NATIONAL GEODETIC SURVEY

# NOAA's National Geodetic Survey Utilization of Aerial Sensors for Emergency Response Efforts

JACIE Civil Commercial Imagery Evaluation Workshop 2006

Stephen White

National Oceanic and Atmospheric Administration

# Our Focus

NATIONAL GEODETIC SURVEY

- NOAA
  - National Ocean Service
    - National Geodetic Survey
      - Remote Sensing Division

- Primary programs
  - Coastal Mapping Program
  - Aeronautical Survey Program

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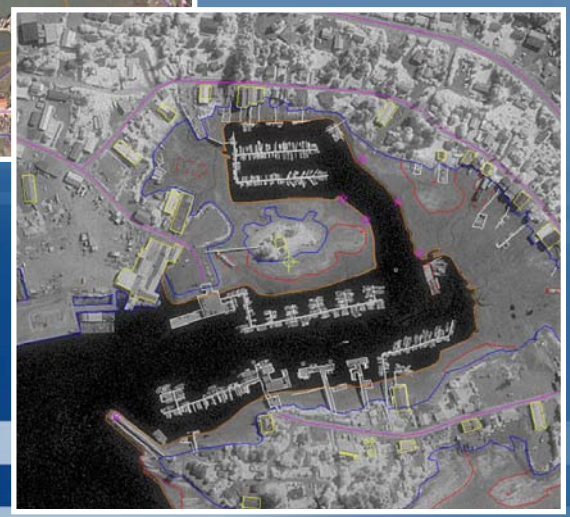
# Digital Photogrammetric Workstation used for aerotriangulation and feature extraction



# CSCAP: The Coast and Shoreline Change Analysis Program

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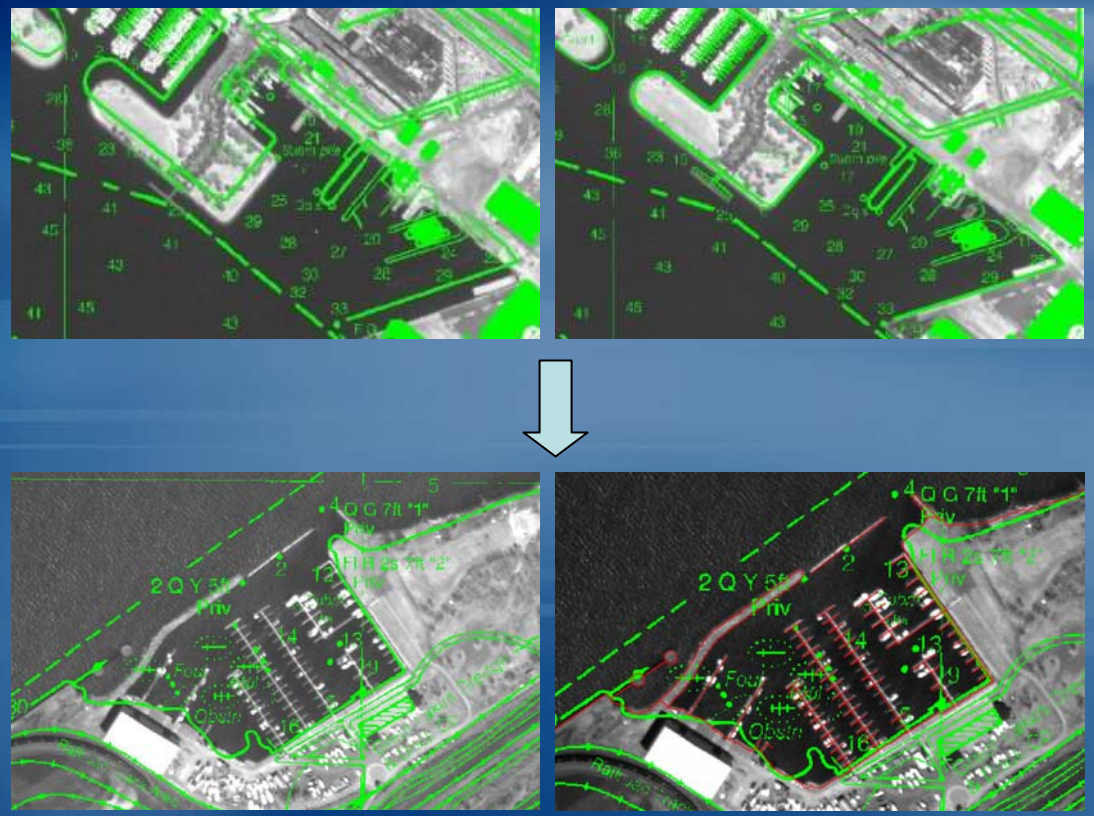
## Satellite Imagery

Image Source: Digital Globe

## Georeference to meet accuracy needs



Updated as needed

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# Evaluation of Digital Cameras through Contracting

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- DMC
- ADS40
- Vexcel UltraCam

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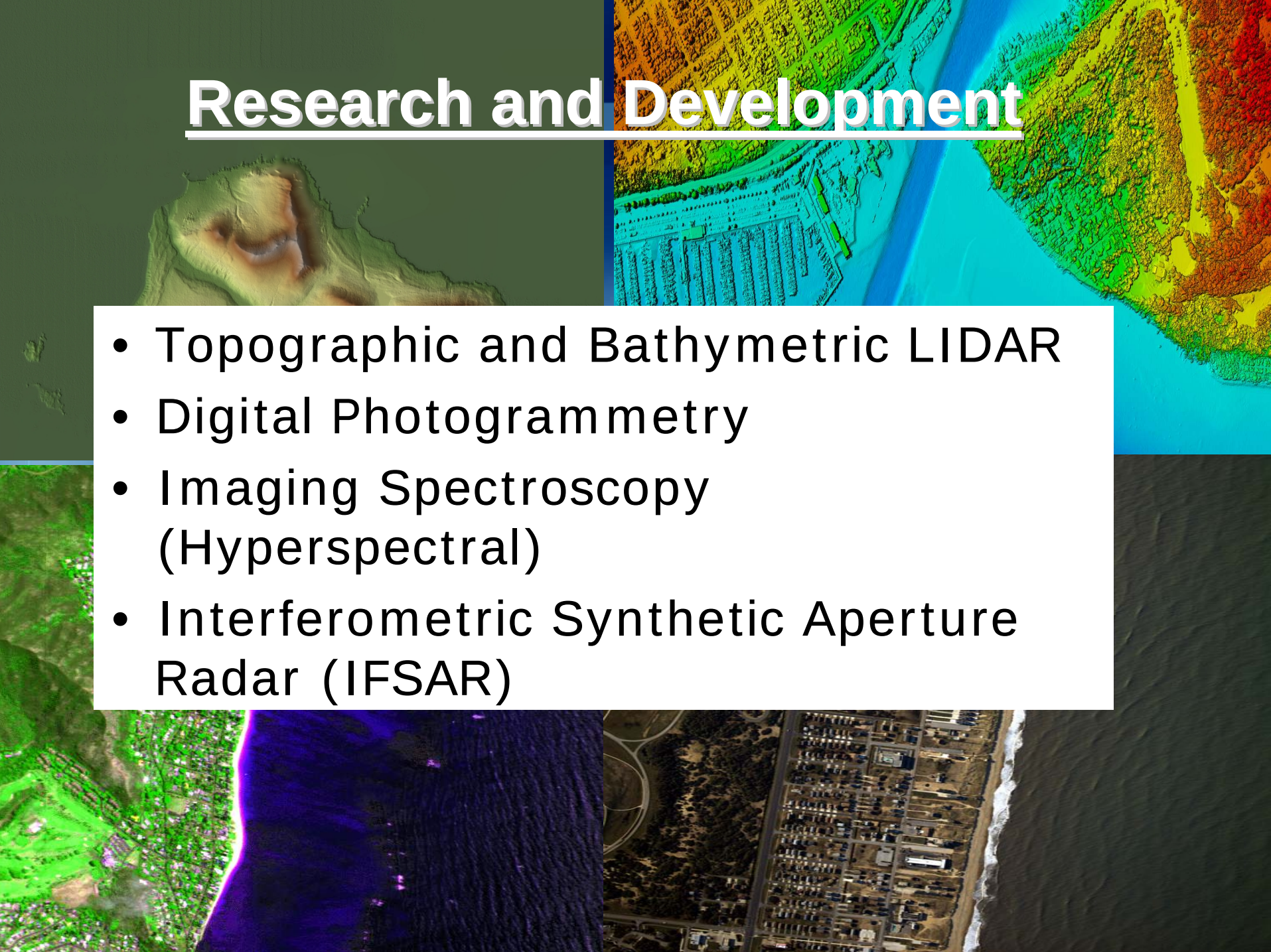
# Research and Development

- Topographic and Bathymetric LIDAR
- Digital Photogrammetry
- Imaging Spectroscopy (Hyperspectral)
- Interferometric Synthetic Aperture Radar (IFSAR)



# Coastal Mapping with Lidar

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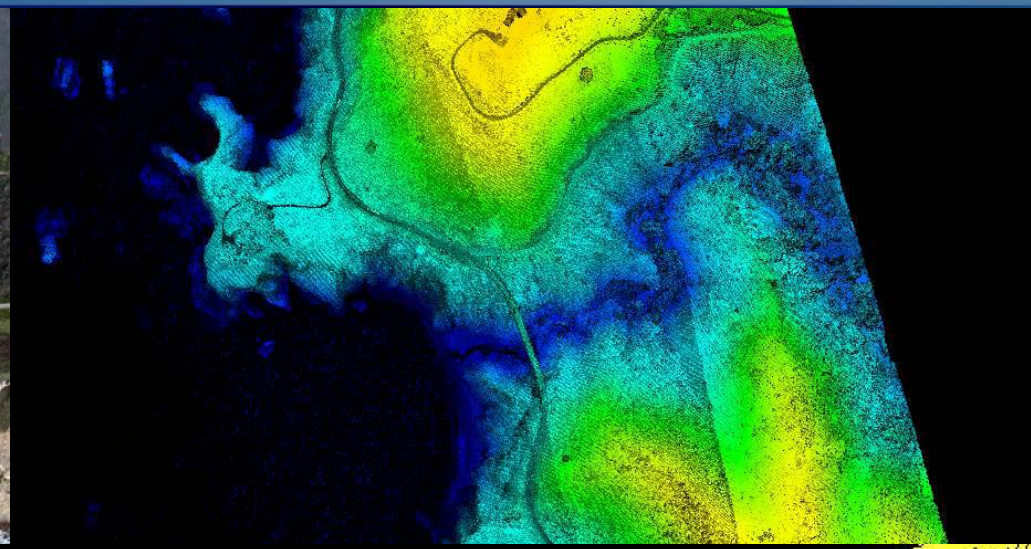

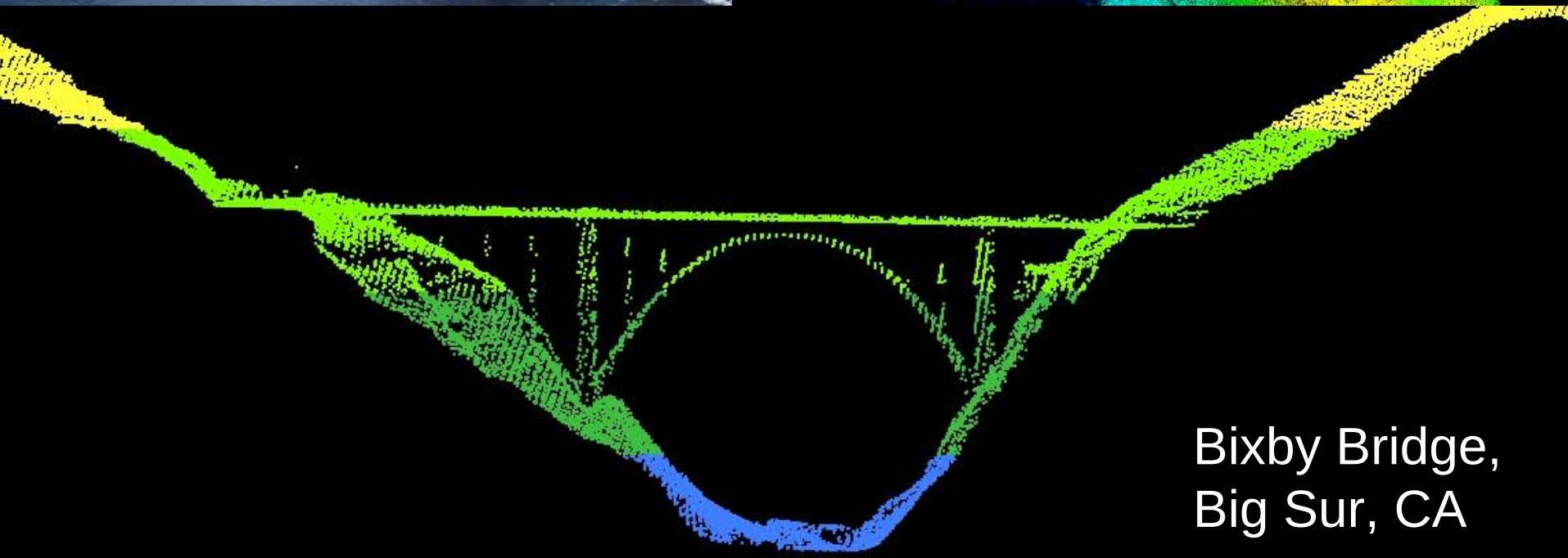

Bixby Bridge,
Big Sur, CA

# VDatum

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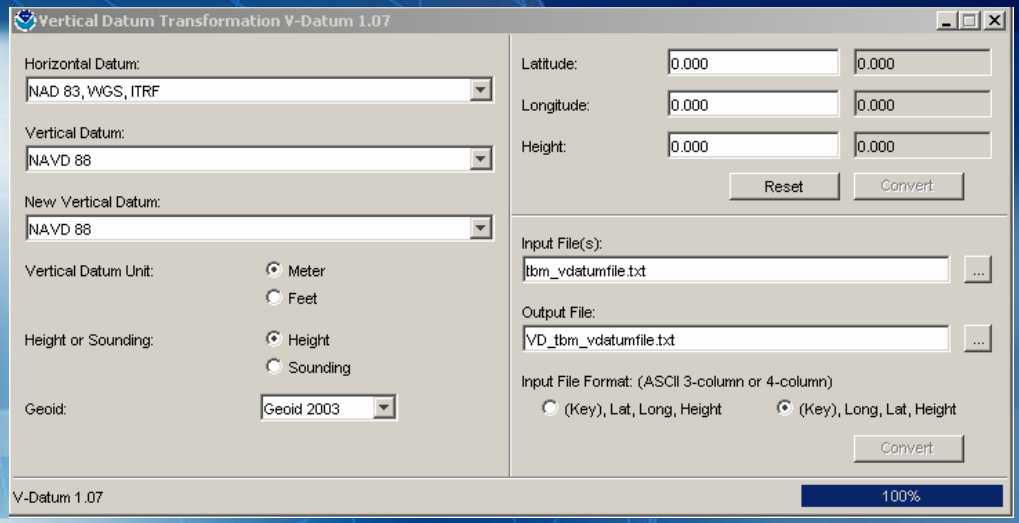


**VDatum converts elevation data (heights and soundings) among the 28 different vertical datums**

For shoreline extraction using VDatum is critical.

Currently available for:

Tampa Bay, New York Bight, Delaware Bay, Central California, Puget Sound, Strait of Juan De Fuca, Lake Charles and Port Fourchon, LA and northern North Carolina

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# The Datum Transformation Roadmap

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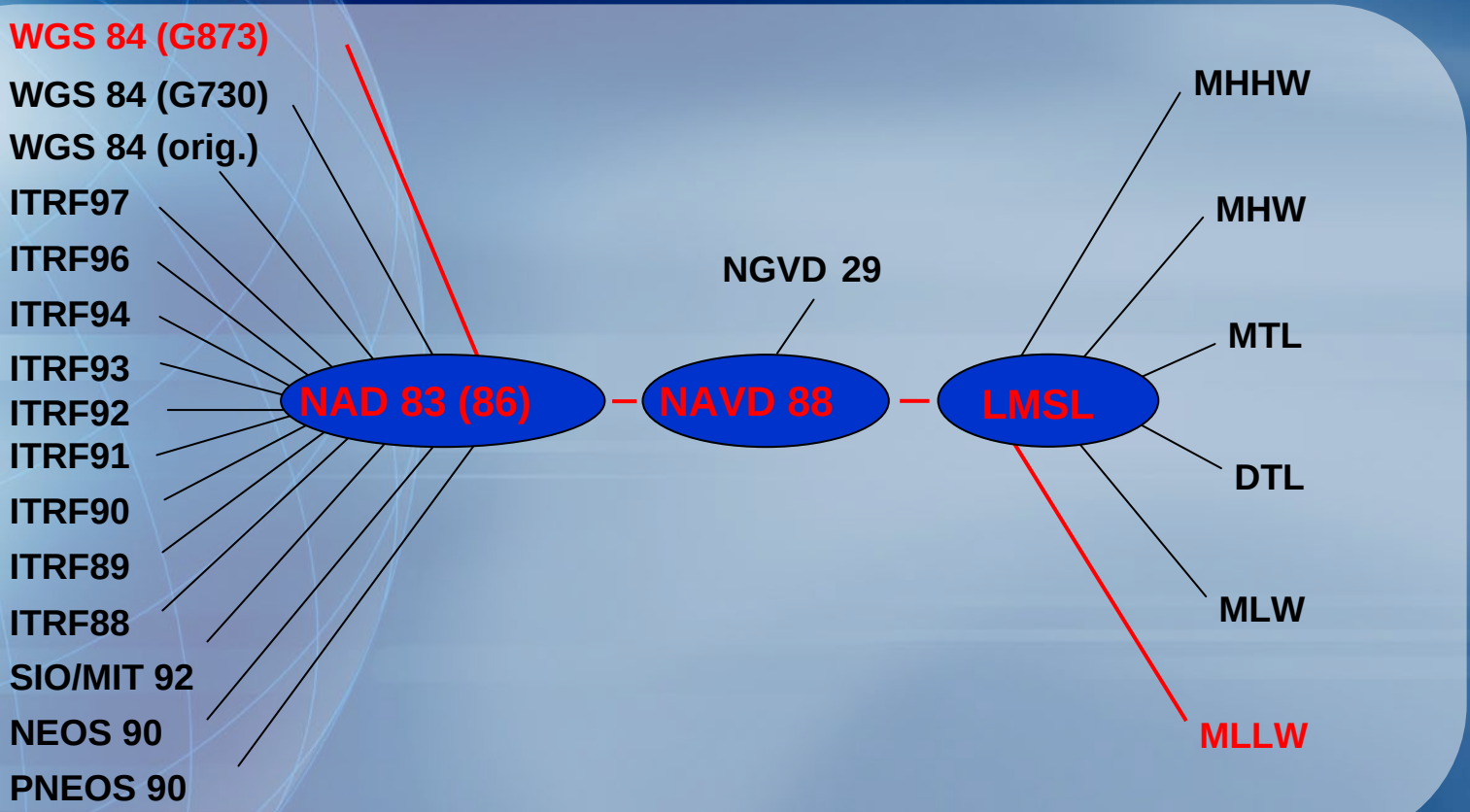

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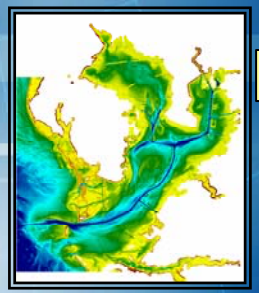
USGS Topography

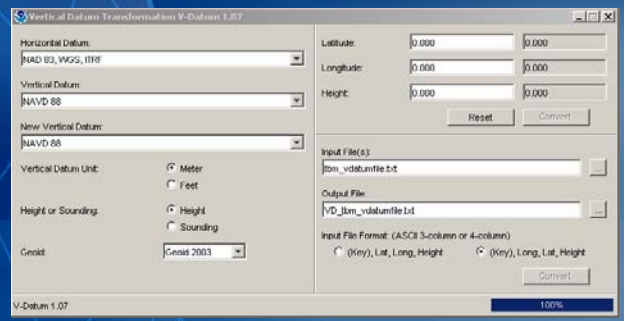


NOAA Bathymetry

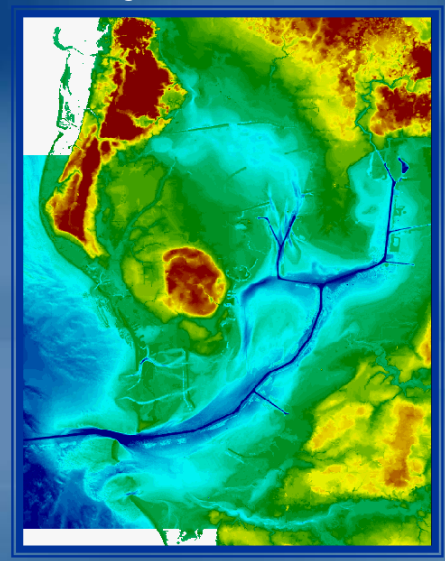
**Geoid Model**

**Tidal Model**

**Ellipsoid Model**



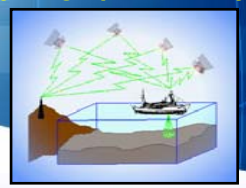

**Integrated Bathy / Topo Digital Elevation Model**



## VDatum

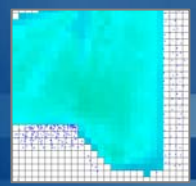
(Vertical Datum Transform Tool)

***RTK-GPS vertical referencing Hydrographic Surveys***



***Shoreline from LIDAR in the intertidal zone***

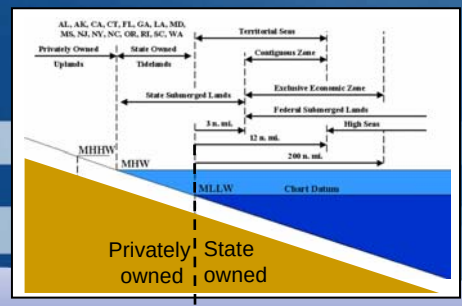
***GIS users in the Coastal Community***



***NOAA-USGS shoreline inconsistencies***


***National Bathymetric Database***

***Marine Boundaries & Legal Issues***

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# North Carolina Sea Level Rise Project – A VDatum application

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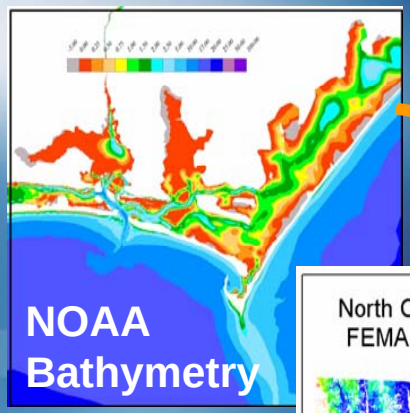
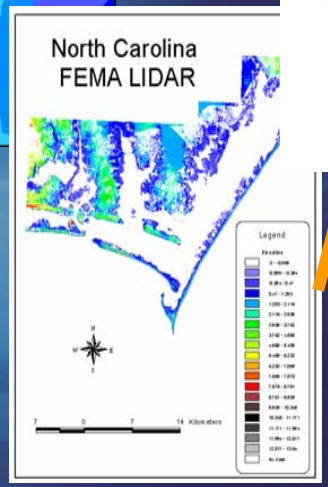
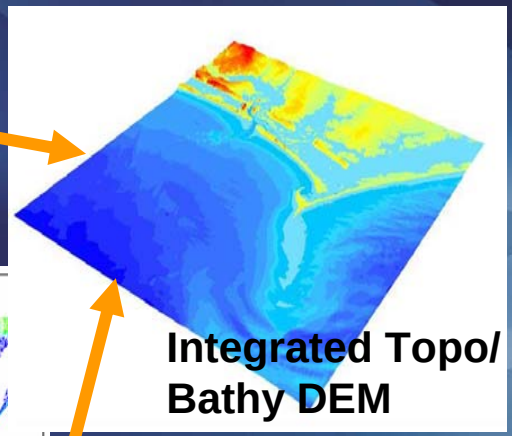


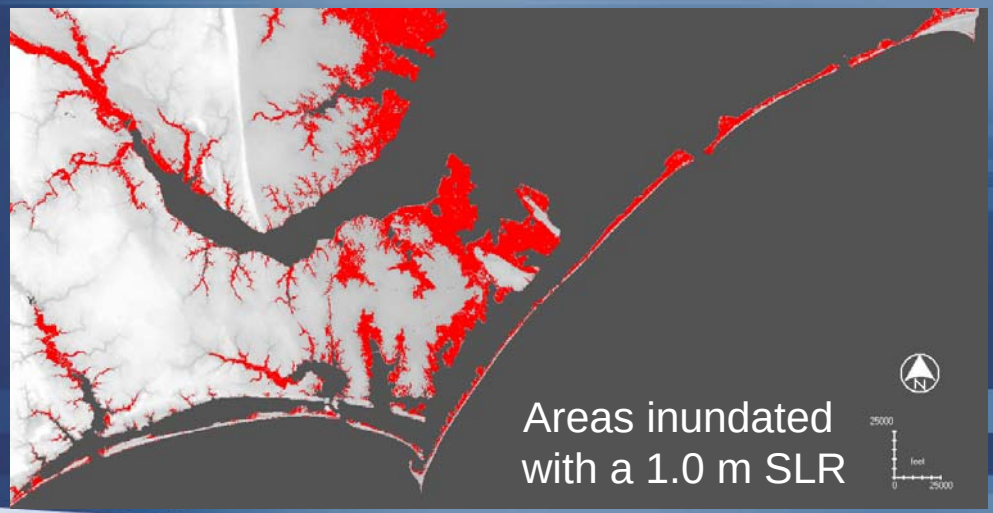

Land
Elevations



Integrated Topo/
Bathy DEM

Create a DEM

To assess
Sea Level Rise

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# Lidar Shoreline Extraction

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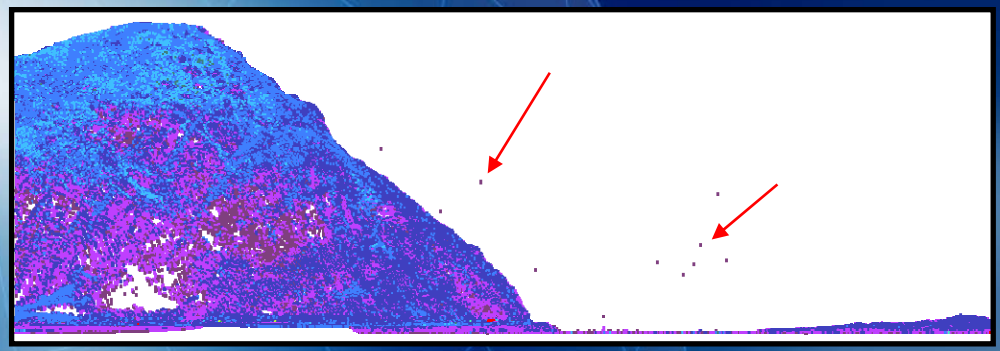
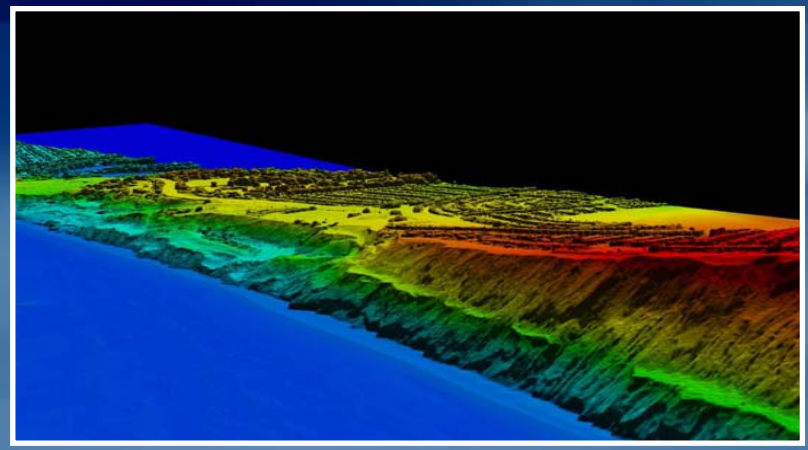
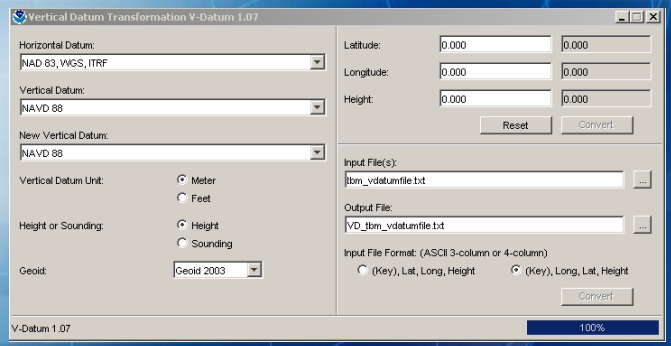
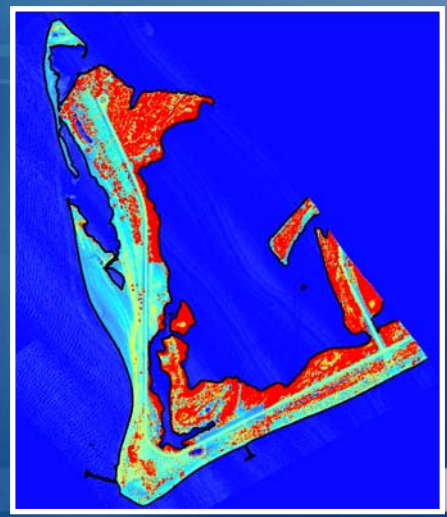
Edit Lidar Point Cloud








VDatum



Contour Shoreline from DEM


QA/QC and perform error analysis

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# Research Projects

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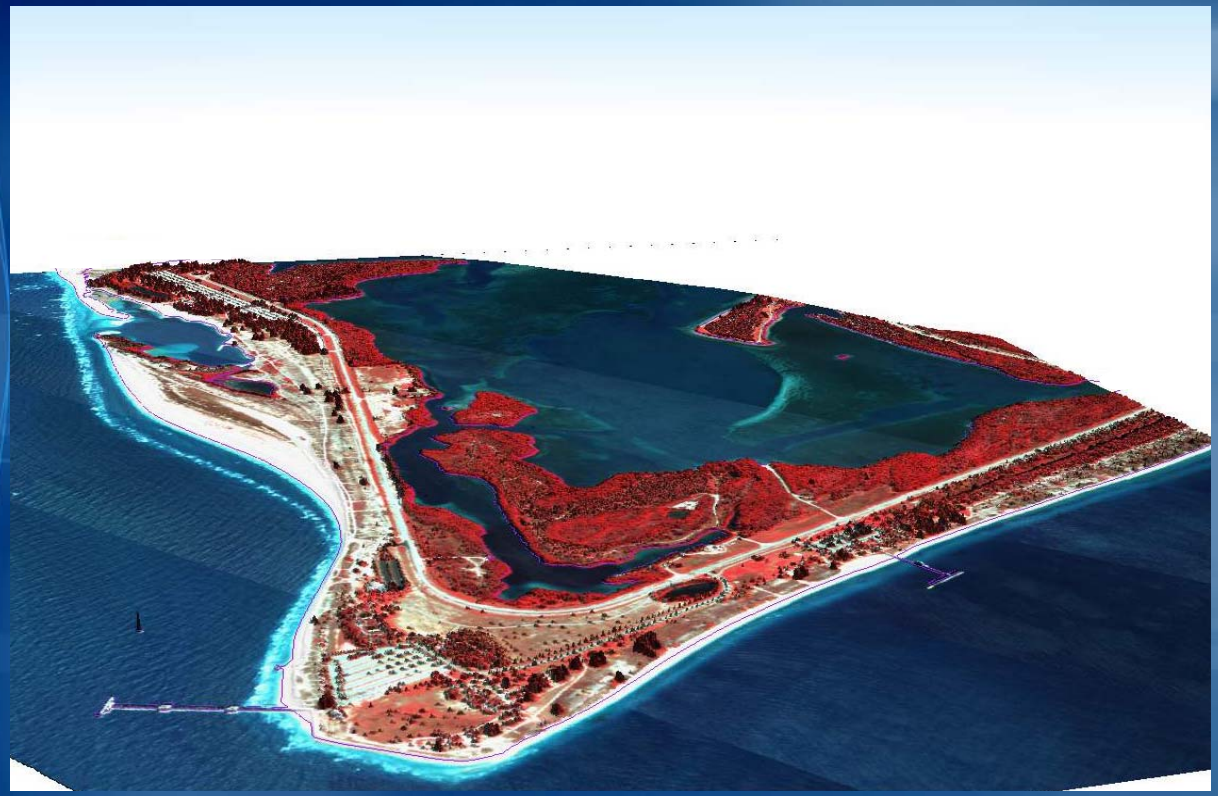
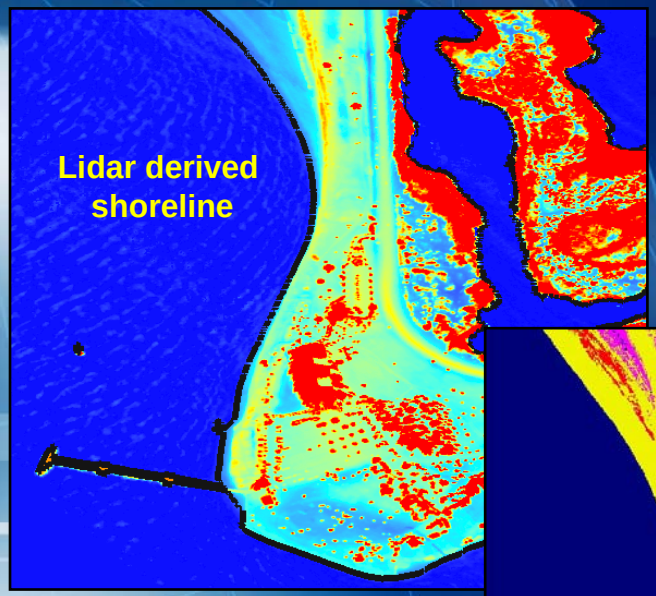
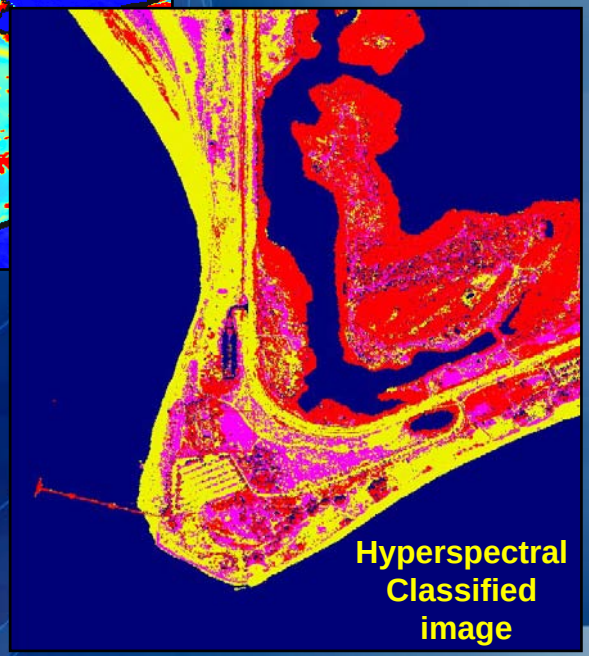
- A multiple sensor approach to shoreline mapping

# Research Projects

NATIONAL GEODETIC SURVEY





**Feature attributed lidar-derived shoreline superimposed on an orthorectified image**

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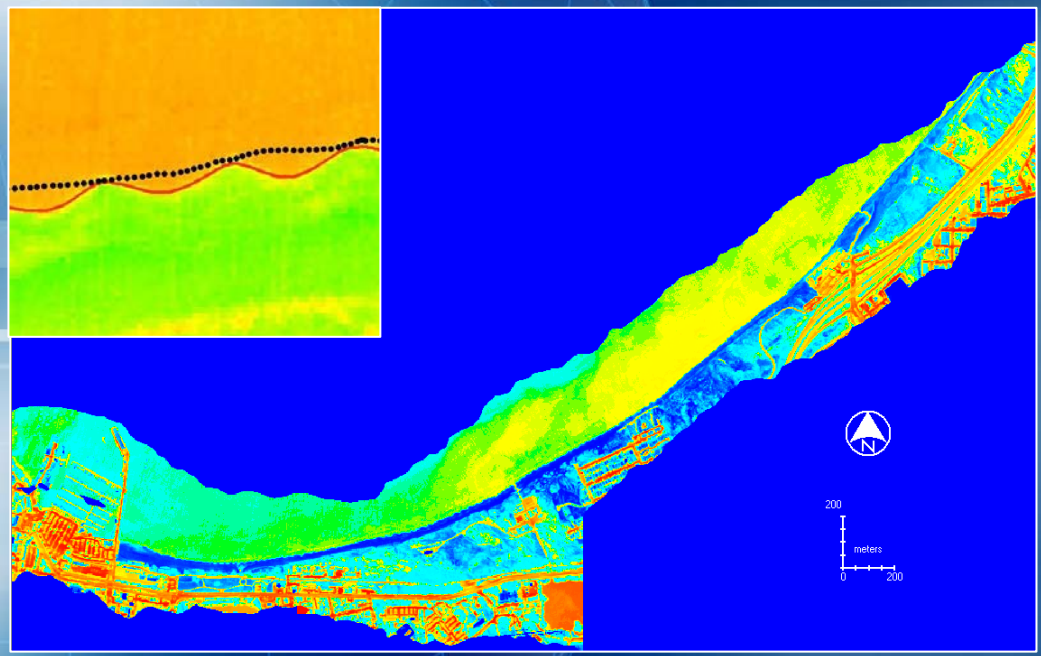
# Research Projects



- Investigating Thermal Imagery for Shoreline Delineation




# Emergency Response

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# Background



- Remotely sensed data is acquired to support NOAA's homeland security and emergency response requirements (ESF #10, #11, and #13 of the National Response Plan).
- RSD maintains the capability to provide tools, technology, and expertise in a timely and efficient manner.
- The remotely sensed data collected is disseminated to federal, state, and local government agencies as well as the general public to facilitate support efforts.

# Historical Accounts



- **Over the last several decades, NOAA has assisted with recovery from a variety of natural and human induced disasters, including:**
  - March 27, 1964: On Good Friday, Alaska was struck by an earthquake and tsunami.
  - Hurricanes: Camille (1969), Ceila (1970), and Frederick (1979).
  - February 1978: Nor'easter damage along the New England coastline.
  - Oil Spills: breaking up and sinking of the Texaco Oklahoma (1971) and the Campeche Bay oil spill (1979).

# Historical Accounts

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**March 27, 1964: Alaska struck by an earthquake and tsunami.**

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# Historical Accounts

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Nor’easter (February 1978)

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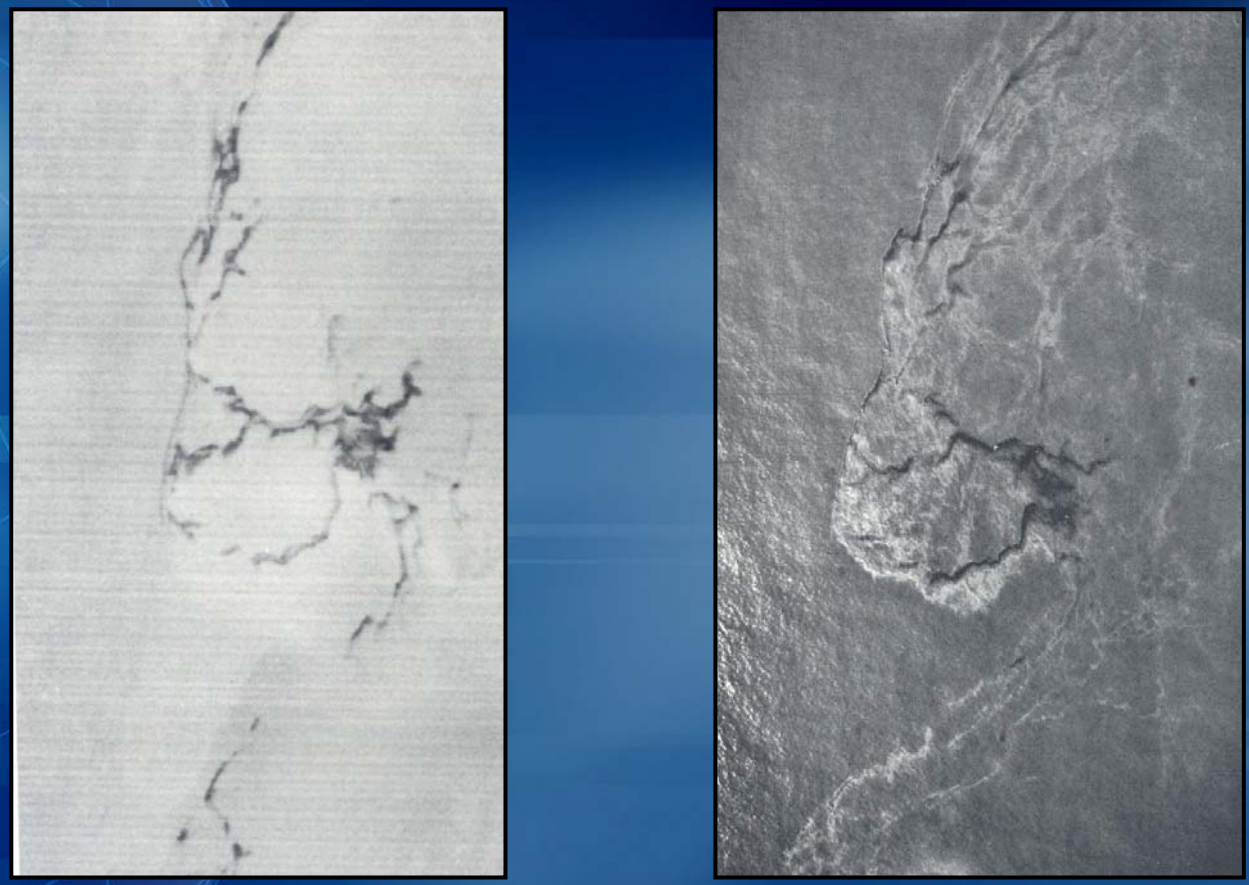
# Historical Accounts





Oil Slick from the breaking up and sinking of the tanker Texaco Oklahoma (1971)

# Recent Projects



- Provided support in the recovery and clean up efforts at the World Trade Center and Pentagon following the September 11 terrorist attacks.
- Acquiring lidar to assist with homeland security in port areas.
- **Hurricanes:** Isabel (2003), Ivan (2004), Jeanne (2004), Dennis (2005), Katrina (2005), Ophelia (2005), Rita (2005), and Wilma (2005).

# Hurricane Isabel

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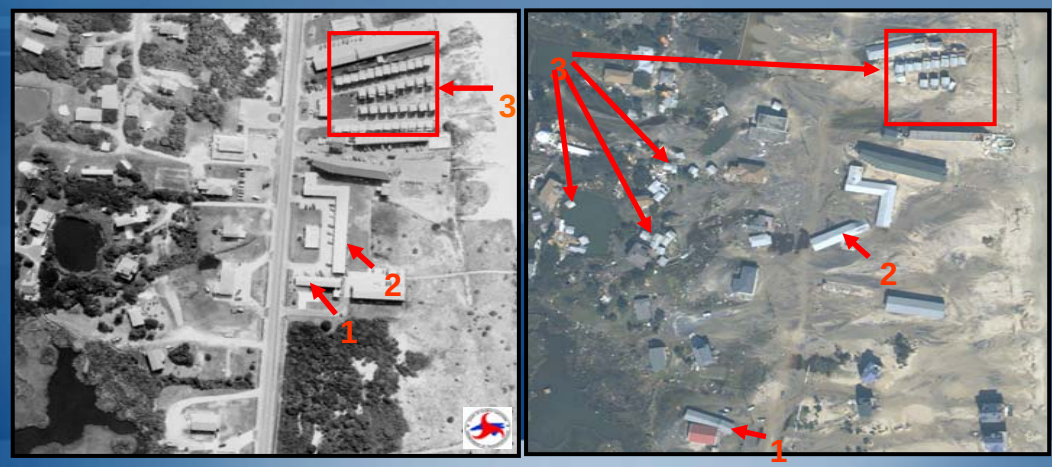
- On September 18, 2003 Hurricane Isabel made landfall along the North Carolina Outer Banks as a category 2 storm.
- Utilizing the DSS, several flights were made between September 19th and 21st to capture the altered coastline.
- Over one thousand high resolution images were acquired and made available for viewing.

Hatteras Village, North Carolina




1998 September 19, 2003

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# Hurricane Katrina

NATIONAL GEODETIC SURVEY

- Hurricane Katrina made landfall near Plaquemines Parish Louisiana with winds of 140 mph and then again near the Louisiana/ Mississippi border with 125 mph winds.
- Utilizing the DSS, several flights were made between August 30th and September 8th to capture the altered coastal areas.
- Over eight thousand high resolution images were acquired and made available for viewing.
- The NGS website has experienced over 73 million hits.

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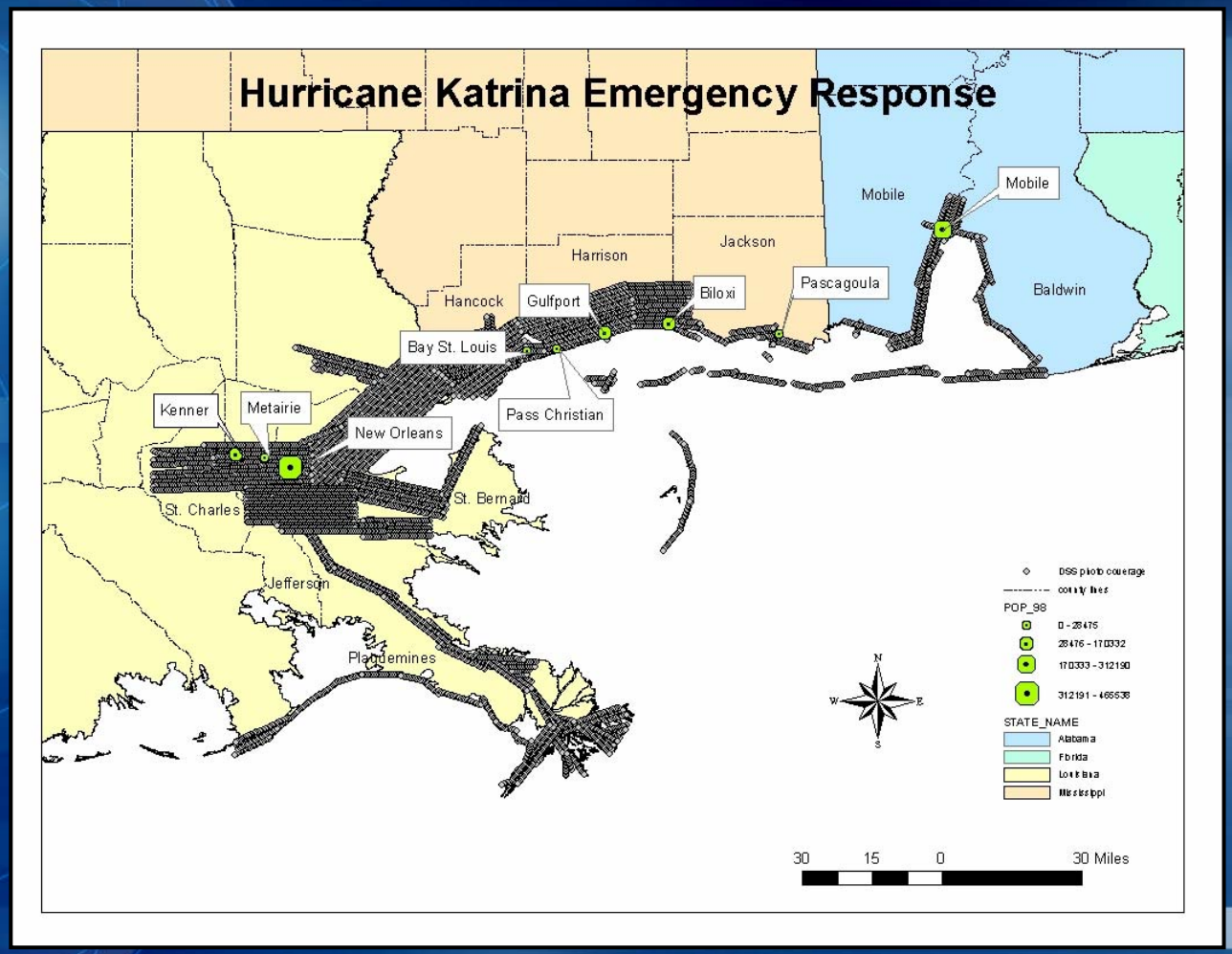
# Hurricane Katrina

NATIONAL GEODETIC SURVEY

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# Hurricane Katrina
## Grand Isle, LA

NATIONAL GEODETIC SURVEY


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# Hurricane Katrina

## Venice, LA

NATIONAL GEODETIC SURVEY

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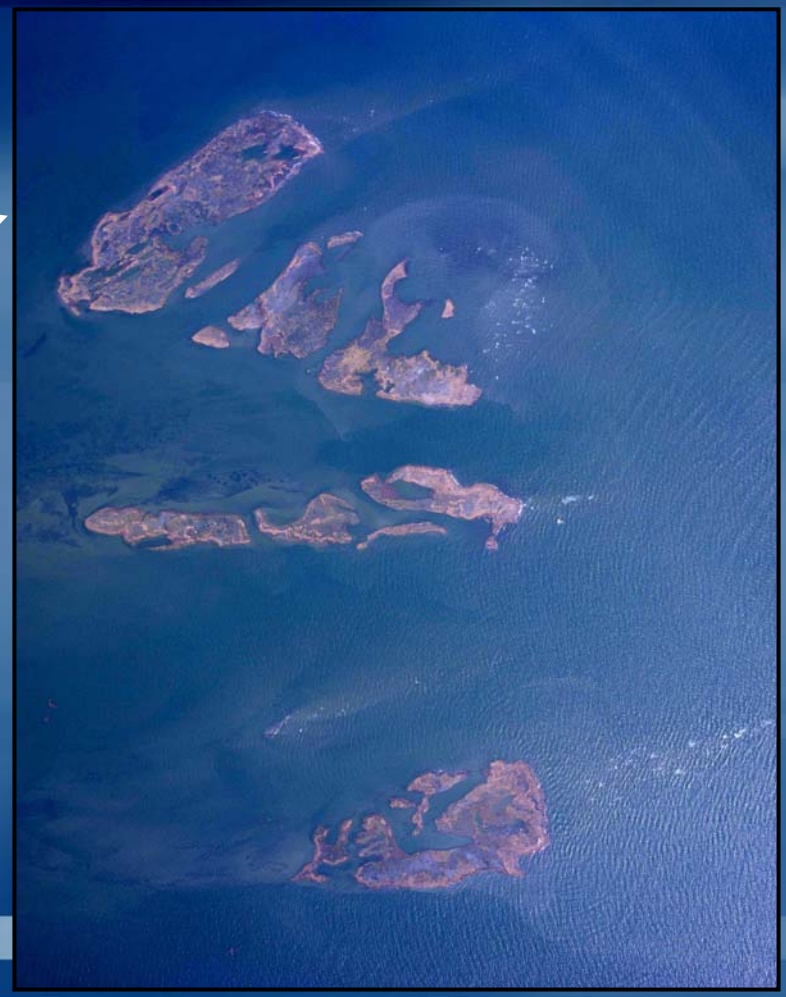
# Hurricane Katrina
## Chandeleur Islands, LA

NATIONAL GEODETIC SURVEY

October 15, 2004

Imagery Courtesy of NASA


September 16, 2005



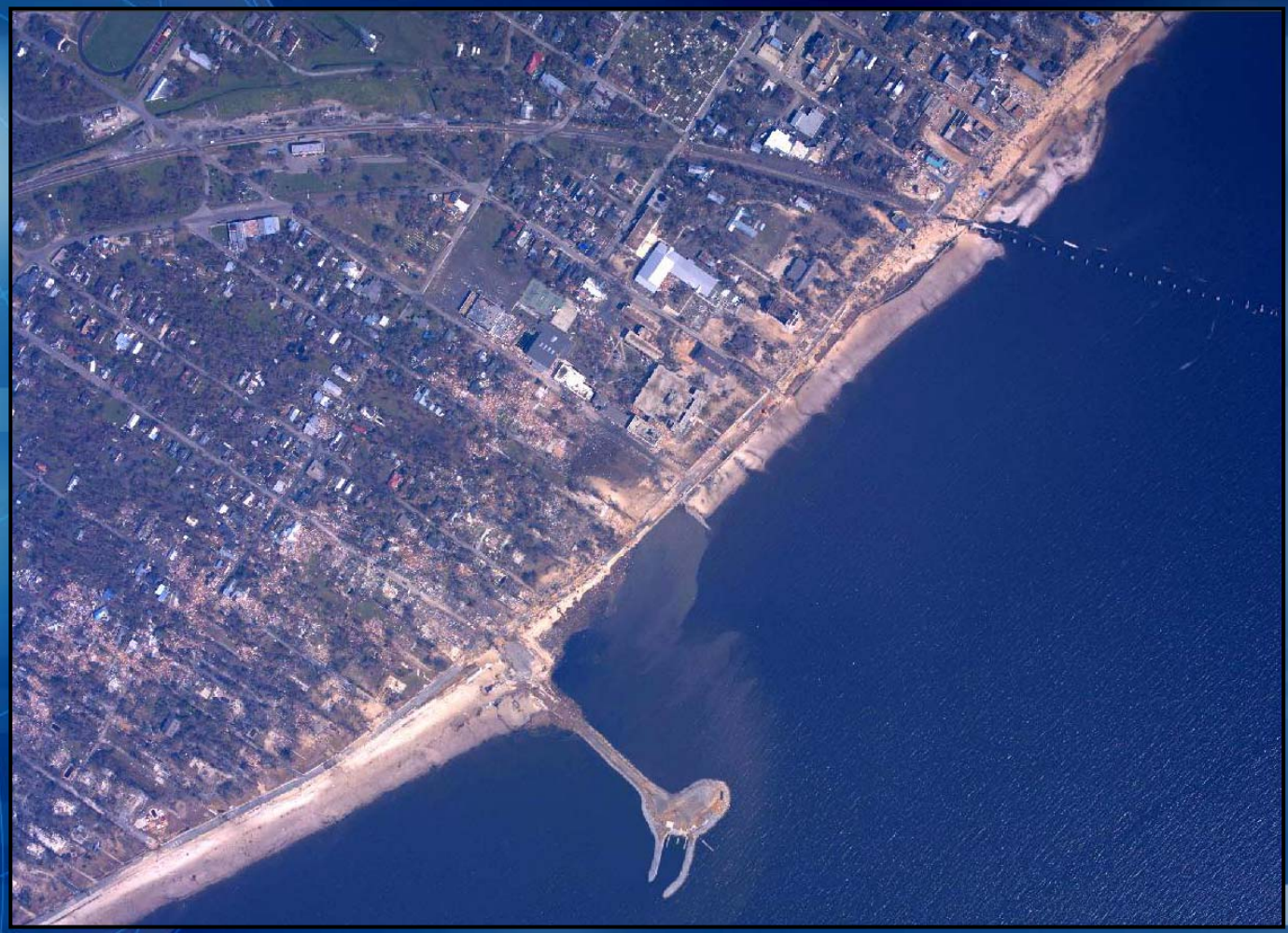
DSS Imagery

National Oceanic and Atmospheric Administration

# Hurricane Katrina

## Bay St. Louis, MS

NATIONAL GEODETIC SURVEY



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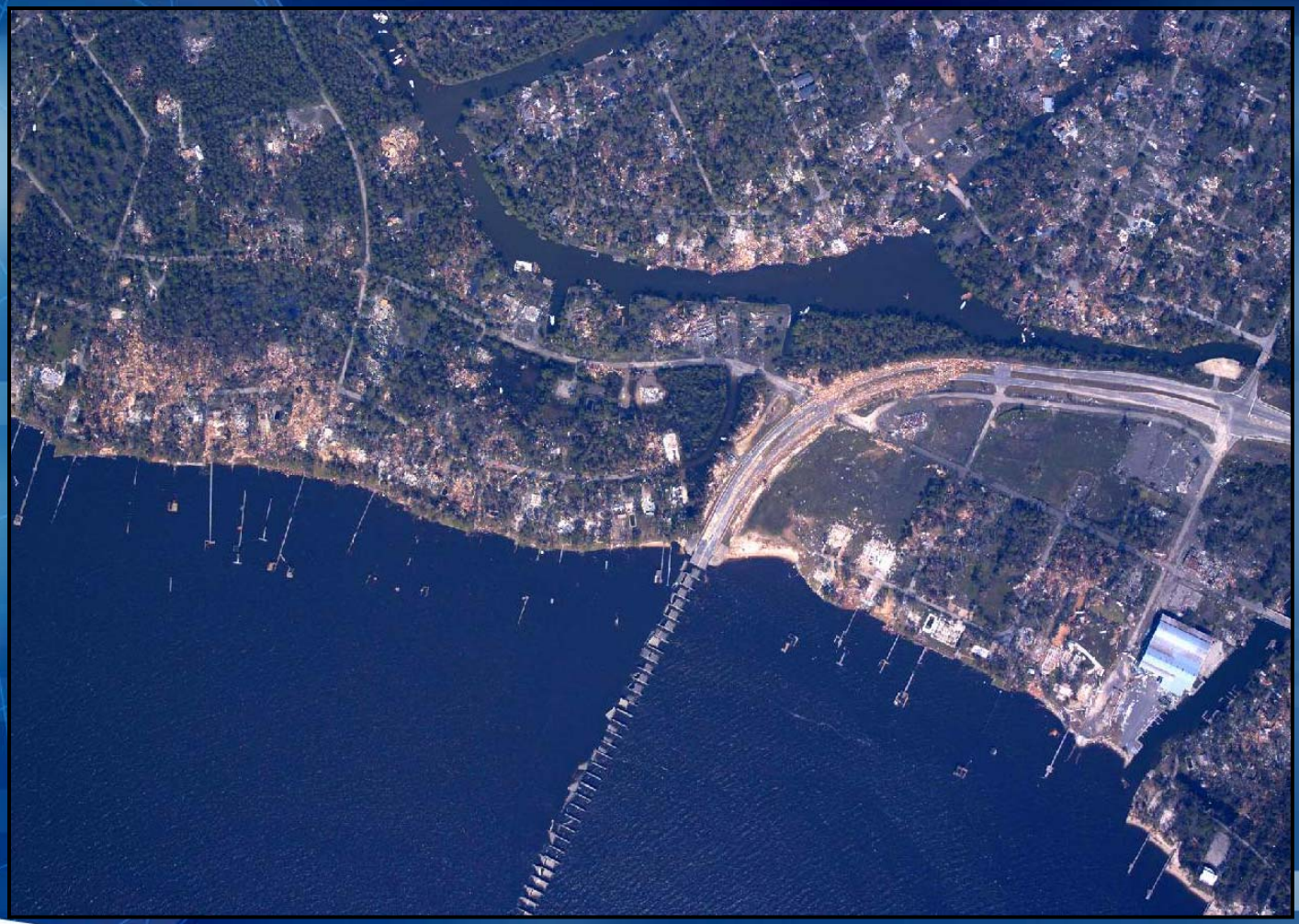
# Hurricane Katrina

## Pass Christian, MS

NATIONAL GEODETIC SURVEY



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# Hurricane Katrina
## Gulfport, MS

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# Hurricane Katrina
## Gulfport, MS

NATIONAL GEODETIC SURVEY

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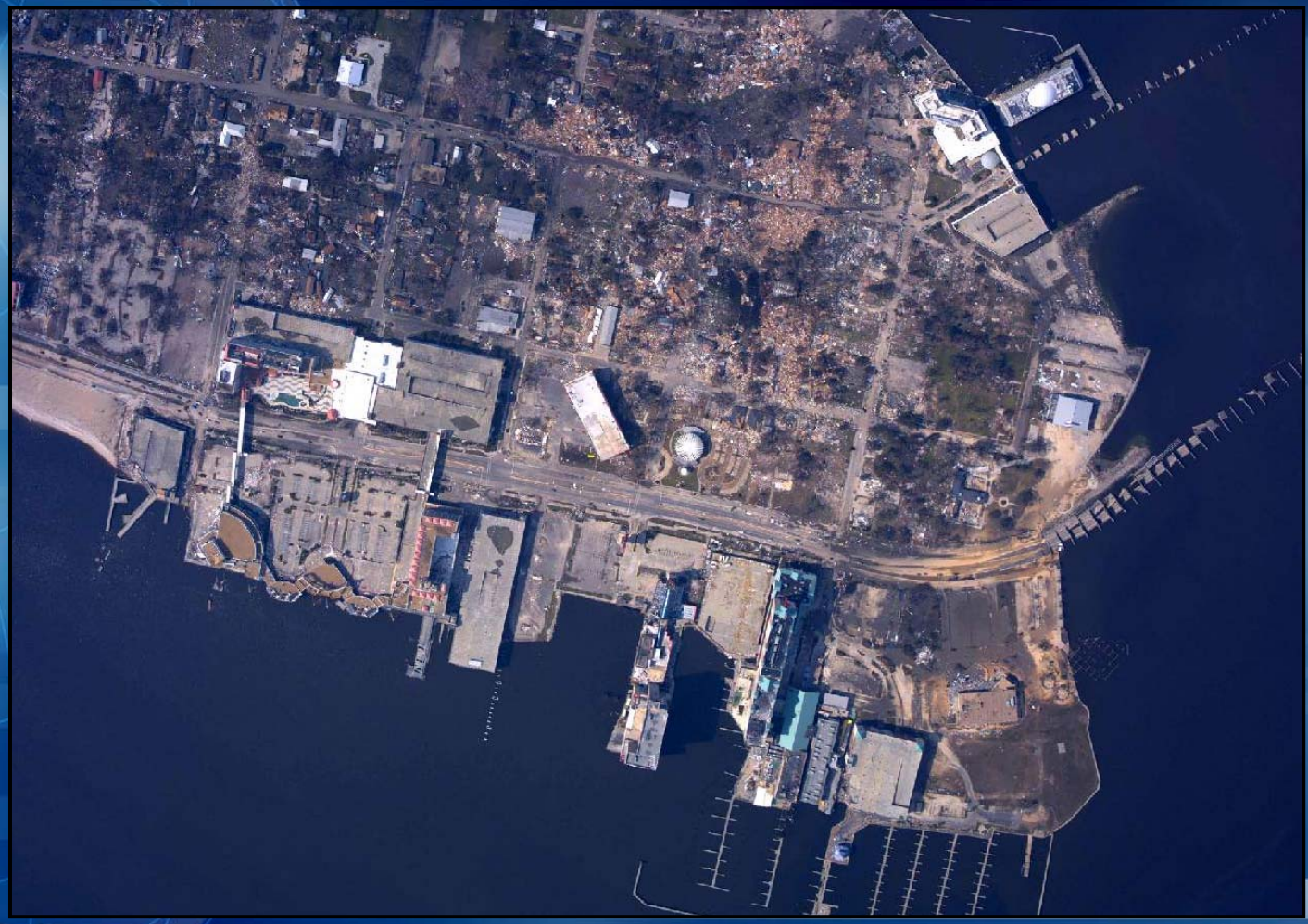
# Hurricane Katrina
## Biloxi, MS

NATIONAL GEODETIC SURVEY



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# Hurricane Katrina

## Dauphin Island, Al

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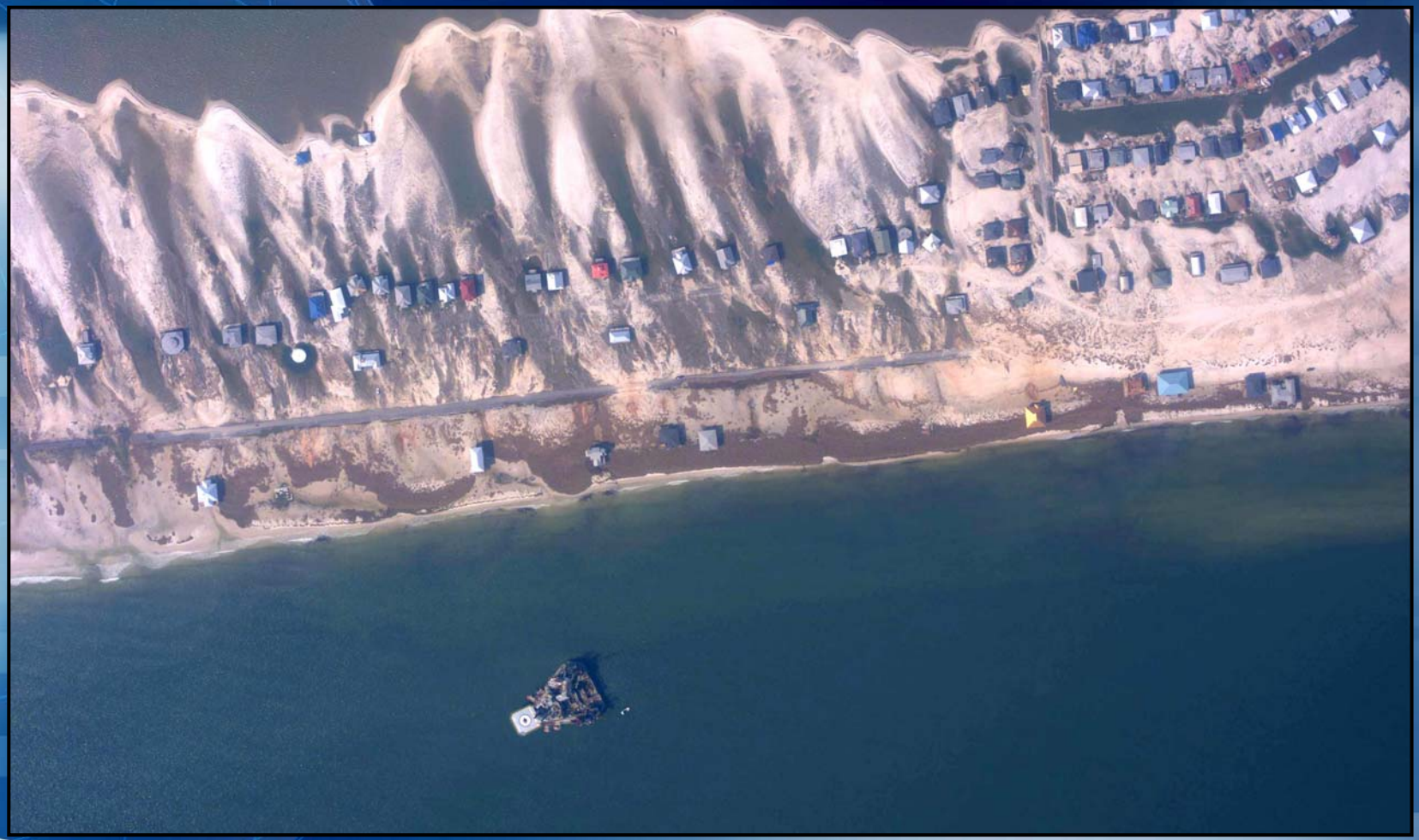

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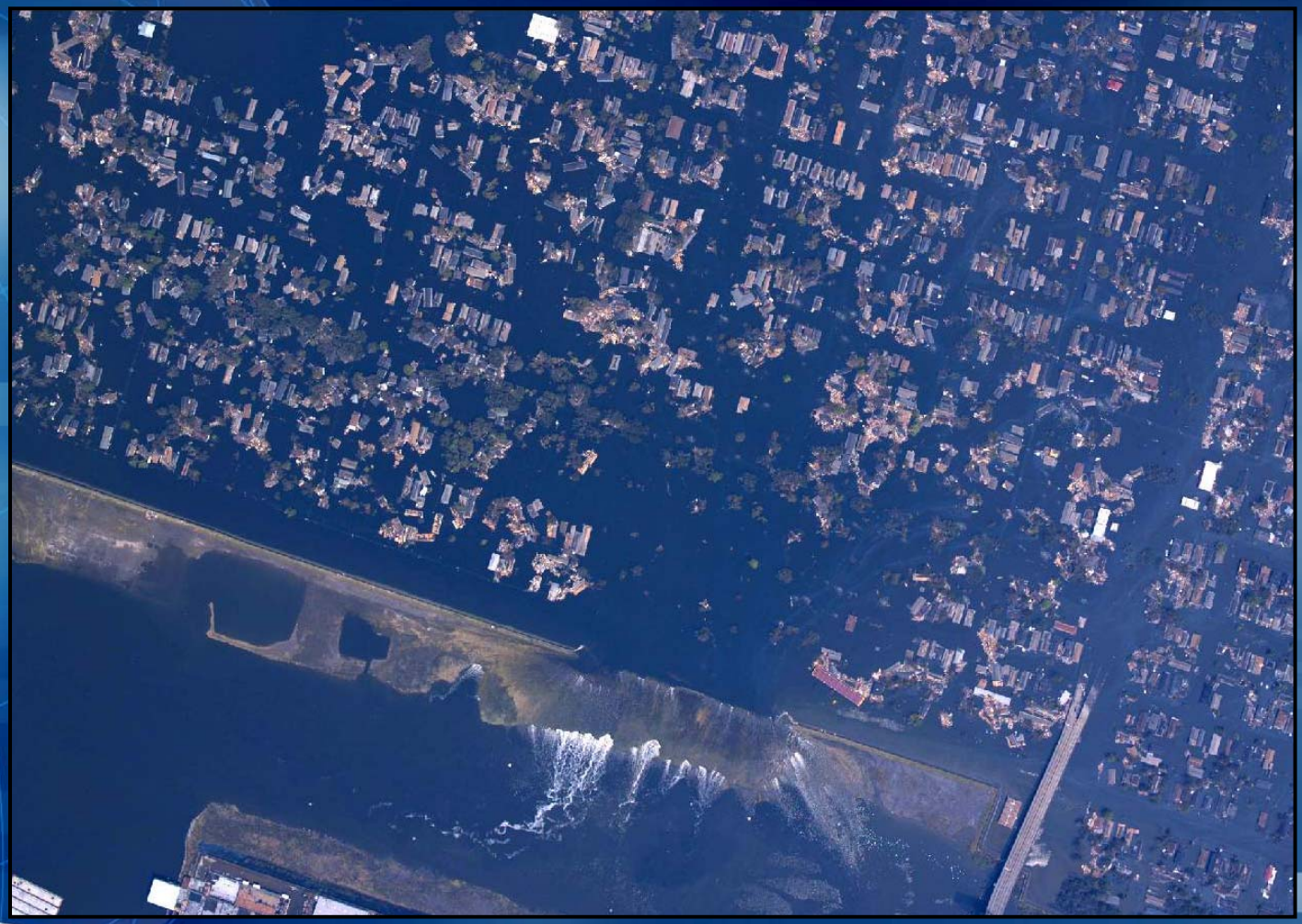
# Hurricane Katrina

## New Orleans, LA

NATIONAL GEODETIC SURVEY



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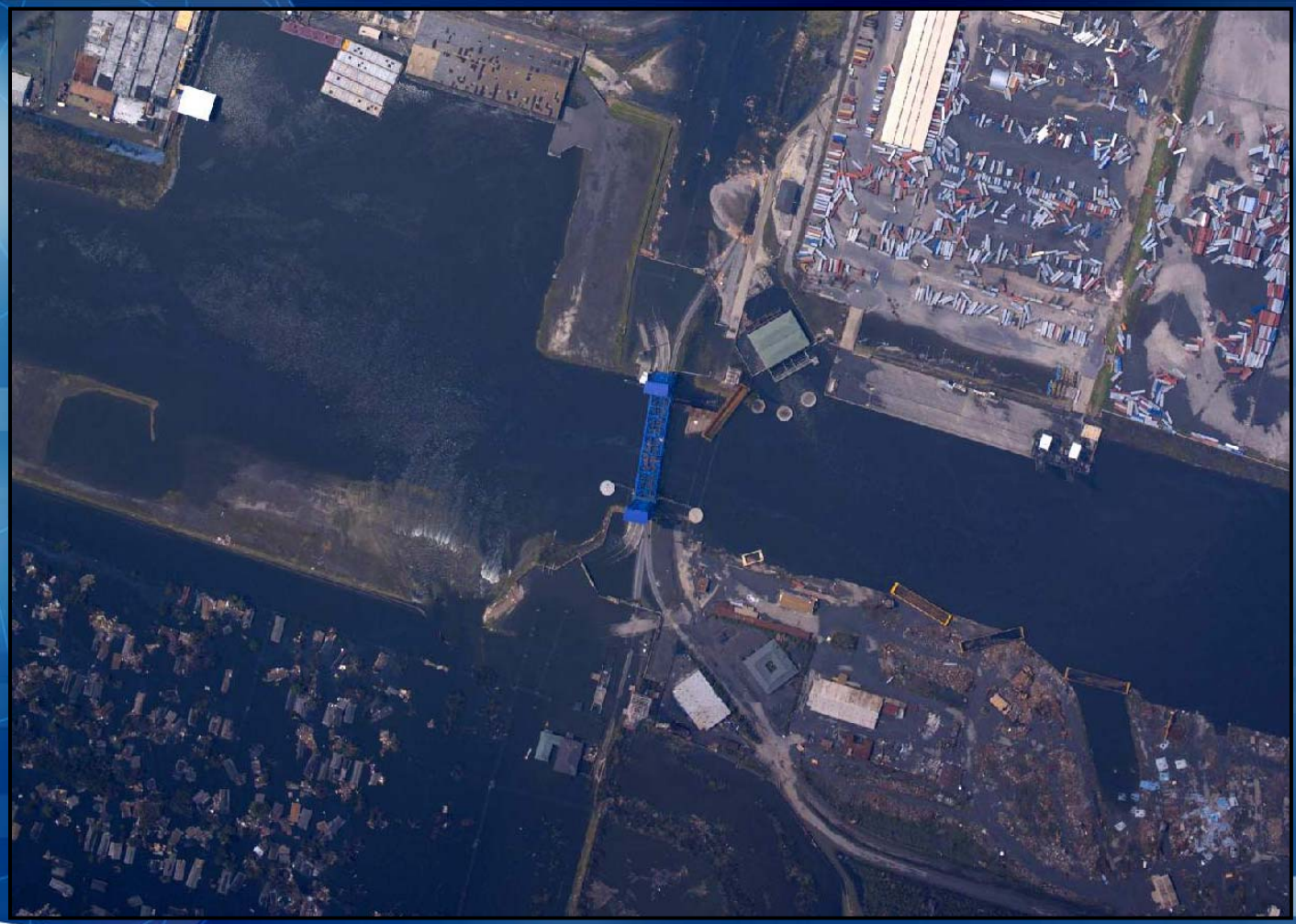
# Hurricane Katrina

## New Orleans, LA

NATIONAL GEODETIC SURVEY



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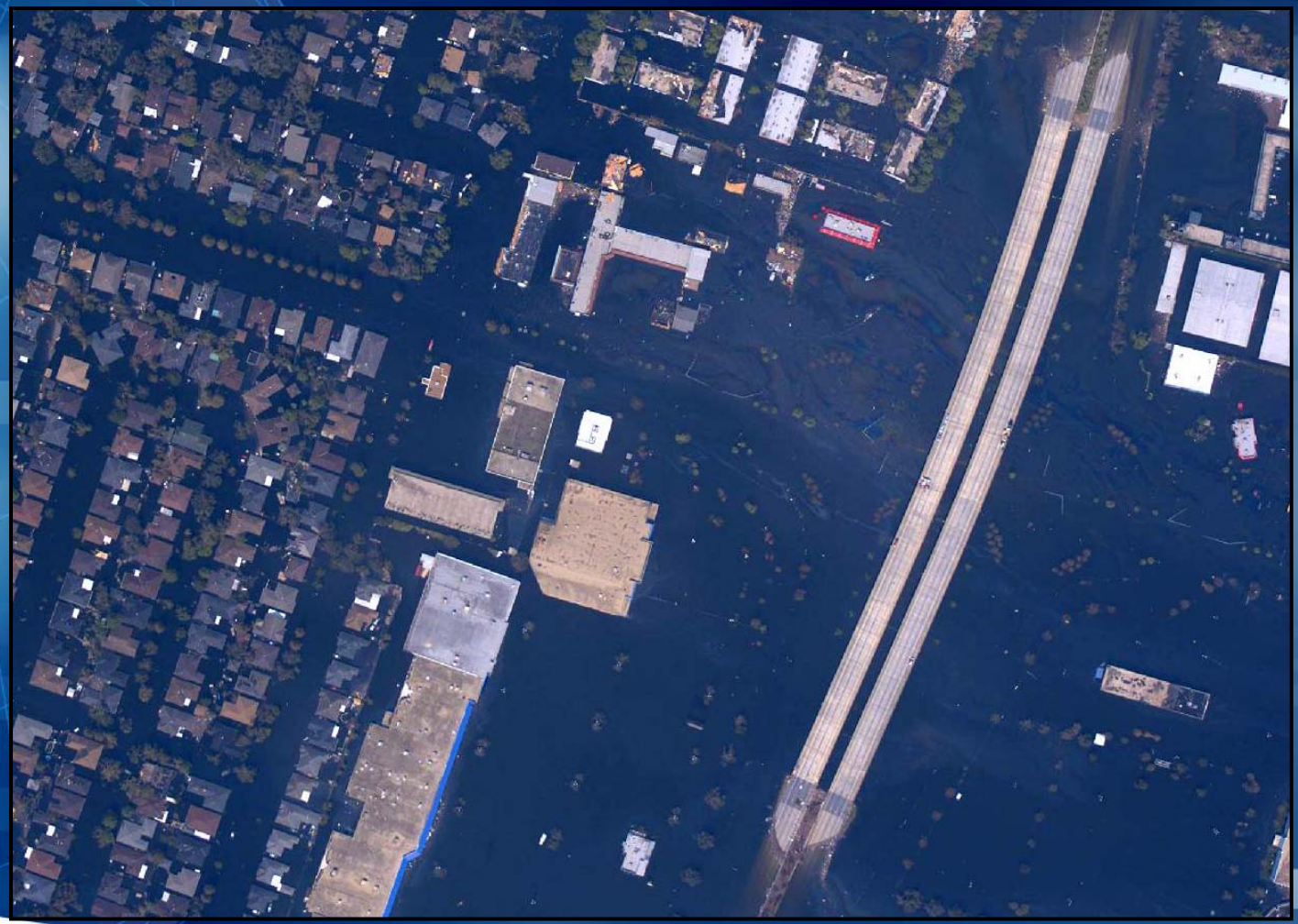
# Hurricane Katrina

## New Orleans, LA

NATIONAL GEODETIC SURVEY



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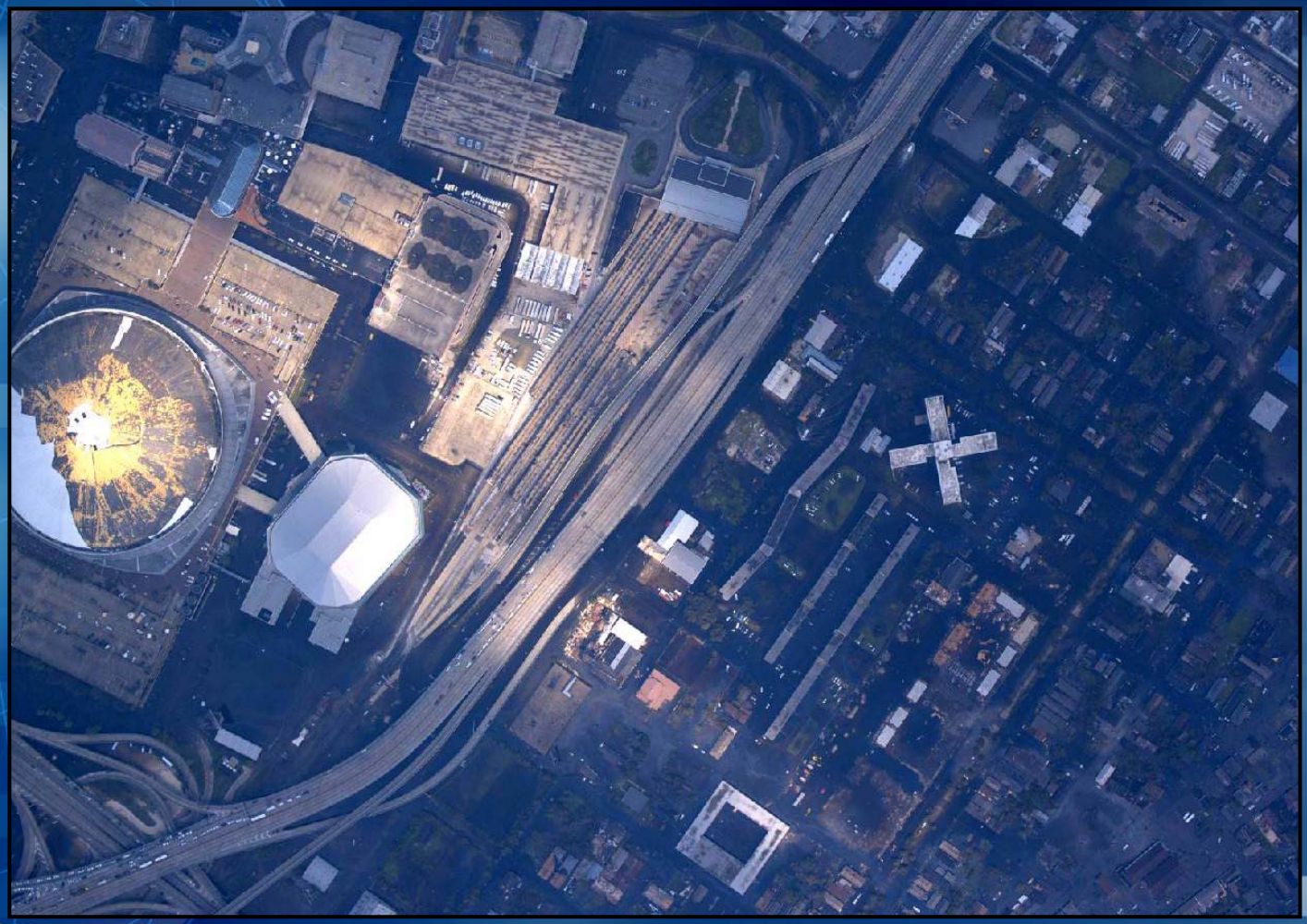
# Hurricane Katrina

## New Orleans, LA

NATIONAL GEODETIC SURVEY



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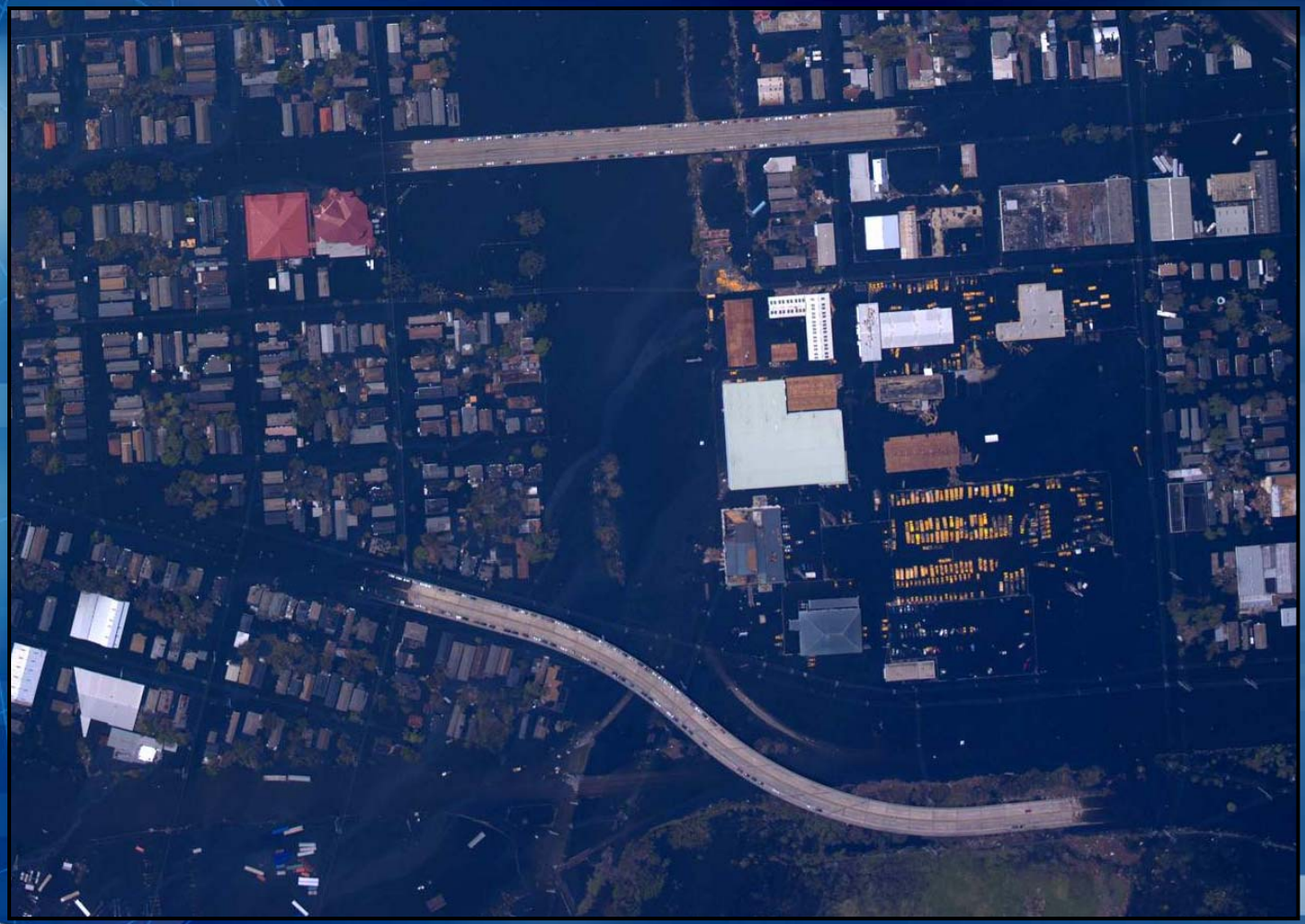
# Hurricane Katrina

## New Orleans, LA

NATIONAL GEODETIC SURVEY



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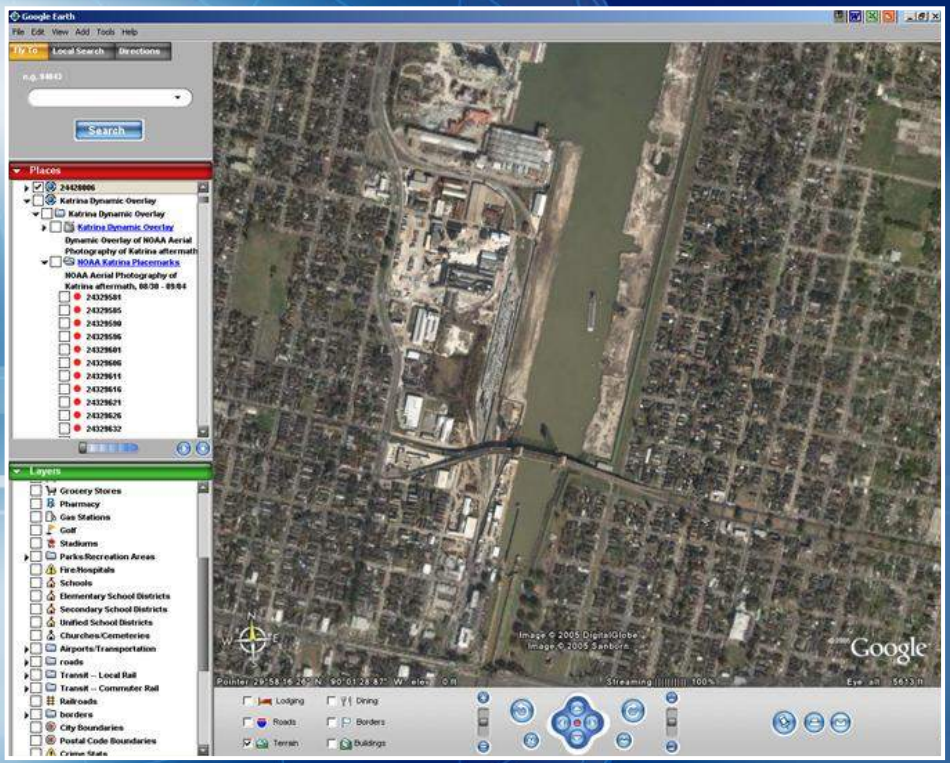
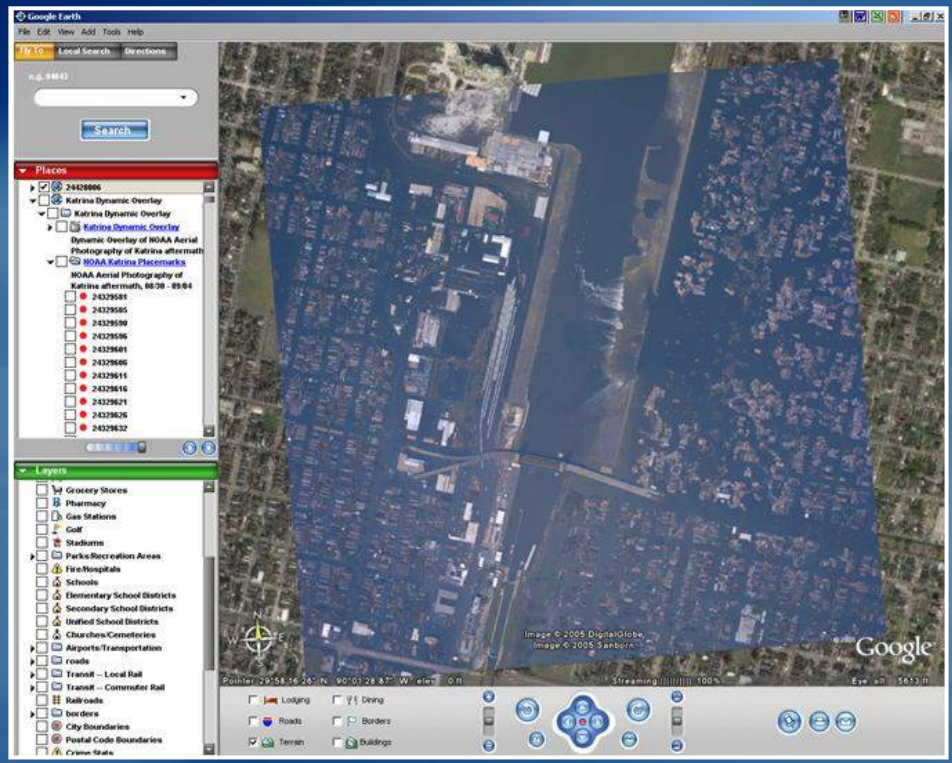
# Hurricane Katrina
## New Orleans, LA

NATIONAL GEODETIC SURVEY




**Google Earth incorporates NGS imagery.**

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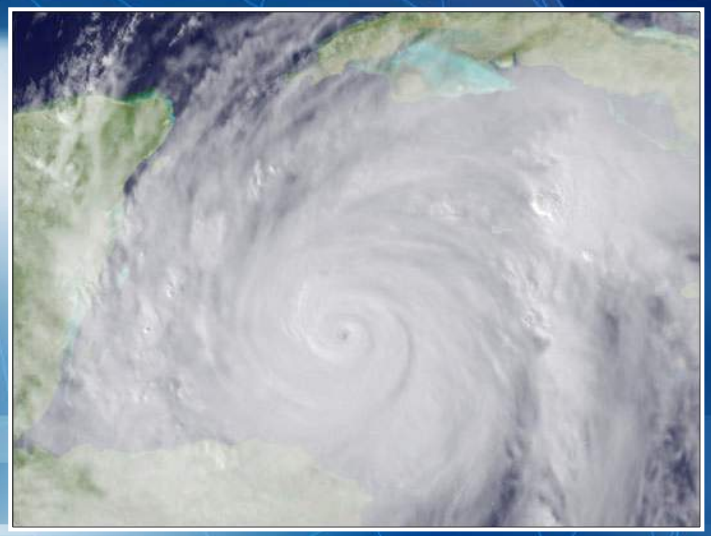
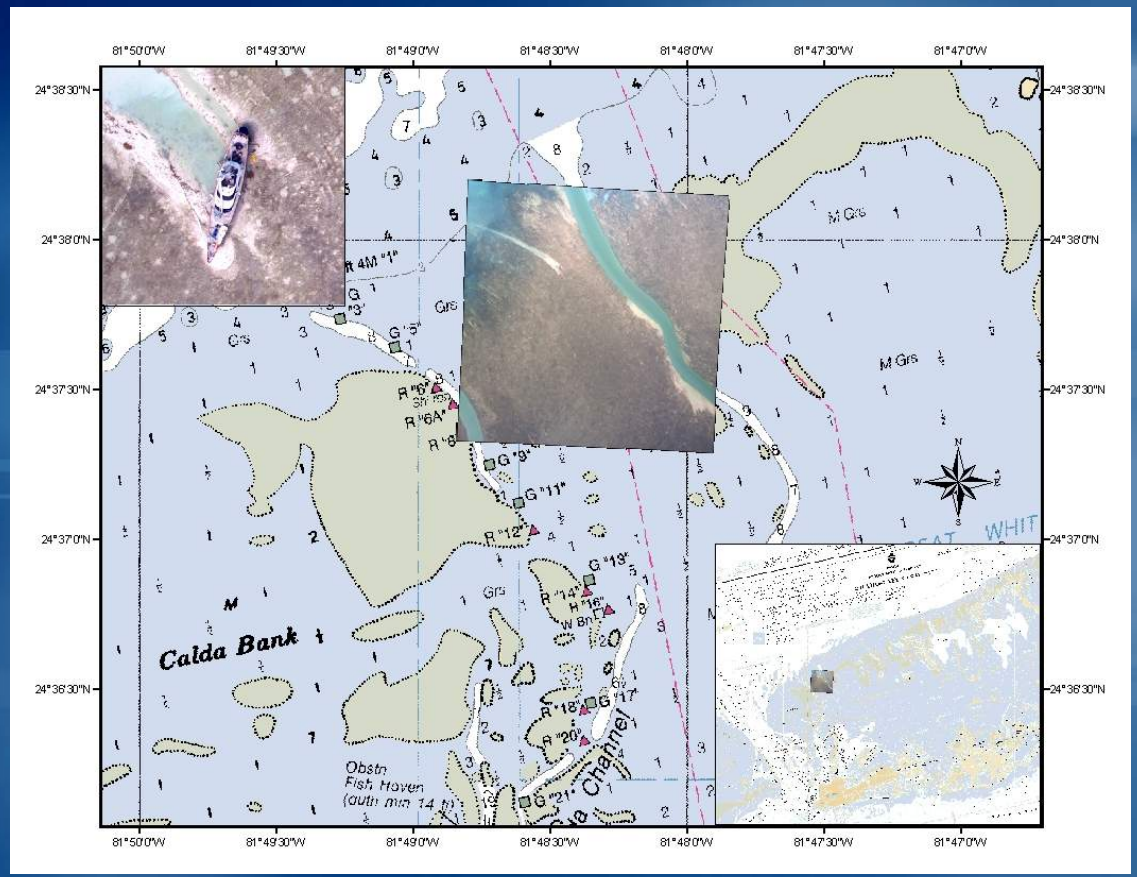
# Hurricane Wilma

NATIONAL GEODETIC SURVEY





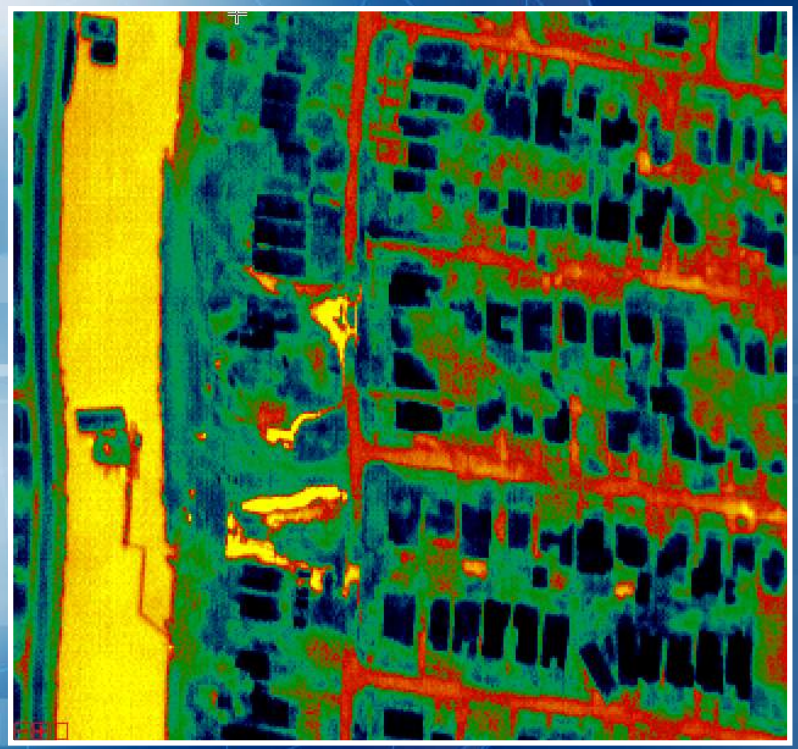

- Hurricane Wilma made landfall on October 24th with winds near 120 mph (category 3 intensity) in southwestern Florida near Cape Romano.
- Approximately 1,600 high resolution images were acquired and made available for viewing.

National Oceanic and Atmospheric Administration

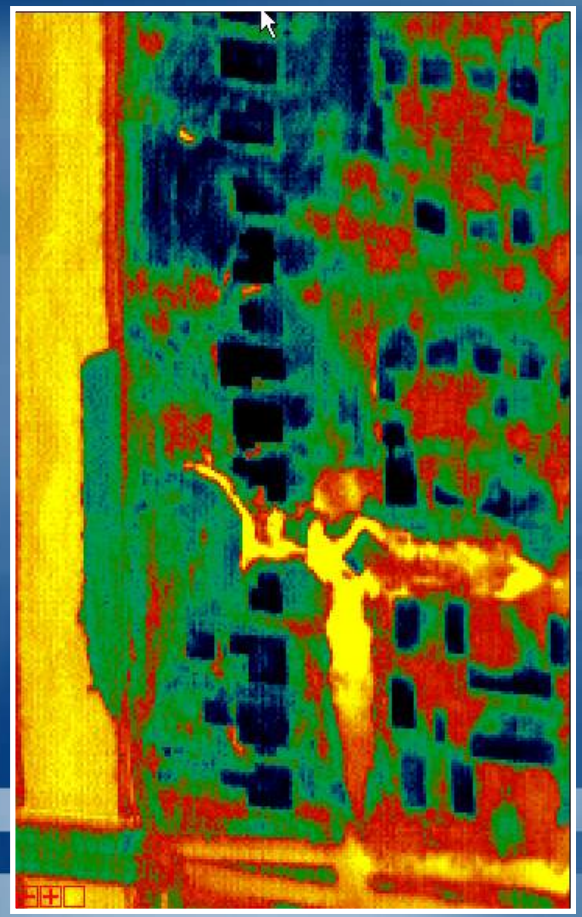
# Thermal Collection to assist with Levee Inspection

NATIONAL GEODETIC SURVEY

17th Street Canal



Industrial Canal



National Oceanic and Atmospheric Administration

# Summary



- **Remote Sensing Division has two mapping programs:**
  - Coastal Mapping
  - Airport Survey
  - Research and Development that support both programs
- **NOAA/NGS/RSD plans to acquire remotely sensed data in the future to support the agency's homeland security and emergency response requirements.**
- **The data will continue to be disseminated and promoted in a manner to facilitate support efforts.**
- **This data also assist in supporting the testing and development of guidelines for the acquisition and utilization of remotely sensed data for the integration into NOAA programs.**