Coast Survey’s Operations in Alaska

International Arctic Research Center
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Presentation Overview

• Background on Coast Survey and the role of a Navigation Manager
• Coast Survey’s organizational goals
• Coast Survey’s Alaskan survey plans
• Overview of Coast Survey’s workflow; how survey plans come together and discuss products and specifications
• Identify areas for potential collaboration
• Transition into discussion
What is NOAA’s Office of Coast Survey?

- First U.S. government science agency, formed in 1807 by Thomas Jefferson
- Responsible for surveying and creating navigational charts to aid maritime commerce
  - Maintains a suite of over 1,000 nautical charts
- Able to commission or conduct response surveys to allow re-opening of ports after hurricanes or other disasters
  - Conducted surveys in Cook Inlet following November earthquake
- Falls under U.S. Department of Commerce
Coast Survey’s Charting Responsibility

Coastline: ~95,000 miles
EEZ: ~3.4 million square miles
What is a Navigation Manager?

• The liaison between Coast Survey HQ and the local maritime community

• Please talk to me about:
  • Inaccuracies on charts
  • Surveying and charting requests
  • Issues with tides and currents
  • Requests or suggestions for product improvements
  • Requests for additional data or information regarding existing surveys

• Located in Anchorage at the Federal Building, but I endeavor to visit as much of the state as possible

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What is a Navigation Manager?

• Who do I talk to?
  • Harbormasters and Port Authorities
  • Cruise Line Agency Representatives
  • Maritime Pilot Organizations
  • Harbor Safety Committees
  • Non-Profit Organizations
  • Academic Organizations
  • Other Parts of NOAA
  • The General Public
  • USCG District 17
  • State of Alaska
  • Mariners
The National Charting Plan

**Purpose** Improve NOAA nautical chart coverage, products, and distribution

**Improvements**

- **Reduce** unwarranted alarms
- **Convert** to metric
- **Provide** timelier data
- **Improve** chart coverage
- **Create** an orderly layout
- **Reduce** uncertainties
- **Improve** chart update information
- **Increase** efficiency

**Outcome** Ease of access to more precise, higher-resolution charts that deliver the most up-to-date navigation information possible

All new ENC products will be compiled with standardized contours using whole metric units and charted depths will be displayed in meters*. 

* Non-ECDIS systems should still retain the ability to display other depth units (e.g. fathoms)
Converting to Metric
Current Alaskan ENC Suite
Draft Alaskan ENC Rescheming Proposal

New ENC Scheme Coverage
- New Band5 1:10K & 1:20K
- New Band4 1:40K & 1:80K
- New Band3 1:160K & 1:320K

May 2018
13 New ENCs in Etolin Strait

- **New Scale** is 1:80,000
  - Previously 1:1,534,076
- **Depths in meters:**
  - Decimeters precision to 21m
  - Half-meter precision 21m to 31m
  - Whole-meter precision 31m and deeper
- **Whole-meter contours** at 5m, 10m, 20m, and 30m

http://www.charts.noaa.gov/InteractiveCatalog/nrnc.shtml
In today’s GPS age, customers are expecting exact positions of charted items. For the lower 48, some small area surveys are being planned to address areas with high densities of “PA” / “Rep” / “ED” features, particularly near shipping lanes.
Increasing Chart Production Efficiency

Increase efficiency

Direct input of USCG light list data into production
Improving The Coast Pilot

• The Coast Pilot is a valuable reference for mariners that contains valuable local information not shown on the nautical chart

• Is the current paper Coast Pilot still the best tool for the modern mariner?

• New technology and standards will allow for dynamic layers and geo-referenced text to allow for a seamless interface with electronic navigation systems
Recent Accomplishments in the Arctic

- In the past five years...
  - 33 new surveys have been conducted in the Arctic
  - 5 new charts have been produced

- 2013
  - Surveyed the vicinity of Red Dog Mine
  - Opportunistic trackline surveys across Arctic
  - Released Chart 16190, Bering Strait North

- 2014
  - Released Chart 16145, Delong Mountain Terminal

- 2015
  - Surveyed Prince of Wales Shoal
  - Surveyed Kotzebue Sound & Good Hope Bay
  - Surveyed the approaches to Nome Harbor
  - Surveyed PARS Corridor in conjunction with USCG
  - Surveyed a potential shoal near Utqiagvik

- 2016
  - Surveyed Unalaska Bay & Captains Bay
  - Surveyed Etolin Strait
  - Opportunistic trackline surveys in Bristol Bay
  - Released ENC US4AK98M, Yukon River, AK

- 2017
  - Surveyed Port Clarence
  - Surveyed additional “legs” of PARS Corridor into and out of Nome
  - Evaluation survey of western mouth of Yukon River

- 2018
  - Conducting survey efforts off Point Hope
  - Released US2ARCHD and US2ARCGD covering the Chukchi Plateau

Survey Coverage off Point Hope as of 23-July-2018
Coast Survey’s 2019 Survey Plans

• **Western Alaska and the Arctic**
  • Approaches to Wainwright, AK
    • **NOAA Ship Fairweather; June to August**
  • Vicinity of Cape Newenham, AK
    • **NOAA Ship Fairweather; June to August**
  • Vicinity of Nushagak Peninsula, AK
    • **NOAA Ship Rainier; June to August**
  • Kuskokwim Bay and Vicinity
    • **NOAA Contract Partner; June - August**
  • St. George Harbor and approaches
    • **NOAA Ship Fairweather; August**

• **Southcentral Alaska**
  • Kodiak Island (Cape Chiniak to Dangerous Cape)
    • **NOAA Ship Rainier; April to June**

• **Southeast Alaska**
  • Thomas Bay (near Petersburg, AK)
    • **NOAA Ship Fairweather; TBD (Fall)**
  • Whale Pass (Northern West Prince of Wales Island)
    • **NOAA Ship Fairweather; TBD (Fall)**
  • Offshore Dall Island
    • **NOAA Ship Fairweather, April to June**
  • Lisianski Inlet
    • **NOAA Ship Rainier, May**
Coast Survey Data Workflow

Project Planning
- Performed by Coast Survey HQ with input from Navigation Manager
- Goal is for three year outlook on future projects, but remains dynamic based on funding levels and Political Priorities

Data Acquisition
- Performed by either NOAA or contract partner field unit
- Timing is determined based on operational availability and seasonal considerations

Data Processing
- Performed by field unit following acquisition
- Expected to be completed within 120 days of completion of acquisition

Data QC
- Performed by either Pacific Hydrographic Branch (Seattle, WA) or Atlantic Hydrographic Branch (Norfolk, VA) depending on data source
- Normally takes 120 days for data to work through QC process

Application to Chart
- Final step in process
- Completed by Marine Chart Division in Silver Spring, MD
- Normally within 120 days of completion of data QC

“Ping to Chart” timeline is generally in the order of one to two years
Where do survey areas come from?

- Survey requests come from various sources and through various routes
  - Requests from stakeholders
  - Areas with identified bathymetric or charting deficiencies
  - Specific vessel traffic areas

- Goal is to identify survey areas which would have “greatest good” for all parties involved
  - Could address one large need or many smaller needs

- Much like the National Charting Plan, Coast Survey is working on a “National Survey Plan” to be released in the coming months to help explain survey prioritization
Where do survey areas come from?

- Requests from stakeholders
  - SURF (internal database)
Where do survey areas come from?

• Requests from stakeholders
  • SeaSketch (Federal collaboration)
Where do survey areas come from?

- Areas with identified bathymetric or charting deficiencies
  - Hydro Health Model

Hydrographic Health

The hydrographic health is based on the likelihood of navigational risk, the severity of the consequences of said risk, the changeability of the seafloor, and the quality of the current data for that region.

\[
\text{HEALTH} = \text{GAP} \times \text{RISK}
\]
Where do survey areas come from?

- Vessel traffic areas which have been identified as:
  - Ports & Harbors
  - Anchorage areas
  - Harbors of refuge
  - Narrow passages
  - Traffic corridors

AIS Vessel Traffic on 17-June
How are surveys acquired?

- Generally Coast Survey does 50% of all surveys in-house, and contracts 50% of survey acquisition

- NOAA in-house assets in AK
  - NOAA Ship *Fairweather*
  - NOAA Ship *Rainier*
  - NOAA Mobile Integrated Survey Team (MIST)

- Contract Partners in AK
  - Terrasond (*Palmer, AK*)
  - Fugro (*Anchorage, AK*)
  - eTrac (*Wasilla, AK*)

*A survey launch from NOAA Ship Fairweather*
How is the data processed?

The Survey Products placed at the border of sections indicate each product as triggering a transition from one section to another.

Project Instructions: Chart Limits, Composite Source, Survey Log, TIE Values for Project.

Data Processing: Polygons, Crosslines, Processing, Acquisition Logs, Mightly QC, Survey Log.

Acquisition: Required investigations positioned with Horicon or Tobbile.


Final Review: Need to Clean Your Surfaces?

Re-compute: Scan DIP Forms & Boat Sheets, Feature ETONs & XML Report.

Symbol Legend:
- HIPS
- Bathy Database
- Notebook
- Pydro
- Plot Composer
- Hypack

Software Legend:
- Green: Bathy Database
- Red: Notebook
- Yellow: Pydro
- Blue: Plot Composer
- Pink: Hypack

Office of Coast Survey
National Oceanic and Atmospheric Administration
What are the data outputs?

• The Data Acquisition and Processing Report (DAPR)
  • Documents the standard procedure for all data acquisition and processing within a project
  • Any deviations from this standard are reported in the Descriptive Report

• The Horizontal and Vertical Control Report (HVCR)
  • Documents GNSS stations, water level gauges, or processes used to ensure horizontal and vertical accuracy of survey data
  • As of roughly 2016 all surveys are reduced to MLLW via ellipsoidal methods (vs traditional tidal methods)
What are the data outputs?

• Gridded bathymetric surfaces
  • Data is submitted as a CUBE (uncertainty based) surface
    • Standard resolutions of 1, 2, 4, 8, 16, or 32 meters
  • As of 2018 these surfaces have been variable resolution (based on uncertainty and data density)

• The Descriptive Report (DR)
  • The “story” of the survey, documents details of how/when data for a survey was acquired and processed, highlighting any notable features or discrepancies
  • Documents survey’s adherence to NOAA’s Hydrographic Surveys Specifications and Deliverables (HSSD)
What kind of quality control is performed?

- All data is evaluated against the Hydrographic Surveys Specifications and Deliverables (HSSD)
  - Defines NOAA’s standards for hydrographic surveys and is based on International Hydrographic Organization (IHO) standards
  - Project or survey specific exemptions can be made, and would be documented in the DR
  - Updated annually
Where does the data end up?

- Surveys are archived and publicly available via the National Center for Environmental Information (NCEI)
- These surveys can be investigated via NCEI’s Data Viewer
Where does the data end up?

• Bathymetry is integrated directly into the nautical chart and can be queried and extracted in GIS software when using Electronic Navigational Charts (ENCs)
  • Coast Survey has more information on using ENC direct to GIS

ENC of St. Paul Harbor in Kodiak
Potential Areas of Collaboration

- Feedback from the research community regarding desired survey areas would be incredibly valuable.
- Questions to answer to help me develop a survey request:
  - Who’s asking for the data and who else can benefit?
  - What positive impacts will your research have on maritime safety, local communities, or environmental modeling?
  - When is this data needed, is it time sensitive?
  - Where in Alaska is additional data needed to support your research?
  - Why do you need this type of data?
Potential Areas of Collaboration

• What kind of data densities and/or coverage requirements are needed for your research?
  • This is a constant question when developing survey plans, how much data is “good enough”?

1. **Object Detection Coverage** is assigned for critical under keel clearance areas and may be accomplished with either:
   - Option A) 100% bathymetric bottom coverage with multibeam sonars with object detection multibeam developments (i.e., 50 cm grid resolution in 0-20 m depth range) of contacts and features or
   - Option B) 100% side scan sonar coverage with concurrent multibeam bathymetry collection with object detection multibeam developments (i.e., 50 cm grid resolution in 0-20 m depth range) of contacts and features. Bathymetric splits, where appropriate, are required (Section 5.2.2.1).

2. **Complete Coverage** may be accomplished with either:
   - Option A) 100% bathymetric bottom coverage with multibeam sonars with complete coverage multibeam developments (i.e., 1 m grid resolution in 0-20 m depth range) of contacts and features, or
   - Option B) 100% side scan sonar coverage with concurrent multibeam bathymetry collection with complete coverage multibeam developments (i.e., 1 m grid resolution in 0-20 m depth range) of contacts and features. Bathymetric splits, where appropriate, are required (see Section 5.2.2.1). Note that 100% side scan sonar is insufficient to disprove a feature (see Section 7.2.4). Refer to Section 6.1.2 to confirm proper SSS acquisition parameters. Gaps in 100% SSS coverage should be treated as gaps in coverage and addressed accordingly.

3. **Set Line Spacing** is assigned when acquiring bathymetric data in areas too shallow for efficient full bottom coverage bathymetry or too hazardous for use of equipment. Set line spacing may be accomplished with single beam or multibeam, as specified in the Project Instructions. If both single beam and multibeam are specified in the Project Instructions, a separate single beam surface is required (See 5.2.1.2 Multiple Echo Sounding Sources in a Single or Multiple Grids). Bathymetric splits, where appropriate, are required (see Section 5.2.2.1).

4. **Trackline** survey operations can be classified as either Transit, which is intended to be used simply as an opportunity to collect data while a vessel transits from location A to location B; or Reconnaissance, which is intended to be used when the intended survey products will require a higher level of accuracy than Transit specifications will produce, but a traditional survey consisting of systematic line spacing or full bottom coverage is not required.
Potential Areas of Collaboration

• Bottom Samples
  • We acquire bottom samples to determine “character of the bottom”
  • Is this data useful? Could it be more useful? What would make it more useful?
Potential Areas of Collaboration

• External Source Data (ESD)

Are you aware of available data that could improve the chart?
Potential Areas of Collaboration

- Purchasing sea days on NOAA vessels
  - If there are NOAA survey priorities that are adjacent to your survey priorities, there are options to fund additional acquisition in your area

Seismic inter-agency collaborations on NOAA Ship Rainier

By Ensign Arie Pickett, NOAA

NOAA Ship Rainier spent September completing a multi-leg, joint collaboration project investigating deep offshore areas of the southern California coast. The U.S. Geological Survey (USGS) and Bureau of Ocean Energy Management (BOEM) partnered with NOAA to support a month-long mission to collect geophysical data along the outer continental shelf of California where the area in question features a number of different geologic structures and processes.