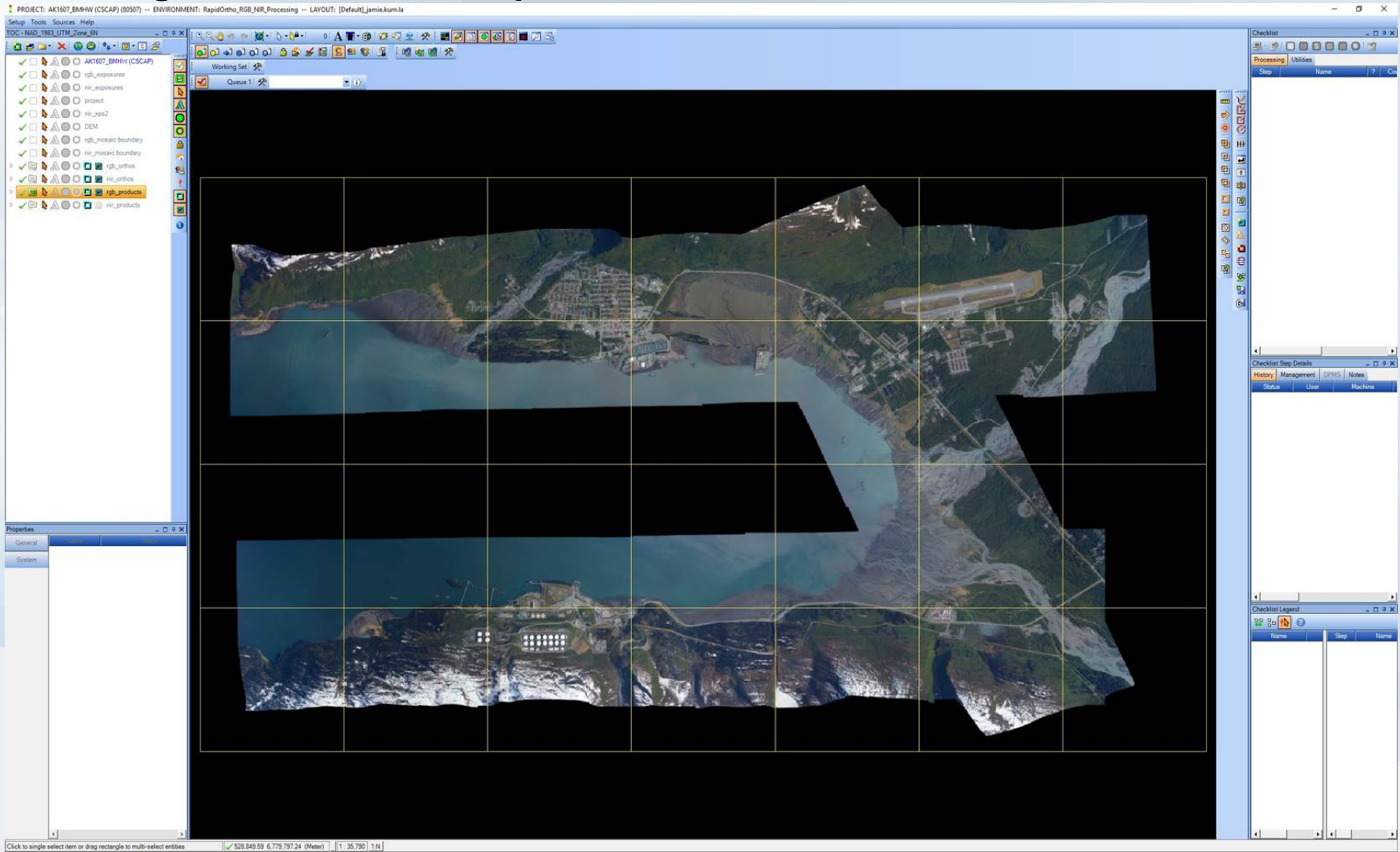
Also available as a bulk download.



National Oceanic and Atmospheric Administration

Orthoimagery Format

GeoCue is used as a workflow manager to coordinate the production of 2.5 km square orthomosaic tiles in GeoTiff format (UTM projection) using OrthoVista and RapidOrtho software.



Orthomosaic Imagery on Digital Coast

The screenshot displays the NOAA Data Access Viewer interface. The browser address bar shows the URL: <https://coast.noaa.gov/dataviewer/#/imagery/search/-8546901.863992339,4117395.1841234467,-8528404.103147328,4129070.940194007/c>. The NOAA logo and "DATA ACCESS VIEWER" are visible at the top left. Navigation tabs include "IMAGERY", "LAND COVER", and "ELEVATION". A search bar at the top left of the map area contains the text "Search By Address, Lat/Lon or Extent". The main map area shows a satellite-style orthomosaic of a coastal region with labels for "Newport River", "Morehead City", "Beaufort", "Atlantic Beach", "Fort Macon State Park", "Back Sound", "Cape Lookout National Seashore", "Davis Bay", and "St. Pauli Manor". A yellow rectangular box highlights a specific area on the map. At the bottom left, there are zoom controls (+, -) and a legend for "Satellite" and "Grey" styles, along with a "5000 ft" scale bar. On the right side, a metadata panel is displayed with the following information:

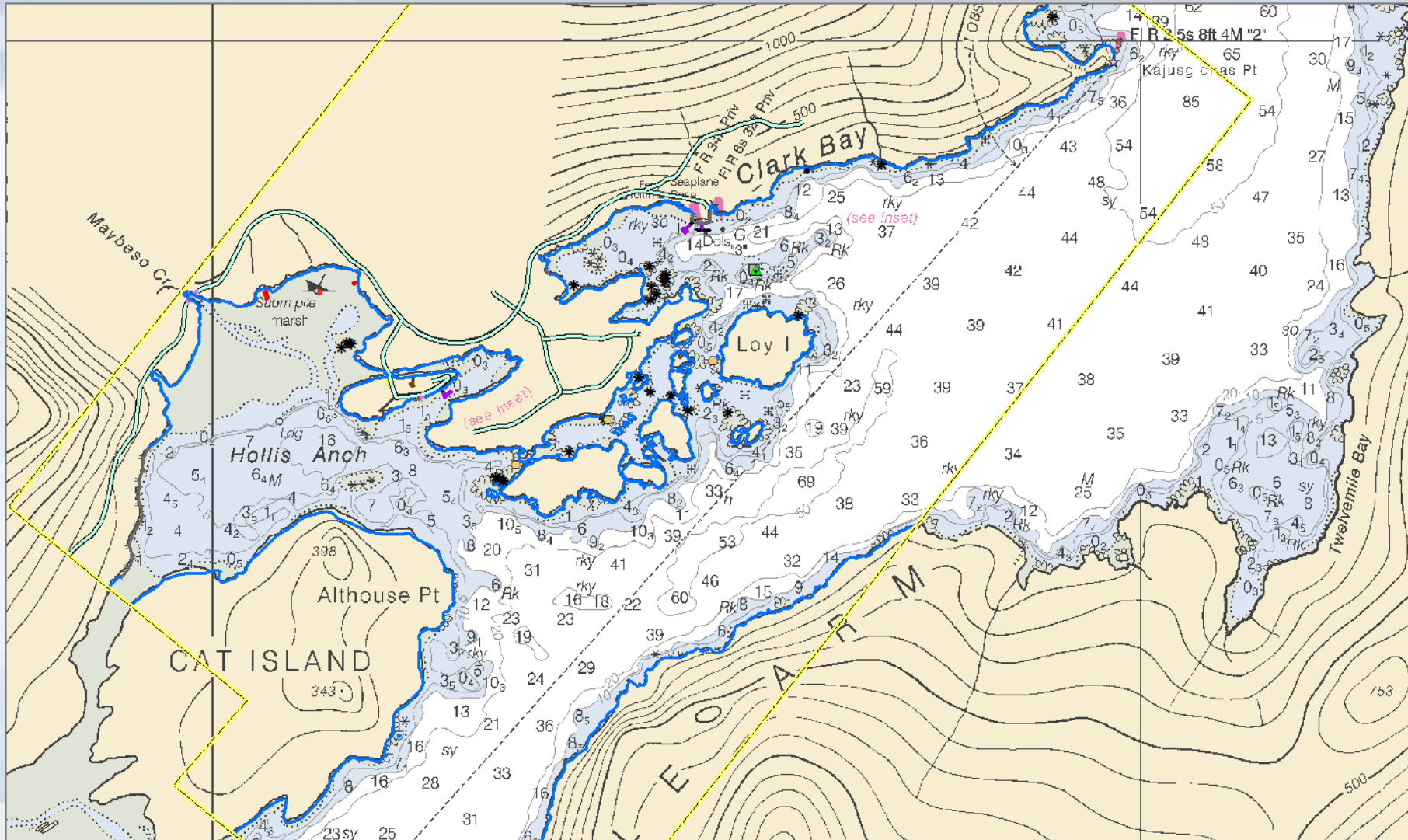
- [Return to Results](#)
- 2014 Cape Lookout, NC MLLW NOAA NGS DSS Natural Color 8 Bit Imagery**
- NOAA National Geodetic Survey
- 2.36 GB
- [Add to Cart](#)
- 0 in cart
- This dataset contains ortho-rectified mosaic tiles, created as a product from the NOAA Integrated Ocean and Coastal Mapping (IOCM) initiative by the National Geodetic Survey (NGS) to increase support for multiple uses of the data.
- Also available as a [bulk download](#).
- Attributes**
 - Cell size (m): 0.5
 - Radiometric resolution (bit): 8
 - Sensor: Digital Sensor System RGB
 - Horizontal Accuracy (cm): 150 - These data are accurate with a 95% circular error confidence level
 - Number of bands: 3
 - Tide controlled: Yes
- Related Links**
 - [Metadata](#)
 - [Image Service](#)

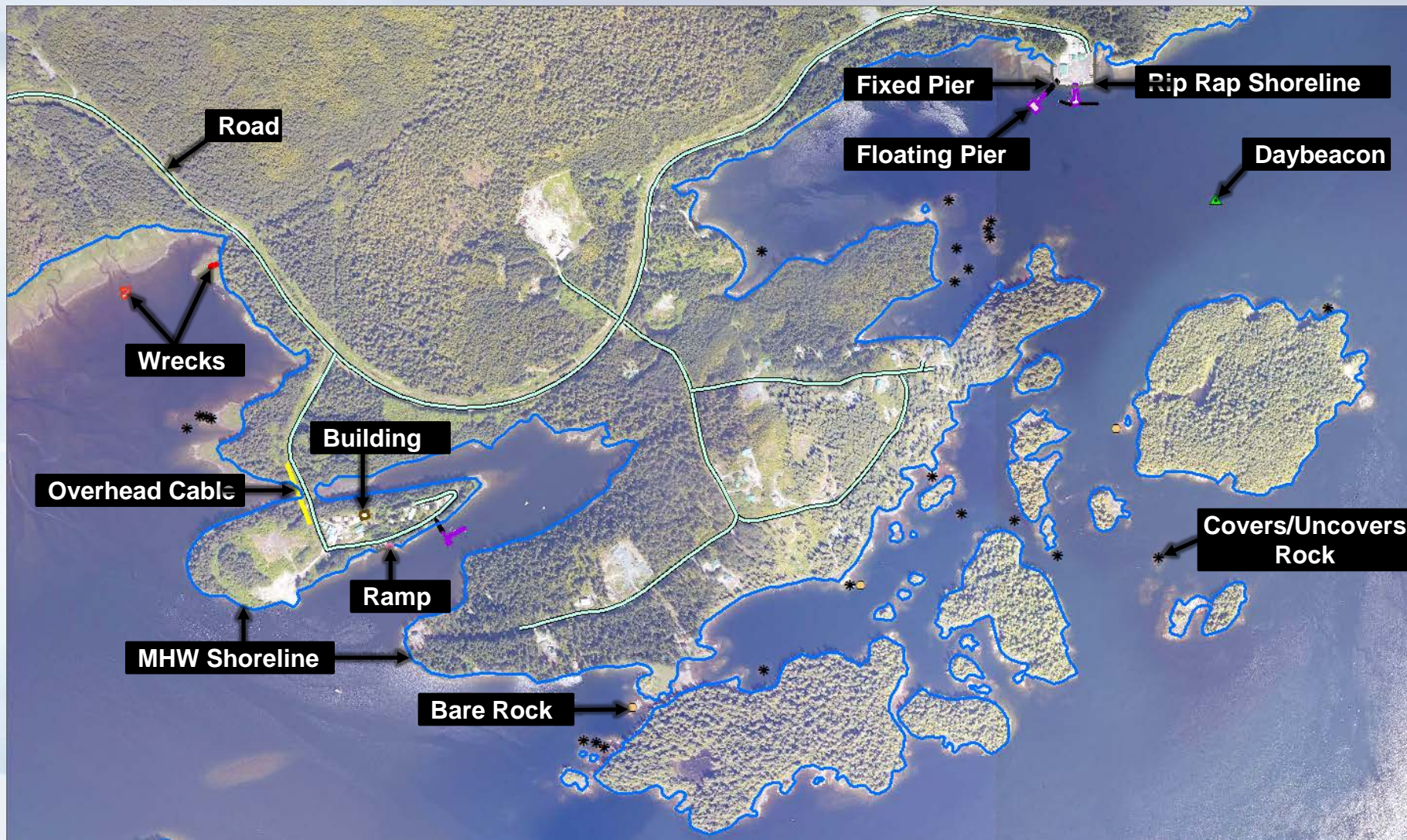
Access to NGS Data on Digital Coast

- **Data Registry (Imagery and Lidar)**
 - <https://coast.noaa.gov/dataregistry/search/collection>
- **Data Access Viewer (Imagery and Lidar)**
 - <https://coast.noaa.gov/dataviewer/#>
- **Coastal Lidar Datasheet**
 - https://coast.noaa.gov/htdata/lidar1_z/geoid12a/data/



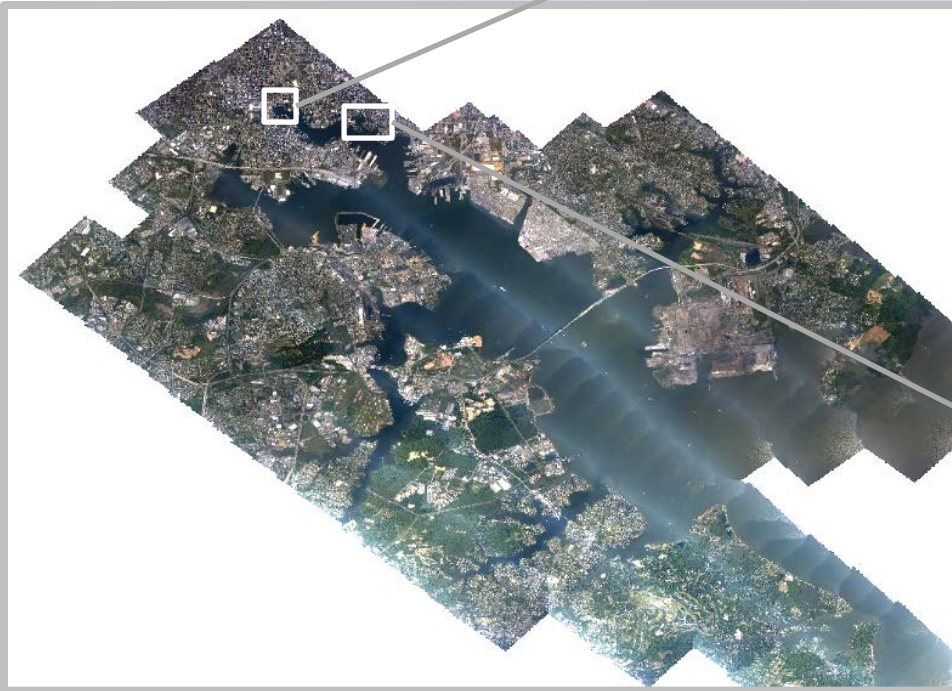
Geographic Cells





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High Resolution Digital Aerial Imagery and Shoreline

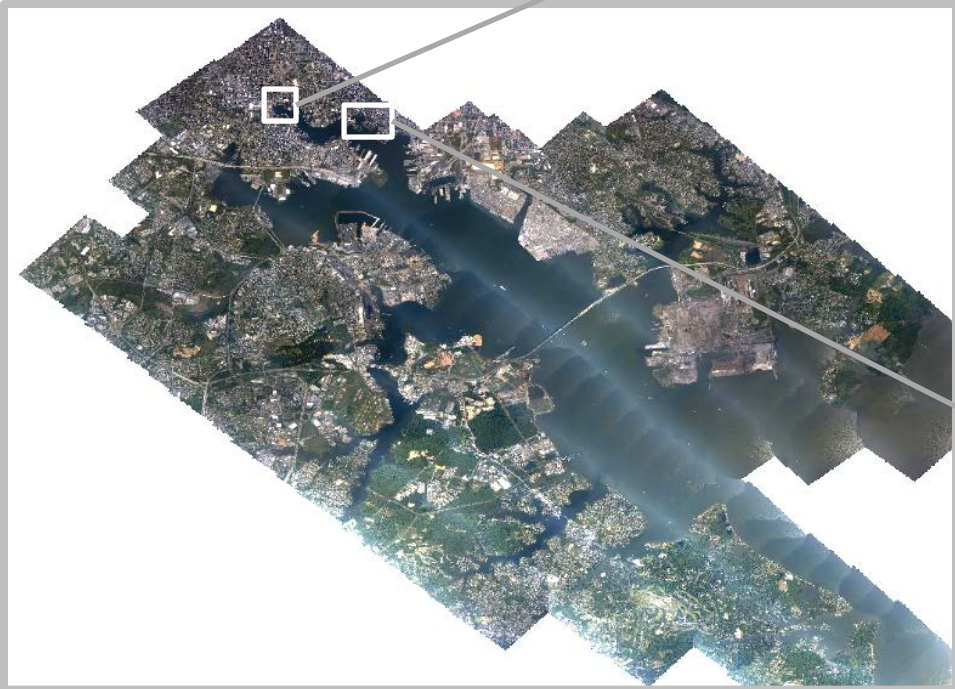


Baltimore, MD



National Oceanic and Atmospheric Administration

High Resolution Digital Aerial Imagery and Shoreline

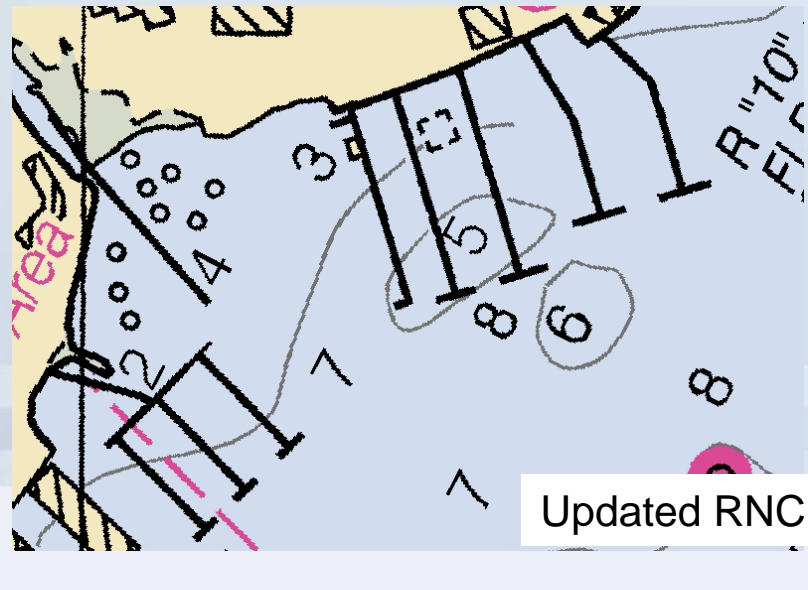
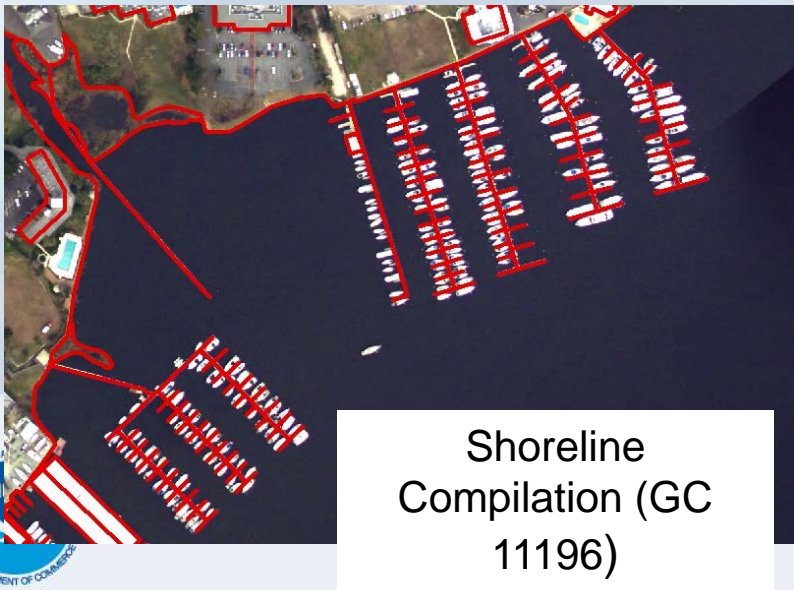
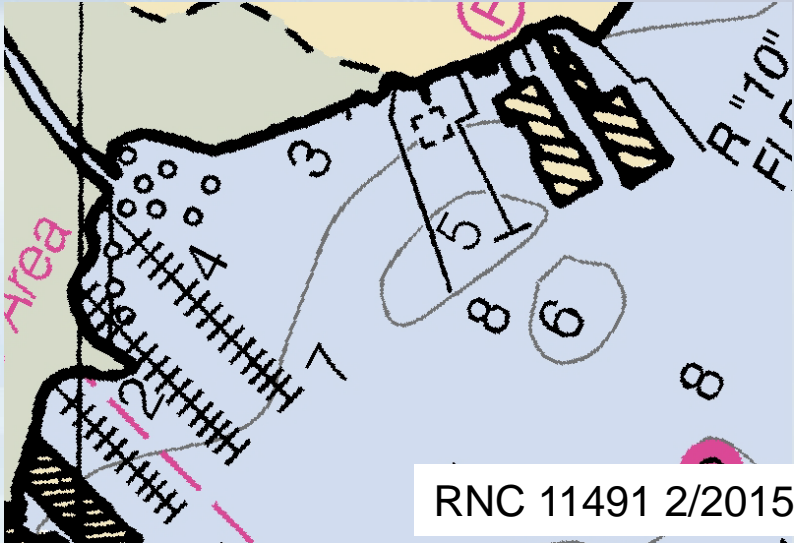


Baltimore, MD

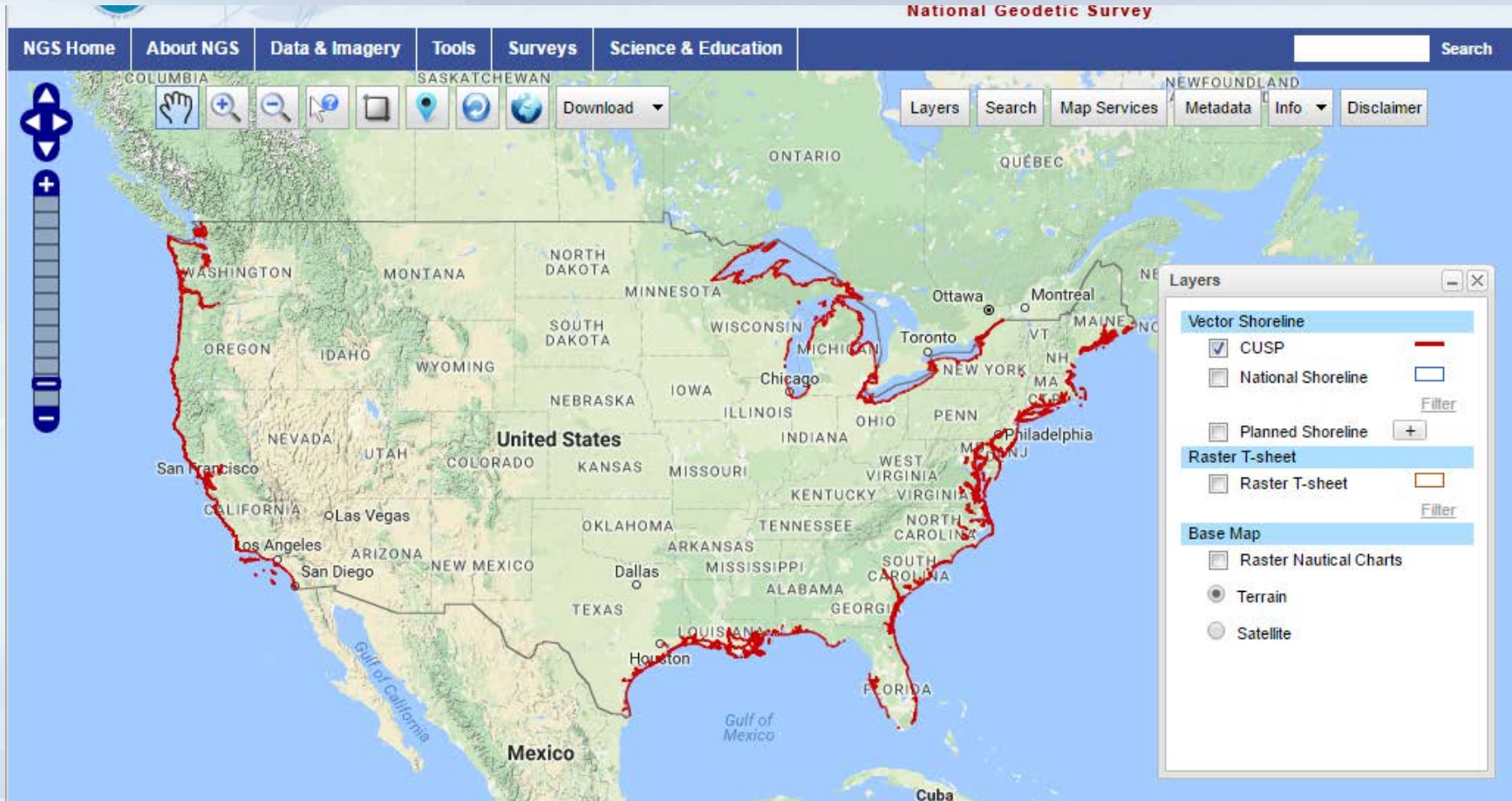


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Coast and Shoreline Change Analysis Program (CSCAP) Jacksonville, FL



Continually Updated Shoreline Product (CUSP)




<https://www.ngs.noaa.gov/NSDE/>



National Oceanic and Atmospheric Administration

Continually Updated Shoreline Product

National Geodetic Survey Positioning America for the Future geodesy.noaa.gov




NOAA's Continually Updated Shoreline Product

NOAA's National Geodetic Survey (NGS) has developed an ambitious project—the Continually Updated Shoreline Product (CUSP)—to provide the most current shoreline representation of the United States and its territories.

Why a new continuous shoreline?
At least 15 federal agencies, most coastal state and local organizations, as well as academic institutions and private companies are consumers of coastal mapping data. Shoreline data assists decision makers in developing coastal community plans, managing resources, mitigating hazard events, conducting environmental analyses, and more.

Goal for CUSP
Shoreline is a dynamic interface between land and water. Over the years, several continuous shorelines have been developed, but many may not have been maintained and, therefore, no longer adequately represent changes to the land-water interface. **CUSP has been designed to deliver continuous shoreline with frequent updates.**

CUSP will identify surveys for inclusion, employ state-of-the-art technology for cartographic review and validation, attribute shoreline features, and develop a strategy to delineate shoreline as it becomes available. Where applicable, CUSP will reference a mean-high water shoreline based on vertical modeling or image interpretation using both water level stations and/or shoreline indicators.



Data Sources for CUSP
CUSP is built upon NGS National Shoreline data and uses both NOAA and non-NOAA contemporary sources to replace older vintage shoreline areas. These data sources—coupled with NOAA tools (such as VDatum) and outside-sourced data sets which meet NOAA standards—contribute to the creation of a continually updated shoreline.

NOAA is exploring additional data sources for CUSP. Shoreline providers who wish to contribute their data to CUSP are encouraged to contact us.

For more information, contact NGS:

- On the Web geodesy.noaa.gov/CUSP
- By email ngs.shoreline@noaa.gov

CUSP

National Oceanic and Atmospheric Administration • National Geodetic Survey

- To provide the most current shoreline representation
- Designed to deliver continuous shoreline with frequent updates
- Employ state-of-the-art technologies
- Attributed shoreline features
- Referenced to Mean High Water datum where applicable
- Includes NOAA and non-NOAA contemporary sources

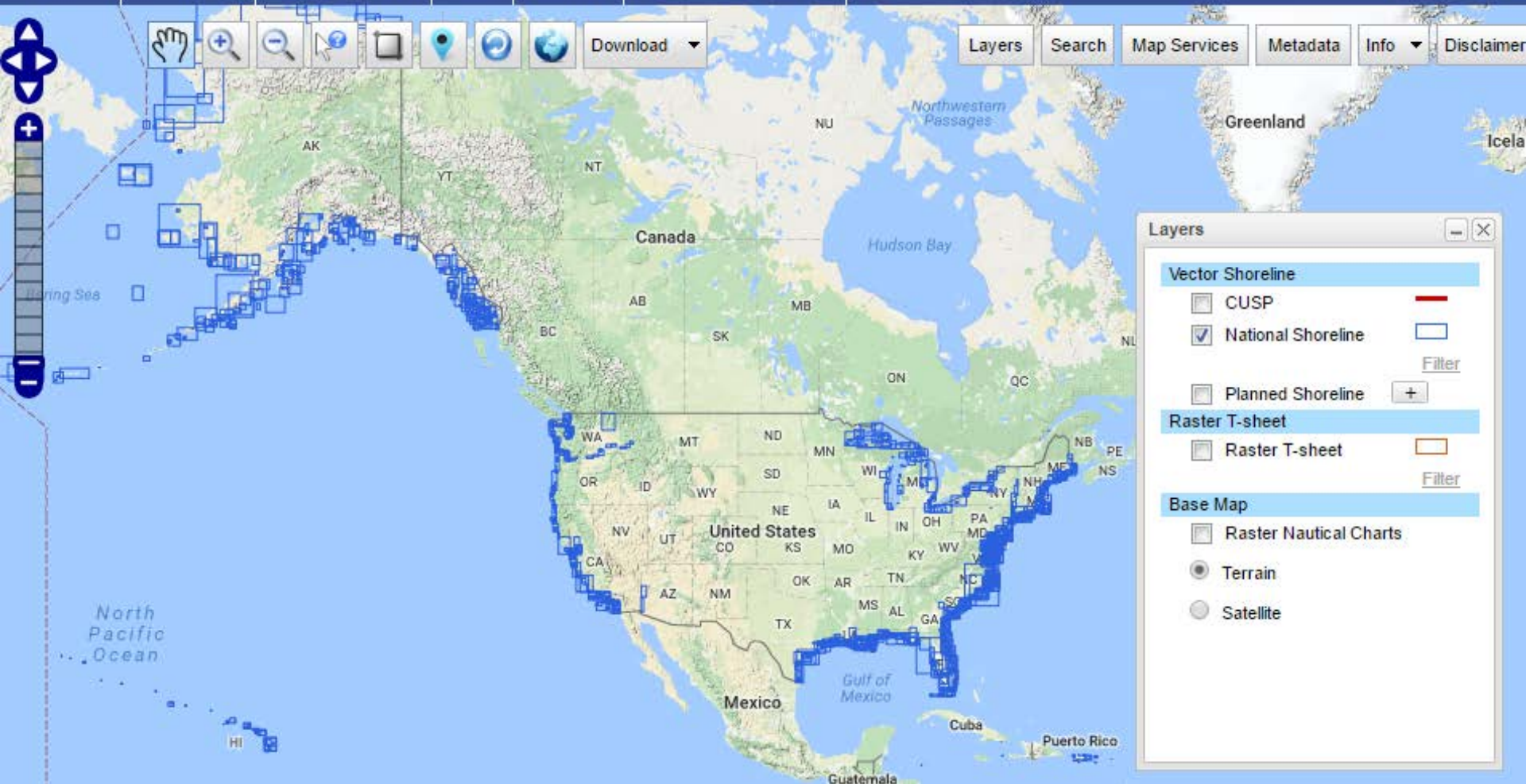




NOAA Shoreline Data Explorer

National Geodetic Survey

- NGS Home
- About NGS
- Data & Imagery
- Tools
- Surveys
- Science & Education



<https://www.ngs.noaa.gov/NSDE/>



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Coastal Oblique Imagery viewer

The screenshot shows the NOAA Coastal Imagery Viewer interface. At the top left is the NOAA logo and the title "Coastal Imagery Viewer". Navigation links include "About", "Contact", "Download", and "Tools". A search bar labeled "Search Address" is on the top right. Below the navigation are tabs for "2015 Imagery" and "2016 Imagery". The main map area displays a map of North America with a red rectangle highlighting a coastal region on the Alaska coast. To the right of the map is a "Get Started:" section with instructions on how to search for an address and use the imagery. Below that is a "GIS Users:" section explaining the format of the downloaded data. At the bottom right, there are two inset images: one showing a zoomed-in view of the highlighted coastal area with a red border, and another showing a close-up of the imagery data with a blue grid overlay.

Coastal Imagery Viewer ? About Contact Download Tools

Search Address

2015 Imagery 2016 Imagery

North Pacific Ocean

Canada

United States

Mexico

Get Started:

Search an address within the acquisition area or zoom in and select a polygon in the left side map pane.

Example address: 3737 Atlantic Ave, Virginia Beach, VA

Mouseover the image in the right side pane to display coordinates in NAD83 (2011) Geographic Latitude / Longitude and U.S. National Grid.

GIS Users:

The image that you download (link in polygon popup) is a GeoTiff and will load as a georeferenced product in a GIS. The data have not been ortho-rectified or fully corrected for topographic relief. Users should download the associated .vrt (Virtual Raster) file. It can be downloaded from the same location by changing the .tif to .vrt.



National Oceanic and Atmospheric Administration

https://geodesy.noaa.gov/storm_archive/coastal/viewer/index.html

NOAA Semi-Oblique Coastal Imaging





Emergency Response Imagery

National Geodetic Survey

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[Search](#)



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

[Tips for navigating the Emergency Response Imagery Viewer.](#)

Emergency Response Imagery:

Navigation

[National Geodetic Survey](#)
[Pre-Event Imagery](#)

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[Tropical Storm Gordon \(2018\)](#)
[Hurricane Nate \(2017\)](#)
[Hurricane Maria \(2017\)](#)
[Hurricane Irma \(2017\)](#)
[Hurricane Harvey \(2017\)](#)
[Hurricane Matthew \(2016\)](#)
[Louisiana Flooding \(2016\)](#)
[Midwest U.S. Flooding \(2015\)](#)
[Illinois Tornadoes \(2015\)](#)
[Hurricane Arthur \(2014\)](#)
[Hurricane Sandy \(2012\)](#)
[Hurricane Isaac \(2012\)](#)
[Hurricane Irene \(2011\)](#)
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[Tuscaloosa, AL Tornado \(2011\)](#)
[North Dakota Flooding \(2011\)](#)
[Hurricane Earl \(2010\)](#)
[Nor'Easter Nov09 \(2009\)](#)
[Hurricane Ike \(2008\)](#)
[Hurricane Gustav \(2008\)](#)
[Hurricane Humberto \(2007\)](#)
[Tropical Storm Ernesto \(2006\)](#)
[Hurricane Wilma \(2005\)](#)
[Hurricane Rita \(2005\)](#)
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[Hurricane Dennis \(2005\)](#)
[Hurricane Ivan \(2004\)](#)
[Hurricane Jeanne \(2004\)](#)
[Hurricane Isabel \(2003\)](#)

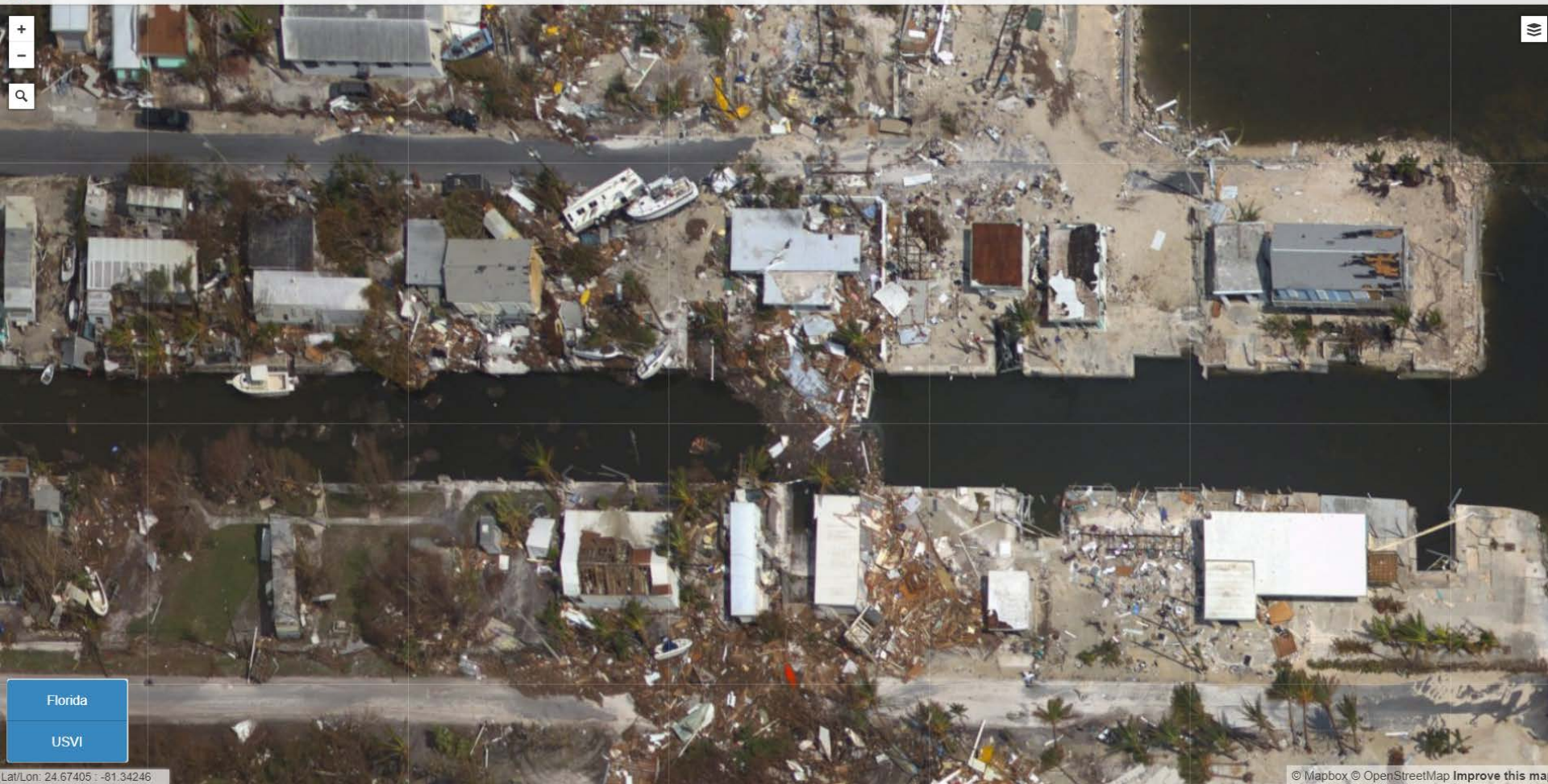
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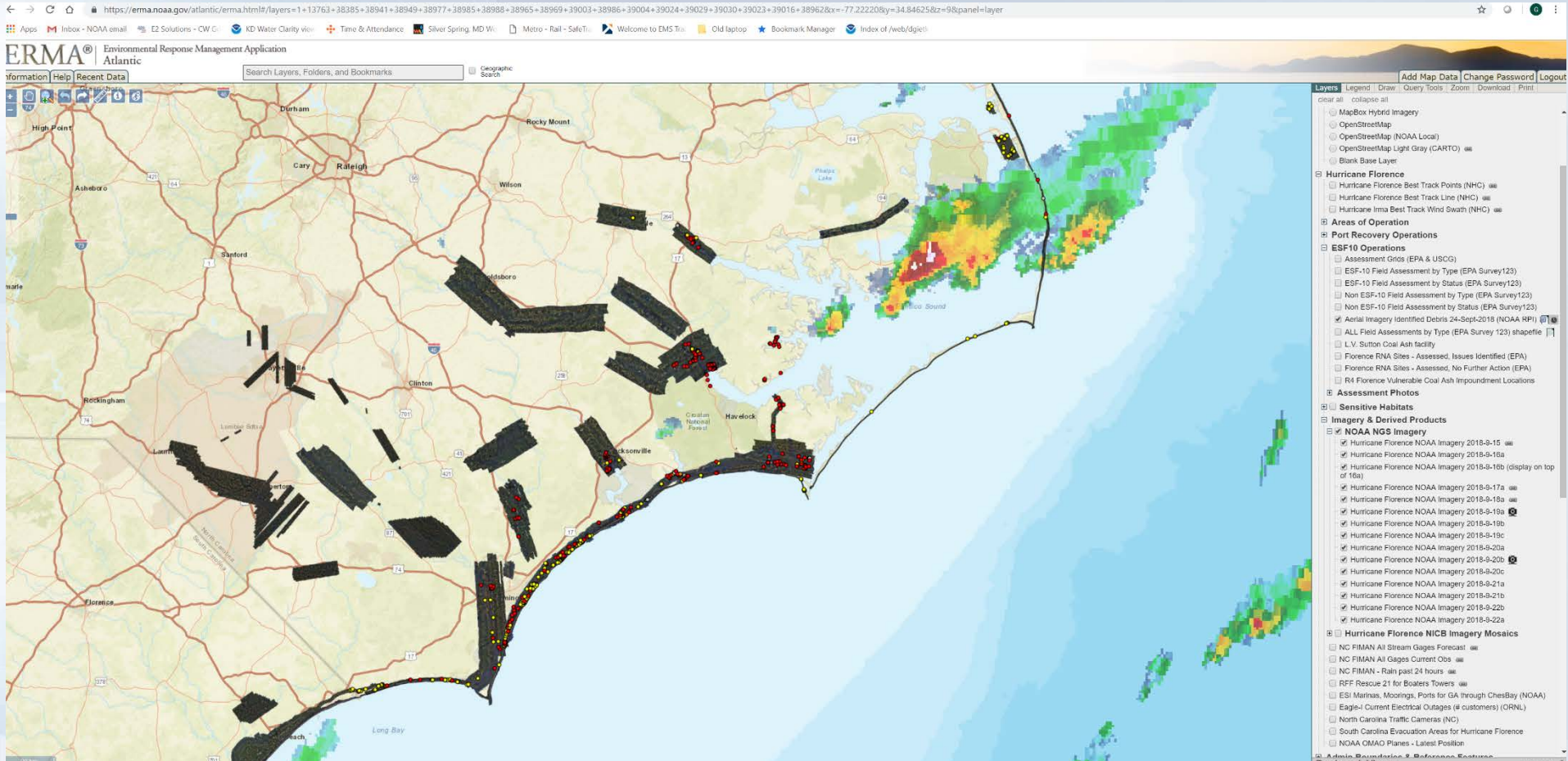


National Oceanic and Atmospheric Administration

<https://storms.ngs.noaa.gov/>

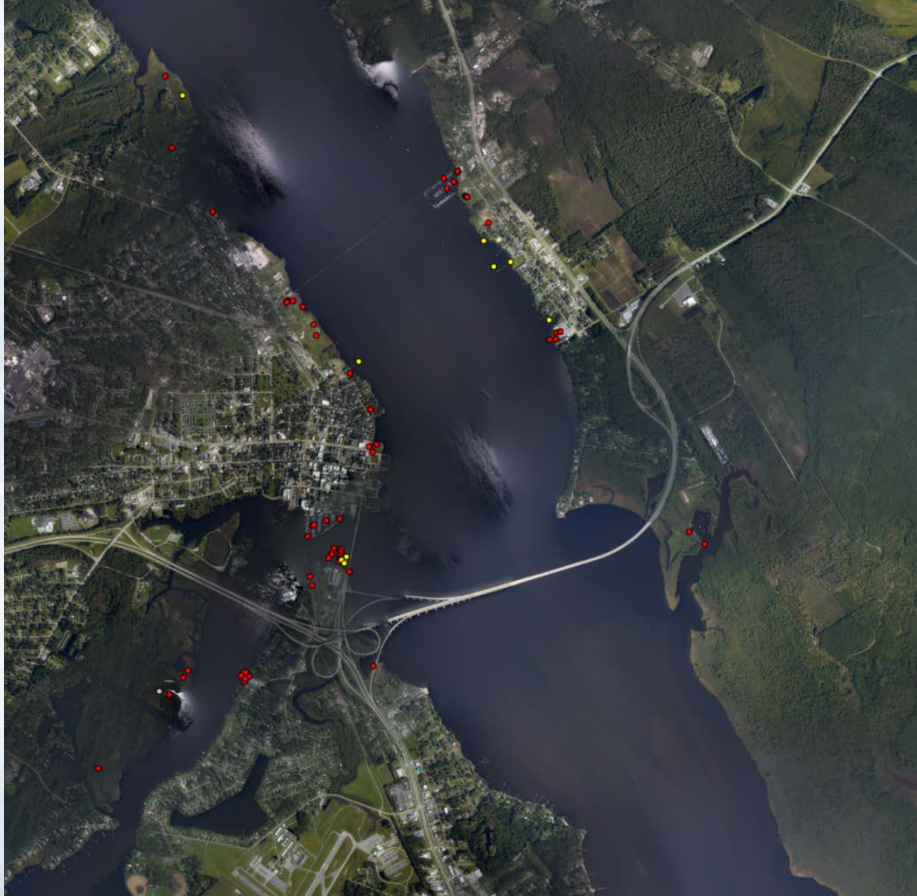


Emergency Response to Florence

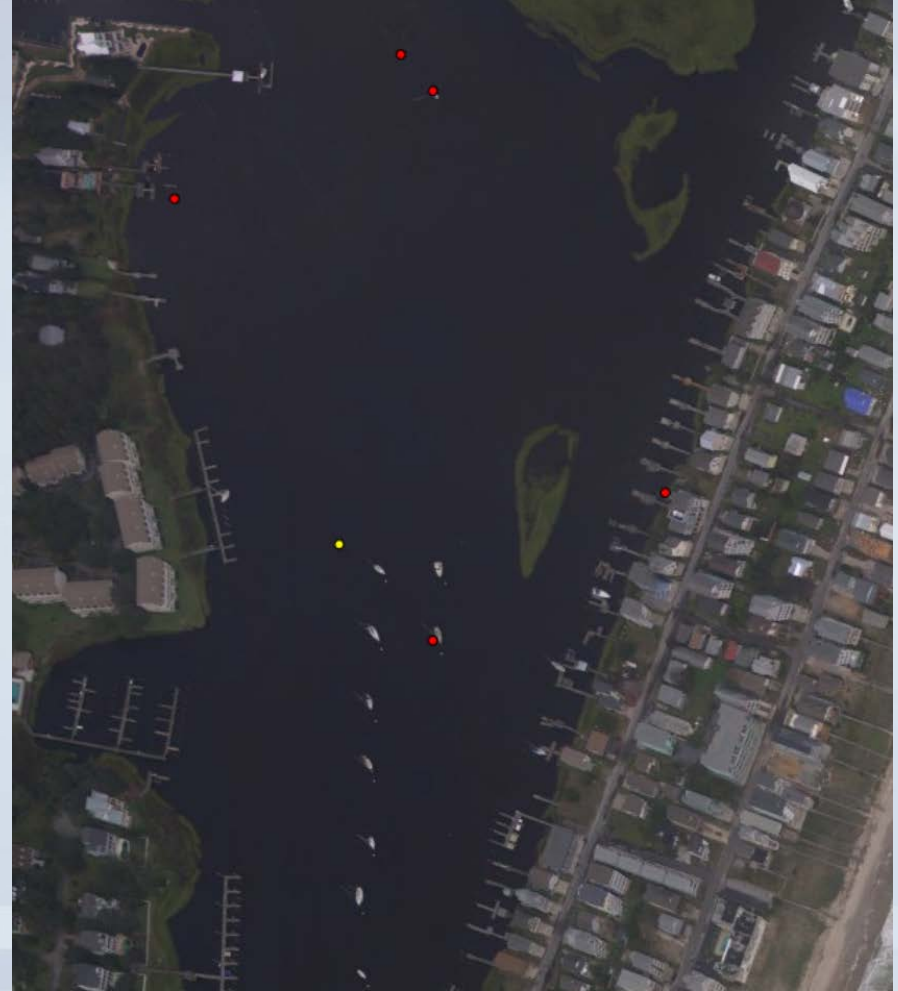


National Oceanic and Atmospheric Administration

Emergency Response to Florence



New Bern, NC



Carolina Beach

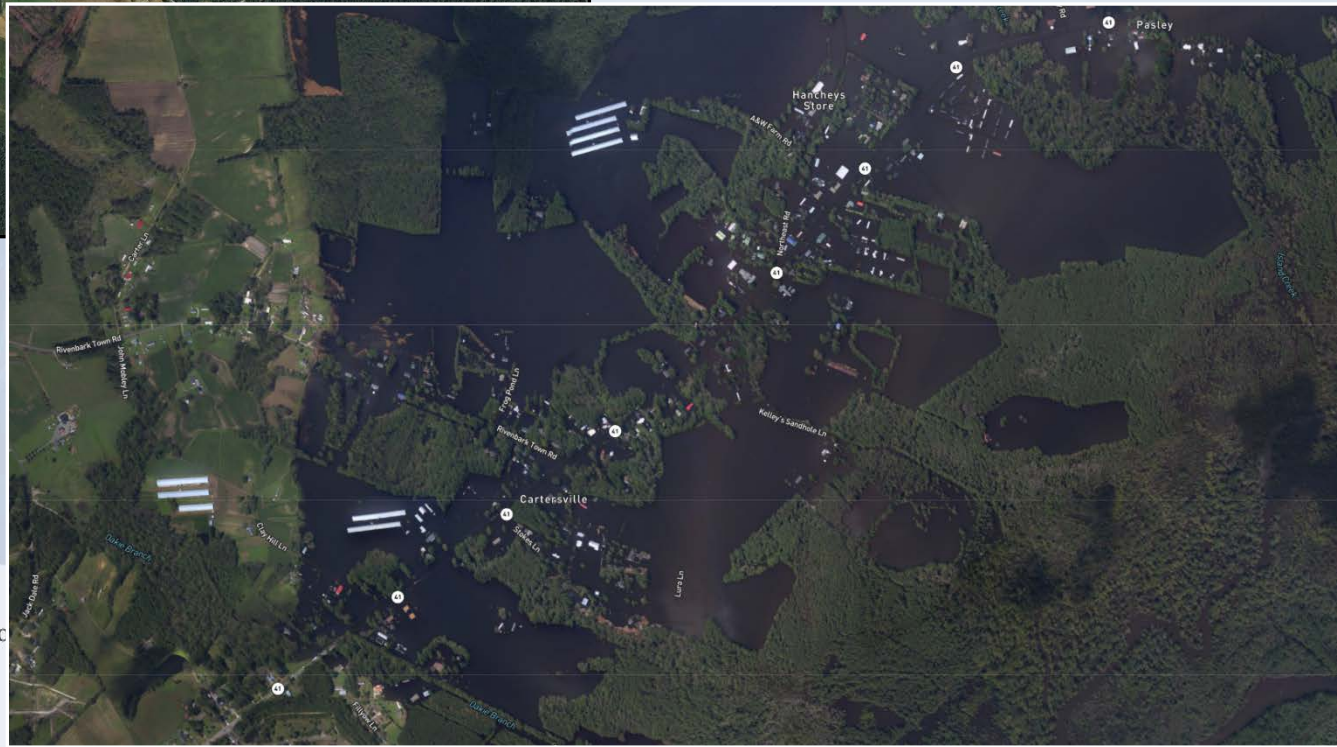


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Emergency Response Imagery

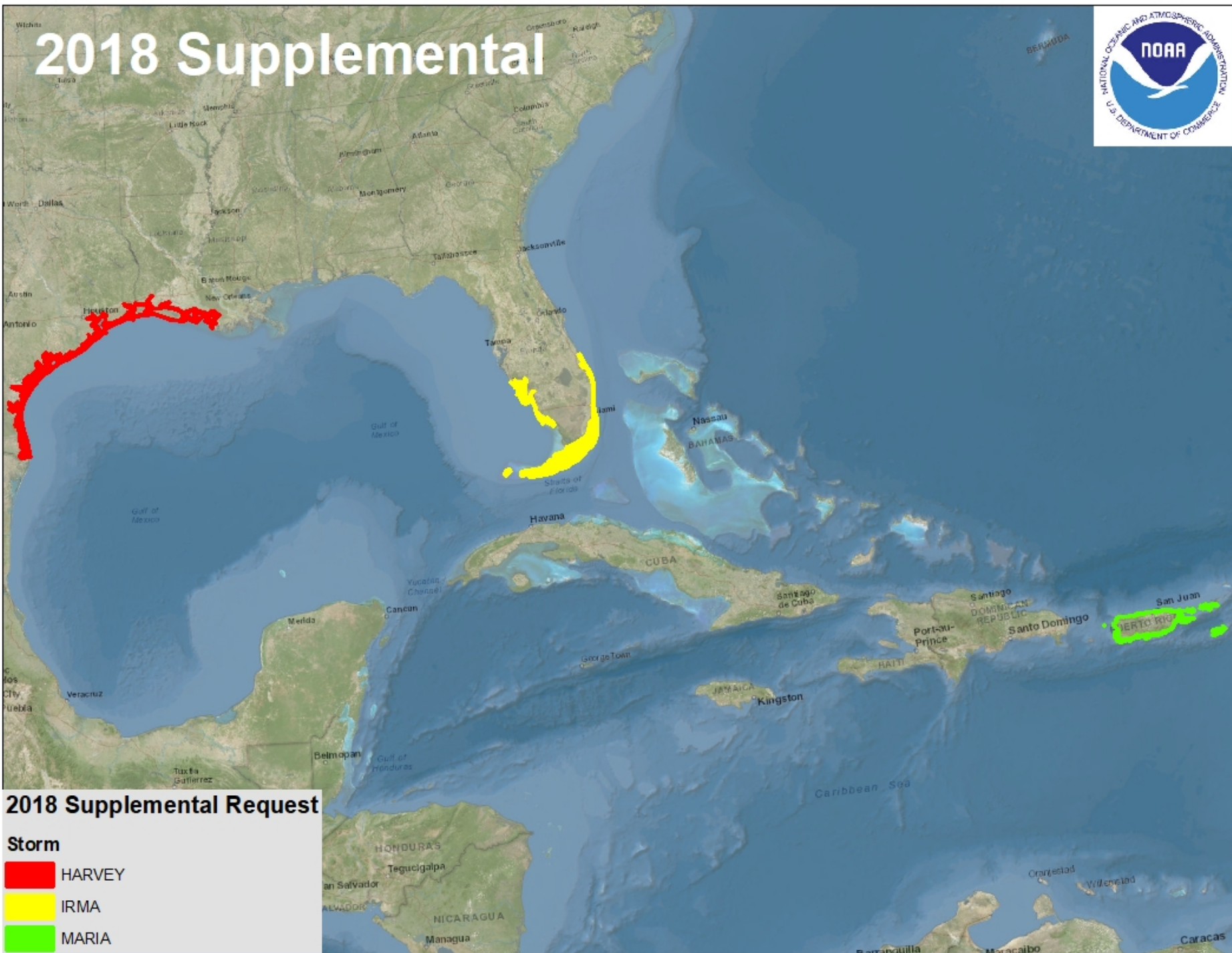


Near Rose Hill, NC






National Oceanic and Atmospheric Administration

2018 Supplemental



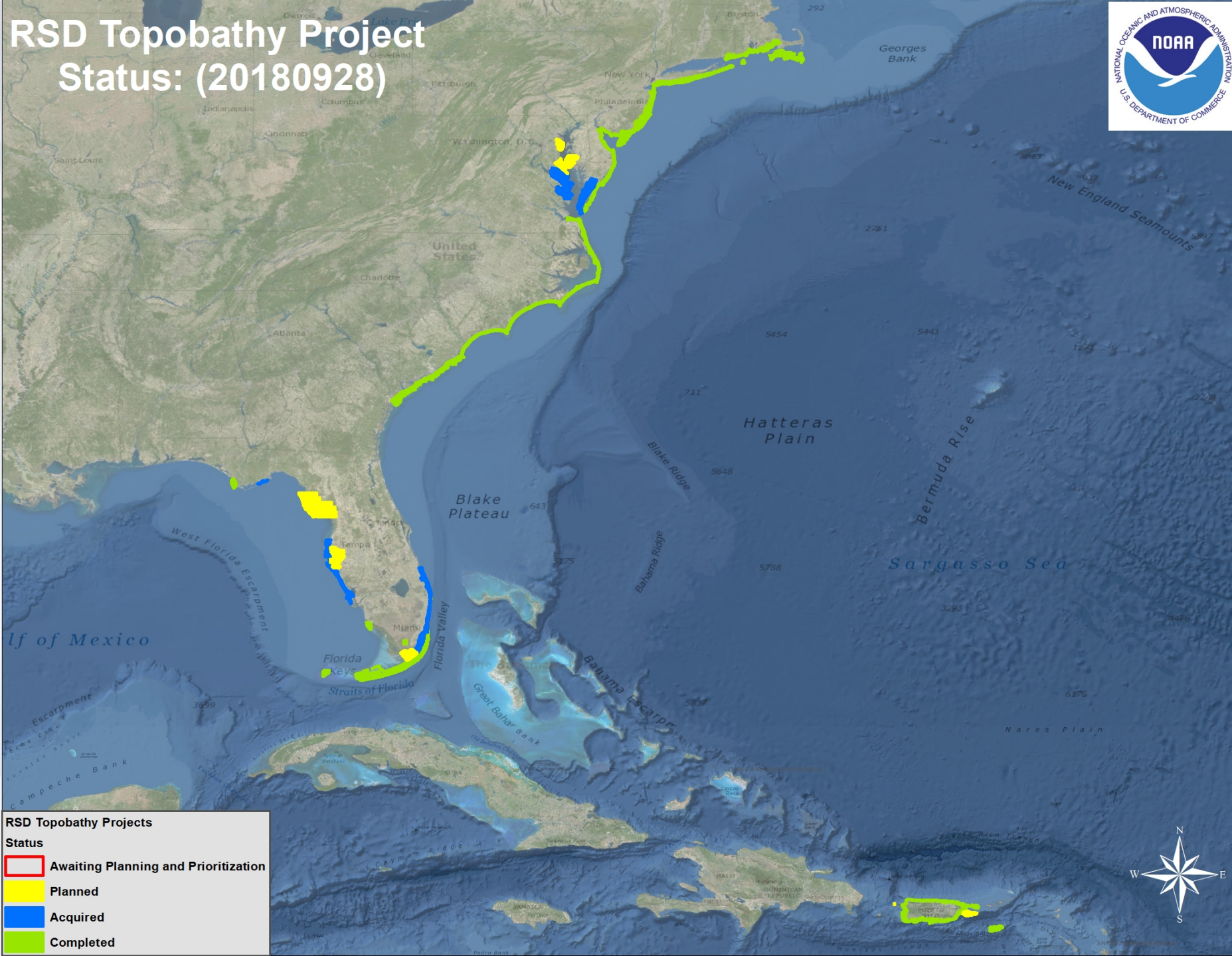
2018 Supplemental Request

Storm

-  HARVEY
-  IRMA
-  MARIA

RSD Topobathy Project

Status: (20180928)



RSD Topobathy Projects

Status

- Awaiting Planning and Prioritization
- Planned
- Acquired
- Completed



Questions?

Mike Aslaksen
Chief, Remote Sensing Division
NOAA National Geodetic Survey
mike.aslaksen@noaa.gov



National Oceanic and Atmospheric Administration

Shoreline Update Expedite (SUE)

- **Goal:** to provide the requested updates within 1-2 workdays.
- **Example workflow:**
 - Received request from MCD on Thu. Aug. 23, 2018 for an update to chart 25670, depicting a large uncharted pier.
 - Determined that RSD aerial imagery flown on 9/24/17 in response to Hurricane Maria had captured the new pier.
 - Compiled the features in ArcGIS using the orthoimagery accessed directly through the NGS Storm Imagery web map tile service (WMTS), and delivered the shapefile to MCD just 3.5 hours after their request.

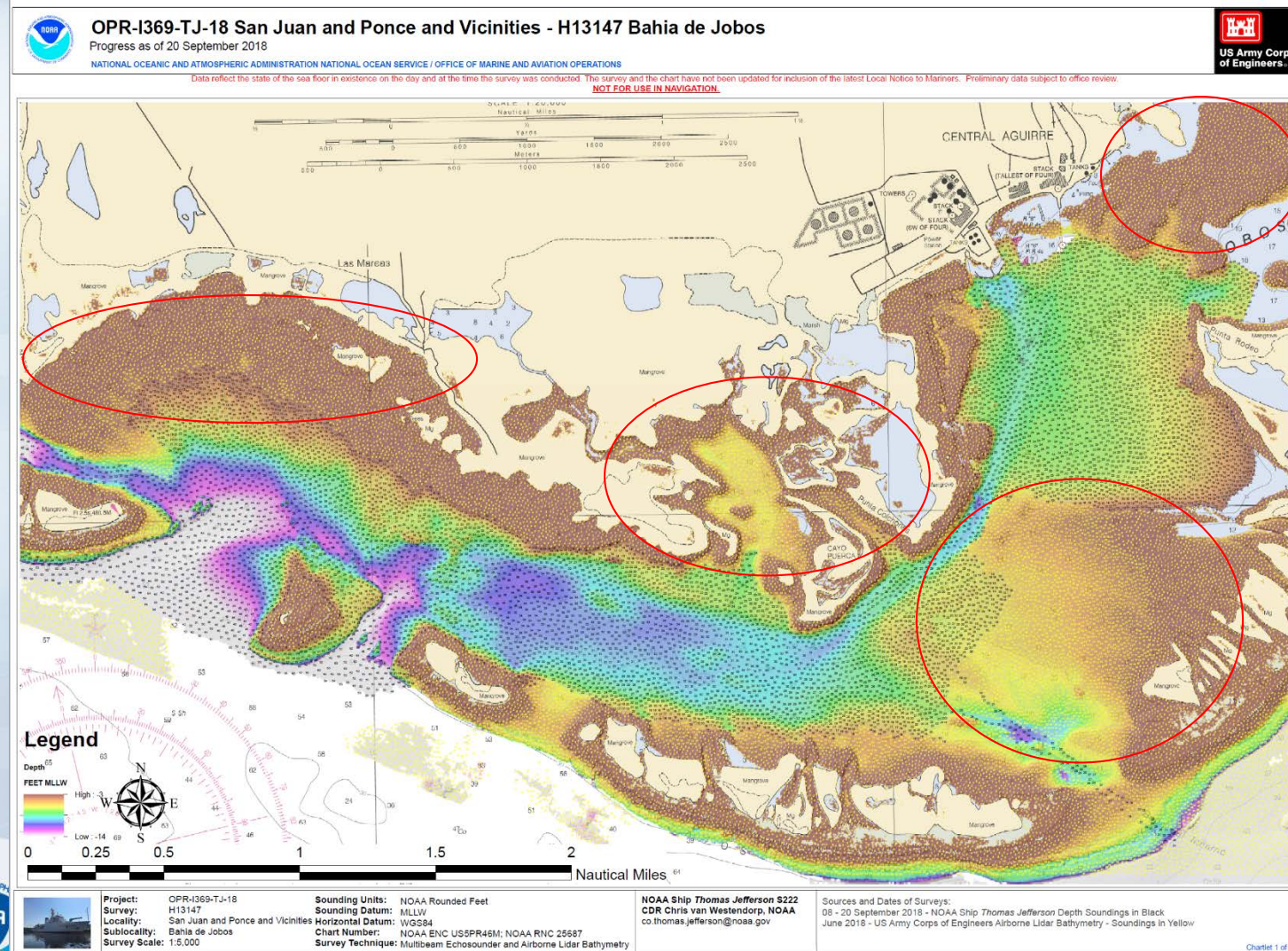


SUE-00022

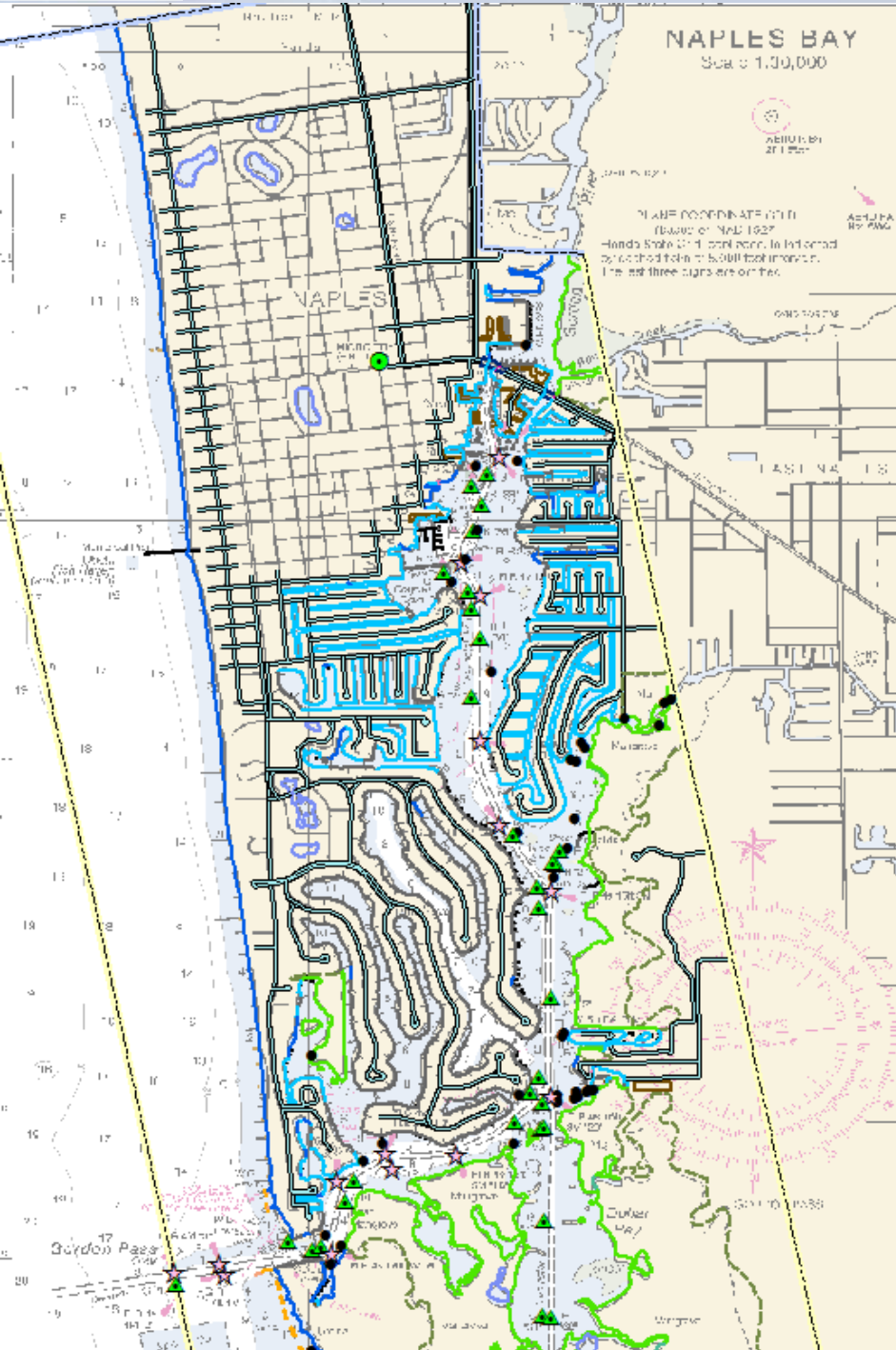
Isla Grande, San Juan, PR



NOAA Sonar and lidar operations

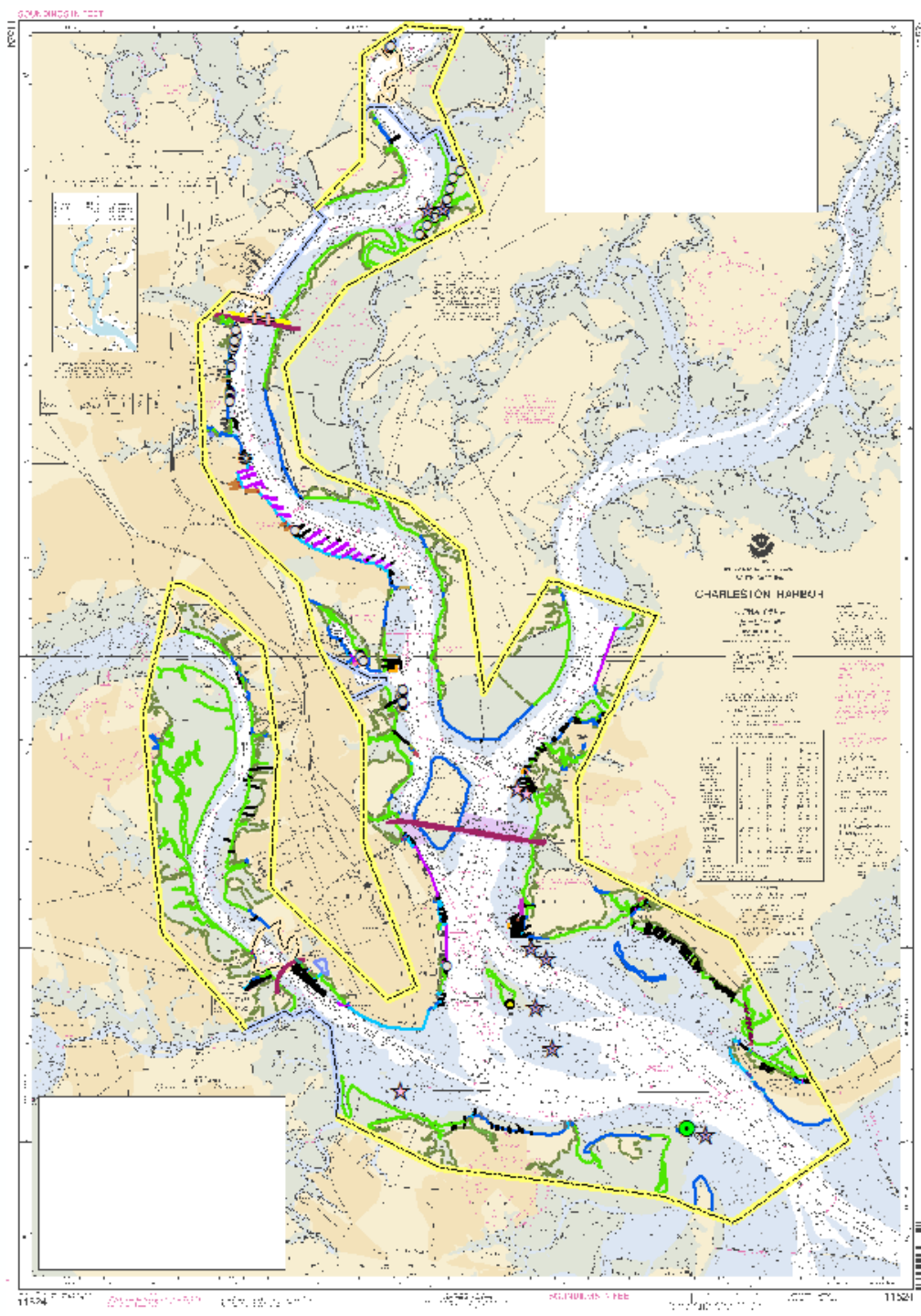


Courtesy of LT Anthony Klemm

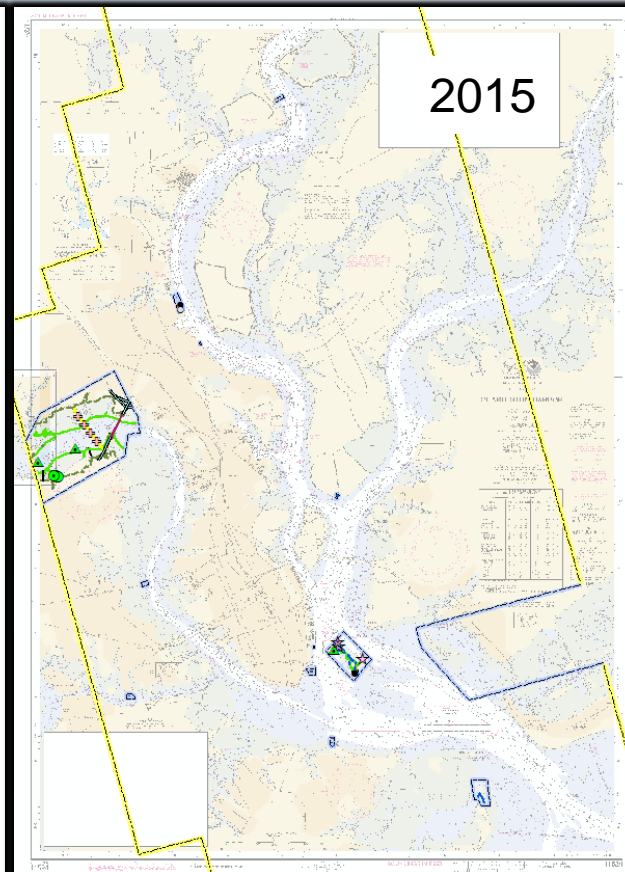
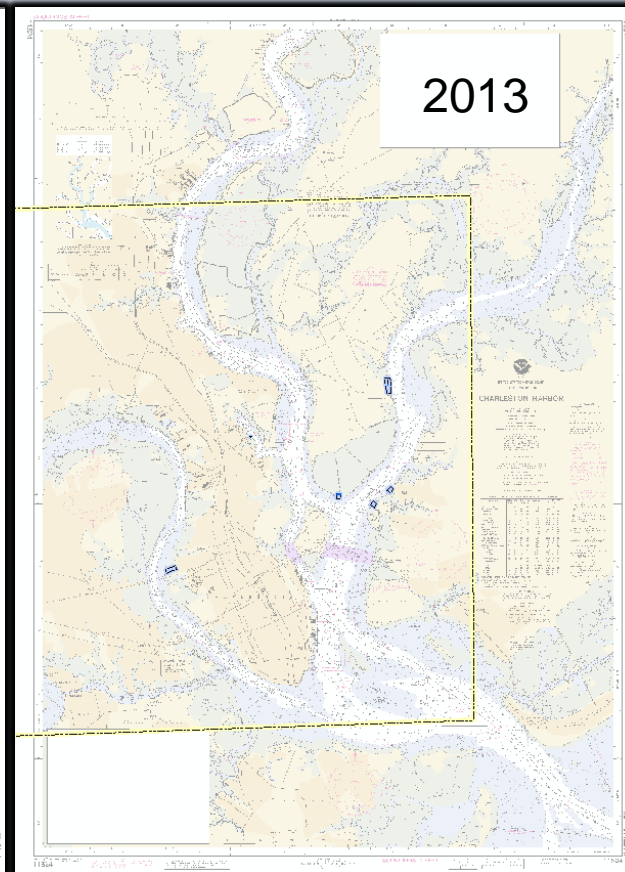
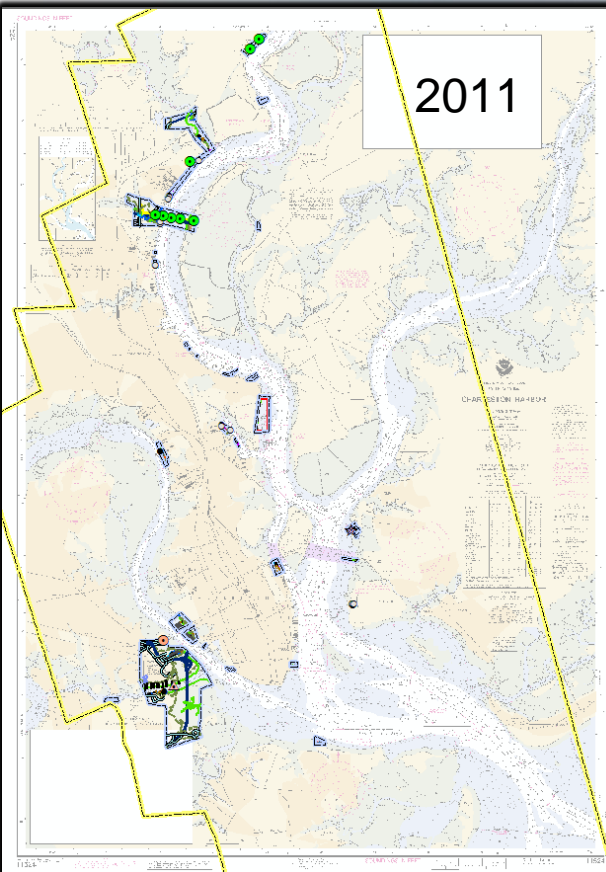


CMP Project with full shoreline compilation

Charleston Harbor near-full shoreline compilation in 2006



Coast & Shoreline Change Analysis Program (CSCAP) Charleston Harbor



Why of interest to NOAA & partners?

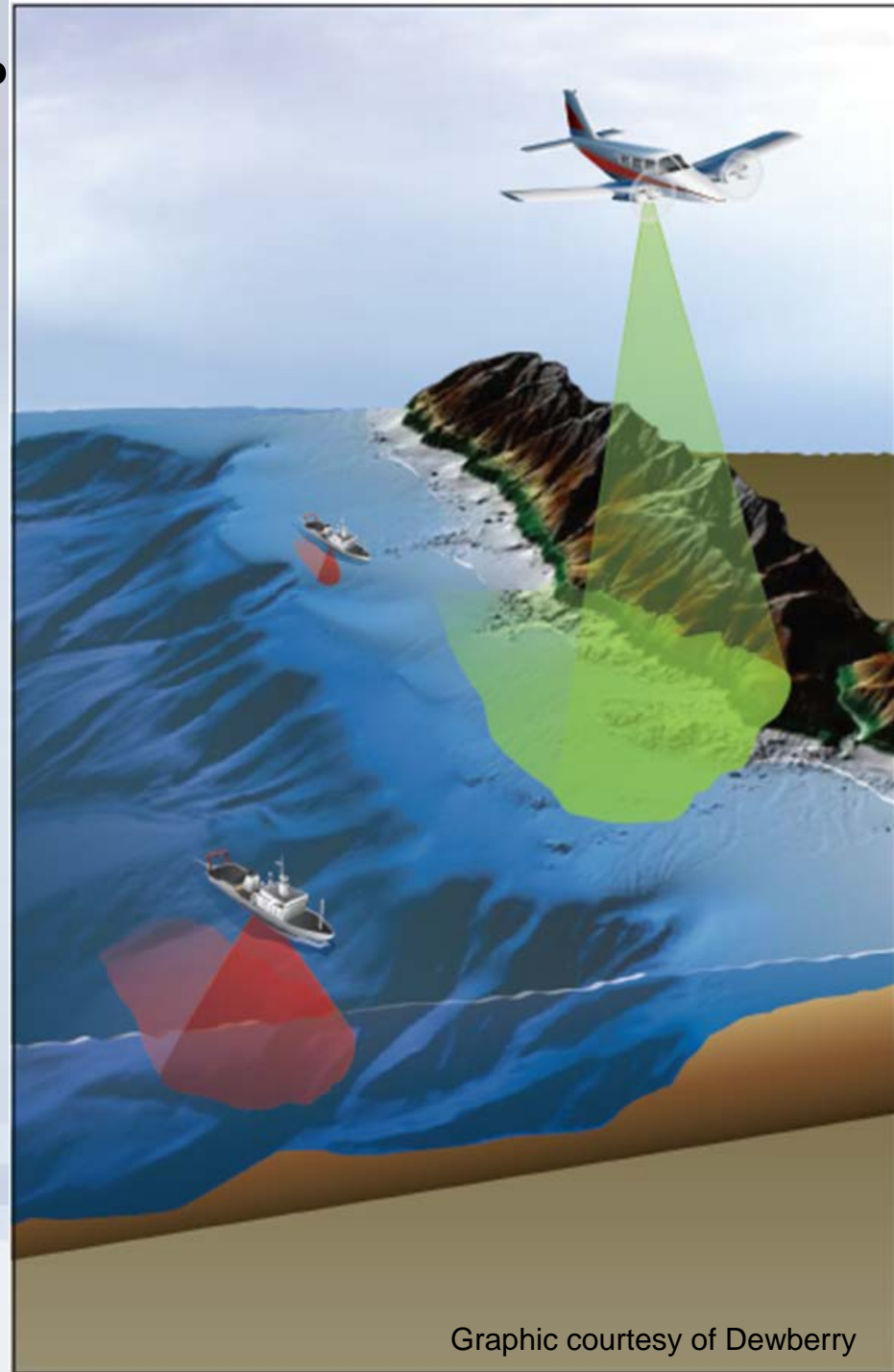
Uniquely suited for shoreline mapping

- Seamless, high-resolution data across backshore, intertidal, and nearshore marine zones
- Fill in shallow water gap (shoreward of NALL line)

IOCM! Map Once-Use Many Times!

- SLR analysis, inundation modeling
- Habitat mapping
- Riverine mapping
- Coastal zone management, coastal science

Increases efficiency and safety of launch and ship operations



National Oceanic and Atmospheric Administration

Graphic courtesy of Dewberry

Data Distribution

Topobathy Lidar: <https://coast.noaa.gov/dataviewer/#app=b23b&bda3-selectedIndex=2>

Format: ASPRS LAS (<http://www.asprs.org/Committee-General/LASer-LAS-File-Format-Exchange-Activities.html>)

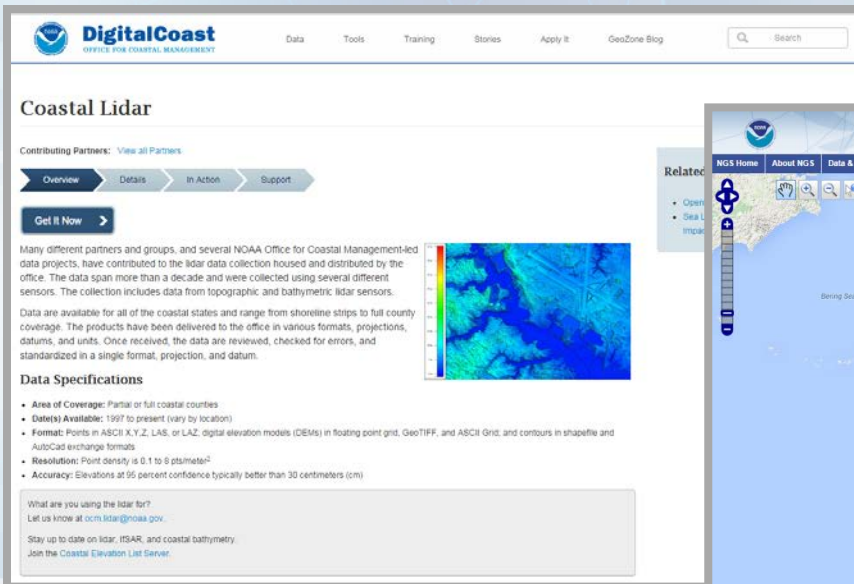
High Resolution Aerial Imagery:

<https://coast.noaa.gov/dataviewer/#app=b23b&bda3-selectedIndex=2>

Format: Geotiff

Shoreline: <http://www.ngs.noaa.gov/NSDE/>

Format: Shapefile



DigitalCoast
OFFICE FOR COASTAL MANAGEMENT

Data Tools Training Stories Apply It GeoZone Blog Search

Coastal Lidar

Contributing Partners: [View all Partners](#)

Overview Details In Action Support

Get It Now

Many different partners and groups, and several NOAA Office for Coastal Management-led data projects, have contributed to the lidar data collection housed and distributed by the office. The data span more than a decade and were collected using several different sensors. The collection includes data from topographic and bathymetric lidar sensors.

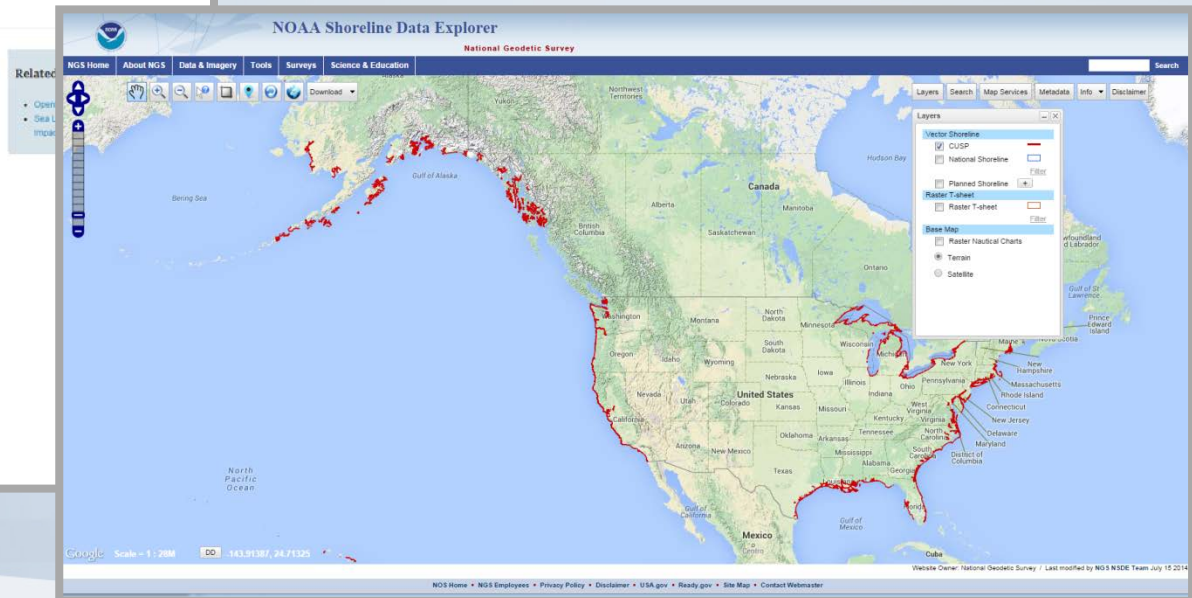
Data are available for all of the coastal states and range from shoreline strips to full county coverage. The products have been delivered to the office in various formats, projections, datums, and units. Once received, the data are reviewed, checked for errors, and standardized in a single format, projection, and datum.

Data Specifications

- **Area of Coverage:** Partial or full coastal counties
- **Date(s) Available:** 1997 to present (vary by location)
- **Format:** Points in ASCII X,Y,Z, LAS, or LAZ, digital elevation models (DEMs) in floating point grid, GeoTIFF, and ASCII Grid; and contours in shapefile and AutoCAD exchange formats
- **Resolution:** Point density is 0.1 to 6 pts/meter²
- **Accuracy:** Elevations at 95 percent confidence typically better than 30 centimeters (cm)

What are you using the lidar for?
Let us know at ocm.lidar@noaa.gov.

Stay up to date on lidar, ISAR, and coastal bathymetry.
Join the [Coastal Elevation List Server](#).



NOAA Shoreline Data Explorer
National Geodetic Survey

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

Layers Search Map Services Metadata Info Disclaimer

Layers

- Vector Shoreline
 - CUSP
 - National Shoreline
 - Planned Shoreline
- Raster T-sheet
 - Raster T-sheet

Base Map

- Raster Nautical Charts
- Terrain
- Satellite

Scale = 1 : 20M DO 143.91387, 24.71325

Website Owner: National Geodetic Survey / Last modified by NGS NSDE Team July 15 2014



National Oceanic and Atmospheric Administration

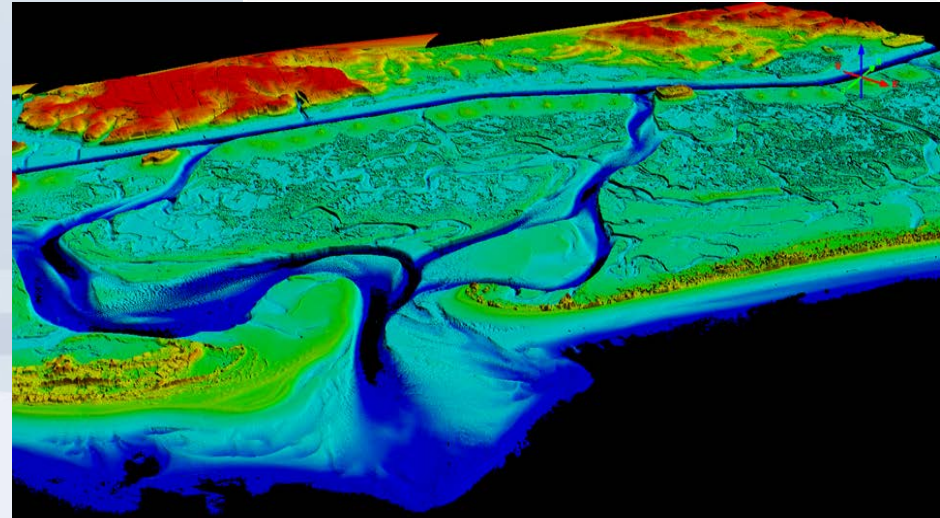
NOAA's Coastal Mapping Program

- Defines the National Shoreline and provides nearshore elevation data
- NOAA nautical charts updates
- 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
- Coastal Intelligence and Resiliency...

9925 miles and 57 ports

1660 sqm

300 RNCs and 60 ENC



National Oceanic and Atmospheric Administration

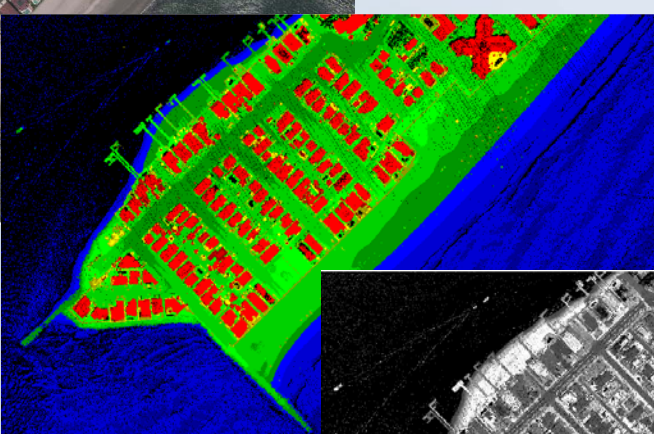
Products NGS delivers and derivatives




Shoreline



Ortho Mosaic Imagery



Lidar Point Cloud and DEMs
(elevation)



Lidar Point
Cloud
(intensity)

Map once use many times!



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RGB
Colorized Lidar
Point Cloud