Positioning the Pacific: NOAA’s Geospatial Activities

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A Common Problem of the Early 19th Century
President Thomas Jefferson
Established the Survey of the Coast

1807

SIXTH CONGRESS OF THE UNITED STATES.

At the Second Session.

Begun and held at the city of Washington, in the territory of Columbia, on Monday the first of December, one thousand eight hundred and six.

AN ACT to provide for surveying the coast of the United States.

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, that the president of the United States shall, for and in his honor, appoint and report, to take a survey of the coast of the United States, to which shall be appointed the said President and such persons, with the said twenty thousand, as shall be appointed by the President, and the said President and such persons, shall, within twenty thousand dollars of any part of the sums of the United States, and also the necessary charges and expenses incurred in the execution of the said survey, for completing, an accurate chart of every part of the coast within the said President.

Approved February 10, 1807.
National Geodetic Survey Mission

To define, maintain and provide access to the National Spatial Reference System (NSRS) to meet our Nation’s economic, social and environmental needs.

- Latitude
- Longitude
- Height
- Scale
- Gravity
- Orientation
- Time Variations
NOAA’s National Geodetic Survey provides the solid thread that weaves through all of NOAA’s observation systems. The positional framework it provides is integral to supporting the agency’s and the nation’s data collection and validation efforts.
The NSRS Continues to Evolve

Positioning America in a dynamically changing world.

Passive Control (Monuments) → Active Control (CORS)
National Geodetic Survey Ten-Year Plan

- Official NGS policy as of January 2008
- Replace NAVD 88 with a GPS/geoid datum
- Replace NAD 83 with a geocentric GPS based datum
How We Maintain and Modernize the NSRS

GPS and GLONASS Receivers

Leveling

Modeling
Continuously Operating Reference Stations (CORS)

1867 Stations on Four Continents

$1 Billion in Direct Benefits FY2011
Pago Pago, American Samoa
Updating the NSRS over Time
National Adjustment 2011
The Pacific Region

NA2011 Pacific stations and vectors

- CORS (active control)
- Passive control

GNSS vectors (all 1677)
Classified by year
- 1993 - 1997 (369 = 22%)
- 1998 - 2004 (541 = 32%)
- 2005 - 2011 (767 = 46%)
Gravity for the Redefinition of the American Vertical Datum (GRAV-D)
GRAV-D in the Pacific

Guam and Northern Marianas

Hawaii

Samoa
Geoid Modeling

Building models from gravity to derive heights from GPS/GNSS

Geoid12 expected to be released in April 2012
NGS Products and Services

NGS Leverages Geospatial and GIS Products and Tools for:

- Shoreline for NOAA Nautical Charts
- Online Positioning User Service (OPUS)
- Datum Transformation Tools
- Horizontal Time Dependent Positioning
- LIDAR and Derivative Products
- Emergency Response Activities
- Monitoring Sea Level Change
Importance of a Current Shoreline Using a Current Datum

- 1993 compilation of Asuncion Island in the Northern Mariana Islands
- Updated position 2.5 miles to the north of the original position
- Project jointly funded by the State Department to resolve an EEZ dispute with Japan specifically over fishing rights
Shoreline Mapping
Pearl Harbor

IKONOS Image courtesy of Geo Eye

ENC US5HA54M
Updated Shoreline

2005 ENC US5HA54M

2012 ENC US5HA54M
Online Positioning User Service (OPUS)

- >15 min of L1/L2 GPS data >>> geodesy.noaa.gov/OPUS/
- Processed automatically on NGS computers, tied to CORS
- Solution via email - in minutes

Fast, easy, consistent access to NSRS
Online Positioning User Service (OPUS)

1.5 Million Solutions since 1992
$207 Million in Estimated Benefits FY2011
NADCON

- Developed to facilitate conversion between datums
- American Samoa and Guam have been added to the available grids
**Horizontal Time-Dependent Positioning (HTDP)**

- Software and web service
- Allows transformation of positions and velocities between reference frames at desired epochs
- Provides predicted horizontal crustal motion anywhere in the US and its territories by using an analytical model
Improved Mapping with LIDAR

Flood Zone Boundary
Red – Original
Blue – Improved with LIDAR

Slide by Gary Thompson, NC Geodetic Survey
Mobile Web application allows emergency responders to view imagery in the field.

Post Hurricane Irene – August 28, 2011

Credit: Bing Maps
Sea Level Change

Integration of local sea level trends and vertical land velocities.
NOAA Geospatial Offerings

• Pacific Islands Digital Coast Partnership
• Online geospatial training
• Coastal-Change Analysis Program
• Elevation data
• Tsunami inundation modeling
• Web-based tools
Digital Coast

• **Approach:** Bring the geospatial and coastal management communities together

• **Outcome:** A constituent-driven, integrated, enabling platform supporting coastal resource management
More than just data...

The Digital Coast also provides the tools, training, and information needed to turn these data into the information most needed by coastal resource management professionals. Read more...

Welcome to the new Digital Coast. If you have questions or comments, please contact us.

Data
Learn more about the kinds of data available and download data.

Tools
Use these tools to turn data into the useful information your organization needs.

Training
Update your skills by participating in one of these training programs.

In Action
See how data and tools are used to address coastal management issues.

Approaches
In this section, Digital Coast resources are packaged in a way that best assists coastal communities working to address a specific issue.

Coastal Inundation Toolkit
Understand the basics and get the tools that will help make your community more resilient.

Offshore Renewable Energy Planning
Get the data and tools needed to make strong decisions.

Featured Resources
Building Resilient Coastal Communities
See how coastal counties can use Digital Coast to build resilient communities.

Mississippi Geospatial Clearinghouse
A comprehensive spatial information warehouse of geographic information system (GIS) resources for Mississippi for use by government, academia, and the private sector.

Recent Updates  Sign up for updates

Testimonials

“Digital Coast has a real role in standards, guidelines, specifications for elevation data, datums, and inundation mapping.”

Staff member, NOAA National Marine Sanctuaries
Pacific Islands Regional Digital Coast Partnership

- First regionally-focused Partnership meeting
- Broad participation
- Six key issues discussed
- Top priority is to inventory historic aerial imagery and make it available

August 2011
Online Training

Map Projections, Datums, and Coordinate Systems
• Provides an introduction to the concepts of these mapping elements with application examples for the Pacific region

Introduction to Lidar
• Provides an introduction to the concepts of lidar data with application examples for the Pacific region
Digital Coast Data Holdings

- Benthic
- Elevation
- Hydrography
- Imagery
- Land cover
- Boundaries
- Socioeconomics
Coastal-Change Analysis Program

- National coastal land cover and change mapping program
- Consistent, accurate products with standard data and methods
- Focus on intertidal areas, wetlands, and adjacent upland
Coastal-Change Analysis Program

- High resolution data products for the Pacific Islands (2.4 meter resolutions)
- Complete 2005 baseline
  - Hawaii (main eight)
  - American Samoa
  - Guam
  - CNMI
- 2010 change updates in progress
Hawaii Topobathy Inventory

- Inventory of all known topographic and bathymetric data sets
- Identifies over twenty descriptive attributes about each data set
- Supports topobathy surface generation – best available
- Reduces risk of duplicate data acquisitions
Importance of Data Quality

- Any old data won’t work
- Inundation applications require high vertical accuracy (low error)
- Data standards exist
Guam – with topobathy lidar
American Samoa – without lidar
Current Initiatives – American Samoa

- **Mobile Lidar**
  - Collected in 2011
  - Ultra-high resolution
  - 7 priority villages

- **Airborne Lidar**
  - Full island/reef complex
  - Planning for 2012-2013
Current Initiatives – Northwest Hawaiian Islands

Airborne lidar collected during summer of 2010 over low-lying islands
Tsunami Inundation Modeling

- Initial modeling focused on four bays on the island of Guam
- Modeling for the Commonwealth of the Northern Mariana Islands and American Samoa will follow.
Report Generator

The tool automatically generates a report for any area (parcel, part of a parcel, multiple parcels, indicates floodplain zones, base flood elevations, CZM special management areas, tsunami evacuation zones) and a map of the area.
Hawaii Flood Response Tool

- Standardized data, resolutions, and formats
- Integrated real-time flood data and information with local GIS data in one location
- Simple and easy to use
- Updates automatically
- Applicable statewide but can be easily modified to meet local needs
Thank you