



Great Lakes Coastal Program Managers Meeting

Buffalo, NY

September 23-25, 2008

Heather Stirratt





Presentation Objectives

- Get to know NOAA projects in the Great Lakes region
- Learn about NOAA assets and how they can help you
- Identify opportunities for collaboration

=> Improve customer service by representing the full agency and better integrating our products and services



NOAA Mission

*To understand and predict changes
in the earth's environment
and conserve and manage coastal and marine resources
to meet our nation's economic, social,
and environmental needs.*



Because data alone is not enough...



Digital Coast gives organizations that manage coastal resources easy access to data and related resources.

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Digital Coast provides the total package needed by state, local, and non-profit organizations.

It not only offers easy access to downloadable data, but also the data-specific training, sample applications, and tools needed to address coastal issues.

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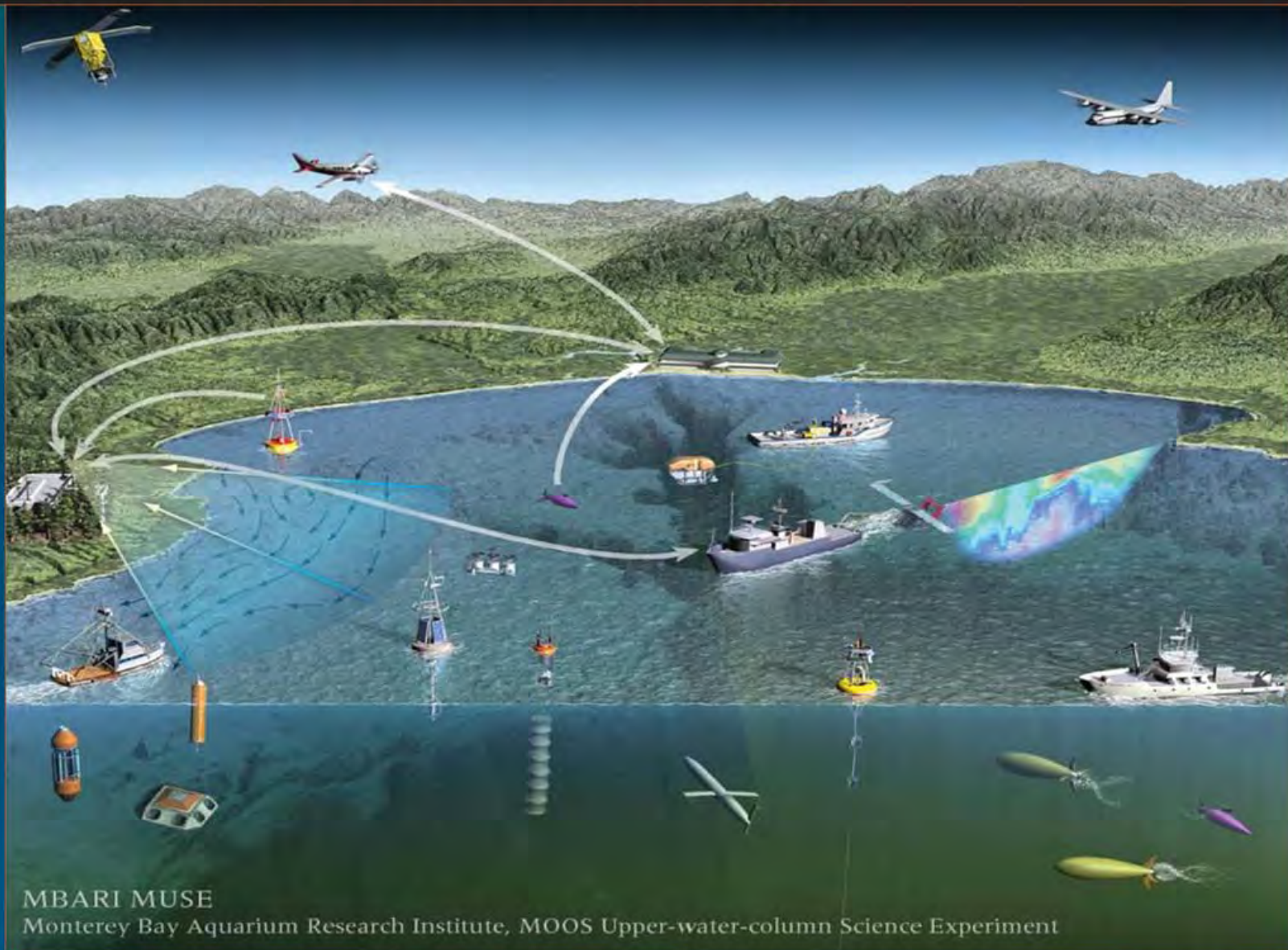
Joint Project Agreement Update...



- Smart Growth Case Studies
- Great Lakes Habitat Priority Planner
- Training
 - Impervious Surface Analysis Tool (ISAT)
 - Non-point Source Pollution and Erosion Comparison Tool (N-SPECT)
- Outreach to CZ Community
 - GLIN Coastal Pages
- Ports and Navigation
- Data and Information Integration and Dissemination



Integrated Ocean Observing



MBARI MUSE

Monterey Bay Aquarium Research Institute, MOOS Upper-water-column Science Experiment

Great Lakes Observing System



- IOOS® currently funding the development and management of GLOS as part of a national network of regional observing systems
- New Executive Director of Great Lakes Observing System - Jennifer Read

Light Detection And Ranging (LIDAR)



Joint Airborne Lidar Bathymetry
Technical Center of Expertise



Seamless Topobathy – Lake Ontario

- Models of 100-year water supplies and levels for Lake Ontario (IJC LOSL);
- Water supply sequences based on different climate change scenarios and hydrological models that could be used to generate additional supply sequences (IJC LOSL; Croley 2003; Mortsch *et al.* 2005);

Impacts of Falling Lake Levels on Coastal Habitat Distribution and Function in the Great Lakes: Assessing Management Options for Wetland Migration

A proposed project by The Nature Conservancy (TNC) with support from the NOAA Coastal Services Center (CSC) and others

In the face of climate change, water levels in the Great Lakes are forecast to decline by significant amounts due to higher temperatures, reduced winter ice cover, changing wind patterns, and subsequent dramatic increases in evaporation. Great Lakes water levels, and their fluctuations, are critical to determining the distribution and function of coastal habitats. Seasonal, annual, and multi-year fluctuations around the mean water level are considerable and are dependent on precipitation, temperature, and water supplies from tributaries and connecting channels. Regulation of water levels on Lake Superior and Lake Ontario, through dams in outlet rivers, adds an additional layer of complexity to the examination of the impacts of climate change. Consequently, translating changes in average lake levels to changes in habitat availability, distribution, and quality is highly complex, but understanding these impacts is necessary to develop effective conservation and management strategies.

Project Objectives – This project will support conservation and management strategies that incorporate climate change impacts by:

- Developing predictions of climate change effects on lake levels in a form useful for modeling coastal habitat change on a regulated lake;
- Predicting the impacts of these changes on wetlands and littoral habitats to identify conservation strategies that are locally and regionally appropriate; and
- Considering how regulation of lake water levels may interact with changing hydrology, and providing guidance to decision makers on approaches to regulation that may lessen impacts.

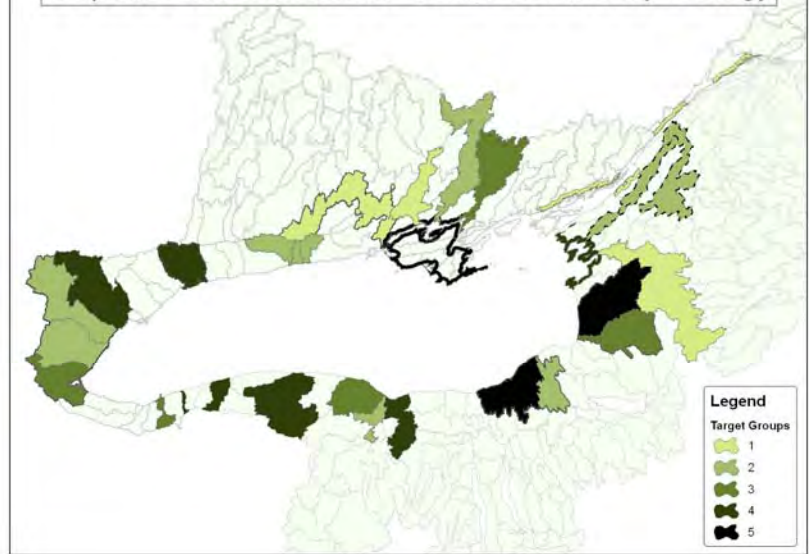
Products and analyses from the project will be informed by and shared with regional councils, agencies, coastal managers, and the public so that conservation priorities for coastal habitat protection and management can take into account likely climate change impacts. Key steps in this 3-year project include:

1. Convene a workshop of scientists, coastal managers, and modelers experienced in water management, hydrology, ecology, and climate change and establish a bi-national collaborative working group.
2. Create high-resolution elevation maps for priority areas of shoreline, including both topography and bathymetry (a topobathy surface), to model coastal habitat response to water level changes.
3. Develop plausible future water supply sequences for Lake Ontario that are based on regional climate models or downscaling from global models.
4. Combine water supply sequences with alternative water regulation plans to predict lake levels. Examine impacts on factors that drive coastal habitat distributions and how different dam regulation plans may influence climate change impacts.
5. Identify potential areas to protect and/or restore by considering factors that might promote, impede, or prohibit habitat and species adaptation to climate change.
6. Convey habitat scenarios to the coastal management community for consideration in conservation and development decisions.

Relationship to Existing Great Lakes Efforts – This project will assemble climate modelers, ecologists, coastal managers, and water regulators—whose professions are interrelated and often complementary, but whose time and funding limit collaboration—to address needs of the management community and bring together key data sets and approaches for modeling impacts of climate change on Lake Ontario coastal habitats. Many components of this project already exist or are under development:

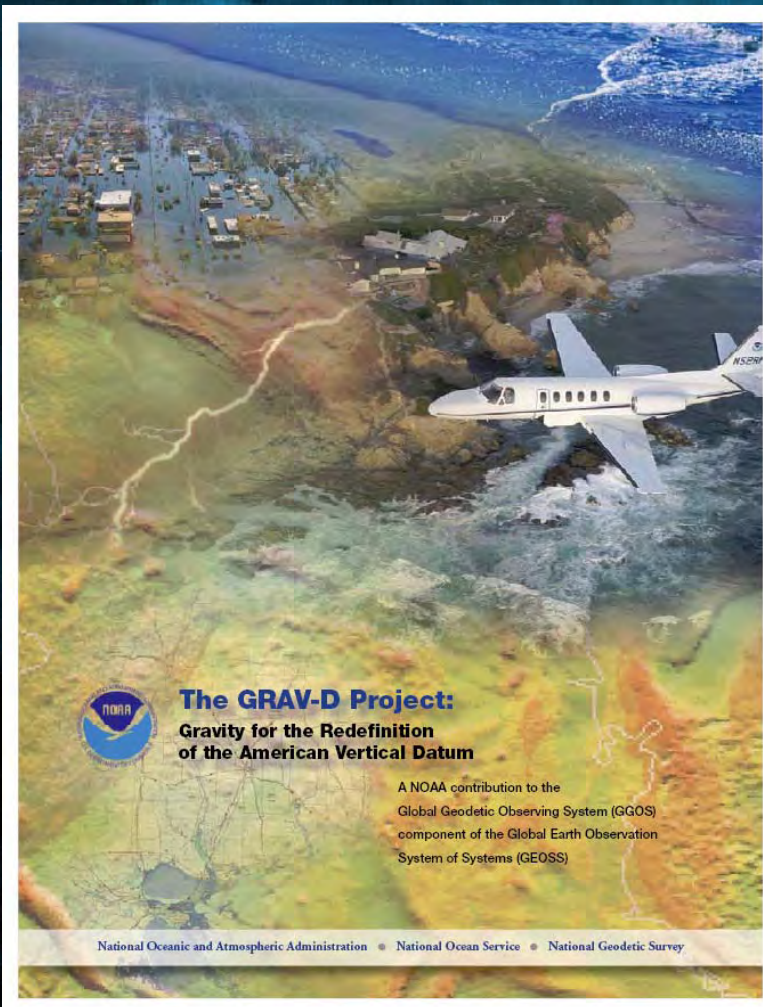
- Great Lakes Regional Needs Assessments: 1) *Great Lakes Needs Assessment*, July 2006 (Great Lakes Commission and NOAA CSC) and 2) *Preparing for a Changing Climate*, October 2000 (Great Lakes Regional Assessment, www.geo.msu.edu/gira/assessment/assessment.html)
- 2001 bathymetry of the nearshore and topography of portions of the above-water shoreline (International Joint Commission Lake Ontario-St. Lawrence study (IJC LOSL)); new data from USACE and counties.
- Regional Climate Models (RCMs) for the Great Lakes that provide regionally relevant climate predictions for key drivers of lake level (i.e., Kling *et al.* 2003 and newer ones developed by Environment Canada, NOAA Great Lakes Environmental Research Lab, and others)

Proposed Action Sites, Lake Ontario Biodiversity Strategy





Gravity for the Redefinition of the American Vertical Datum (GRAV-D)



Wisconsin Farm June 2008

Source: <http://news.bbc.co.uk/2/hi/americas/7445834.stm>

International Great Lakes Datum Update - 2015

Natural Resources Canada
Pêches et Océans Canada
Environment Canada

USGS

An International Partnership

Updating the International Great Lakes Datum (IGLD)

Thomas F. Landon and Regina C. O'Neil

Abstract: Movement of the earth's crust due to tectonic rebound requires the revision of the datum, or elevation reference system used to define water levels within the Great Lakes. Laurentian Basin system, every 35 to 40 years. This update, one of the world's greatest fresh water resources, is shared and is resource jointly managed by the United States and Canada. The revision of this elevation reference system, the International Great Lakes Datum (IGLD) requires the updating of IGLD at approximately 100 new locations in the United States, as compared to the number control stations on each of the major lakes. The revision is targeted for the revised year 2015, gradually to be implemented several years later. The revised datum is critical to the updating of navigational charts and navigation safety, particularly during periods of low lake levels. This paper describes the many details involved in the updated version of IGLD, including implementation plans and how the effort will impact the National Ocean Service estimates of the VDatum used for the Great Lakes.

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NOAA'S SEASONAL GAGING PROGRAM TO SUPPORT THE IGLD UPDATE

What Is The Program Of Seasonal Gaging Program?

- Station for IGLD elevation is approximately 100 new locations and where data from the existing control stations on each lake.
- Each lake is considered as a single control station, but leveling errors and local variations in gravity have a noticeable effect on elevations determined from leveling.
- Station is referenced to IGLD as established at one major station on each lake (Cedar Milligan and Stone are considered and use one control station located at Shaker Beach, MD).
- The second station is used to determine any adjustment to the major control station by a survey of the water level.

How Is A Water Level Transmitted?

- Temporary gauges are installed in places over the years of the National seasonal tide and water level data collection for the four summer months.
- The data set is completed for each lake on the major station of data for that lake.
- The difference between the major and temporary sites is determined, referred to as the Hydraulic Correction.
- The Hydraulic Correction is then applied to the data set from the temporary sites to establish the data set on an equivalent station with the major.

How Is IGLD Established For Stations On The Surrounding Shores?

- Water stations are on a sloping surface rather than on a horizontal surface, so an Hydraulic Correction is applied to the data set.
- Definition leveling using dynamic height has been used to directly establish IGLD 1985 at river stations.

What Level Of Error Is Expected To Remain?

NOAA's Goal: Complete The Seasonal Program

- Anticipated long term benefit to NOAA budget.
- Enhance, verify, and complete of the water level gauges.
- Coordinate all gauges, including tide gauges, leveling to land based control points.
- IGLD elevations on one mark at each station obtain relationship with dynamic height datum and with the CGRS network.
- Data processing, compilation of their position correction, and determination of the updated elevation datum.
- Coordination of the update through the COGLES/ED.

What Results Does The Seasonal Program Provide?

- Supports the IGLD update by establishing the water level reference for each lake through interpretation of the Hydrographic Survey and NOAA.
- Updated elevations are used for navigational charts updates by the Canadian Hydrographic Survey and NOAA.
- Greater reference for navigation safety, particularly in periods of lower water levels.
- Provides reference in case of changing related to updated datum corrections for consistency by the US Army Corps of Engineers.
- Supports the IGLD elevation industry and commercial trading community.

What Is The International Great Lakes Datum (IGLD)?

- Internationally coordinated vertical datum plane used to define water level heights within the Great Lakes, Laurentian Basin System.
- IGLD is established each datum on low water datum.
- The current datum IGLD 1985, originally published for the United States (US).

What Is Updating The Datum?

- The datum update is part of the support of the Coordinating Committee for Great Lakes Basin Hydrologic and Hydrographic Data (COGLES/ED).
- Established in 1973 to establish more precise datum for datum reduction and comparison of data, serving as a model for future updates.
- Composed of members and representatives from Federal agencies of the United States and Canada.

Atlantic Coastal Movement

Five years of position information and crust motion from the geodetic network in the St. Clair, St. Lawrence and Lake Ontario basins.

Why Is An Updated Datum Required?

- Tectonic rebound from the years of the glacier results in movement of the earth's crust.
- The Great Lakes are one of the world's greatest fresh water resources.
- The international in the United States and Canada requires a shared responsibility and coordination of water level, gaging and management of water resources.
- The International requirement for shared responsibility is a common datum reference frame for navigation.
- IGLD 1985 was the first coordinated datum plane covering both the sides of the North American Continental Datum of 1985.

NOAA National Charting Report

Low water datum (water datum) will be changed to match the IGLD 2015.

- Charting on charts remains the same, new charts will be printed including the new datum.
- Methods of registering surfaces of Lake Superior and Lake Ontario will remain the same.
- Changes of registered data (charts) will be assigned new elevations.
- Elevations assigned to water levels will be based on the new datum.
- Monthly water level information published by the USGS and NOAA will reflect the new datum.

St. Clair River Special Project

1. Charting
2. Hydrographic
3. Navigation
4. Environmental

Weekly St. Lawrence River Outflow Data (M3)

Water level (meters) vs. Time (hours)

What Are The Limitations Of Vertical Datum?

Canadian leveling system: heights of bench marks, originating with the level at Benning, Canada, measured with the length of water level stations for IGLD 1985 - each specific method for the time took several years to complete the leveling.

- Dynamic height measured for gravity adjustment is an approximate of the potential for bench mark elevation.
- Approximation of systematic leveling errors over approximately 1000 years resulted in the greater errors in height on the west side of the Great Lakes basin.
- Leveling done only once required maintenance on a regular basis, height loss in the eastern half of the United States and Canada.
- Leveling requires bench marks which are subject to coastal erosion, tree decay, and deterioration over time, many marks are lost each year.
- In 2002 and beyond, maintenance of the national bench mark network and systematic leveling is too costly and time consuming.

What Are The Components Of An Improved Vertical Datum?

- A high accuracy national geoid model to link the United States and Canada.
- High international projects are in progress in the United States and Canada to achieve:
 - Implementation of a global vertical datum as Canada planned for 2000/2010.
 - IGLD project in the United States targeted for implementation in 2015.
 - Expanding and modernization of national networks of Canadian only Operating Reference Station (ORS) permanent ORS sites.
- NOAA's ORS project comprises:
 - Expand reference quality "heights".
 - Eliminate gravity leveling for less and clients.
 - Relative quality for benchmark use.
 - NOAA published the reference geoid in October 2007.
- A revised, American vertical datum for the US and Canada is required for the coordinated datum reference frame for navigation of the Great Lakes.
- A new vertical datum is essential for the integration of both United States, Canada and the Hydrographic Commission, but will be updated in IGLD 2015.

What Do Customers Need?

- Fast, accurate, easy-to-use reference to height using Global Positioning System (GPS) technology.
- Coordinated heights worldwide.
- A new freely used model for every reference of vertical datum and current from the model.

Where Does The Great Lakes Engineer Head To Engage To Vertical Datum?

- All US and Canadian water level stations are based on IGLD 1985.
- Many of US and Canadian water level stations have at least one bench mark with CGRS datum 1-D coordinates.
- The US has established 12 included CGRS water level datum using 2011, with the first set from 2010 and 2012.
- Vertical datum has been established to include IGLD 2015 based on geoid height and Hydrographic Commission, but will be updated in IGLD 2015 when implemented.

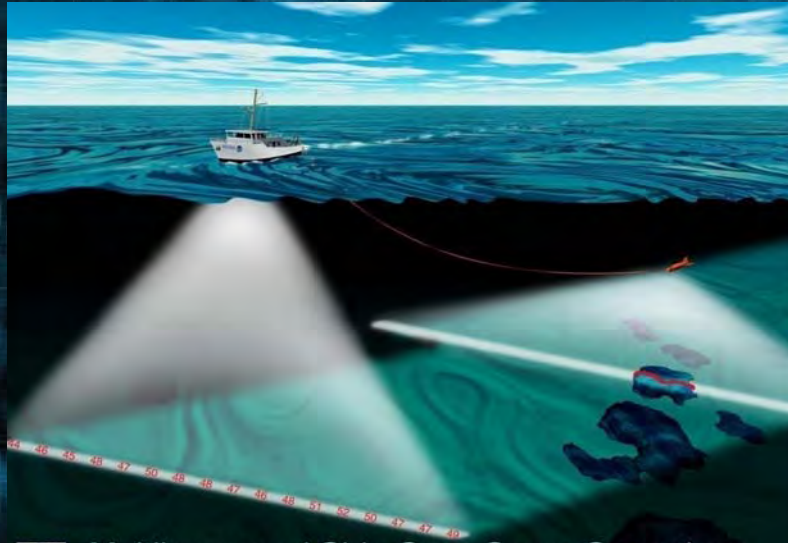
2015 Update of the Vertical Datum

IGLD 2015 will be based on the geoid model.

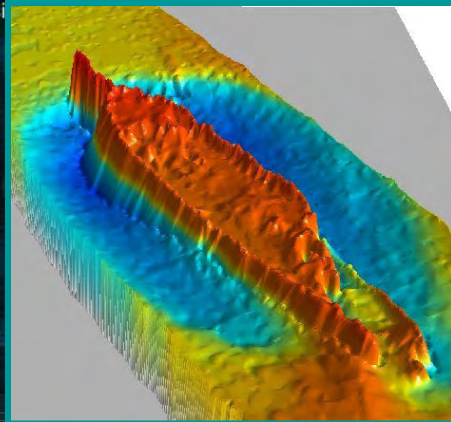
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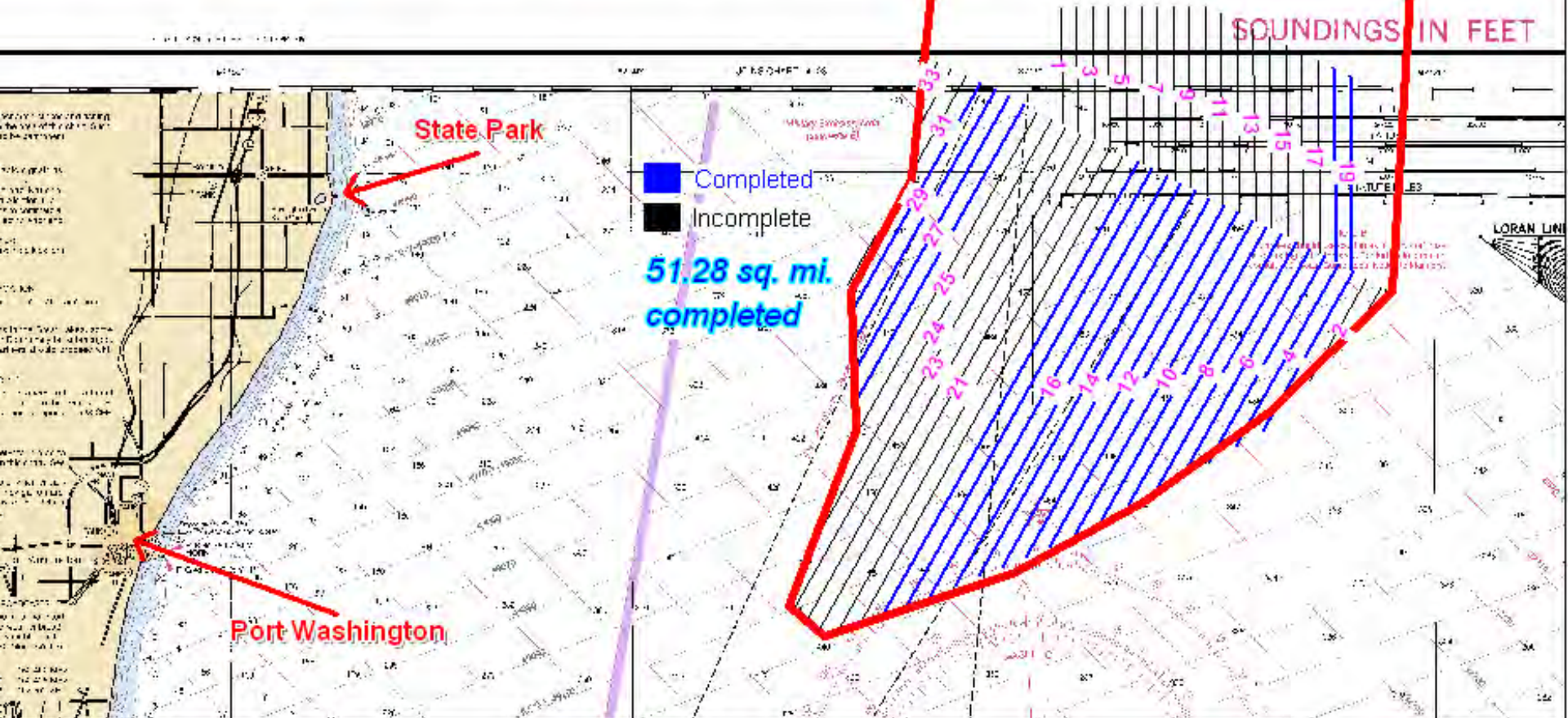
Preserving Great Lakes Maritime Heritage



Multibeam and Side-Scan Sonar Operations
National Ocean Service / Hydrographic Surveys Division



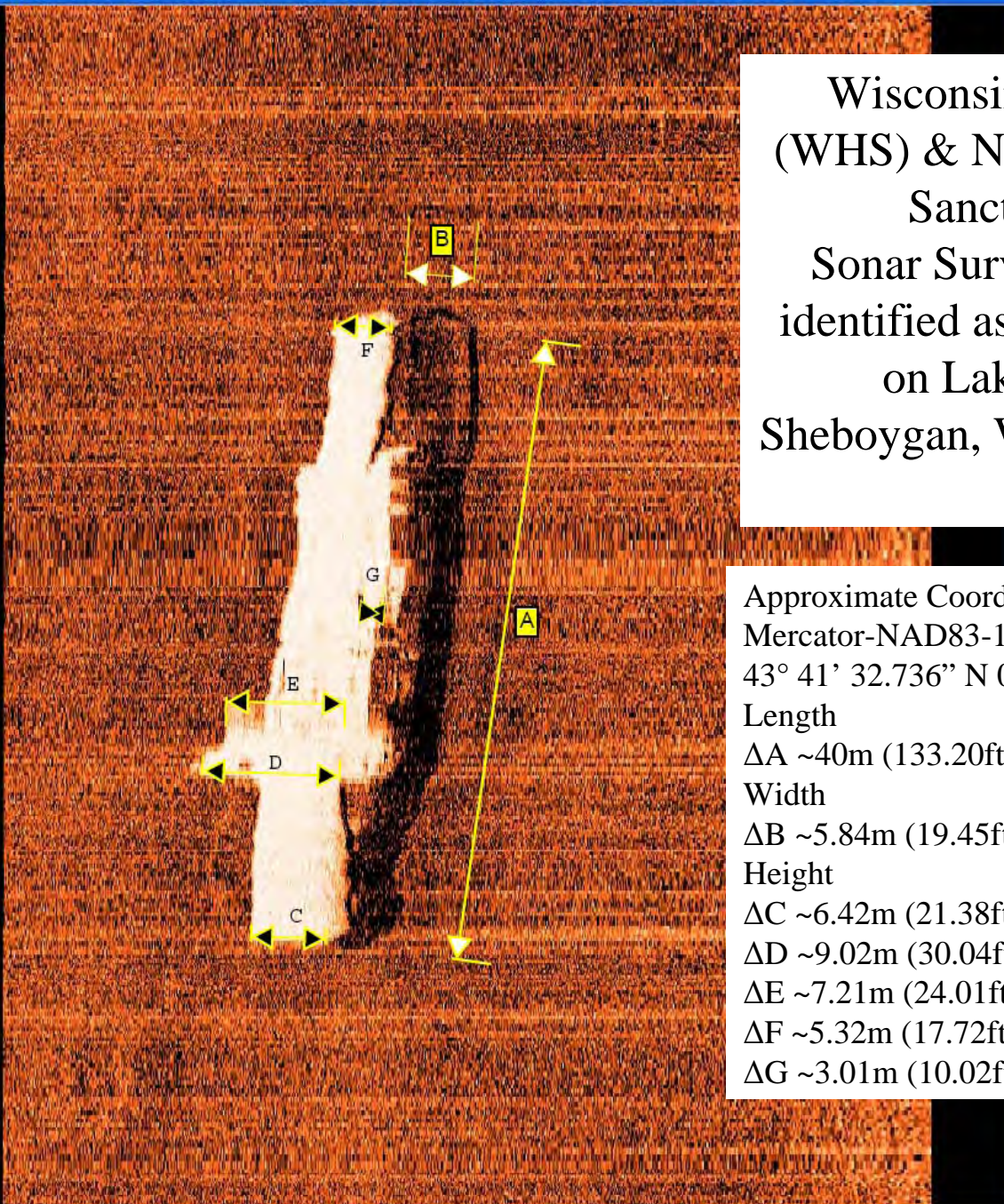
Wisconsin Side Scan Sonar Survey August 4th thru 7th, 2008





Robert C. Pringle (Tugboat Steamer)





Wisconsin Historical Society
(WHS) & NOAA National Marine
Sanctuary Side Scan
Sonar Survey of the shipwreck
identified as the Robert C. Pringle
on Lake Michigan near
Sheboygan, Wisconsin from August
4-8, 2008

Approximate Coordinates (Universal Transverse
Mercator-NAD83-16N-Degrees Minutes Seconds)
43° 41' 32.736" N 087° 33' 17.43" W

Length

$\Delta A \sim 40\text{m}$ (133.20ft)

Width

$\Delta B \sim 5.84\text{m}$ (19.45ft)

Height

$\Delta C \sim 6.42\text{m}$ (21.38ft)

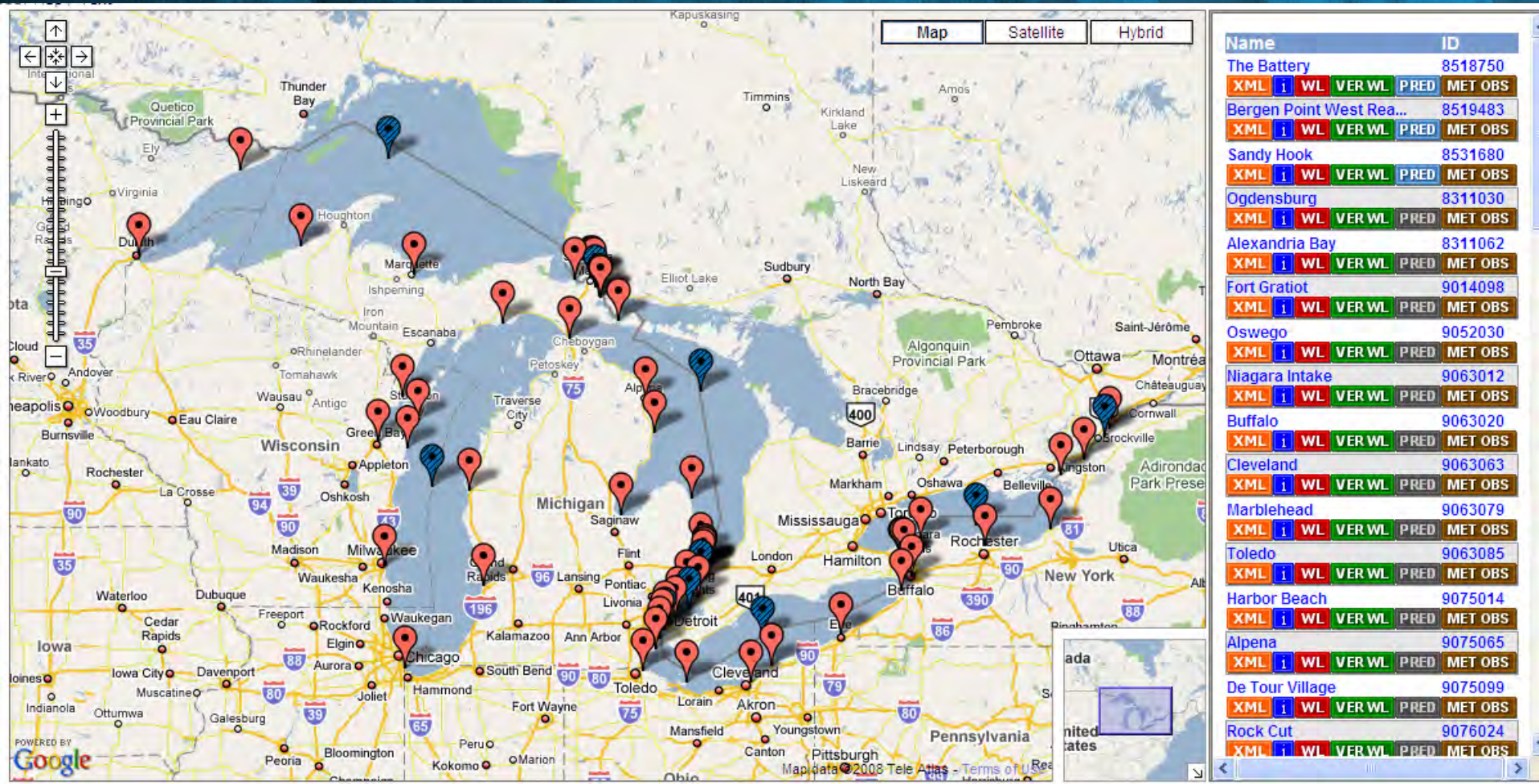
$\Delta D \sim 9.02\text{m}$ (30.04ft)

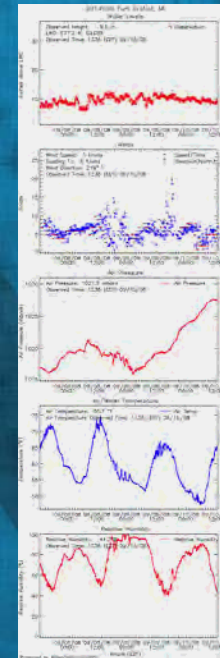
$\Delta E \sim 7.21\text{m}$ (24.01ft)

$\Delta F \sim 5.32\text{m}$ (17.72ft)

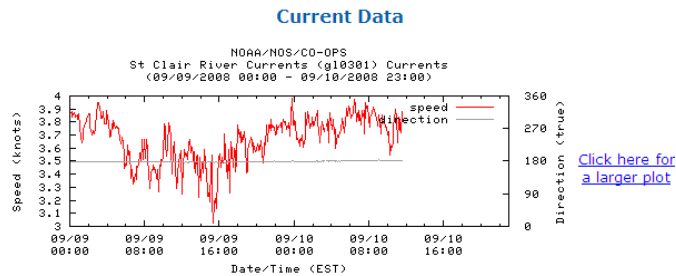
$\Delta G \sim 3.01\text{m}$ (10.02ft)

Water Level and Current Stations





St Clair River Currents - [Data Disclaimer](#)
 Station ID: gl0301



Begin Date: 09 / 09 / 2008 00:00 Time Zone: Greenwich (UTC) Local
 End Date: 09 / 10 / 2008 23:00

[View Tabular Data](#) [View Plot](#) [Reset](#)

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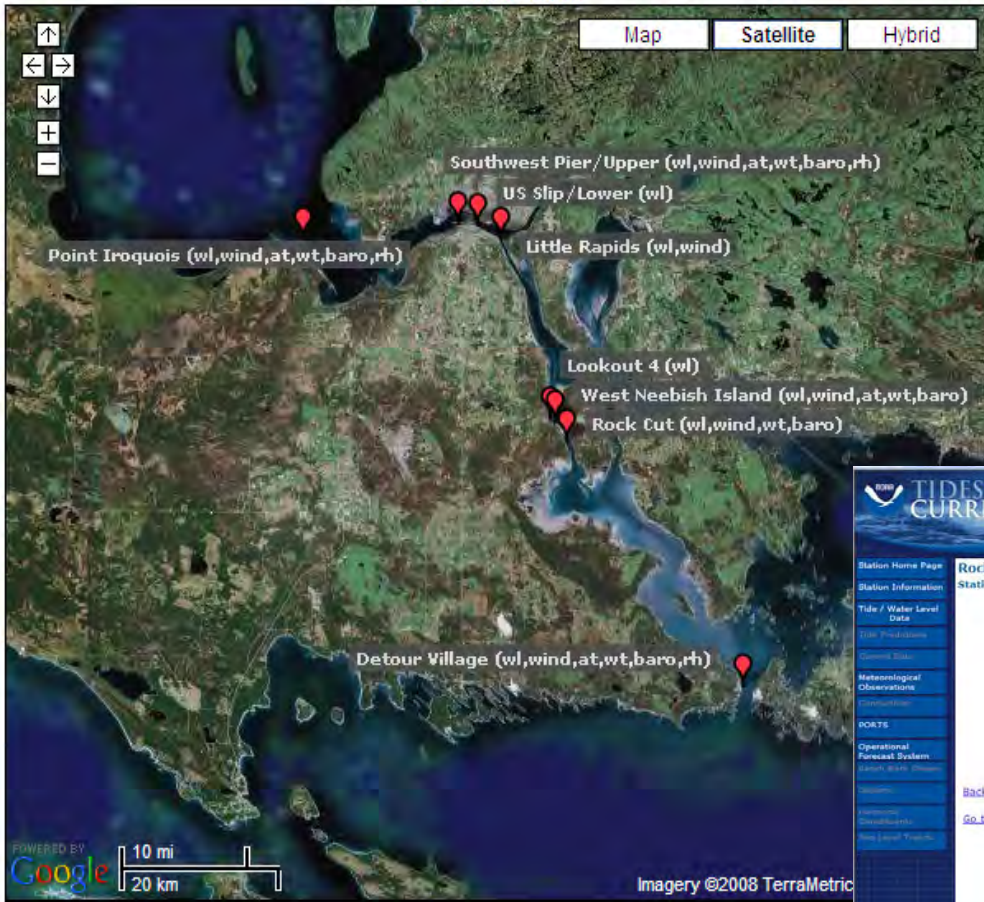


Physical Oceanographic Real-Time System (PORTS®)

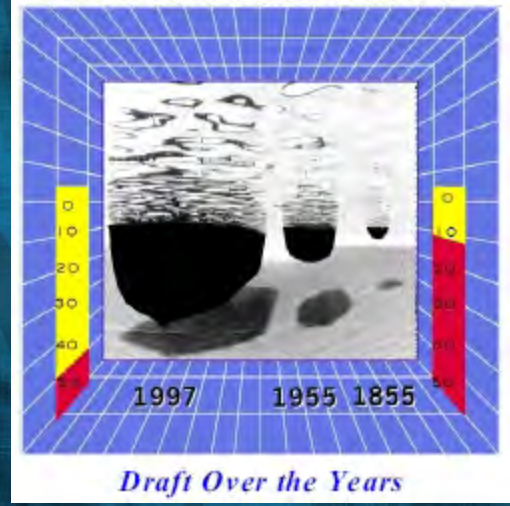
Real Time Text Summary New! **Text-based PORTS® Screen**

Voice data response system:

301-713-9596



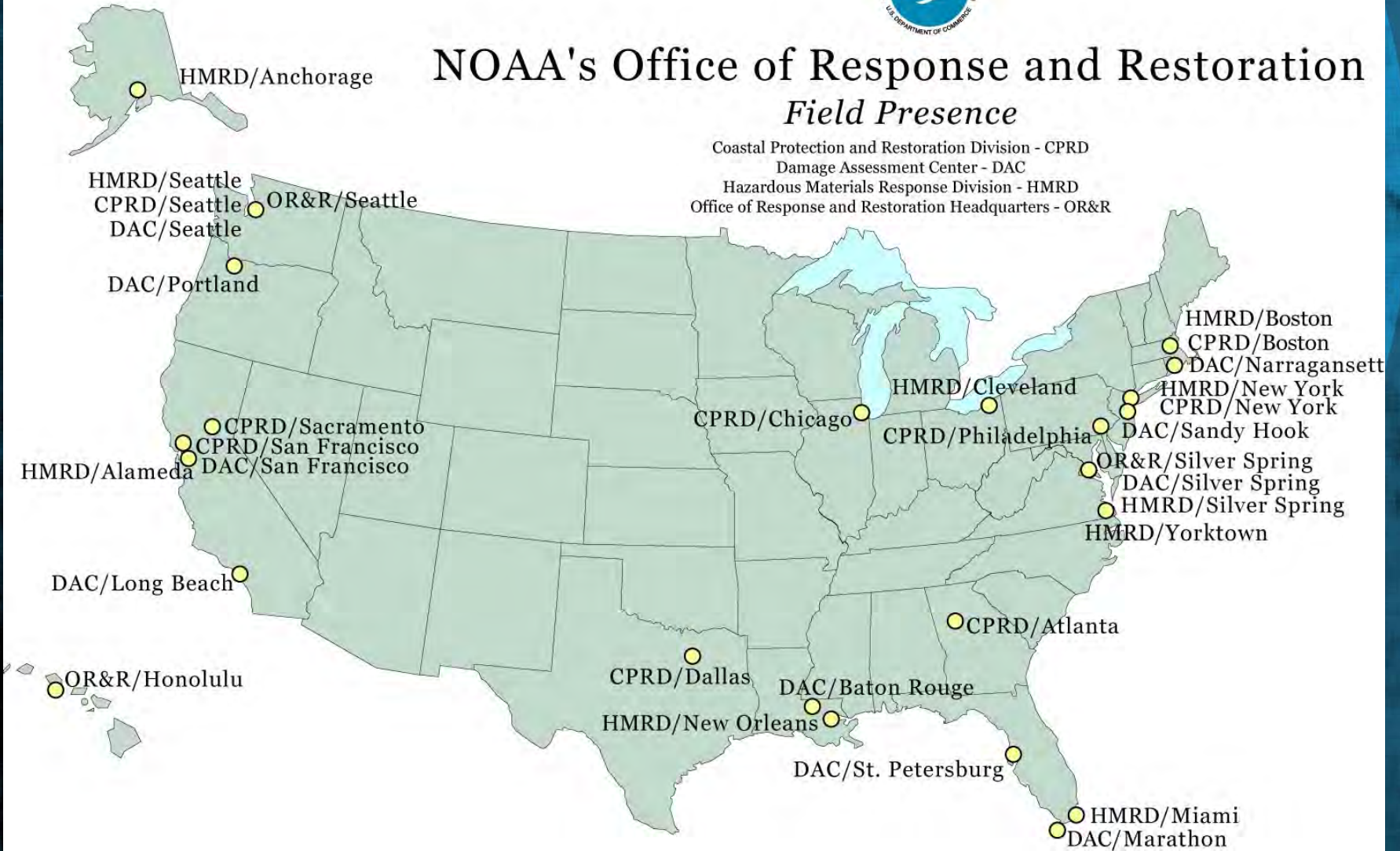
DECREASING MARGIN OF ERROR





NOAA's Office of Response and Restoration *Field Presence*

Coastal Protection and Restoration Division - CPRD
Damage Assessment Center - DAC
Hazardous Materials Response Division - HMRD
Office of Response and Restoration Headquarters - OR&R



Research in the Great Lakes

- Multiple Stressor Research
- Climate
- Center for Sponsored Coastal Ocean Research (CSCOR)
- Center of Excellence for Ocean and Human Health



Forecasts, Monitoring, and Event Response

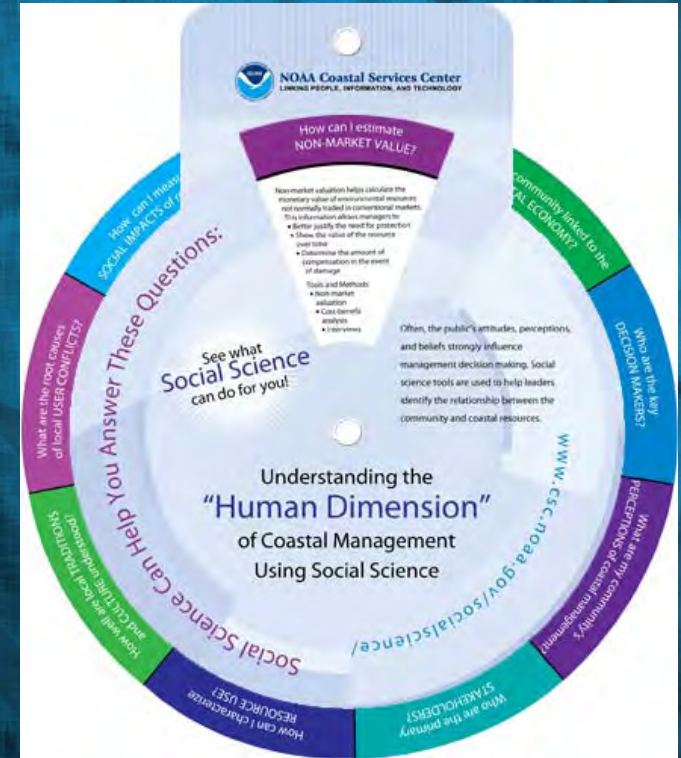
- Ecological Forecasting (ECOFORE)
- Water Level Forecasting
- Mussel Watch
- Monitoring and Event Response for Harmful Algal Blooms (MERHAB)
- Integrated Water Resources Science Service (IWRSS)



LandSat image of *Microcystis* bloom in Western Lake Erie, August 2003

Human Dimensions

- Survey Design
- Needs Assessments
- Stakeholder Participation
- Human Dimensions Wheels
- Array of Social Science Tools and Management Applications





NOAA Great Lakes Regional Team Priorities

- Aquatic Invasive Species
- Restore/Protect Habitat
- Restore Areas of Concern
- Control Pollution
- Reduce Bioaccumulative Toxins
- Standardize Information Collection, Storage, and Distribution
- Sustainable Water Resources
- Minimize Risk to Human Health
- Navigation Services
- Evaluate/Interpret Information to Forecast Climate Change
- Educate the Public about Great Lakes Maritime Heritage
- Great Lakes Coastal Strategy



Future Challenges

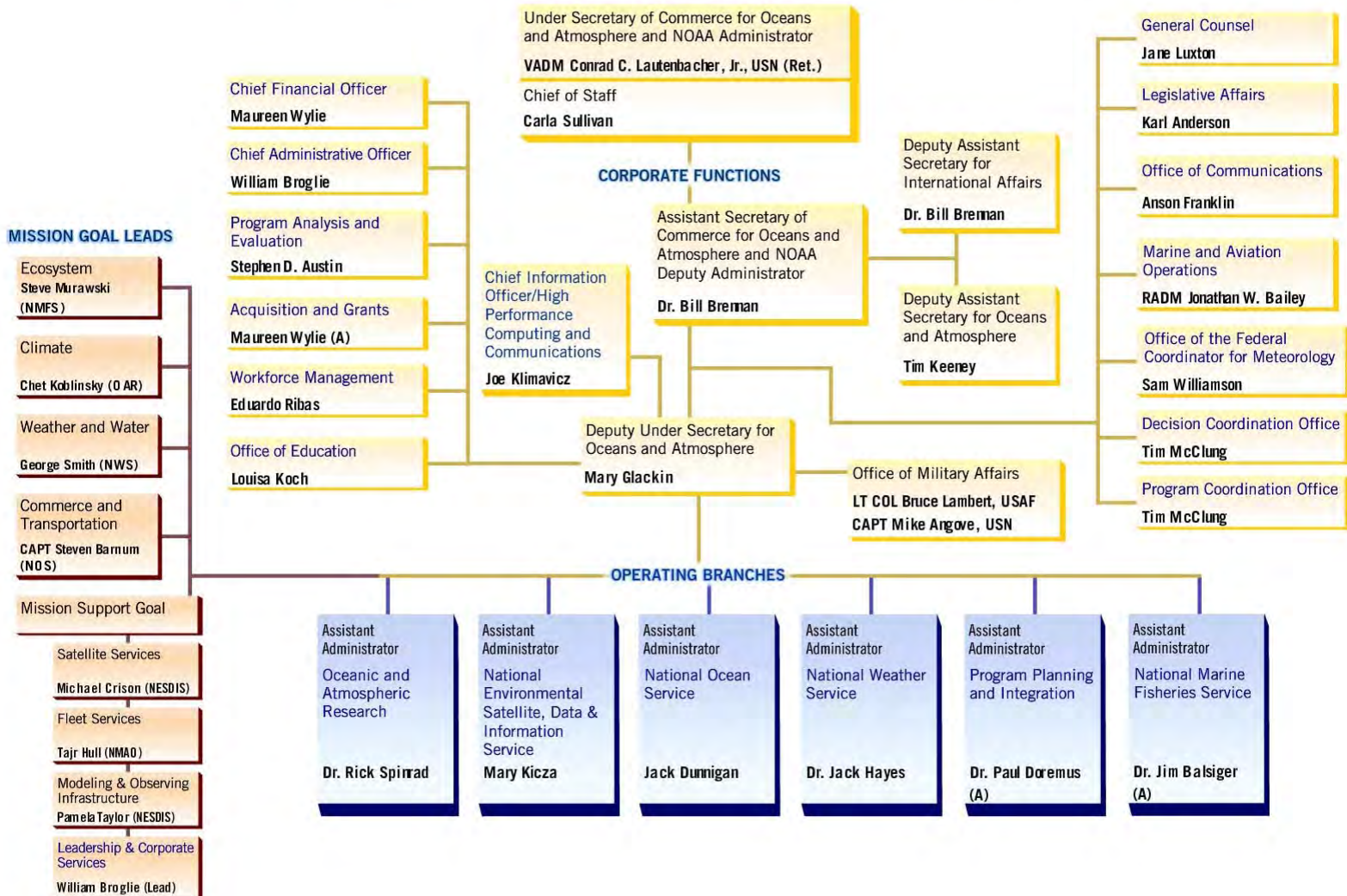
- High impact events
- Climate change
- Projected increased growth in trade
(quantity and volume)
- Energy needs
- Coastal migration
- Partnerships



Backup Slides



NOAA ORGANIZATION



NOAA's Ocean Service

