2016 Alaska Coastal Mapping Summit (ACMS)

Tuesday June 14, 2016, 1-5 pm AKDT

Columbia Ballroom at Hotel Alyeska, Girdwood, Alaska

Held in tandem with 108th Association of American State Geologists Annual (AASG) Meeting

Please note: AASG meeting registration is not required to attend the ACMS

Map Once, Use Many Times

Host:	Ashley Chappell, NOAA
Facilitator:	Nic Kinsman, NOAA
Sponsors:	NOAA Alaska Regional Team/NGS/OCS, AASG

The ACMS has been organized by the Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM). The IWG-OCM is a working group of the Subcommittee on Ocean Science and Technology (SOST) that was was established in 2006 to "facilitate the coordination of ocean and coastal mapping activities and avoid duplicating mapping activities across the Federal sector as well as with State, industry, academic and non-governmental (NGO) mapping interests."
Participating agencies include FEMA, BOEM, NSF, NGA, EPA, USFWS, NAVY, USCG, and NASA.

Purpose:
The ACMS is an opportunity for governmental partners, regional/local authorities, academia, the private sector, non-governmental groups, and anyone interested to share data needs and explore opportunities for collaboration on coastal mapping data acquisitions in Alaska. Discussion topics shall include long-term mapping requirements, near-term acquisition plans, and coastal data (elevation, bathymetry, and imagery) collection strategies across the participating organizations and entities.

All participants are encouraged to upload any existing, planned or desired project extents, if applicable, to the Arctic/Alaska portion of the U.S. Federal Mapping Coordination SeaSketch site ahead of the ACMS.

Please ensure that all SeaSketch submissions include the following details in either the shapefile attributes or in an accompanying email to Cassie Bongiovanni (cassandra.bongiovanni@noaa.gov):

- Data Type: topo lidar, topobathy lidar, single beam, etc.
- Collection Year: year in which the data is planned or proposed to be collected
- Project Status: not funded, planned, collecting, processing, etc.
- Point of Contact: the person whom all queries about the project should be directed
- Collection Date: the date of which the data is proposed to be or was collected
- Owner: the organization which owns the data

Call-in for remote attendees: 1-888-459-8313, 6564989#
Webex: http://www.mymeetings.com/nc/join.php?sigKey=mymeetings&i=747612595&p=&t=c

(no passcode needed, leave blank)

Time	**Item**	**Speaker**
1:00 - 1:10	Introduction	Nic Kinsman
1:10 - 1:30	Overview of the Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM) and the National Coastal Mapping Strategy	Ashley Chappell
1:30 - 1:45	Recap of February 2016 Alaska Nautical Charting Workshop and NOAA OCS activities in Alaska	Tim Smith
1:45 - 2:00	Recap of June 7 JALBTCX visit to Alaska and USACE Alaska activities/priorities in Alaska	Tom Sloan
2:00 - 2:15	Notable challenges, best practices, and NOAA NGS activities in Alaska	Nic Kinsman
2:15 - 2:45	SeaSketch Tour	Ashley Chappell
2:45 - 3:00	BREAK	
3:00 - 4:30	Flash Talks (<7 minutes each):	*Moderated by Nic Kinsman*
	- USGS Pacific Coastal and Marine Program	Ann Gibbs
	- NOAA NMFS/ShoreZone	Steve Lewis
	- USGS Alaska Mapping (+ Arctic DEM)	Tracy Fuller
	- UAF/NTWC	Cindi Preller
	- BOEM	Warren Horowitz
	- FWS (WALCC)	Joel Reynolds
	- Alaska DNR (DGGS Coastal Hazards)	Jaci Overbeck
	- AK Hydro	Kacy Krieger
	- GeoNorth	Jon Heinsius
	- Fugro	Rada Khadjinova
	- Quantum Spatial	Russ Faux
4:30-4:50	Open Floor Discussion	All
4:50 - 5:00	Closing Remarks and Next Steps	Ashley Chappell
5:00 - 7 pm	Coastal Mapping Mixer at Aurora Bar & Grill	*no host bar*

All ACMS presentation materials will be compiled and combined with additional contributed content from other partners for distribution after the meeting. To submit additional content to this distribution, please contact nicole.kinsman@noaa.gov by June 15 (day after ACMS). Non-presented materials for inclusion in the final ACMS summary presently include slide decks from USACE (a full JALBTCX overview); Coastal and Ocean Resources, Inc.; Dewberry; the DHS/UAA Arctic Domain Awareness Center ...and counting.

2016 ACMS Attendee List

Affiliation	Last	First	Email	Attendance Type
AECOM	Pearson	Michelle	michelle.pearson@aecom.com	in person
AK Hydro	Krieger	Kacy	kekrieger2@uaa.alaska.edu	presenter
AK Hydro	Plivelich	Mike	mtplivelich@alaska.edu	remote
Alaska DNR	Johnson	Anne	anne.johnson@alaska.gov	in person
Alaska DNR	Orange-Posma	Amy	amy.orange@alaska.gov	in person
Alaska DNR	Raynes	Brian	brian.raynes@alaska.gov	in person
Alaska DNR DGGS	Overbeck	Jacquelyn	jacquelyn.overbeck@alaska.gov	presenter
Alaska DNR DGGS	Schaefer	Janet	janet.schaefer@alaska.gov	in person
Alaska DNR/Army(JBER)	Poe	Noah	ipoe@me.com	in person
Alaska DNR/UAA Geomatics	Pearson	Sean	seaneo@gmail.com	in person
Alaska Forestry	Mceachen	Heather	heather.mceachen@alaska.gov	in person
ASHSC	Aho	John	eqman39@gmail.com	in person
BLM Alaska	Hillis	Cathy	chillis@blm.gov	in person
BLM Alaska	Noyles	Chris	cnoyles@blm.gov	in person
BOEM	Horowitz	Warren	warren.horowitz@boem.gov	presenter
BSEE	Carr	Scott	w.scott.carr@bsee.gov	in person
CHS	Forbes	Steve	stephenforbes@eastlink.ca	in person
CORI	Morrow	Kalen	kalen@coastalandoceans.com	remote
CORI	Schoch	Carl	carl@coastalandoceans.com	remote
Dewberry	Maune	David	DMaune@dewberry.com	remote
Fisheye	Grabacki	Stephen	fisheyecon@gmail.com	in person
Fugro	Earl	Shannon	SEarl@fugro.com	in person
Fugro	Khadjinova	Rada	RKhadjinova@fugro.com	presenter
Fugro	Saade	Ed	ESaade@fugro.com	in person
GeoNorth	Heinsius	Jon	jheinsius@geonorth.com	presenter
Illinois State Geologic Survey	Brown	Steven	steebrow@illinois.edu	in person
Illinois State Geologic Survey	Theuerkauf	Ethan	ejtheu@illinois.edu	remote
Illinois State Geologic Survey	Thompson	Todd	tthomps@indiana.edu	in person
JOA	Wardwell	Nathan	nathan@joasurveys.com	in person
Kodiak Mapping	Ditmer	Isaiah	kodmaps@mtaonline.net	in person
Michael Baker	Lough	Trevelyn	Trevelyn.Lough@mbakerintl.com	in person
Michael Baker	Sweeney	Con	csweeney@mbakerintl.com	in person
NLURA	Clark	Bob	rclark@northernlanduse.com	in person
NLURA	Gobeille	Myles	mgobeille@northernlanduse.com	in person
NOAA Alaska	Holman	Amy	amy.holman@noaa.gov	in person
NOAA NGS	Kinsman	Nic	nicole.kinsman@noaa.gov	presentor
NOAA NGS/RSD	White	Stephen	stephen.a.white@noaa.gov	remote
NOAA NMFS/ShoreZone	Lewis	Steve	steve.lewis@noaa.gov	presenter
NOAA NTWC	Preller	Cindi	cindi.preller@noaa.gov	presenter
NOAA NWS Alaska	Zingone	Eddie	Eddie.zingone@noaa.gov	in person
NOAA OCS	Bongiovanni	Cassie	cassandra.bongiovanni@noaa.gov	remote
NOAA OCS	Chappell	Ashley	ashley.chappell@noaa.gov	presenter
NOAA OCS	Smith	Tim	timothy.m.smith@noaa.gov	presenter
NPS Alaska	Venator	Sarah	sarah_venator@nps.gov	in person
NUNA (Barrow)	Gaylord	Allison	nunatech@usa.net	remote
Quantum Spatial	Faux	Russ	faux@quantumspatial.com	presenter

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Quantum Spatial	McCullough	Adam	amccullough@quantumspatial.co	in person
Quantum Spatial	Sparks	Stephen	ssparks@quantumspatial.com	in person
Quantum Spatial	Vernlund	Caitlin	Cvernlund@quantumspatial.com	in person
Resource Data, Inc.	Wawrzonek	Rich	richw@resdat.com	in person
SeaGrant Alaska	Holen	Davin	dlholen@alaska.edu	in person
TerraSond	Busey	Brian	bbusey@terrasond.com	in person
Terrasond	Newman	Thomas	tnewman@terrasond.com	in person
TNC/ShoreZone	Ingram	Kelly	kelly.ingram@tnc.org	in person
U Texas, El Paso	Cody	Ryan	rpcody@utep.edu	in person
UAA ADAC	Causey	Doug	dcausey@alaska.edu	in person
UAF/Fairbanks Fodar	Nolan	Matt	matt2013@drmattnolan.org	remote
US Army	Gutierrez	Jason	jasongutierrez00@gmail.com	in person
US Army	Sullivan	John	johnsullivan936@gmail.com	in person
USACE	Shaw	Wendy	wendy.l.shaw@usace.army.mil	remote
USACE	Wozencraft	Jennifer	jennifer.m.wozencraft@usace.arm	remote
USACE Alaska Region	Sloan	Thomas	tsloan@usace.army.mil	presenter
USCG	Passic	Andy	Chester.A.Passic@uscg.mil	in person
USDA/NCRS	Thielke	Sydney	Sydney.Thielke@ak.usda.gov	in person
USFWS	Christensen	Bret	bret_christensen@fws.gov	in person
USFWS, WALCC	Reynolds	Joel	joel_reynolds@fws.gov	presenter
USGS	Brock	John	jbrock@usgs.gov	in person
USGS	Devaris	Aimee	adevaris@usgs.gov	in person
USGS	Kimball	Suzette	suzette_kimball@usgs.gov	in person
USGS	Quirk	Bruce	quirk@usgs.gov	in person
USGS Alaska	Anderson	Becci	rdanderson@usgs.gov	in person
USGS National Map	Fuller	Tracy	tfuller@usgs.gov	presenter
USGS, PCMSC	Gibbs	Ann	agibbs@usgs.gov	presenter
USGS, PCMSC	Richmond	Bruce	brichmond@usgs.gov	in person
Virginia Tech	Jensen	David	ajdavid6@vt.edu	remote

Interagency Working Group On
Ocean And Coastal Mapping

Alaska Coastal Mapping Summit and IOCM: Who, why, what, how

Ashley Chappell, NOAA

June 14, 2016

What is IOCM?

IOCM is *planning, acquiring, integrating, and managing* ocean and coastal geospatial data and derivative products for easy access and use by the greatest range of users.

<u>Three primary tasks:</u>

1. Data Acquisition

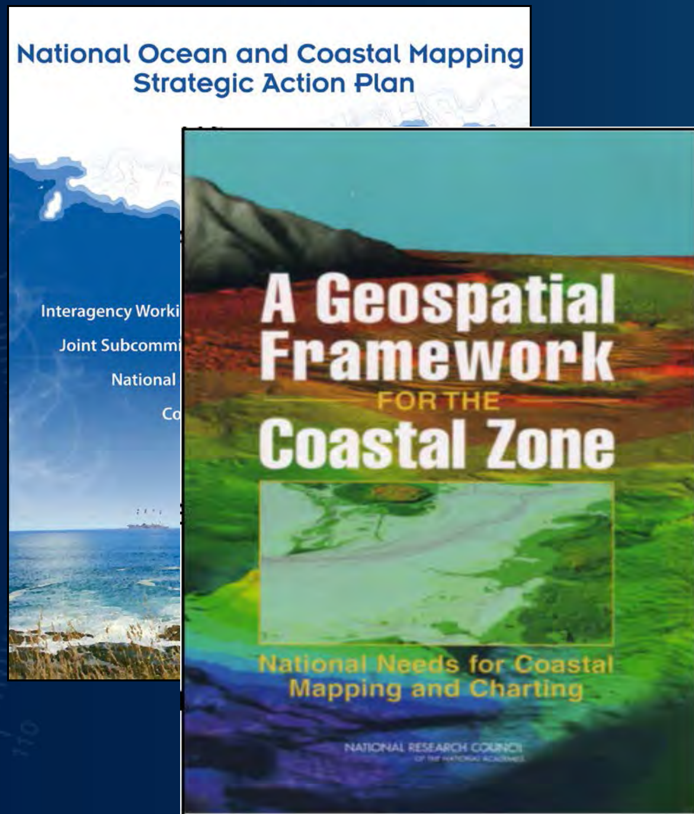
2. End-to-End Data Management

3. Maximum Use and Re-Use of data

Ocean and Coastal Mapping Integration Act of 2009

The Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM)

WHO:
- NOAA
- USGS
- USACE
- NAVO
- BOEM
- NSF
- NGA
- USCG
- EPA
- FEMA
- NASA
- *and other appropriate Federal agencies involved in ocean and coastal mapping.*

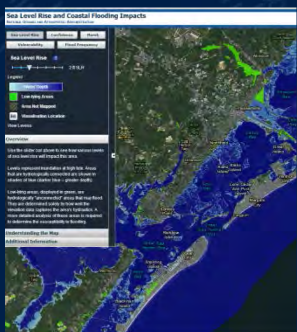


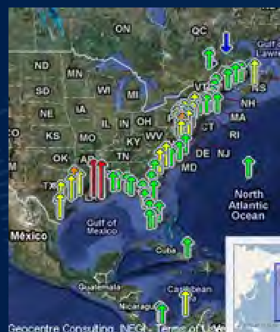
- Co-chaired by NOAA, USGS, and USACE
- Charged with facilitating "the coordination of ocean and coastal mapping activities and avoid[ing] duplicating mapping activities…"
- Ocean and Coastal Mapping Integration Act of 2009: develop an "Ocean and Coastal Mapping Plan"
- National Ocean Policy: develop a topobathy lidar plan, National Coastal Mapping Plan

Coastal Mapping Data

Planning for Long-Term Resilience

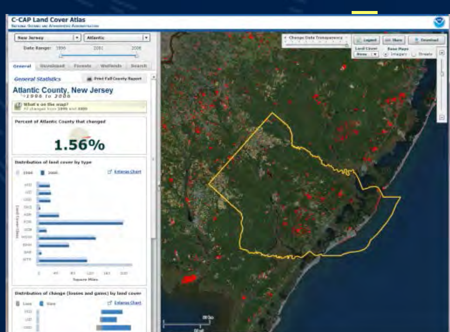
Promoting Resilience to Coastal Hazards and Climate Change

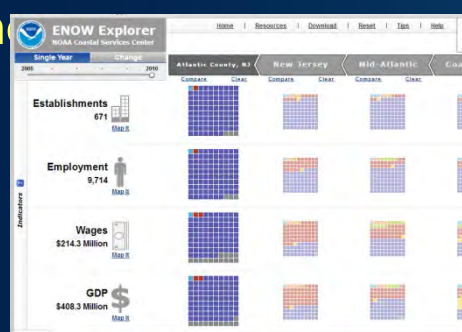




Building a Weather-Ready Nation

Supporting Community Livability,





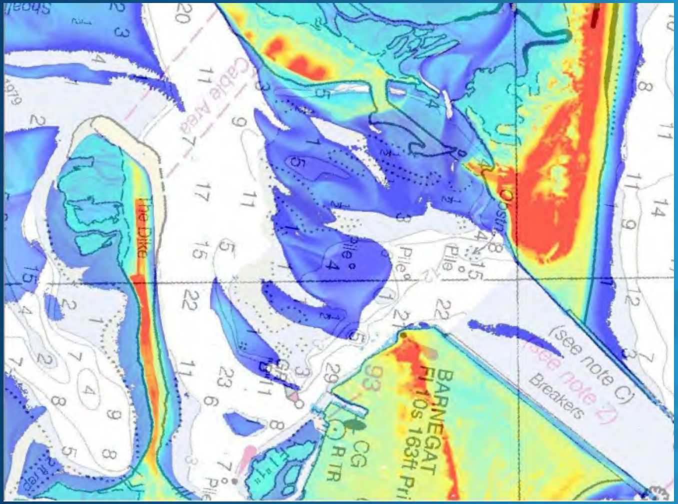
Ensuring Safe, Efficient, and Environmentally Sound Navigation

National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

- **GOAL:**
  - To survey/map the Nation's coasts/nearshore areas for multipurpose use
  - Repeat

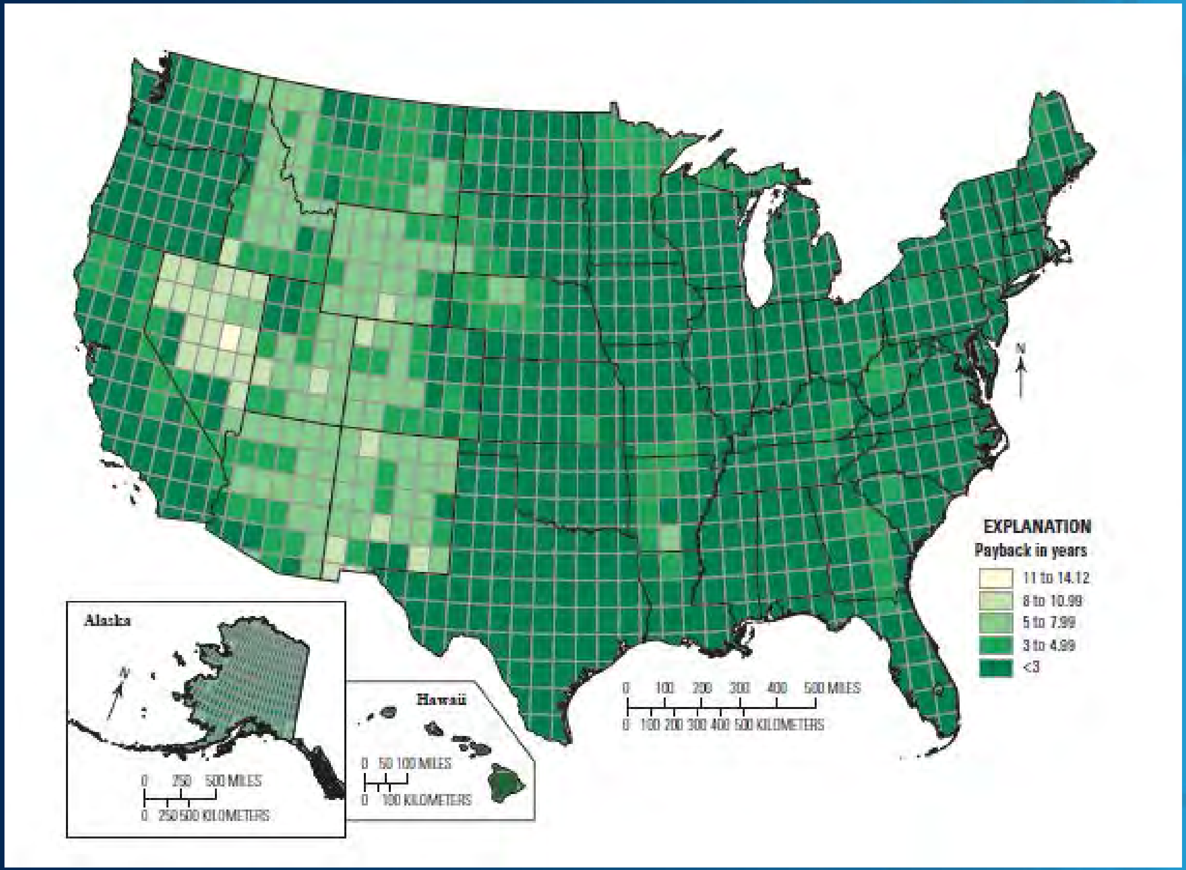
- **Requires:**
  - Coordination
  - Broad Range of Partners
  - A Plan



National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

- Focus initially on coastal bathy-topo Lidar
- Version 2.0:
  - Offshore/OCS
  - Acoustic
  - Aerial photography, HSS



USGS analysis of 2012 NEEA Study ROI of lidar data, based on multiple-use requirements /uses

National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

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Uses of Bathy Topo Lidar Data:

Shallow water bathymetry
Shoreline delineation
Topobathy DEM's
Regional sediment management
Land/water interface mapping
Habitat mapping
Bottom type detection
Coastal erosion monitoring
Navigation/Charting

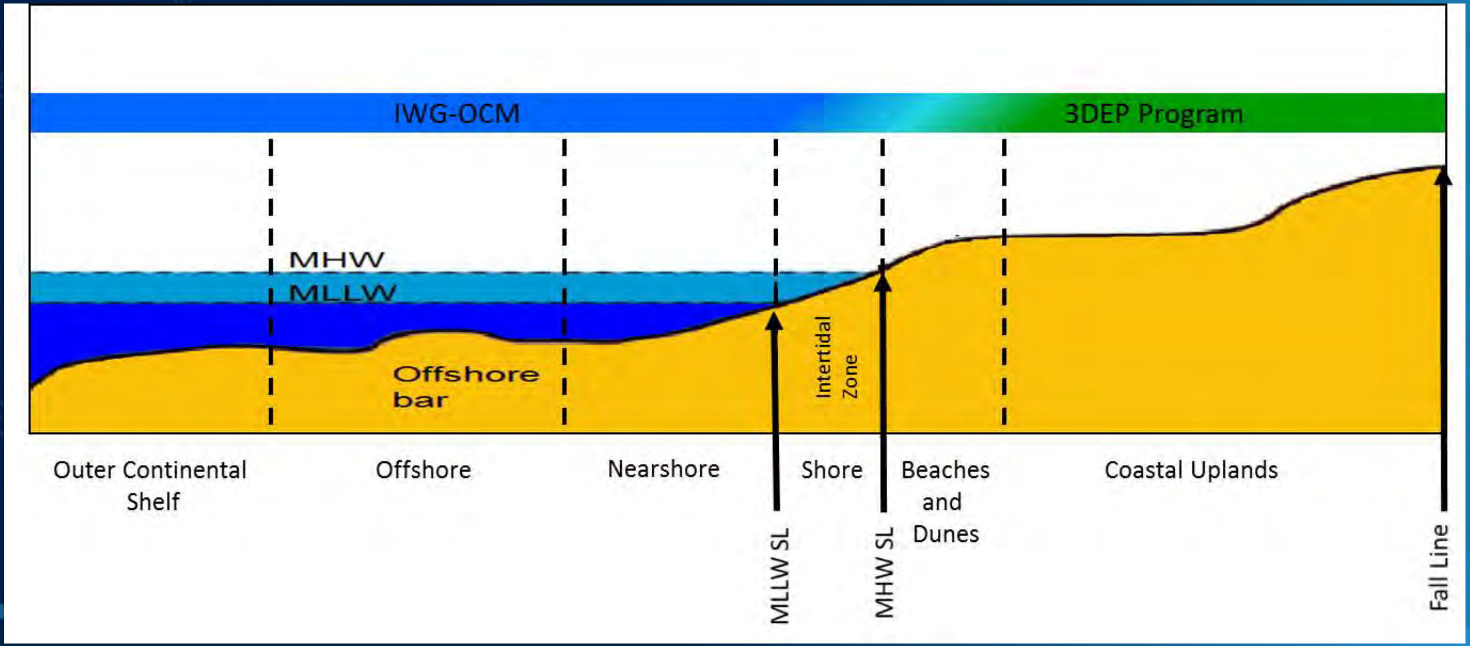
Coastal vulnerability assessments
Infrastructure assessment
Tsunami inundation modeling
Emergency response
Scientific research on processes of coastal change
Coral reef ecology
Coral reef genesis
Ecosystem connectivity

National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

Four Components:

- Annual/Regional Coastal Mapping Summits for coordination
- Common standards;
- Whole life cycle approach to data;
- R&D on new tools/techniques for data collection and use.



National Mapping Coordination

Annual/Regional Coastal Mapping Summits for coordination to:

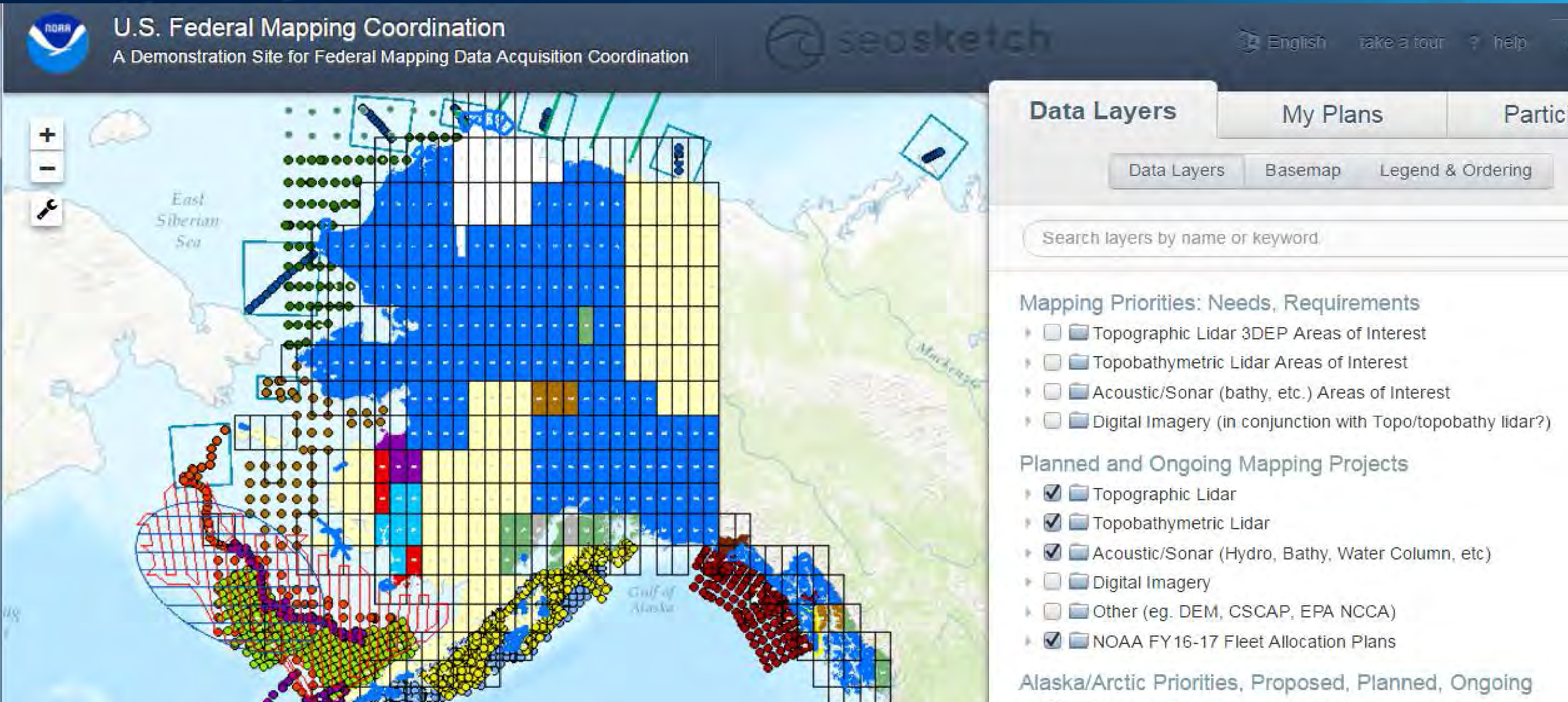
- Increase opportunities for collaboration and reduce redundancies and overlap
- Meet Office of Management and Budget Circular A-16 policy and Government Accountability Office directives for federal sharing of geospatial data acquisition plans
- Share data needs, plans and partnering potential on ocean/coastal mapping data acquisitions

JALBTCX Workshop Annual Summit 14-15 lessons learned:

- Regional summits more effective
- Linking to related planned events, maximizing workshops/conferences that bring interested people together

National Mapping Coordination

- Coordination site as visualization tool for understanding requirements, plans
- NOAA/USGS/USACE and partners worked to maximize Sandy topobathy lidar data collects
- Eg. USACE worked with USGS and WA stakeholders to discuss overlap requirements, modify plans for best outcome



National Coastal Mapping Strategy 1.0

Component 2: Common Standards

- What lidar Quality Levels are:
  - A means of consistently comparing specifications across agencies and coordinating acquisition to meet cross-agency needs
  - A primary component of a specification
  - Specified in terms of vertical uncertainty ("accuracy"), point density, and equivalent nominal point spacing
- What lidar Quality Levels are *not*:
  - A complete specification, in and of themselves
    - Reason: full agency specs for coastal lidar typically include a number of additional components, such as QA/QC requirements, formats for deliverables, ancillary data requirements, etc.

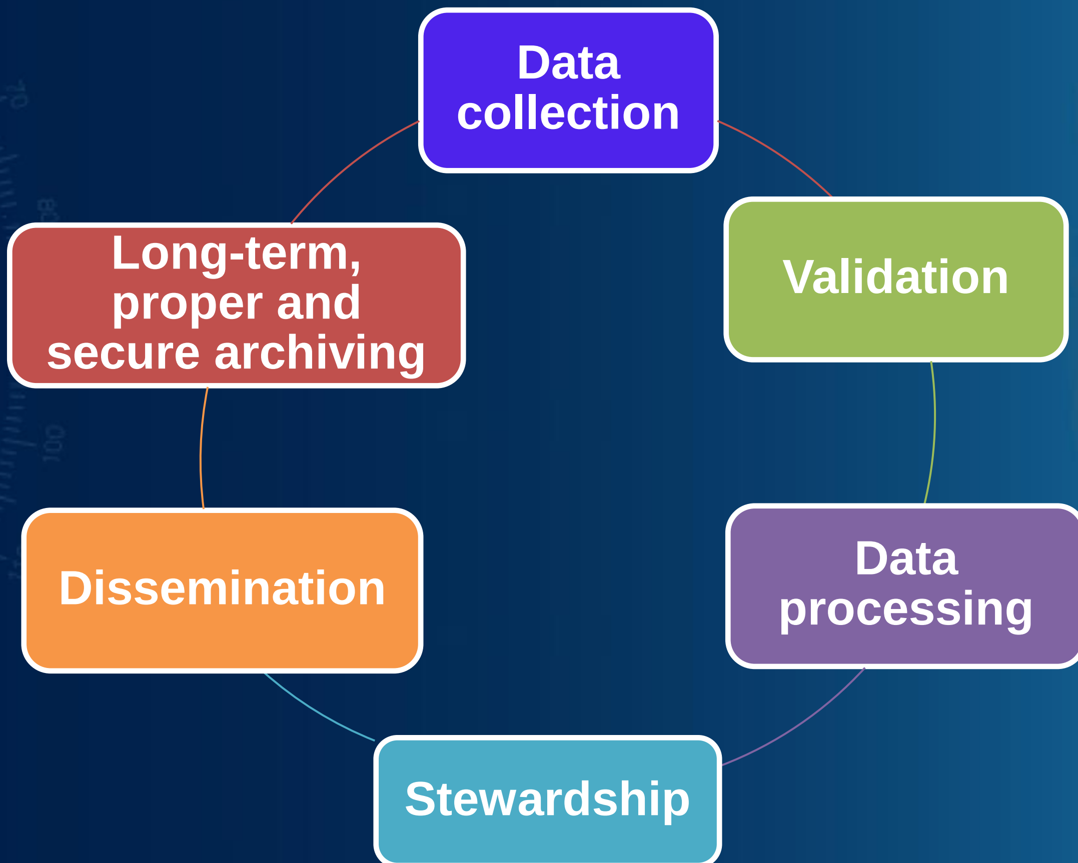
National Coastal Mapping Strategy 1.0

Component 2: Common Standards

Bathy Lidar Quality Level	Source	Vertical accuracy coefficients a,b as in sqrt(a^2+(b*d)^2))	Nominal Pulse Spacing (m)	Point Density (pt/m^2)	Example Applications
QL0$_B$	Bathymetric Lidar	0.25, 0.0075	≤0.7	≥2.0	Detailed site surveys requiring the highest accuracy and highest resolution seafloor definition; dredging and inshore engineering surveys; high-resolution surveys of ports and harbors
QL1$_B$	Bathymetric Lidar	0.25, 0.0075	≤2.0	≥0.25	
QL2$_B$	Bathymetric Lidar	0.30, 0.0130	≤0.7	≥2.0	Charting surveys; regional sediment management General bathymetric mapping; coastal science and management applications Change analysis; deepwater surveys, environmental analysis
QL3$_B$	Bathymetric Lidar	0.30, 0.0130	≤20	≥0.25	
QL4$_B$	Bathymetric Lidar	0.50, 0.0130	≤5.0	≥0.04	Recon/planning; all general applications not requiring higher resolution and accuracy

National Coastal Mapping Strategy 1.0

Component 3: Common data management procedures



"Whole Life Cycle" Data Approach

National Coastal Mapping Strategy 1.0

Component 4: Consensus on targeted research and development

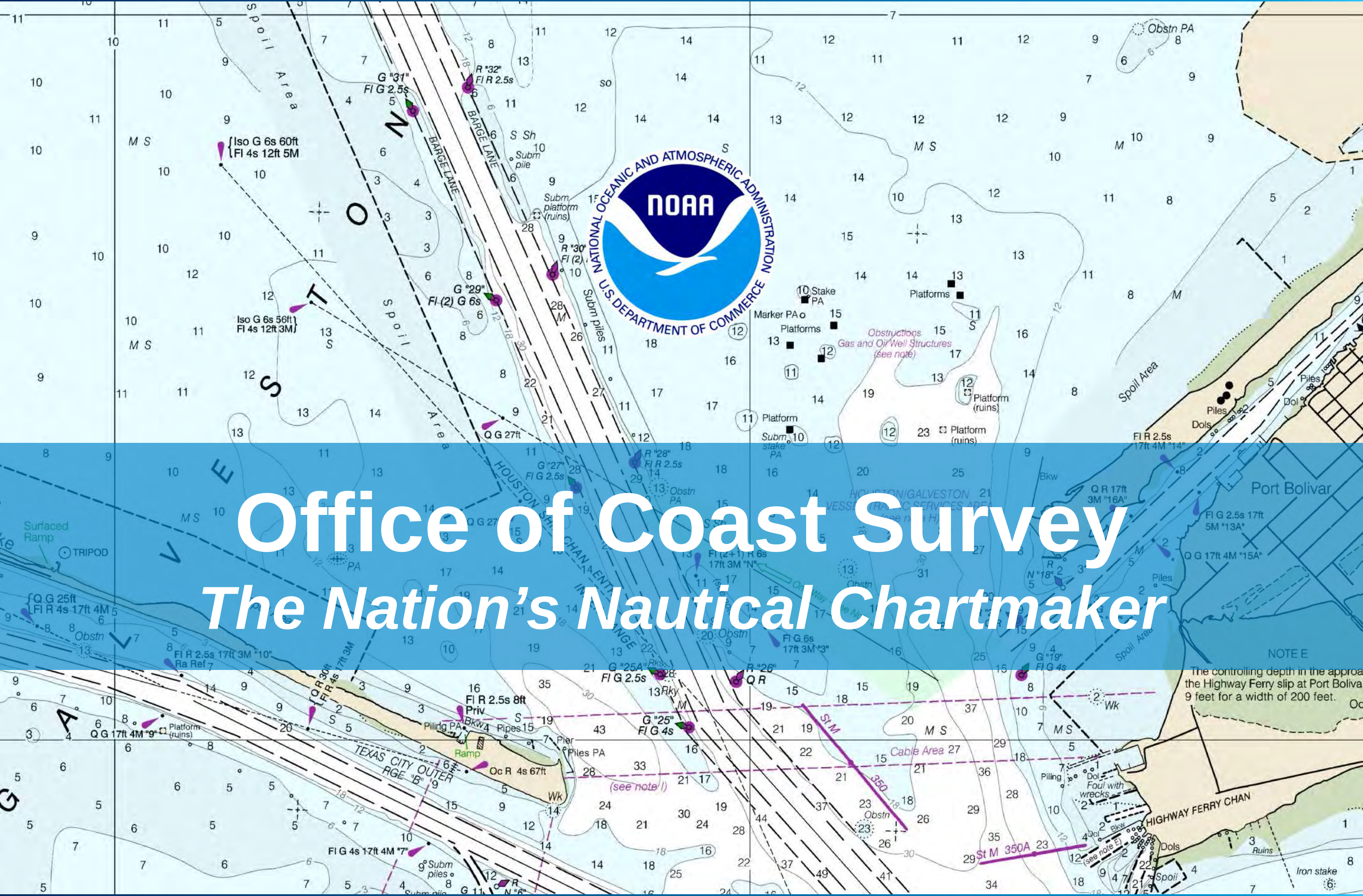
- Topographic /bathymetric lidar and other coastal mapping technologies are rapidly evolving
- Federal coastal mapping R&D programs critical
- Smart to leverage one another's capabilities and stretch limited research dollars

- Mutual interest areas include:
  - New sensor technologies (to improve quality and timeliness of data collection)
  - Algorithms (to process raw data and create usable data and products)
  - New uses for data (e.g., coastal management and science questions)

Want to read the Strategy?
Visit http://iocm.noaa.gov/iwg/

U.S. Federal Mapping Coordination Site:
http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4

Questions? Contact:
ashley.chappell@noaa.gov
jennifer.m.wozencraft@usace.army.mil
daniels@usgs.gov



Office of Coast Survey

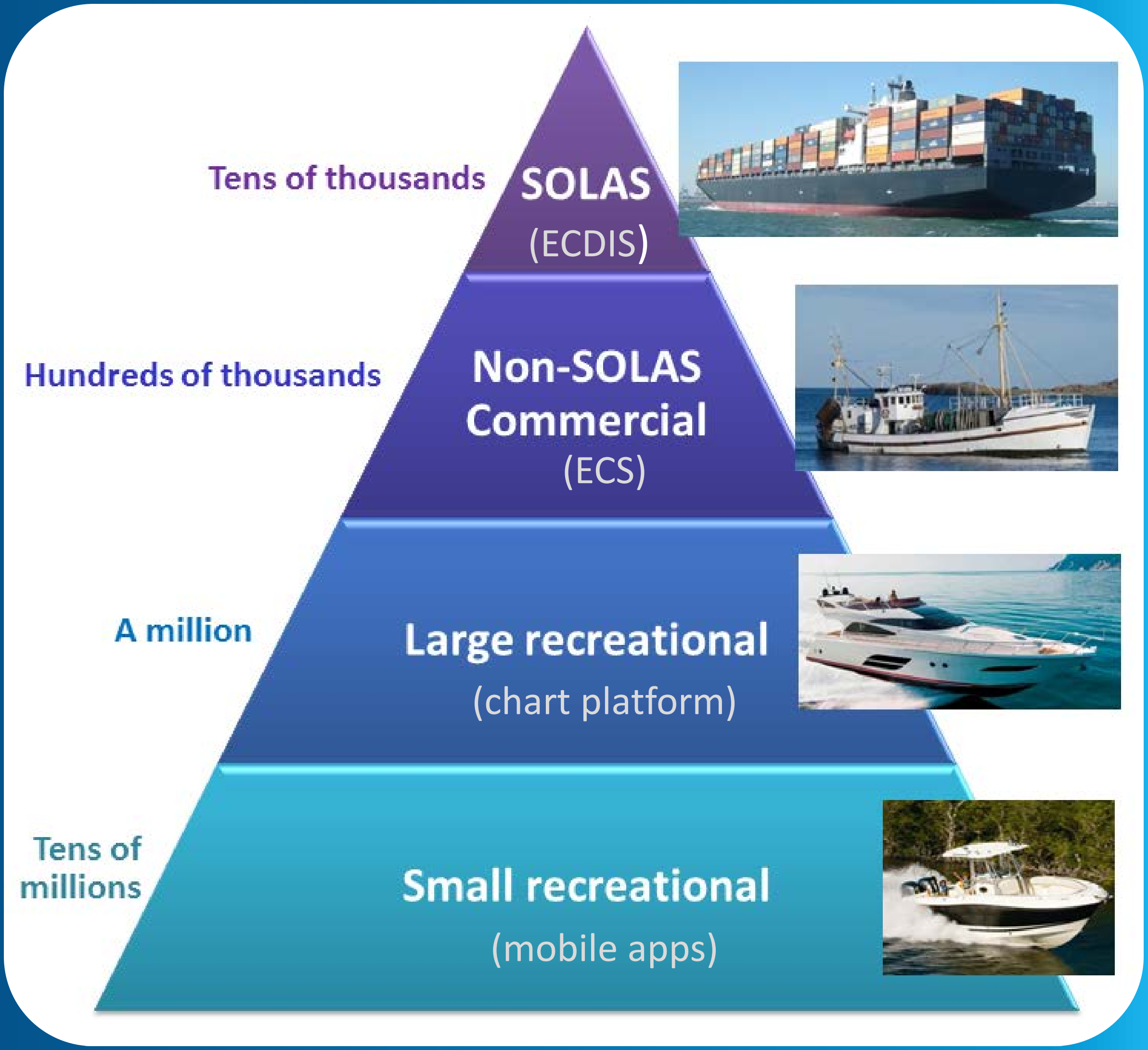
The Nation's Nautical Chartmaker

Open discussions follow each topic

- Overview
  - Rear Admiral Gerd Glang, Director
- Survey plans
  - Corey Allen, Hydrographic Surveys Division
- ENC coverage
  - Andrew Kampia, Marine Chart Division
- Yukon River Provisional ENC
  - Andrew Kampia, Marine Chart Division
- U.S. Arctic Nautical Chart Plan
  - Colby Harmon, Marine Chart Division
- Arctic Navigation Planning Guide
  - Rachel Medley, Navigation Services Division

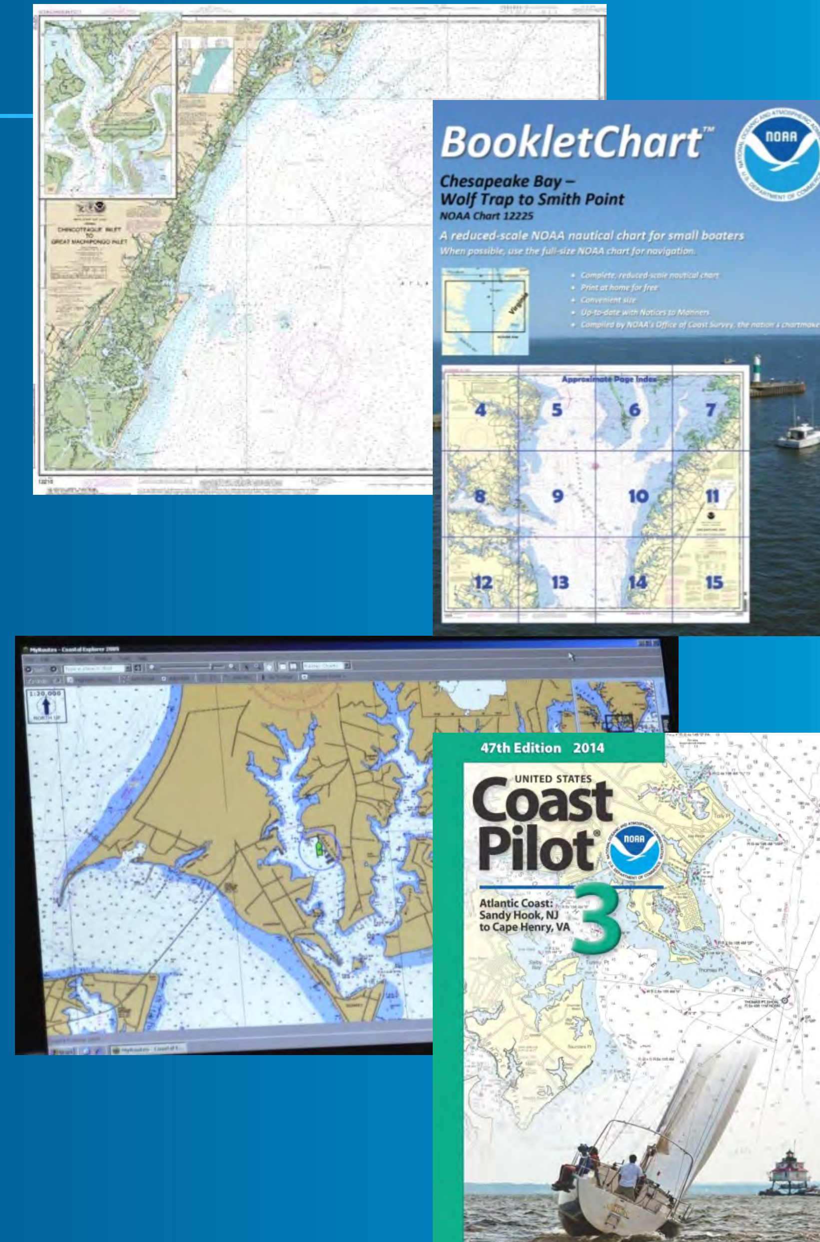
Expanding chart user base

**A SOLAS ship is any ship to which the International Convention for the Safety of Life at Sea (SOLAS) 1974 applies; namely, a passenger ship engaged on an international voyage, or. a non-passenger ship of 500 tons gross tonnage or more engaged on an international voyage.*

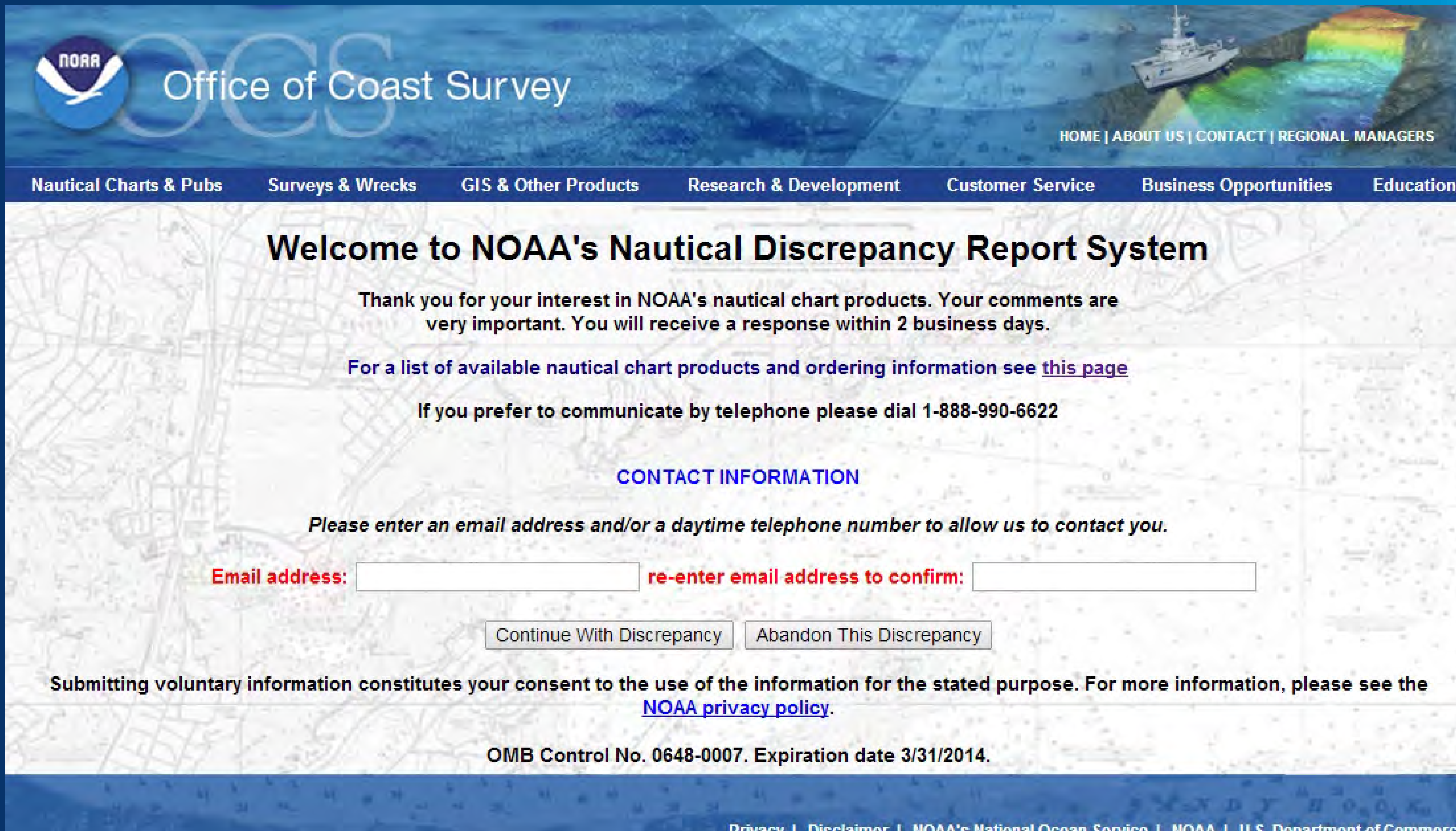


Navigational products

- Paper nautical charts
  - Sold commercially
- PDF charts
  - Free download
- Raster navigational charts
  - NOAA RNC®
- Electronic navigational charts
  - NOAA ENC®
- NOAA BookletChart™
  - Free download
- U.S. Coast Pilot
  - HTML, print, PDF

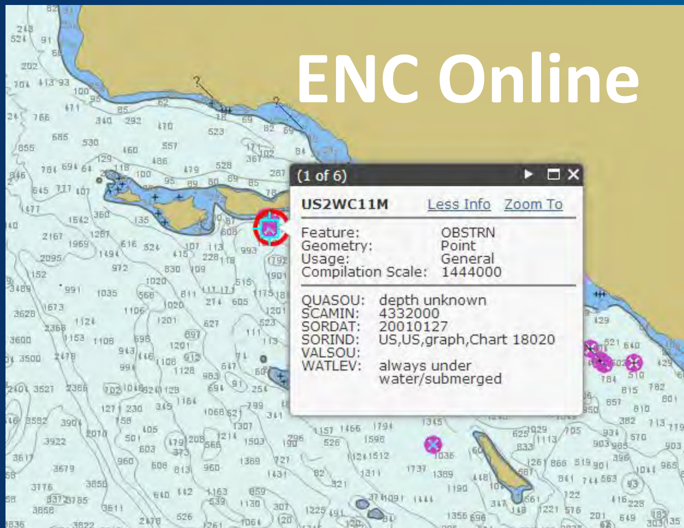


Report chart discrepancies – for *any* chart



nauticalcharts.noaa.gov/discrepancy

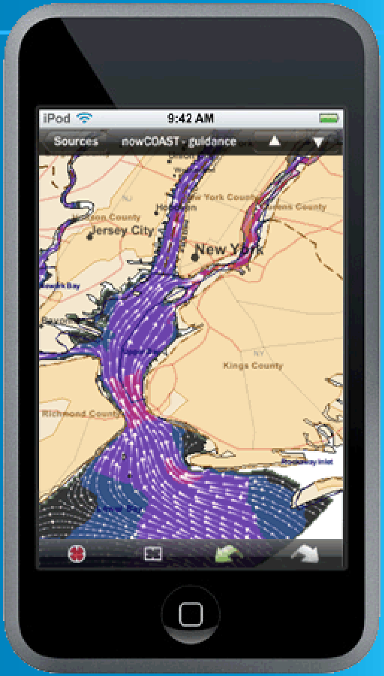
Information at your fingertips



- Can view ENC without ECDIS
- Useful for planning voyages

nauticalcharts.noaa.gov/ENCOnline

nowCOAST
(nowcoast.noaa.gov)
ocean and weather observations and forecasts

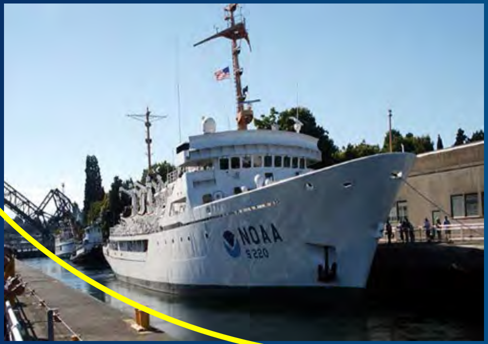


Data service providing fast chart updates to electronic charting systems

NOAA survey assets

ALASKA

Rainier
Newport, Oregon
1968



Fairweather
Ketchikan, Alaska
1968, 2010

Thomas Jefferson
Norfolk, Virginia
1992

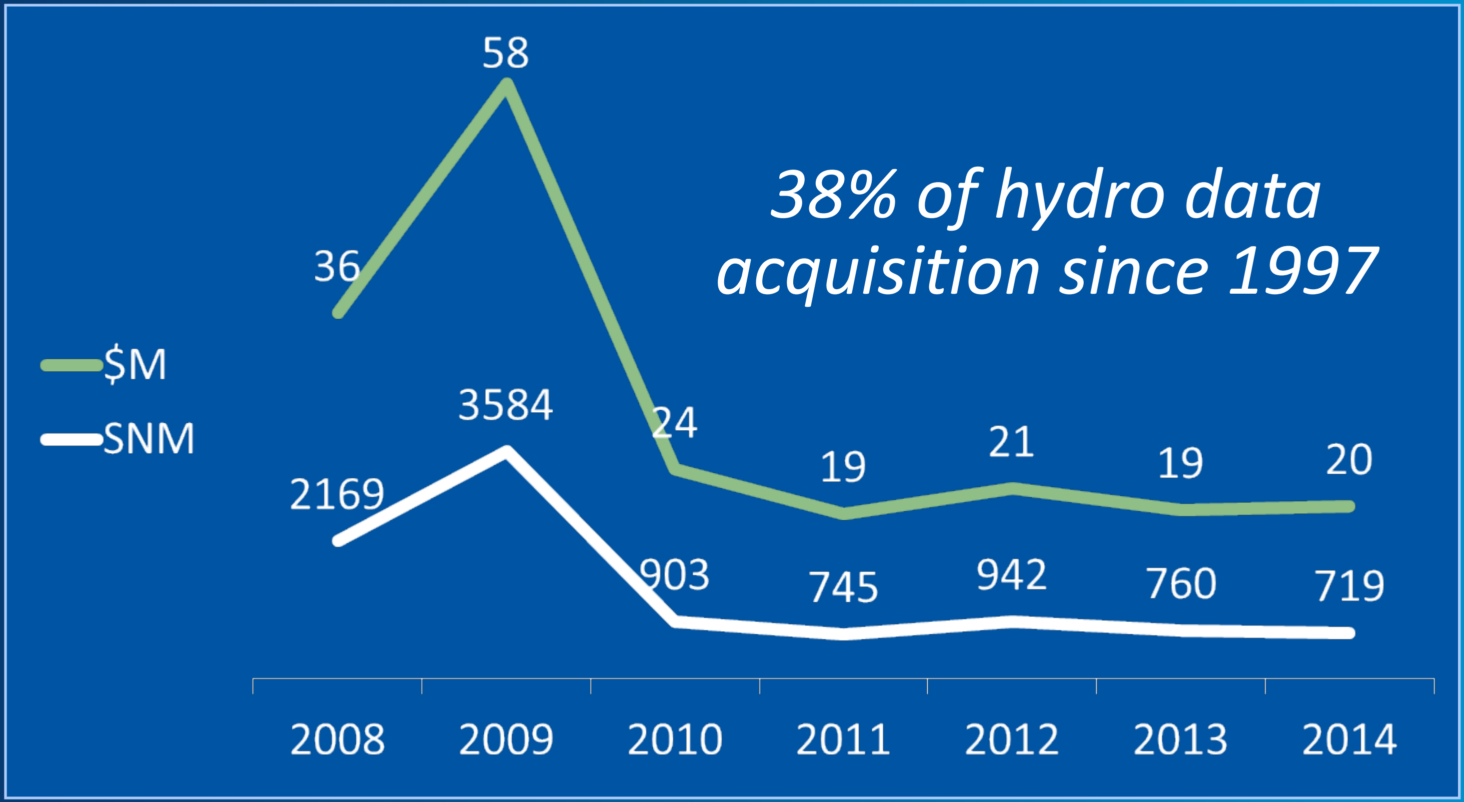
Bay Hydro II
Silver Spring, Maryland
2008

Ferdinand R. Hassler
New Hampshire
2012

6 Navigation
Response Teams

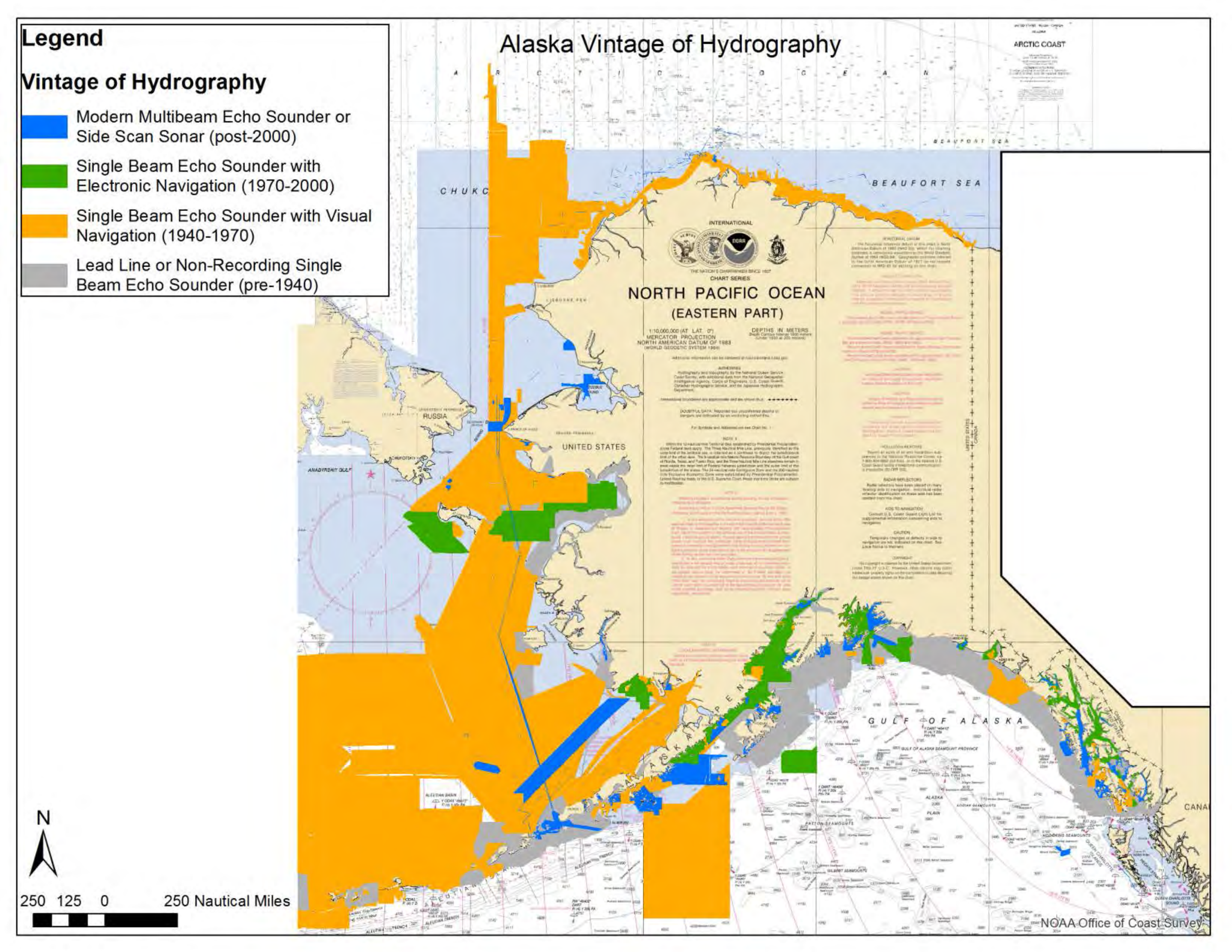
King Air
2009

Contracting partners

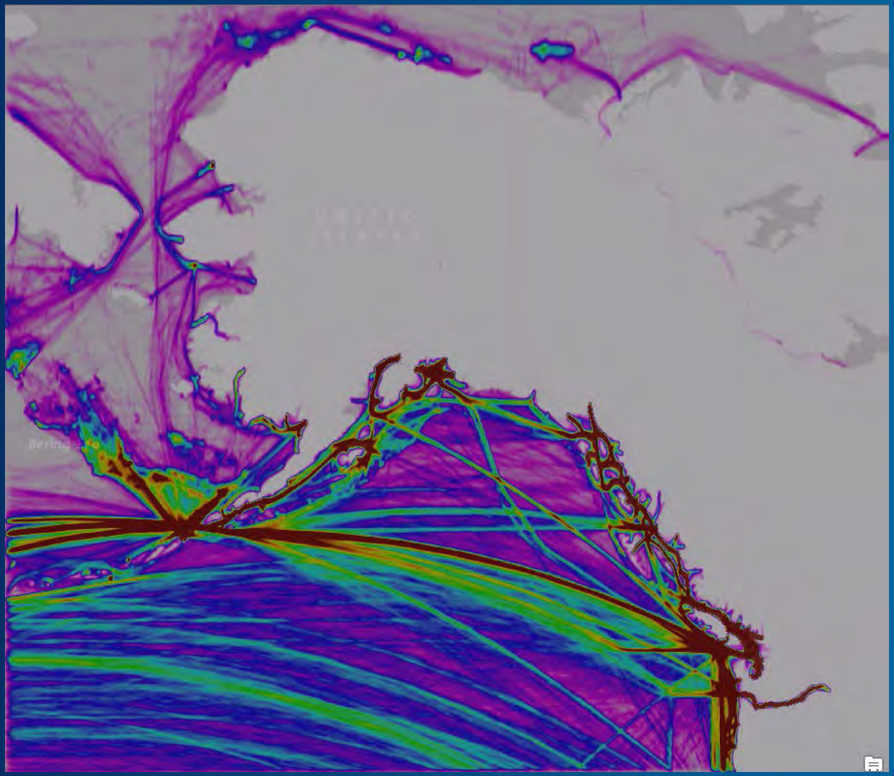


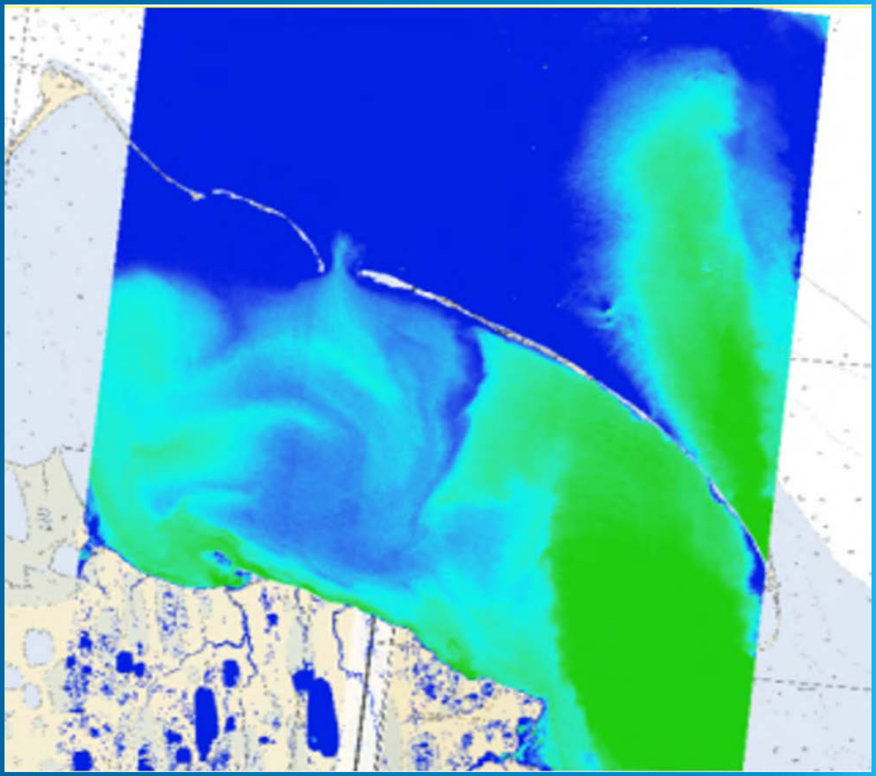
- Eight vendors under Coast Survey's hydrographic services contract (FY15 – FY19)
- Six task orders anticipated for FY16

Modern survey data is lacking



Using new technologies for data





Discussions

- Many vessels do not have AIS. Satellite AIS still has dead areas. Often does not show shallow draft vessels. Vessels under 64’ underrepresented. New USCG rule over 26’; must carry AIS.
- Crowd sourcing: Olex in Norway, Rose Point log files, Navionix track data, IHO bathymetry database.
- Isostatic Rebound? Discern how soundings change over time in dynamic uplift and subsidence areas to systematically.
- How can we reflect land rise in a systematic way?

Discussions

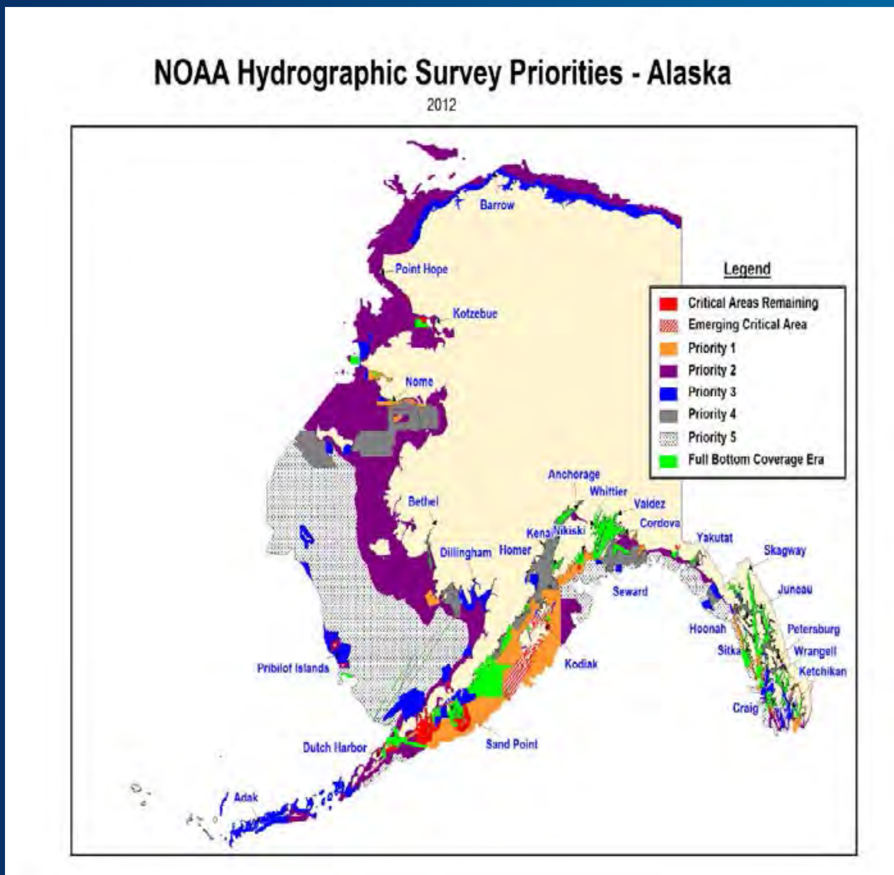
- Is there a way to de-trend primary tide gauge data? Present this as an overlay on the chart so people can make informed decisions about the confidence of the soundings in a region have not been susceptible to uplift.
- Airplanes gather data quickly at a minus tide, but are weather challenged in much of AK. Need more dynamic approach to using various data sources and specs.
- Geoid 2022…
- Intertidal zone in between MLLW/8m; important for inundation modelling.

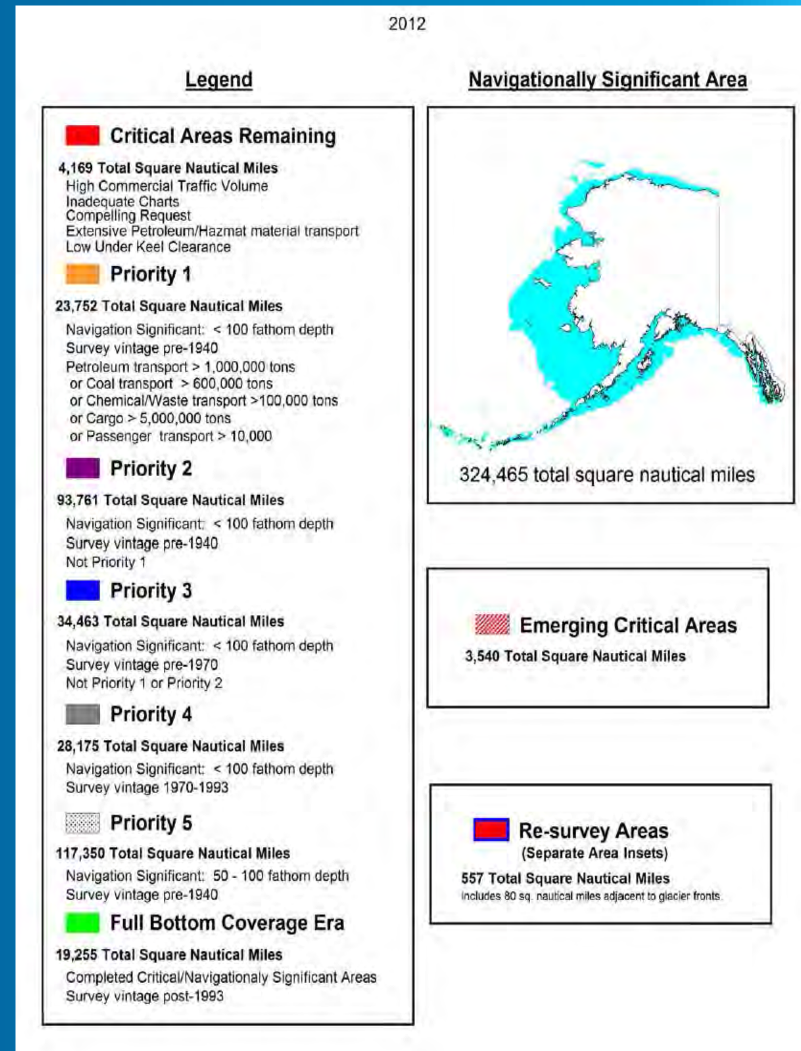
Corey Allen, Hydrographic Survey Division, Operations

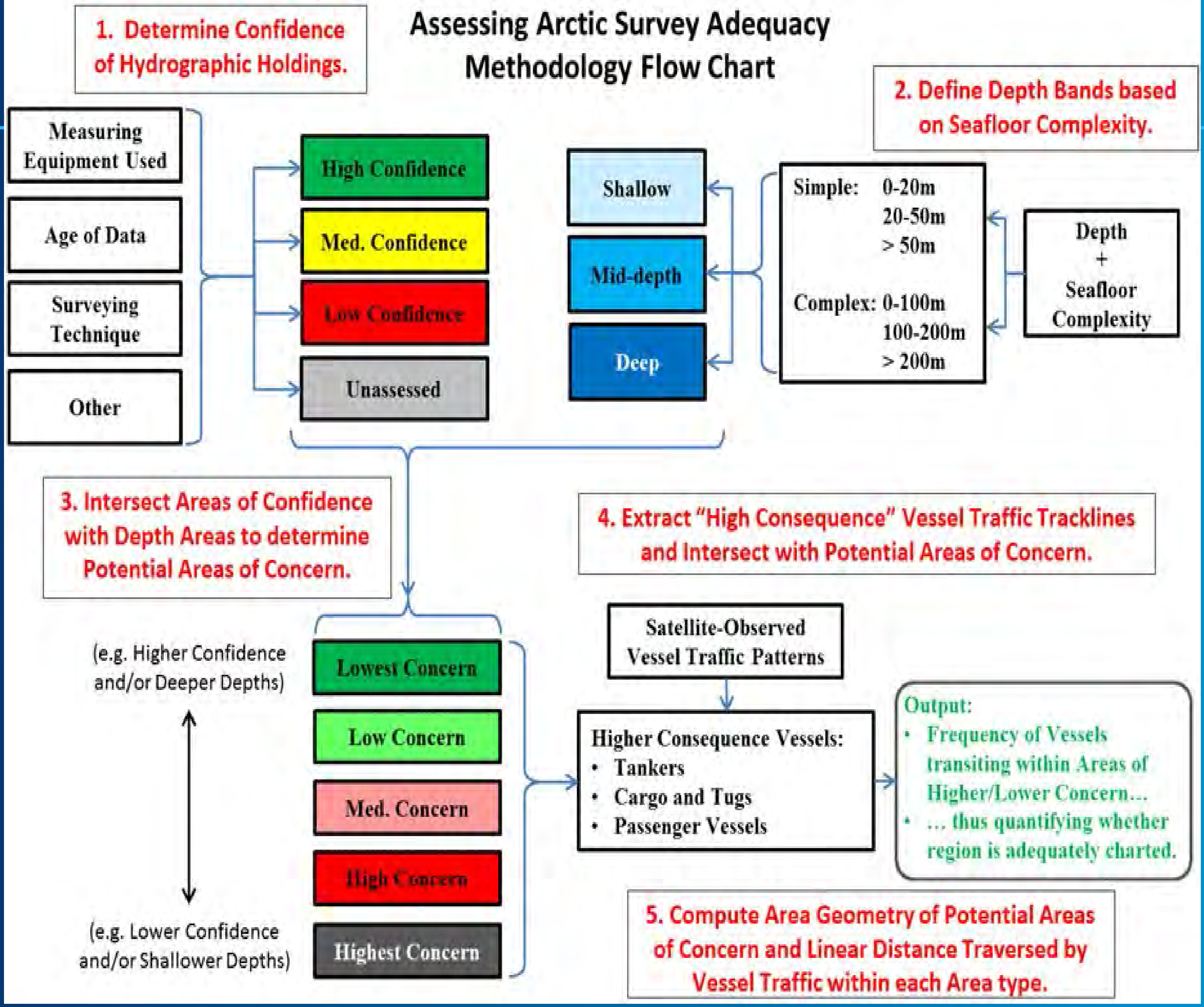
HYDROGRAPHIC SURVEY PLANS

NOAA hydrographic survey priorities (2012)

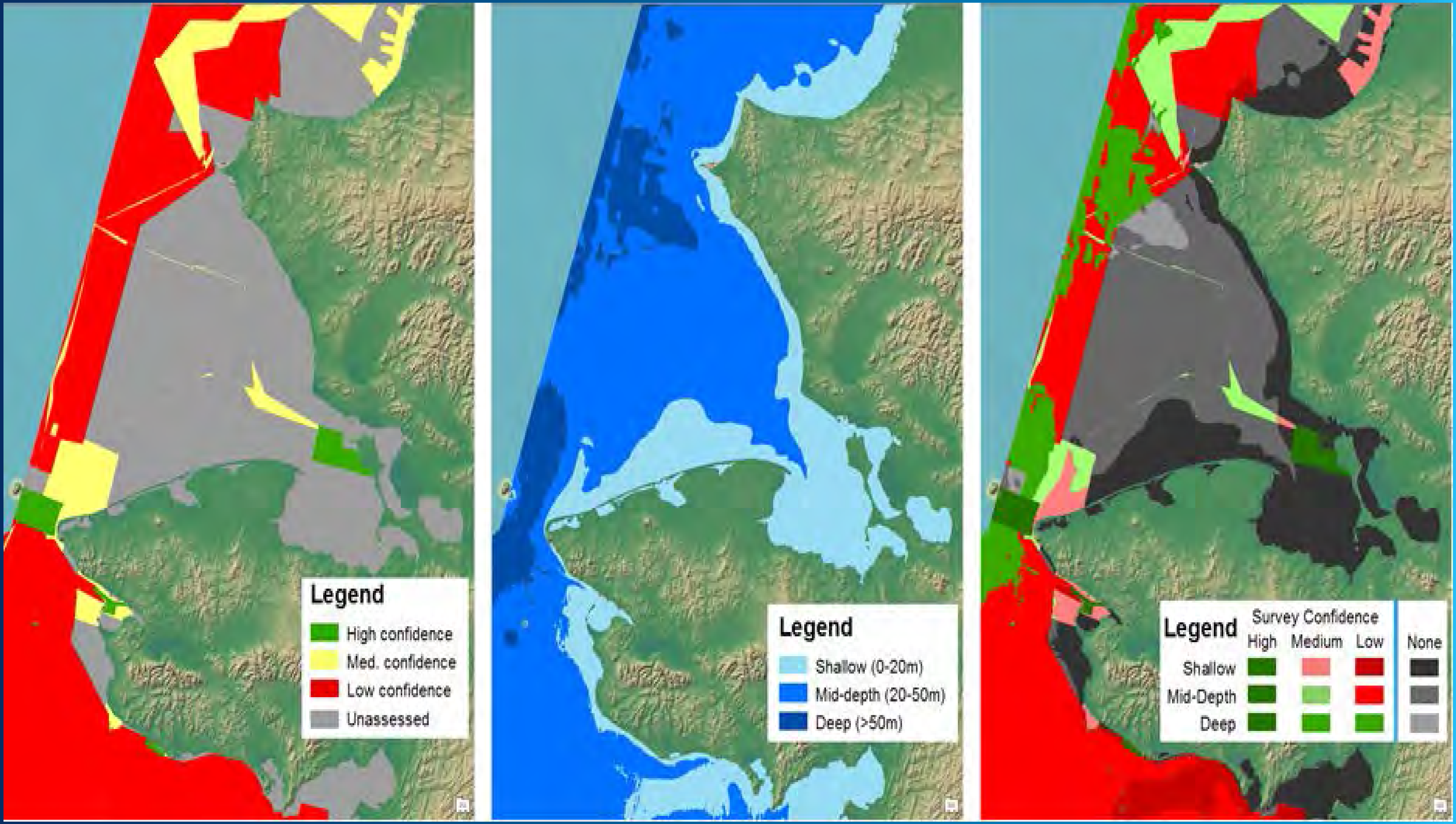
Priorities are static (save "emerging critical") and non-dynamic



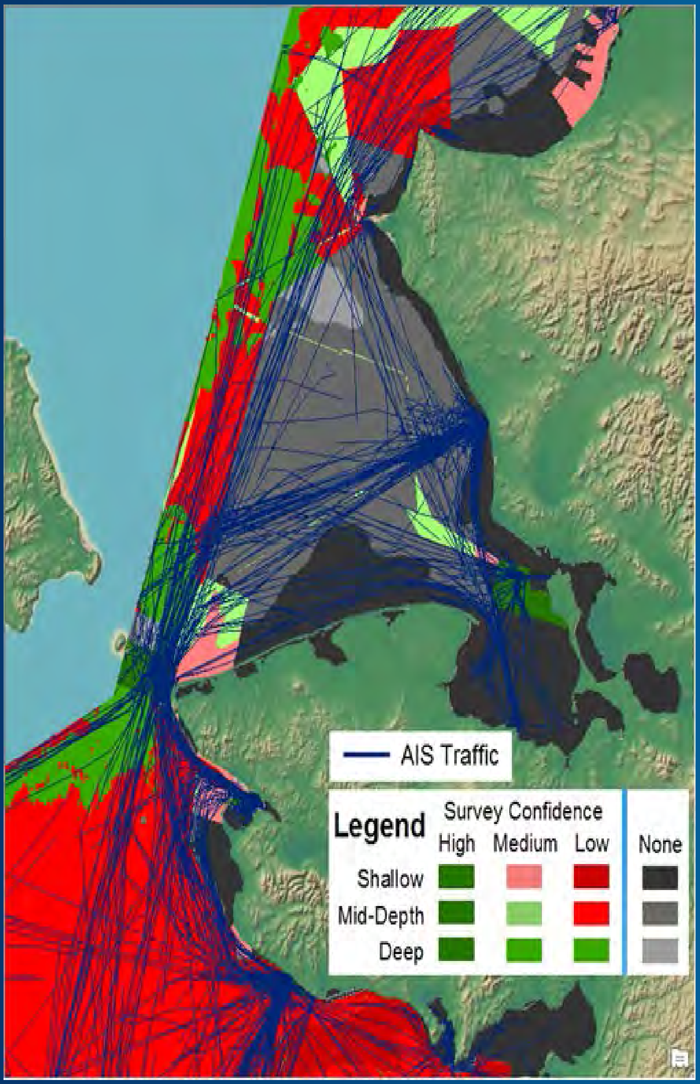


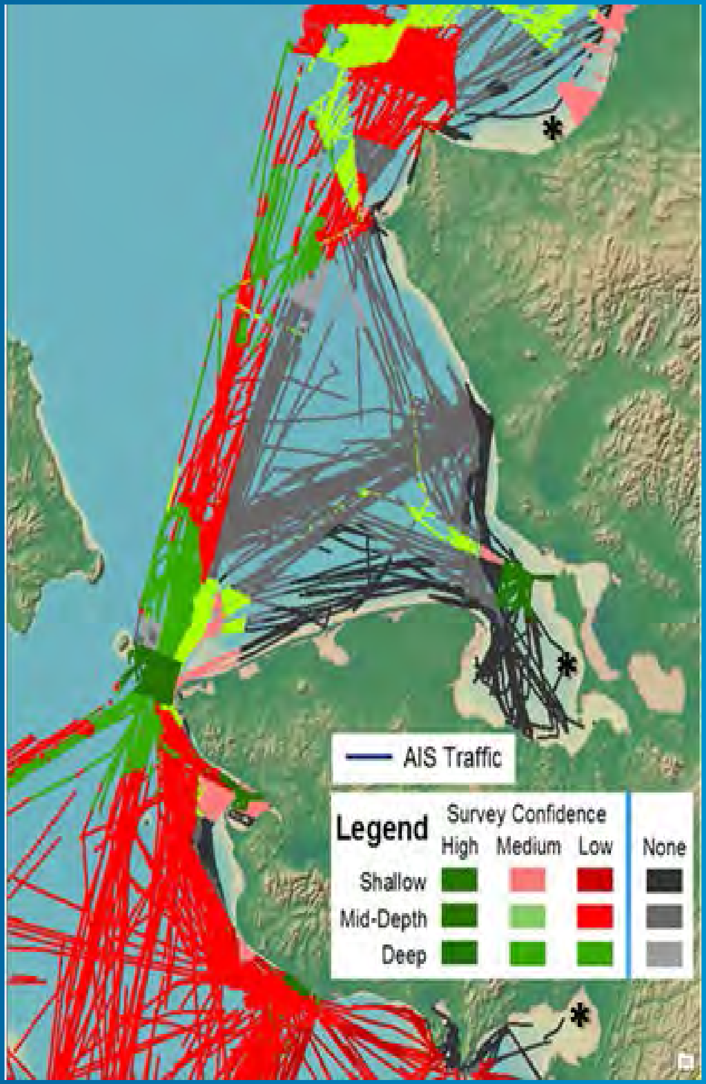

Assessing Arctic Survey Adequacy
Methodology Flow Chart
1. Determine Confidence of Hydrographic Holdings.
Measuring Equipment Used
Age of Data
Surveying Technique
Other
High Confidence
Med. Confidence
Low Confidence
Unassessed
2. Define Depth Bands based on Seafloor Complexity.
Shallow
Mid-depth
Deep
Simple: 0-20m
20-50m
> 50m
Complex: 0-100m
100-200m
> 200m
Depth + Seafloor Complexity
3. Intersect Areas of Confidence with Depth Areas to determine Potential Areas of Concern.
(e.g. Higher Confidence and/or Deeper Depths)
(e.g. Lower Confidence and/or Shallower Depths)
Lowest Concern
Low Concern
Med. Concern
High Concern
Highest Concern
4. Extract "High Consequence" Vessel Traffic Tracklines and Intersect with Potential Areas of Concern.
Satellite-Observed Vessel Traffic Patterns
Higher Consequence Vessels:
• Tankers
• Cargo and Tugs
• Passenger Vessels
Output:
• Frequency of Vessels transiting within Areas of Higher/Lower Concern…
• … thus quantifying whether region is adequately charted.
5. Compute Area Geometry of Potential Areas of Concern and Linear Distance Traversed by Vessel Traffic within each Area type.

Intersection of confidence & depth



Incorporate vessel traffic





Surveying is difficult and expensive

Surveying in Alaska is even *more* difficult and expensive

2010-2015

- average cost of a contracted hydrographic survey: $23k/SNM
- average cost of a contracted hydrographic survey in Alaska: $29k/SNM
- average Alaskan task order : $4.5M or ~150/SNM
  - $4.5M outside of Alaska: 200 SNM (difference of 50 SNM)

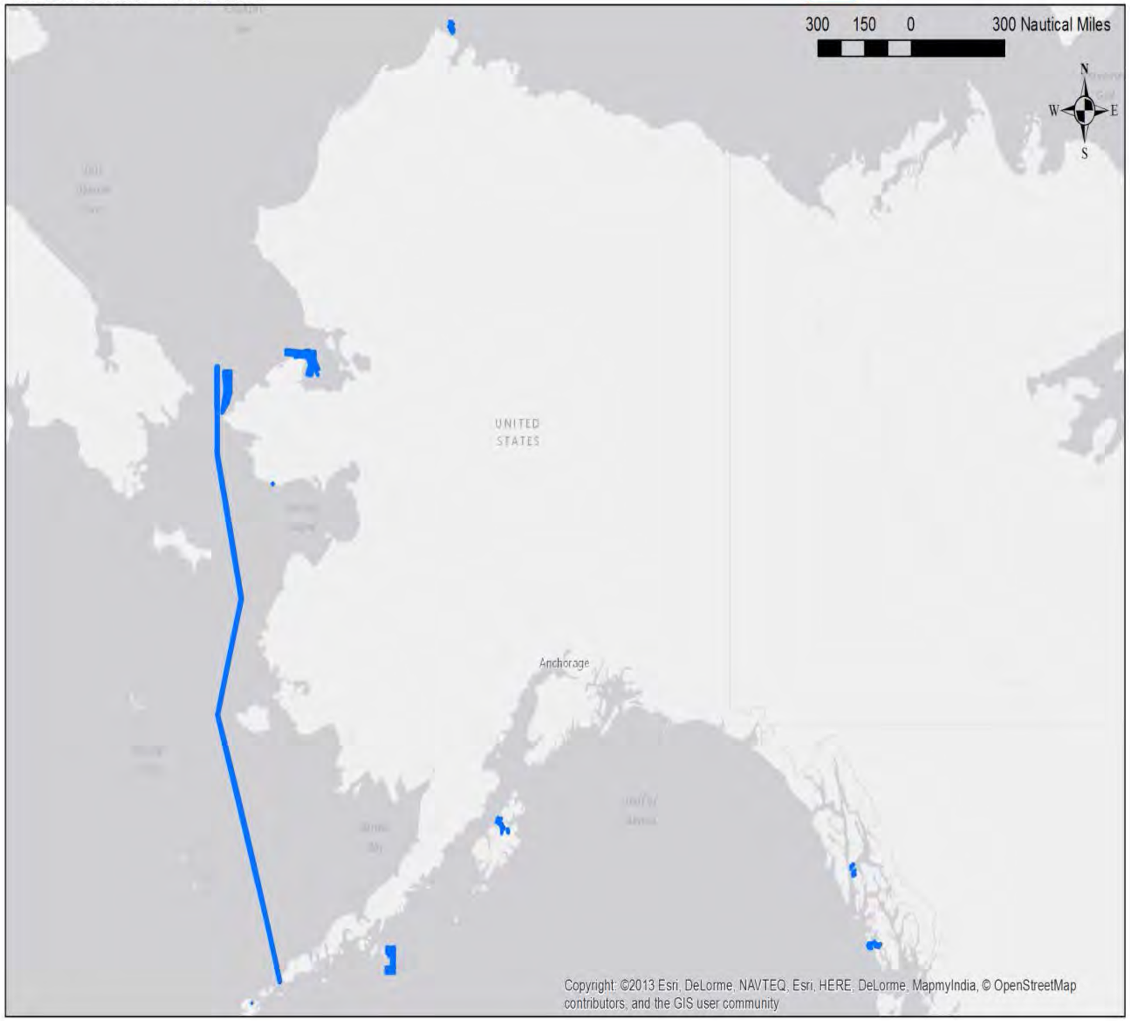
2015 Alaska Hydrographic Surveys (NOAA & Contractor)

Fully Surveyed: 1088 nm^2
Transit Data: ~1500 nm

Legend

Completed Hydrographic Surveys

2015



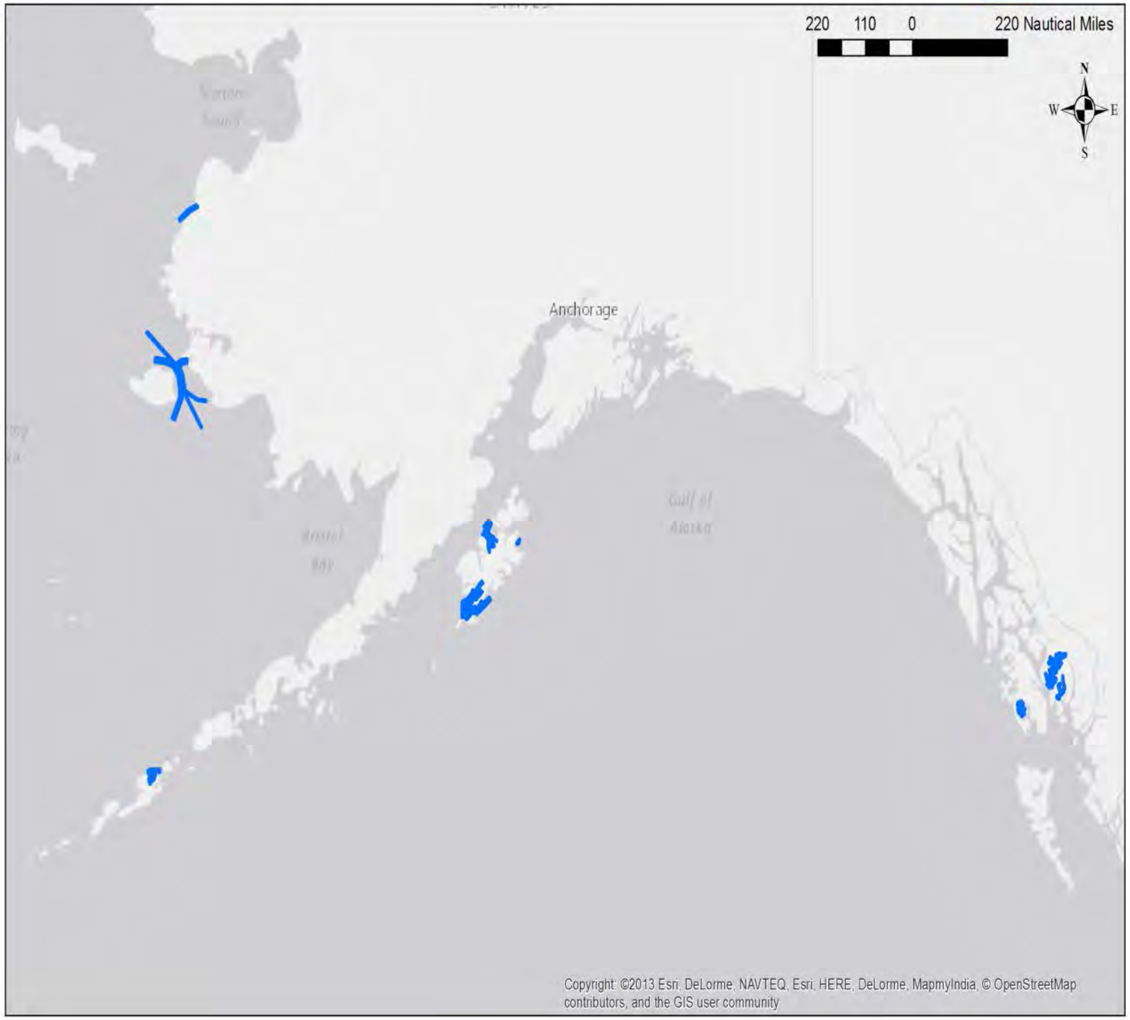
2016 Planned Alaska Hydrographic Surveys (NOAA & Contractor)

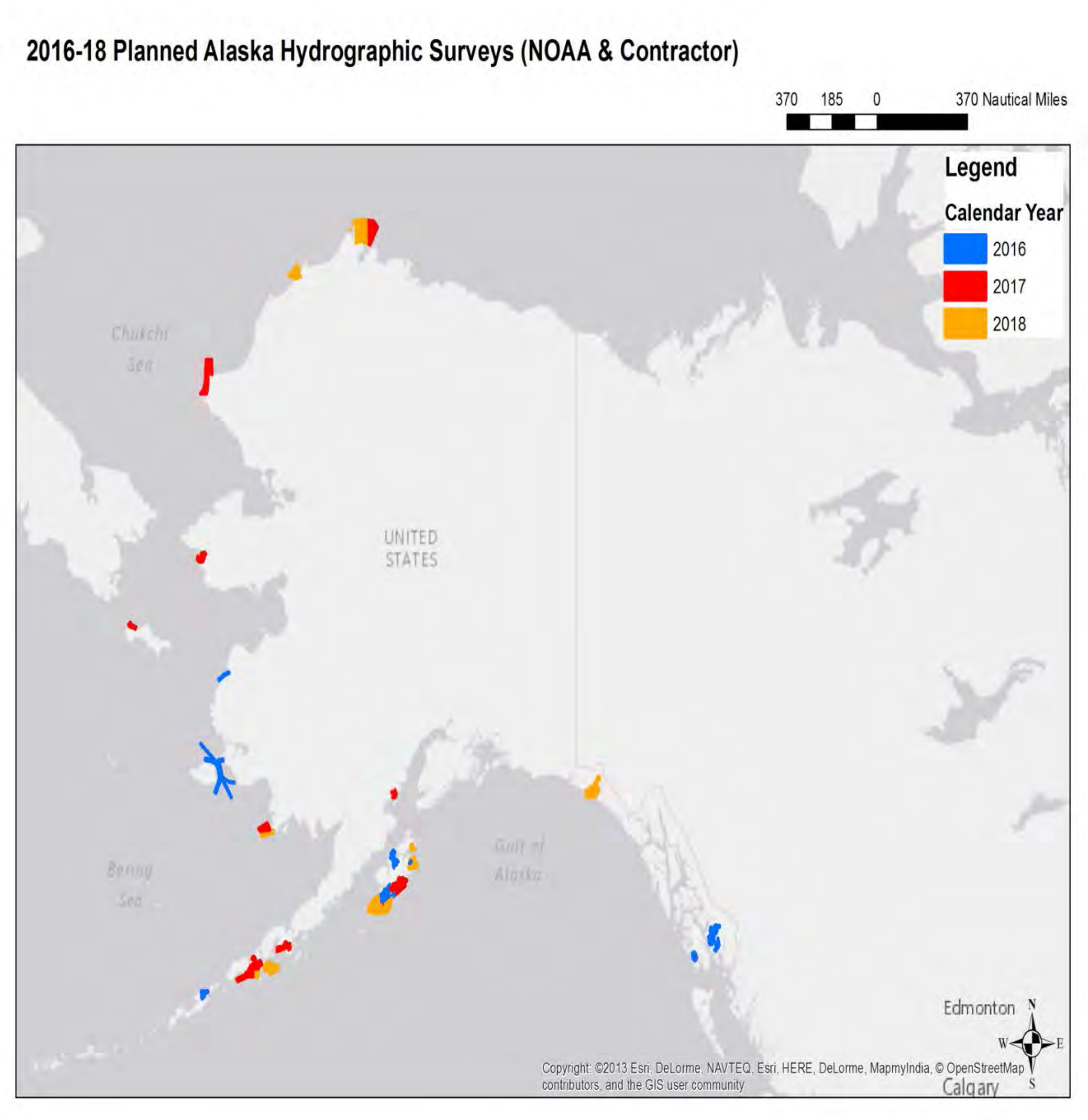
Planned Surveys: ~1500 nm^2

Legend

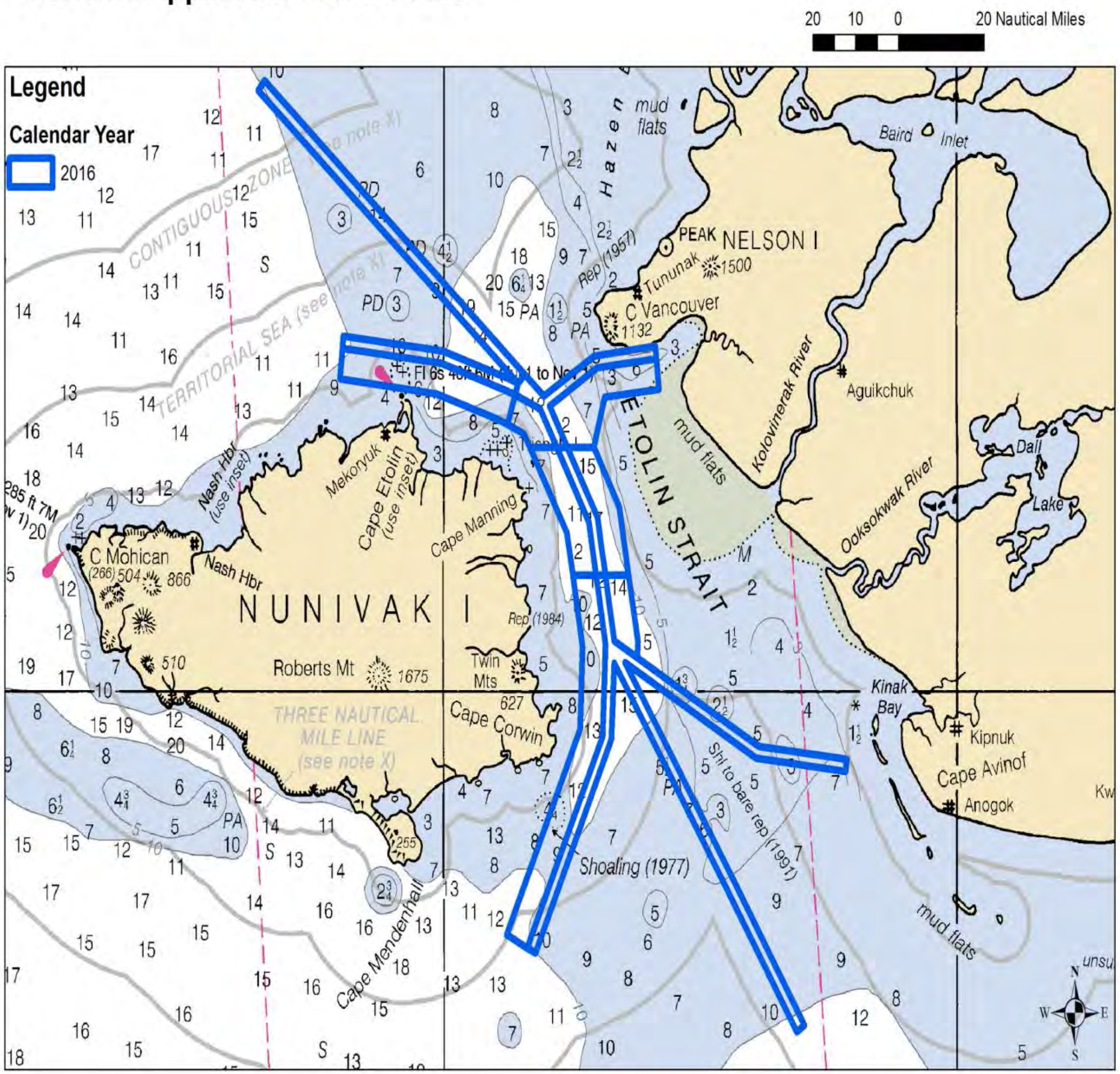
Calendar Year

2016




2016-18 Planned Alaska Hydrographic Surveys (NOAA & Contractor)
370 185 0 370 Nautical Miles
Legend
Calendar Year
2016
2017
2018
Chukchi Sea
UNITED STATES
Gulf of Alaska
Bering Sea
Edmonton
Calgary
N
S
E
W
Copyright: ©2013 Esri, DeLorme, NAVTEQ, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

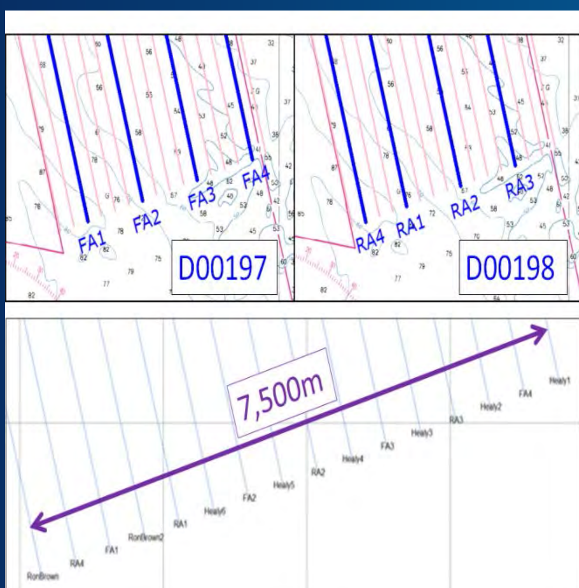
Corridor Approach: Etolin Strait

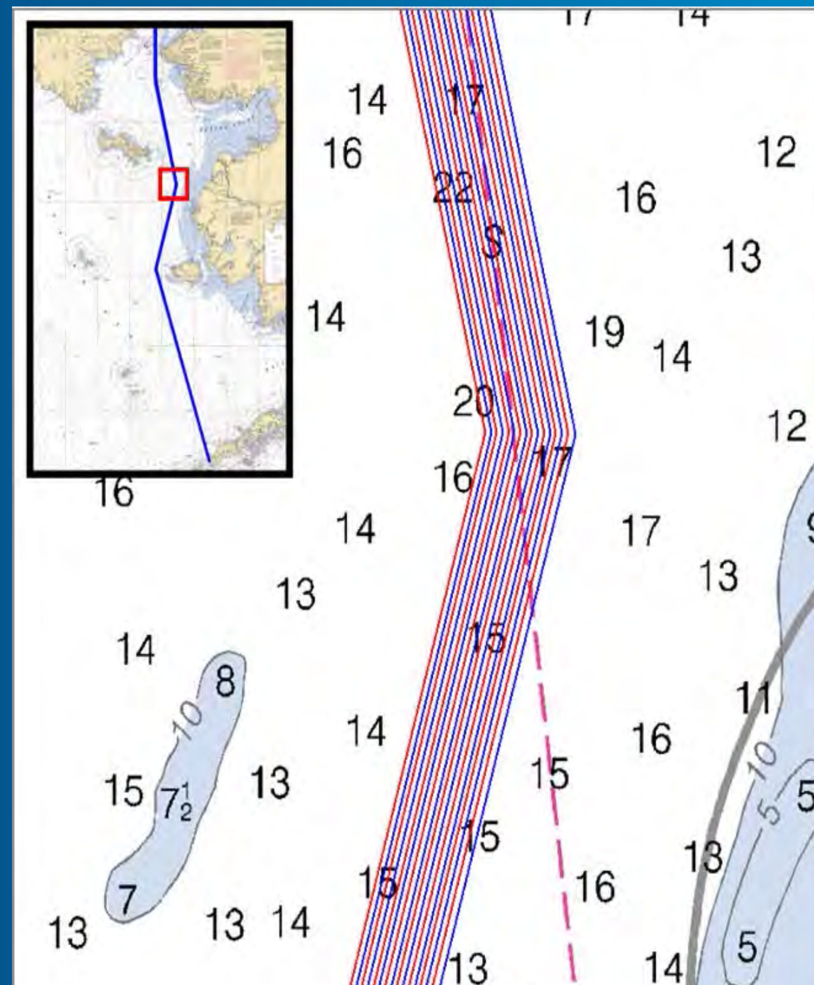


Corridor approach

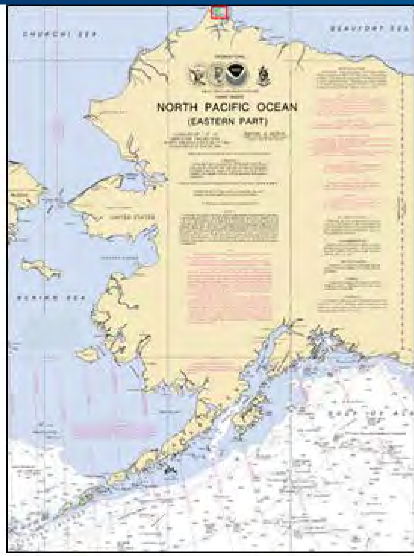
Port Access Route Study (PARS)

Collaborative Effort
NOAA & USCG



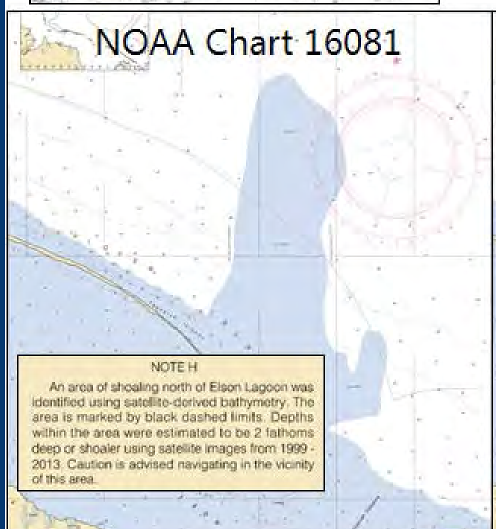


Satellite-derived bathymetry

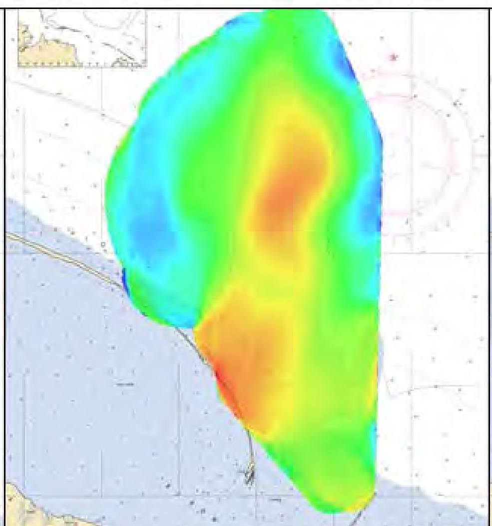


Useful tool for determining change and chart adequacy.

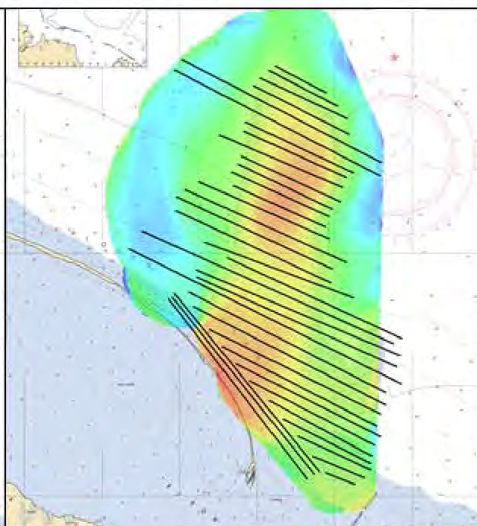
Efficacy limited by depth and oceanography



Estimated Bathymetry



Fairweather Validation Plan



Discussions

- Mobilization costs are significant, addition of more contractors may result in smaller tasks orders.
- May be able to coordinate interagency cooperation for combining efforts – NOAA did this with the state of California.
- NOAA is partnering with USCG Healey in PARS study. Desire for more 'corridor' type surveys.
- Is there room on NOAA ships to take 1 or 2 scientists? Yes. For contractors….?
- USGS interested in surveying Queen Charlotte Fault and other areas in Gulf of AK.

Discussions

- Tankers have low confidence on survey data 3-4 miles offshore of Nunivak.
- Harbors of Refuge - Who decides what is a refuge? HoRs are not specifically portrayed on NOAA raster or ENC products. Port Clarence is one . Nunivak is a place to get out of weather, but is not a harbor of refuge. Chernofski Bay and Nikolski Bay both “Ports of Refuge” on north side of Unalaska Island; both in need of modern surveys. Stressing the importance of these areas for safety has helped to further develop future survey plans.

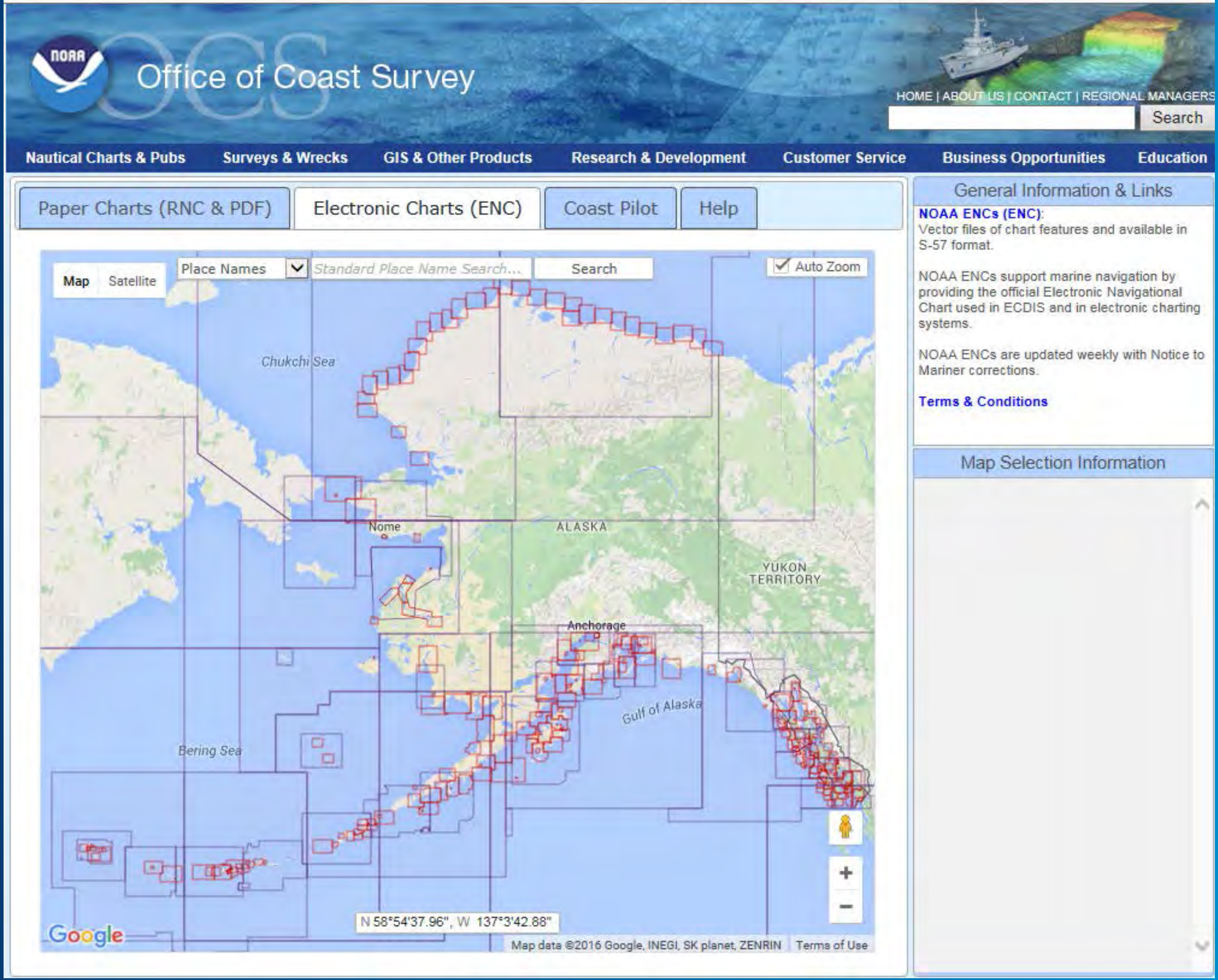
Discussions

- Cook inlet – corridor survey could be easier for updates. AIS-ATON marking Point MacKenzie Shoal
- USACE cook inlet condition survey – once a year.
- Can V-Datum model be focused on Cook Inlet (preliminary)?
- NPS concerned about limiting incidents in Cook Inlet, in which the NPS has two parks with boundaries in the Inlet.
- Need help from many sources , including industry, Exxon, etc… Need to make agreements *before* data is acquired!

Andy Kampia, chief, Alaska Chart Production Branch

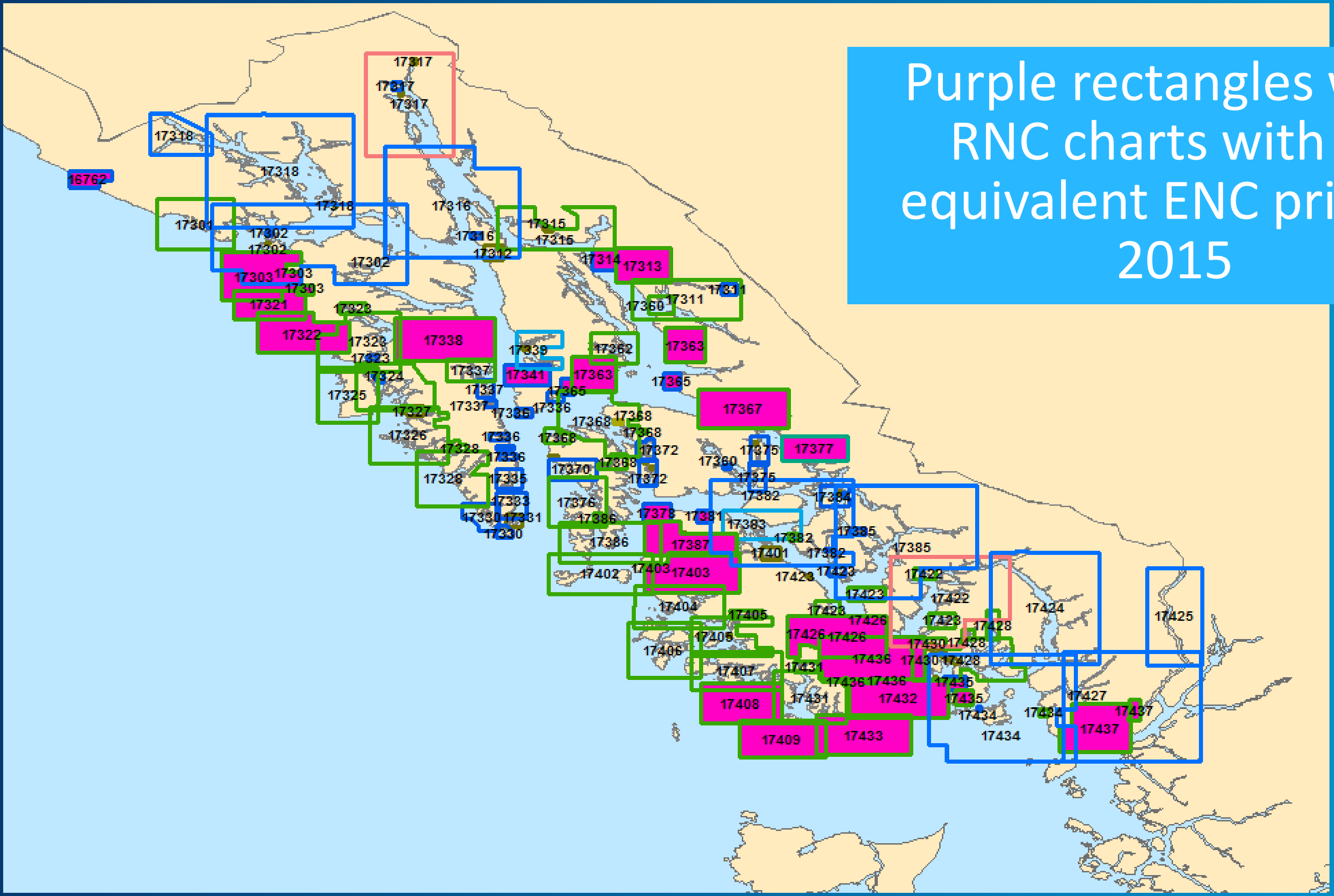
2015 ALASKA ELECTRONIC NAVIGATIONAL CHART PROJECT

301 new edition ENCs



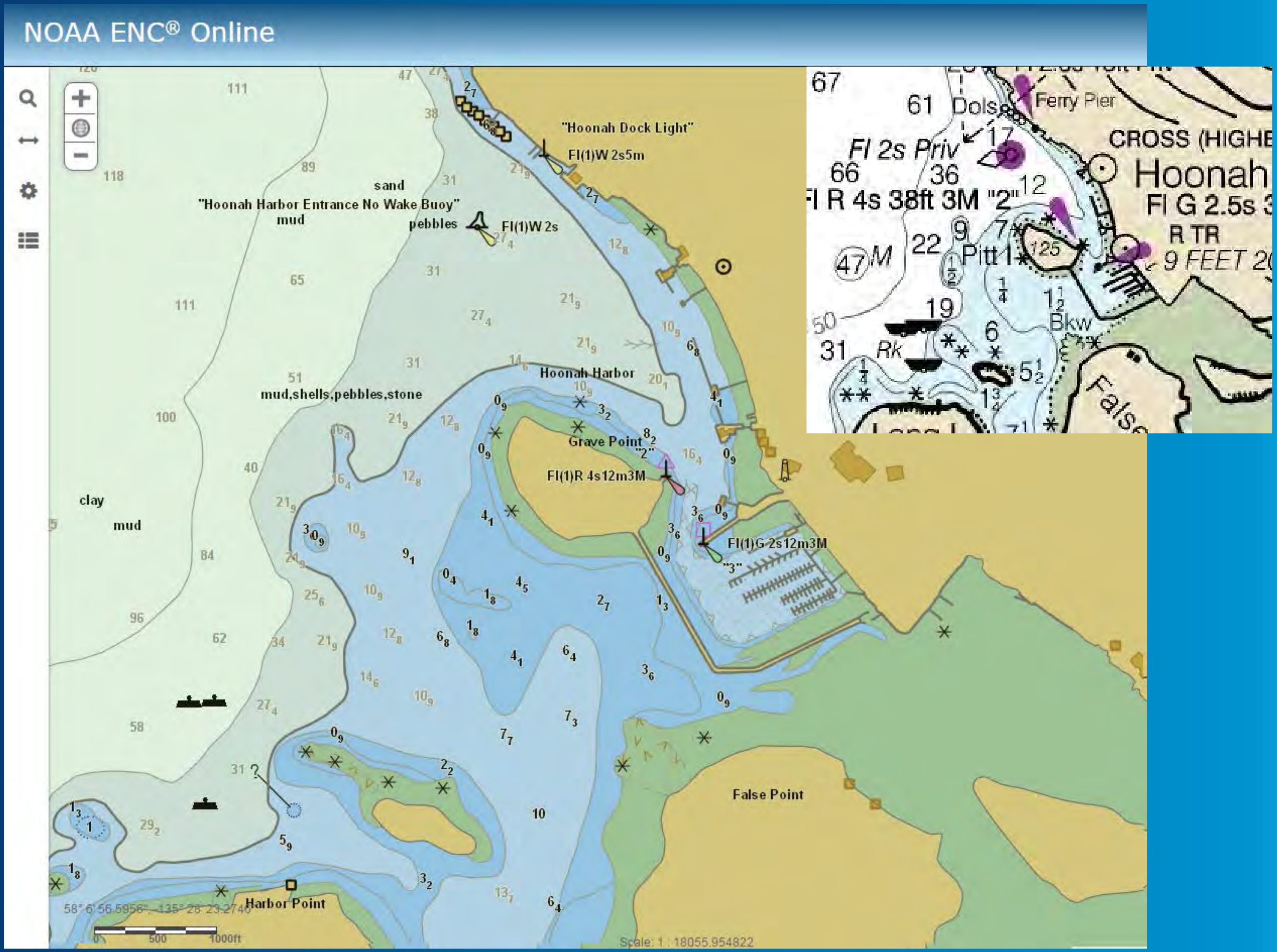
65 – 1st edition ENCs

Example: Southeast Alaska



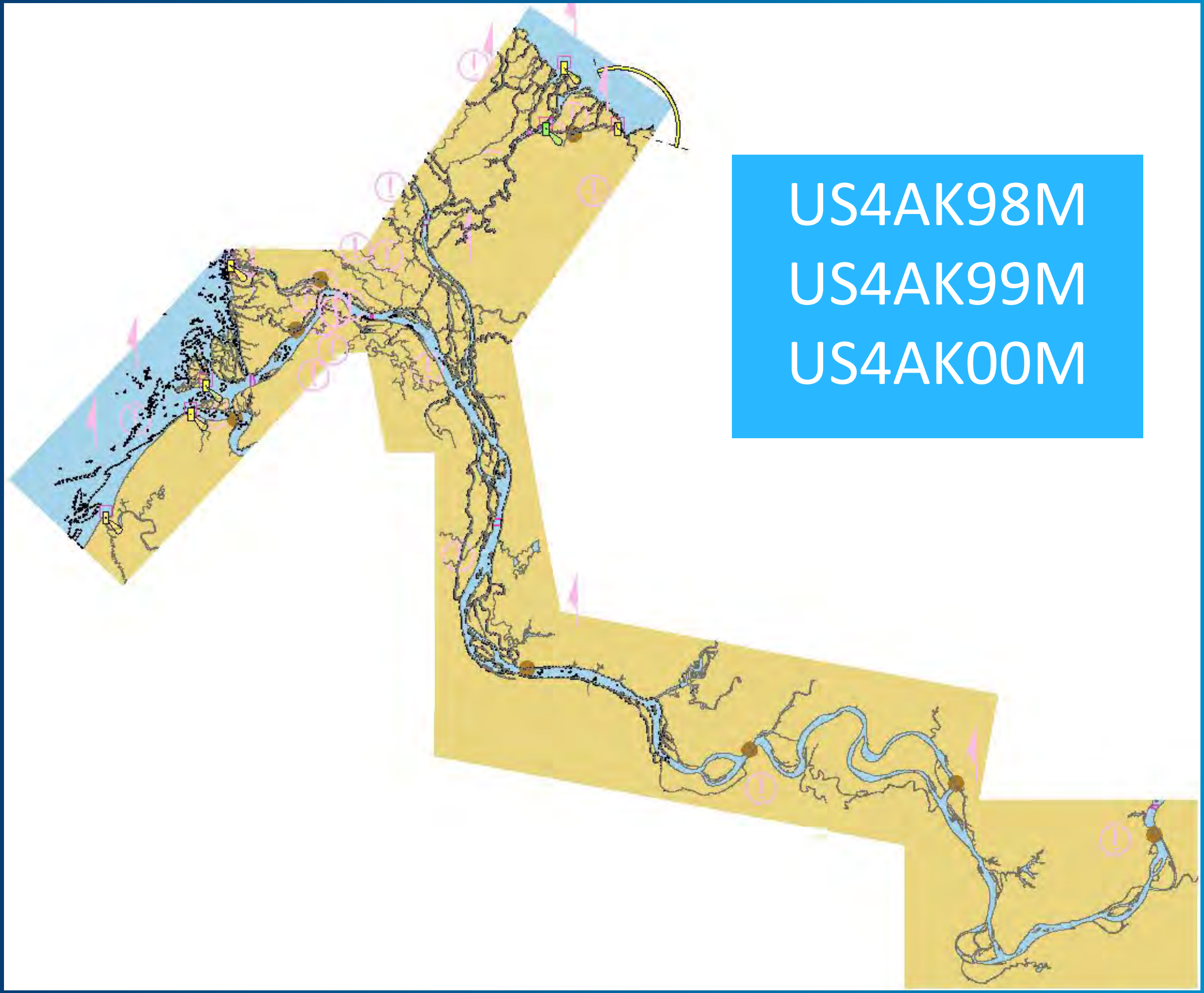
Purple rectangles were RNC charts with no equivalent ENC prior to 2015

Alaska charts are “ENC-first”



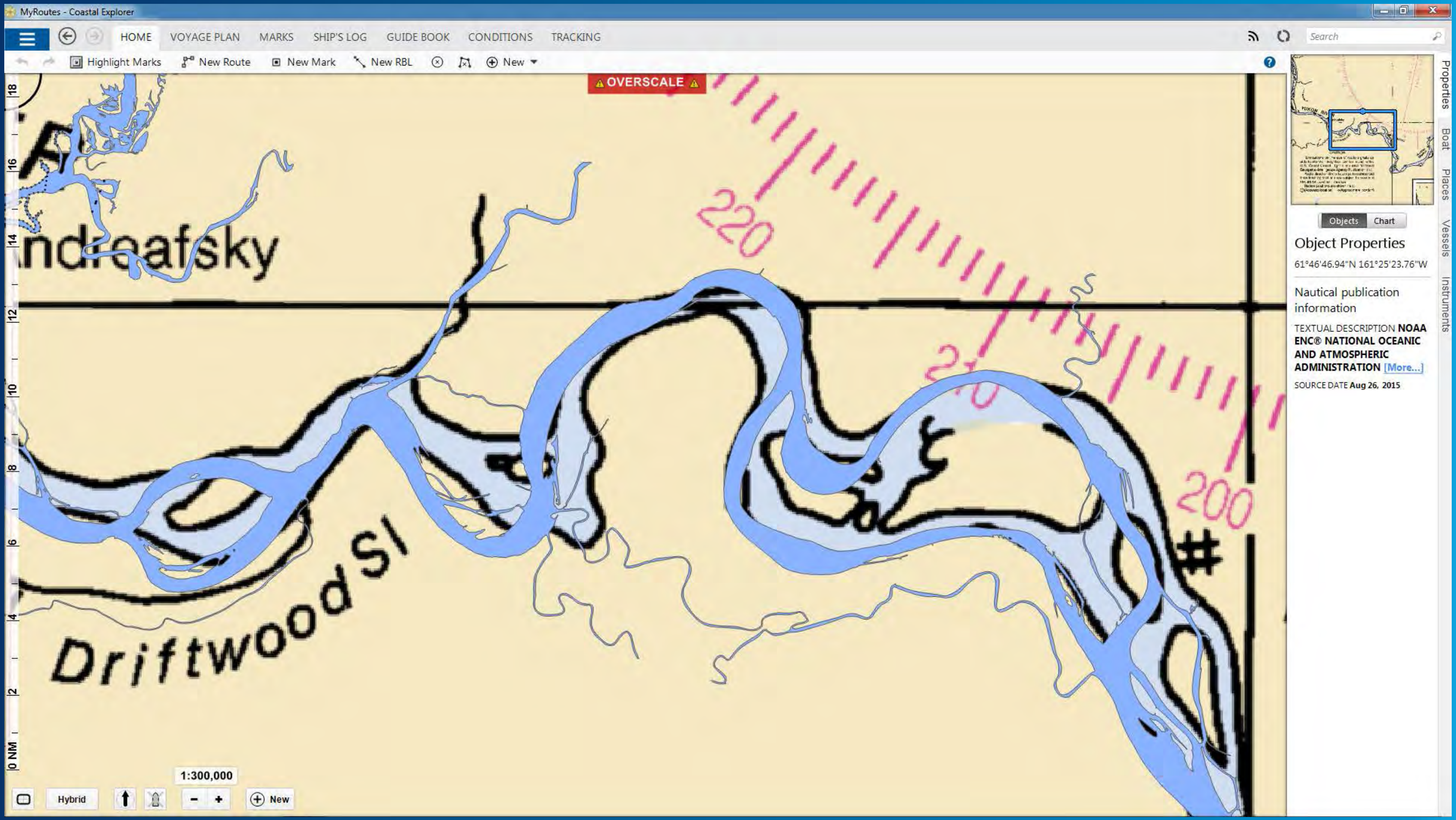
Andy Kampia, chief, Alaska Chart Production Branch ,

YUKON RIVER PROVISIONAL ENCS

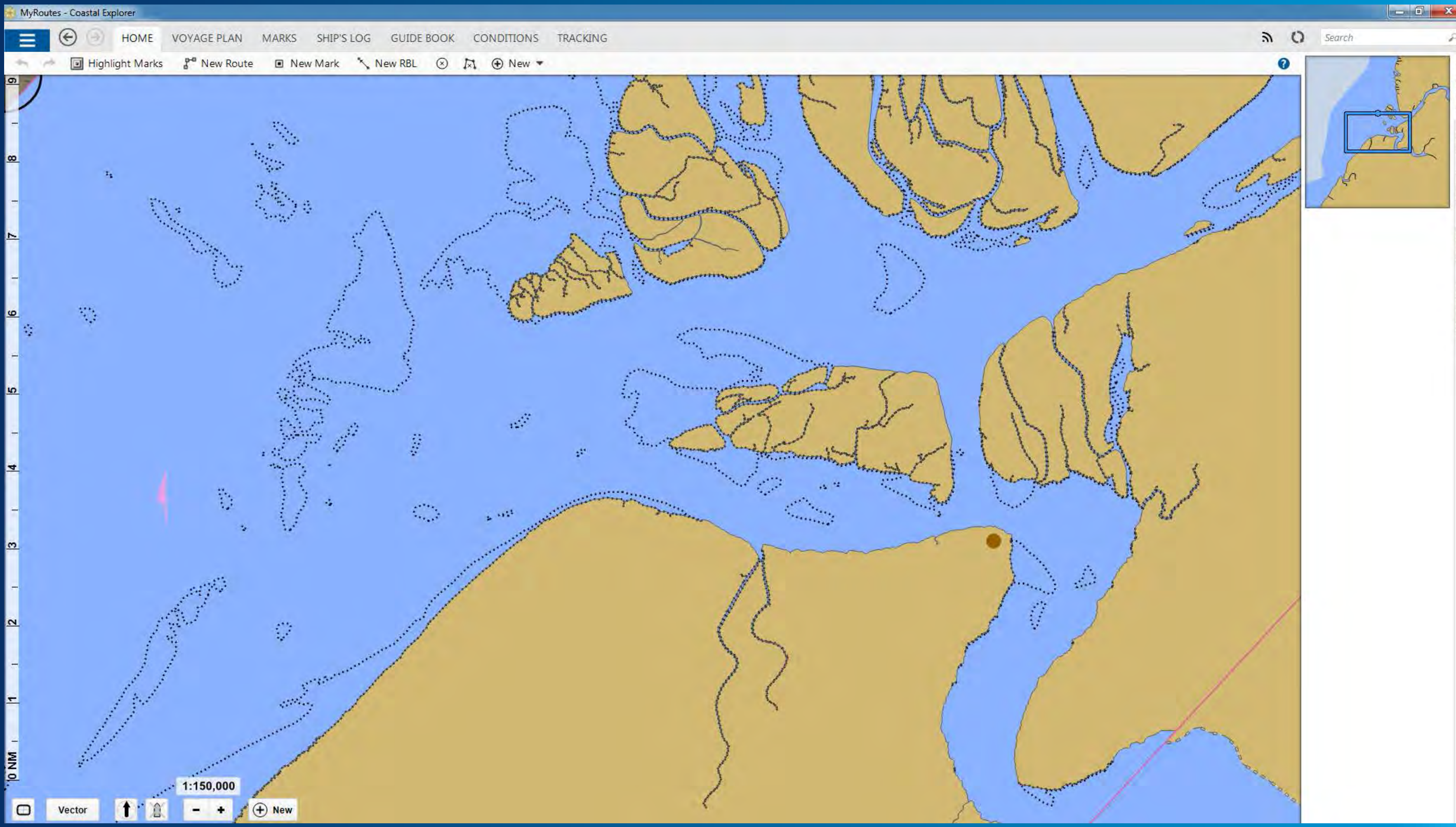


US4AK98M
US4AK99M
US4AK00M

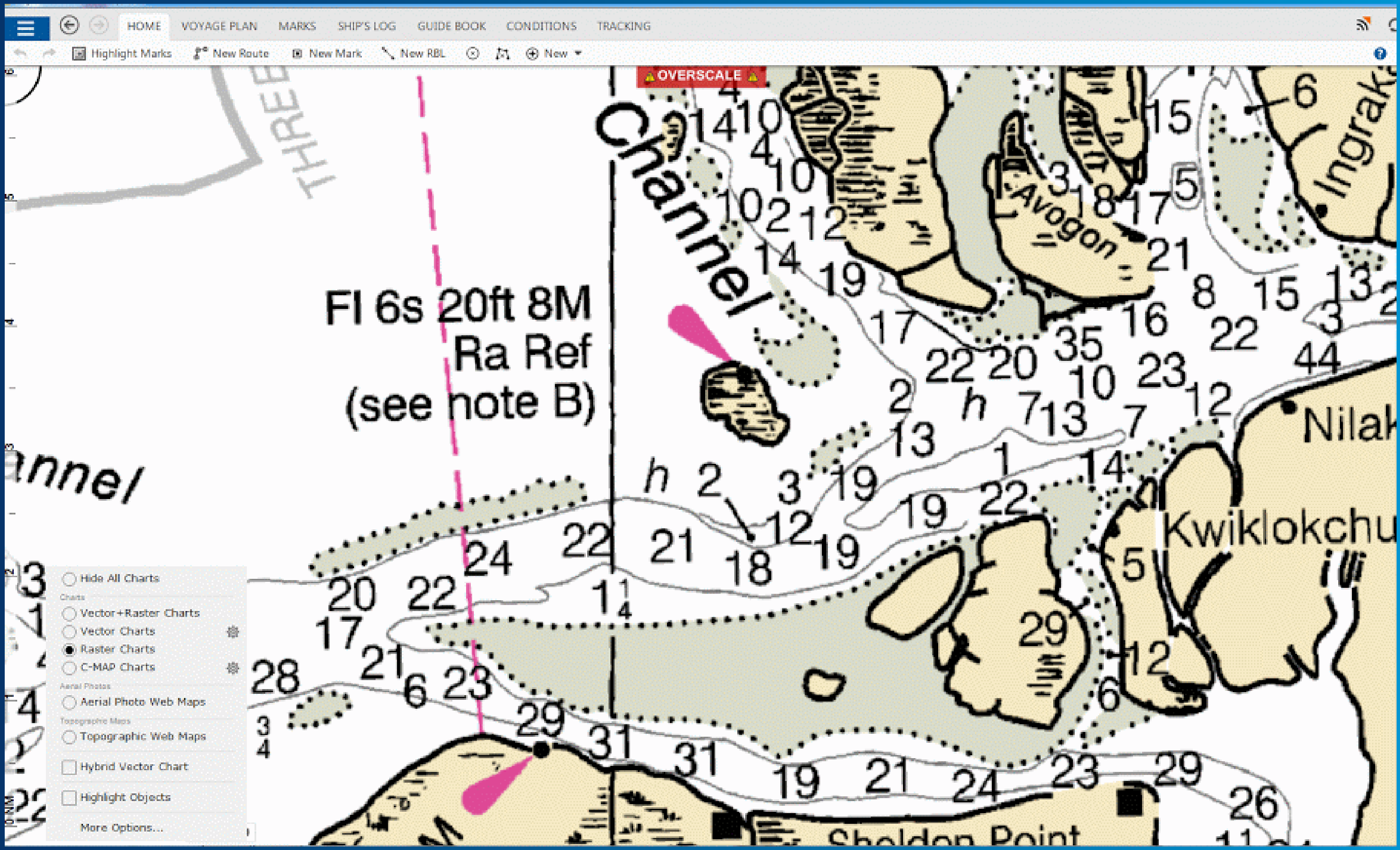
ENC depth areas over RNC (1:300,000)



Shoreline and obstruction areas



ENC vs raster (RNC)



Special notes

WARNING PROVISIONAL ENC

This ENC was constructed using the best data available. All or much of the shoreline, depths and shoals within this ENC are below customary quality, are not corrected for tides, nor based on a known sounding datum. All or much of the charted detail is highly changeable. Navigators should use this ENC with extreme caution.

SATELLITE DERIVED DEPTHS

Shoreline, depths, and obstruction areas within the area of this ENC are derived from satellite imagery from 2015. Their vertical accuracy is typically ± 2m. Uncharted dangers may exist.

Discussion

- Operators are using google earth for voyage planning in Alaska because it is better then what is available.
- Good survey work in western Kotzebue, but not satisfactory for commercial use on eastern side (fuel barges inland/upriver)

Discussion

- The use of non-traditional charting products (eg Yukon River Chart) could prove useful to the Alaska community - in particular tug/barge vessels serve isolated communities along rivers and lakes. Coast Survey and NGS could derive charting products from imagery and SDB to suit the needs of these communities. There is a change in usage - a need for nautical charts at larger scales in rivers - but this does not have to be a traditional chart.

Discussion

- Suggestions to acquire SDB at low water times. Rivers flow susceptible to glacial melt (look to USGS water height gauges) also likes fall imagery - look at 10 year river heights turbidity (erosion). Fall would have less turbidity; best time for being conservative. No longer have the deposits common during high water times.

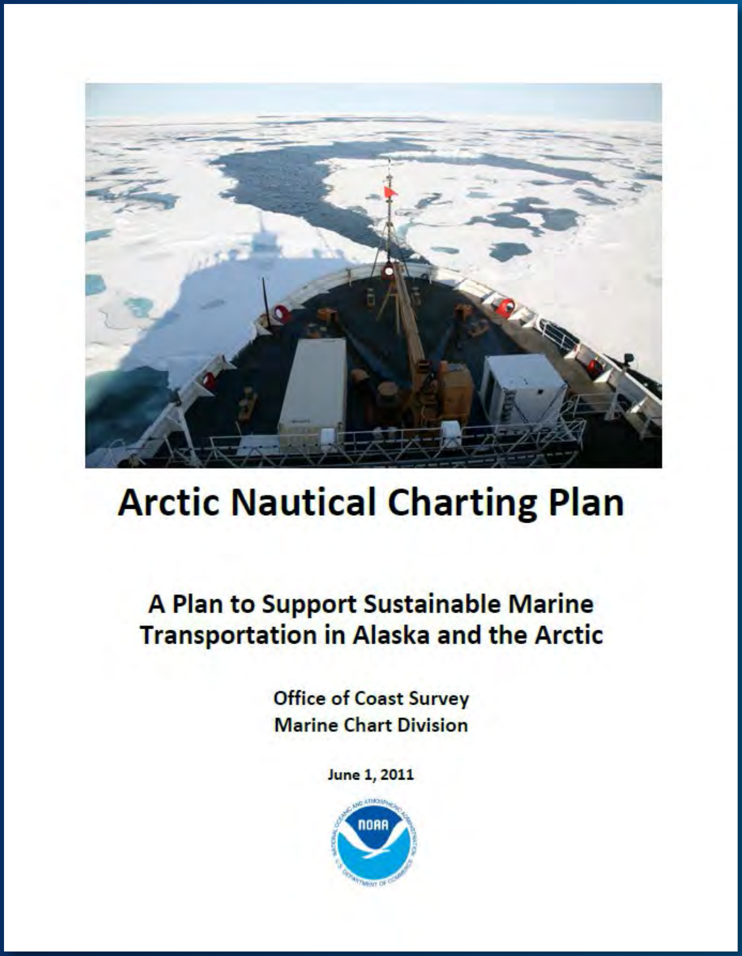
Discussion

- USACE Barge Landing Study 2009 – review to better understand criteria for determining landing sites and understand their risk management.
- Look into partnering / establishing relationship with AVTEC (https://avtec.edu/department/alaska-maritime-training-center) – ENCs
- Port Clarence area may become more commercially viable with the federal land transfer to the Bering Straits Native Corporation.
- Reminded of importance of surveying all around Nunivak Island, not just the Etolin Strait side.

Colby Harmon, Marine Chart Division

U.S. ARCTIC NAUTICAL CHARTING PLAN

First published June 2011

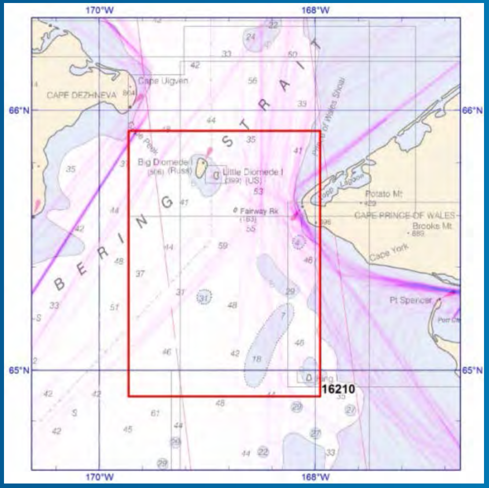

Arctic Nautical Charting Plan

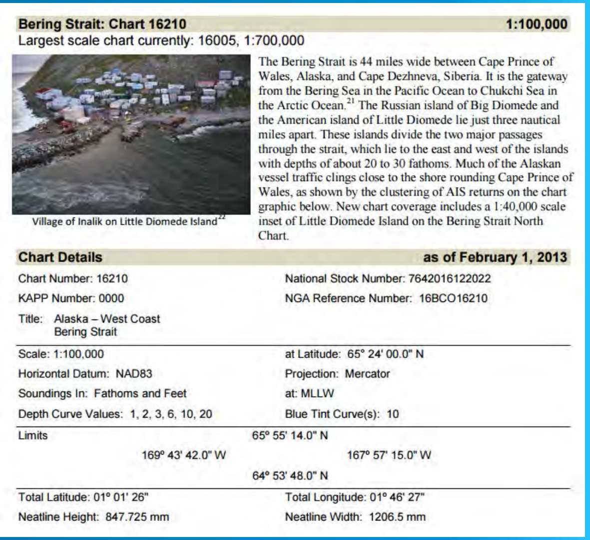
A Plan to Support Sustainable Marine Transportation in Alaska and the Arctic

Office of Coast Survey
Marine Chart Division

June 1, 2011

- Proposed 15 new charts
- For each new chart:
  - Image of footprint
  - Other chart details




Bering Strait: Chart 16210 **1:100,000**

Largest scale chart currently: 16005, 1:700,000

The Bering Strait is 44 miles wide between Cape Prince of Wales, Alaska, and Cape Dezhneva, Siberia. It is the gateway from the Bering Sea in the Pacific Ocean to Chukchi Sea in the Arctic Ocean.[21] The Russian island of Big Diomede and the American island of Little Diomede lie just three nautical miles apart. These islands divide the two major passages through the strait, which lie to the east and west of the islands with depths of about 20 to 30 fathoms. Much of the Alaskan vessel traffic clings close to the shore rounding Cape Prince of Wales, as shown by the clustering of AIS returns on the chart graphic below. New chart coverage includes a 1:40,000 scale inset of Little Diomede Island on the Bering Strait North Chart.

Village of Inalik on Little Diomede Island[22]

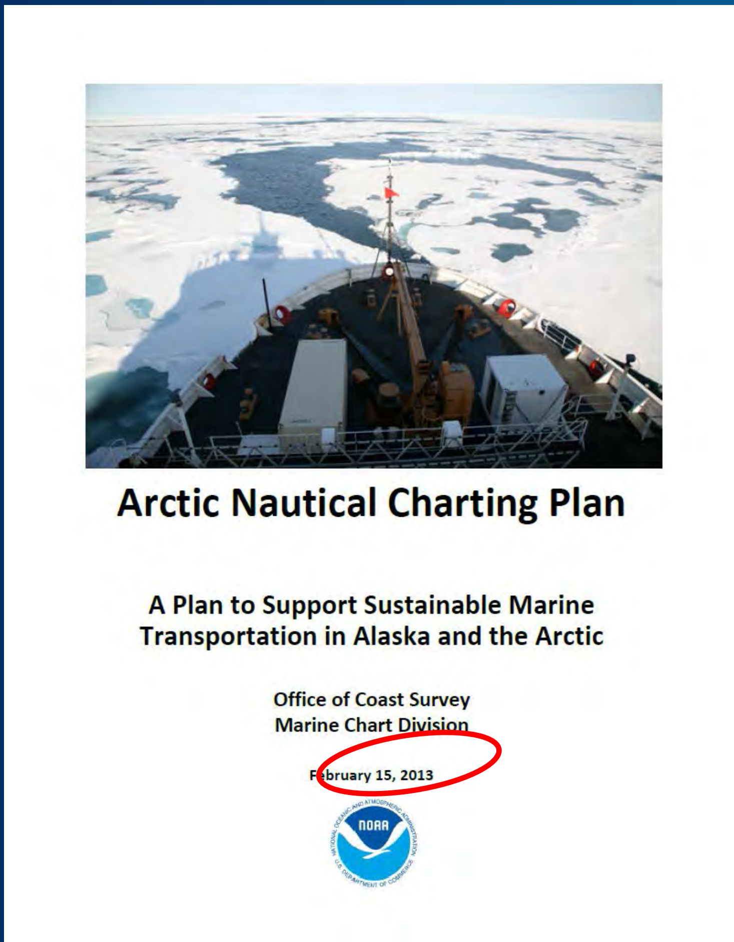
Chart Details **as of February 1, 2013**

Chart Number: 16210	National Stock Number: 7642016122022
KAPP Number: 0000	NGA Reference Number: 16BCO16210
Title: Alaska – West Coast Bering Strait	
Scale: 1:100,000	at Latitude: 65° 24' 00.0" N
Horizontal Datum: NAD83	Projection: Mercator
Soundings In: Fathoms and Feet	at: MLLW
Depth Curve Values: 1, 2, 3, 6, 10, 20	Blue Tint Curve(s): 10

Limits
65° 55' 14.0" N
169° 43' 42.0" W 167° 57' 15.0" W
64° 53' 48.0" N

Total Latitude: 01° 01' 26"	Total Longitude: 01° 46' 27"
Neatline Height: 847.725 mm	Neatline Width: 1206.5 mm

First plan revision: February 2013


Arctic Nautical Charting Plan

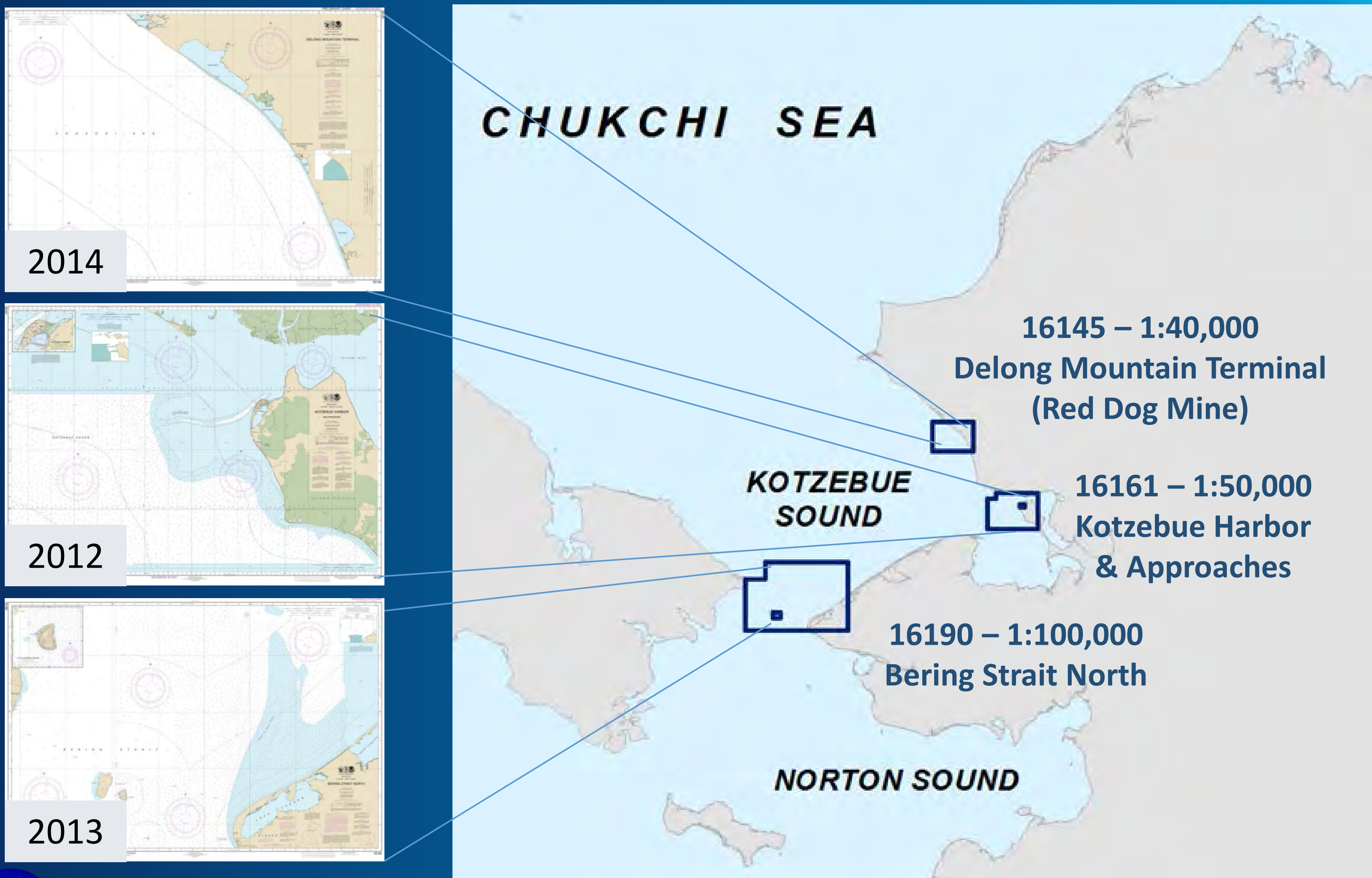
A Plan to Support Sustainable Marine Transportation in Alaska and the Arctic

Office of Coast Survey
Marine Chart Division

February 15, 2013

- Kotzebue Harbor & Approaches
  - Scale 1:30K -> 1:50K
  - Extended coverage to SW
  - Added Cape Blossom inset

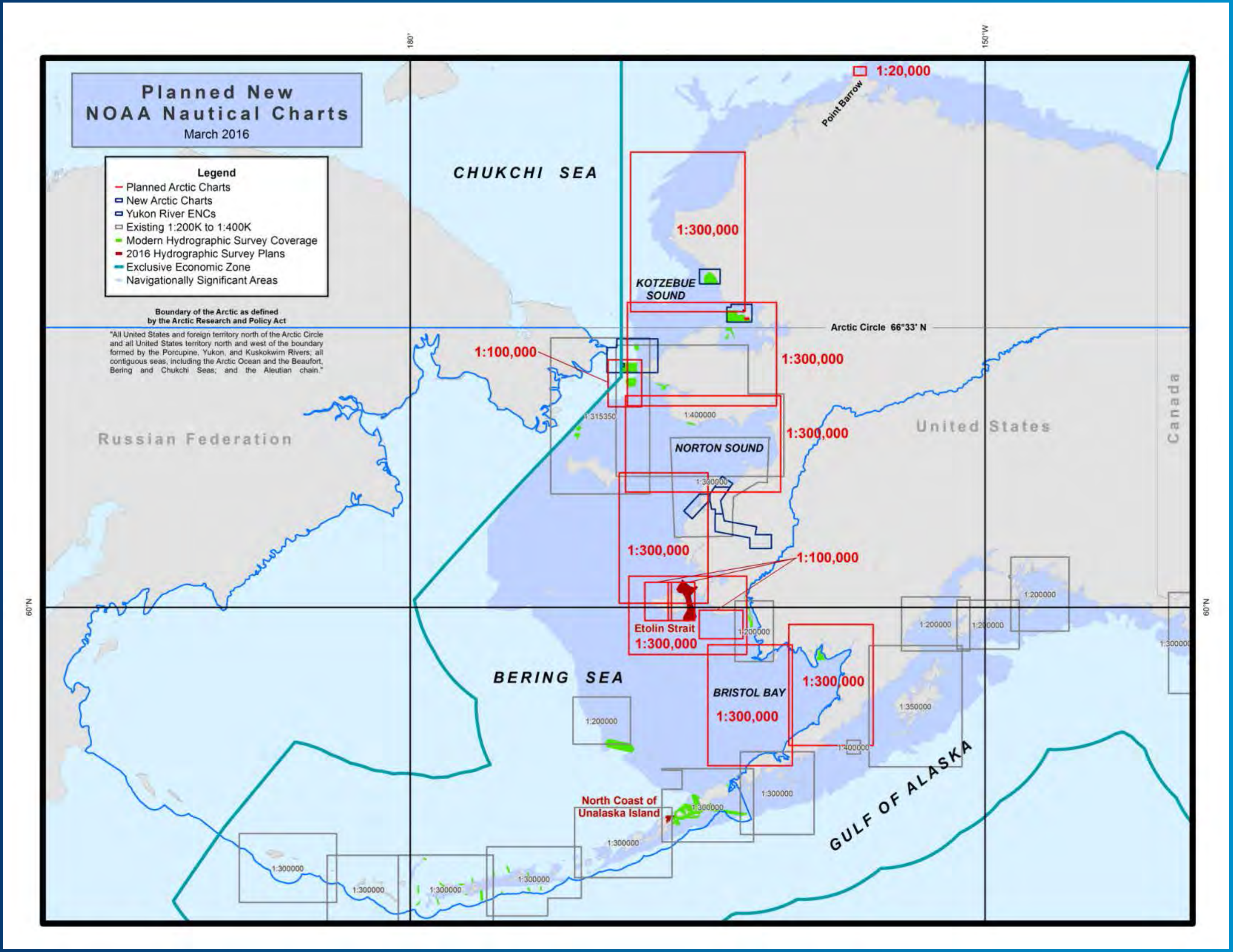
Three charts published



Current plan revision

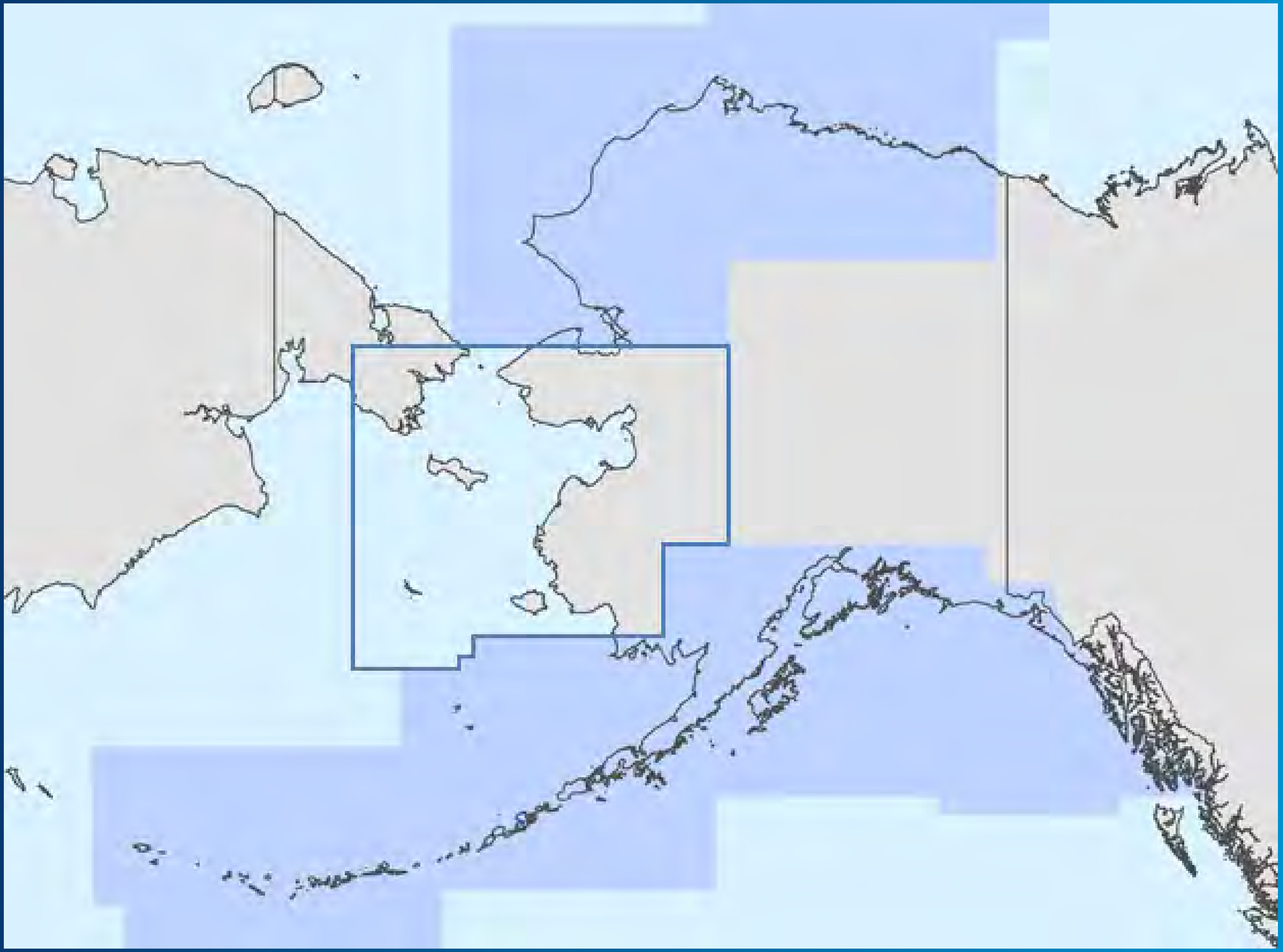
- Draft published June 2015
  - Federal Register request for public comments through Oct 1, 2015
    - 13 comments received
  - Revised coastal (1:300K-400K) chart scheme
  - Moved some charts eastward to close gaps
  - Considering changes in Etolin Strait

Coast Survey will release finalized version of this 3rd revision in the summer of 2016



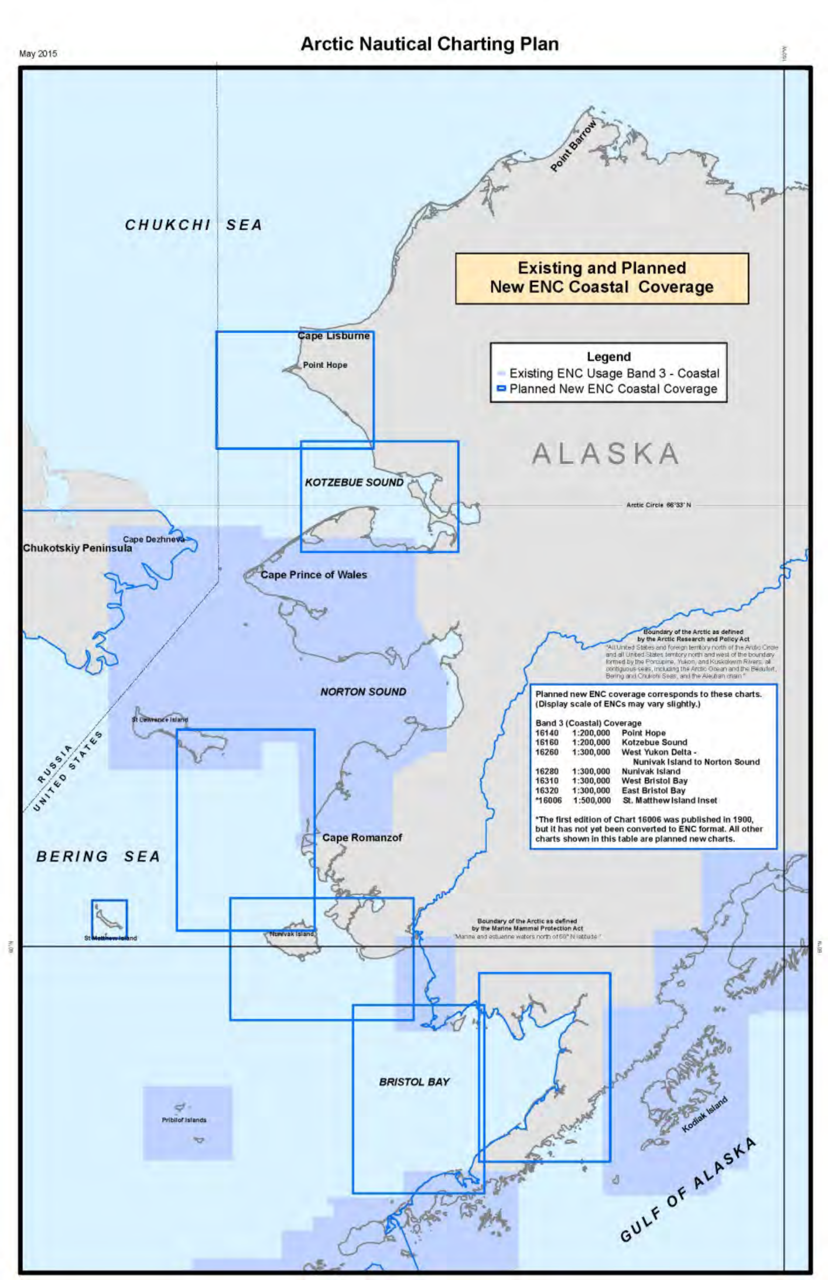
Planned New
NOAA Nautical Charts
March 2016
Legend
Planned Arctic Charts
New Arctic Charts
Yukon River ENCs
Existing 1:200K to 1:400K
Modern Hydrographic Survey Coverage
2016 Hydrographic Survey Plans
Exclusive Economic Zone
Navigationally Significant Areas
Boundary of the Arctic as defined
by the Arctic Research and Policy Act
"All United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain."
180°
150°W
60°N
CHUKCHI SEA
BERING SEA
GULF OF ALASKA
Russian Federation
United States
Canada
Point Barrow
1:20,000
1:300,000
KOTZEBUE SOUND
Arctic Circle 66°33' N
1:100,000
1:300,000
1:315350
1:400000
1:300,000
NORTON SOUND
1:300000
1:300,000
1:100,000
Etolin Strait
1:300,000
1:200000
BRISTOL BAY
1:300,000
1:300,000
1:350000
1:400000
1:200000
1:200000
1:200000
1:300000
1:200000
North Coast of Unalaska Island
1:300000
1:300000
1:300000
1:300000
1:300000
1:300000
1:300000

ENC Band 2 (General) 1:350,000 – 1:1,500,000



ENC Band 3 (Coastal)

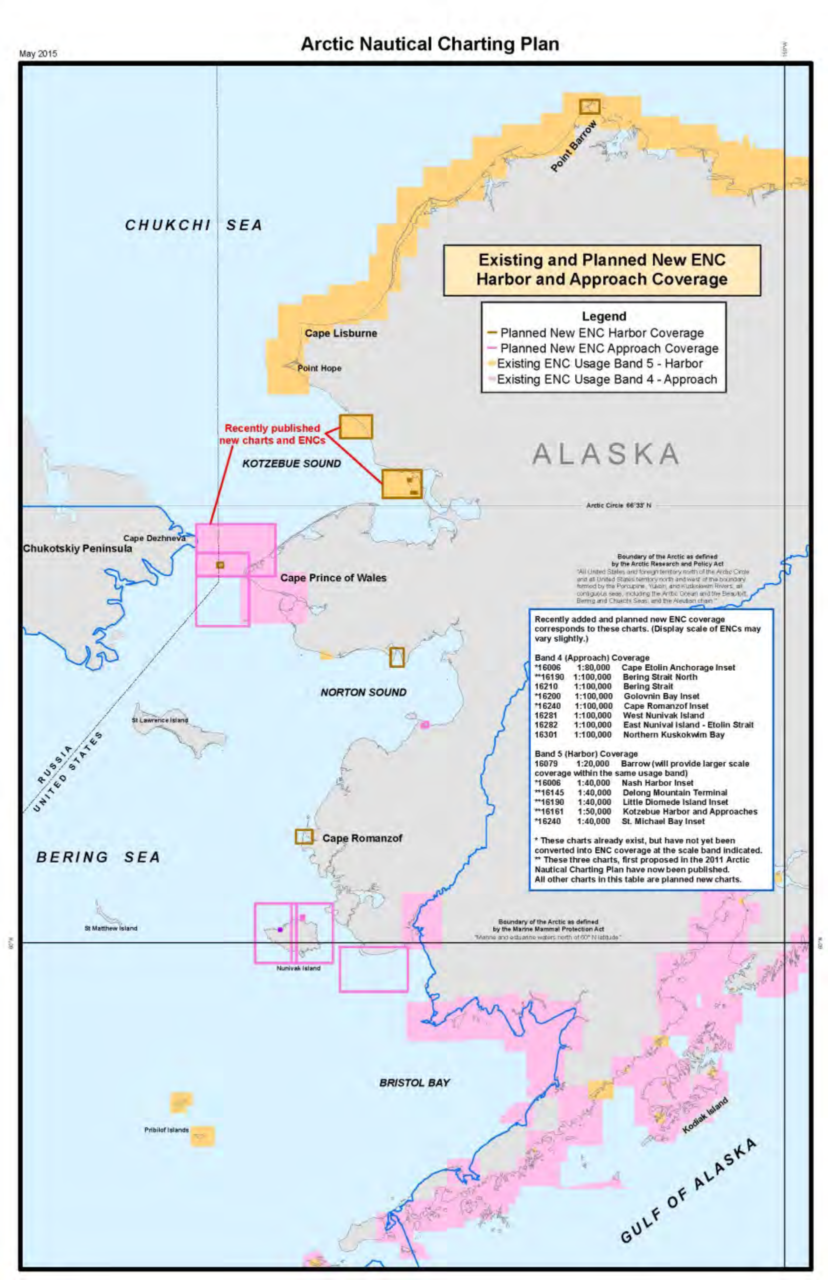
Band 3
1:90,000 – 1:350,000



ENC Band 4 & 5

Band 4 (Approach)
1:22,000 – 1:90,000

Band 5 (Harbor)
1: 4,000 – 22,000



Internet link for the plan

http://www.nauticalcharts.noaa.gov/mcd/docs/Arctic_Nautical_Charting_Plan.pdf

or

An internet search for
"Arctic Nautical Charting Plan"
will usually show the link above as the first result

Discussion

- Illiamna Lake chart - new chart request. Satellite Imagery potential - only care about rocks and shoals.
- Kvichak River and other inland rivers?

Rachel Medley, chief, Customers Affairs Branch

U.S. ARCTIC VOYAGE PLANNING GUIDE

U.S. ARCTIC VOYAGE PLANNING GUIDE

Home

Important Notice | This Guide | Partners and Authorities | Feedback

Navigation in the Arctic region should be considered dangerous.

This Mariner's Voyage Planning Guide must be kept up to date using the latest applicable notice to Mariners that are available. This Guide does not replace information contained in critical nautical charts and other official nautical publications published by services on the authority of national Governments.

Masters should carefully and in good time plan their passage through Arctic waters, making use of navigational charts of sufficiently large scale and with enough detail to ensure the safety of navigation. The latest edition of nautical charts and publications must be used.

The International Maritime Organization is developing a Polar Code that should be consulted for recommended practices for navigating in polar waters. The Polar Code will be finalized in May and enter into force on January 1, 2017.

Disclaimer: The information provided is intended to consolidate information helpful in planning an Arctic voyage, but should not be relied upon exclusively. All relevant information sources should be consulted and all applicable international, national, and state/local (if any) requirements must be adhered to.

Emergency Information
Geography of US Arctic
Navigation
Regulations & Requirements
Weather & Ice

http://www.nauticalcharts.noaa.gov/avpg

or search for "NOAA AVPG"

Discussion

- AVPG ideas: Add Cell phone coverage maps and add VHF channel or other methods of preferred communications for mariners to contact the smaller native villages.
- Pilotage
- Arctic clean seas
- SAR agreement
- Marine exchange of AK
- What channels are used by native villages?

Discussion

- What channels are used by native villages?
- Protected species / regulations
- Are there any active captain-like resources that AK uses?
- Show seasonal assets, such as USCG in Barrow
- NASA world view imagery
- Google-Earth Engine
- American Waterway Operators
- National Association of Maritime Organizations

nautical charts.noaa.gov

Blogging at noaanauticalcharts.wordpress.com

Twitter @NOAAcharts

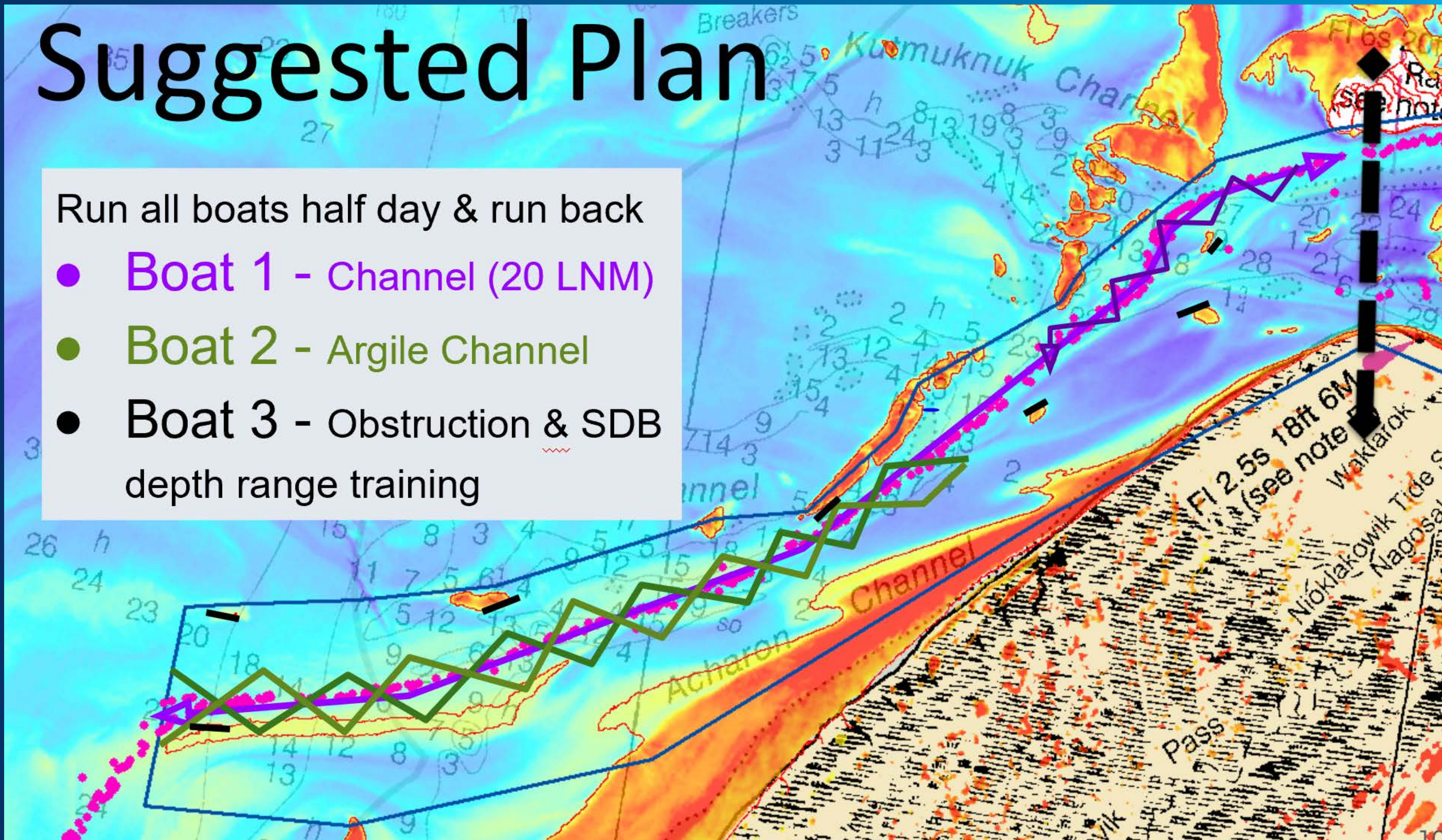
Facebook at NOAA Charts

Yukon River Recon

Suggested Plan

Run all boats half day & run back

- Boat 1 - Channel (20 LNM)
- Boat 2 - Argile Channel
- Boat 3 - Obstruction & SDB depth range training



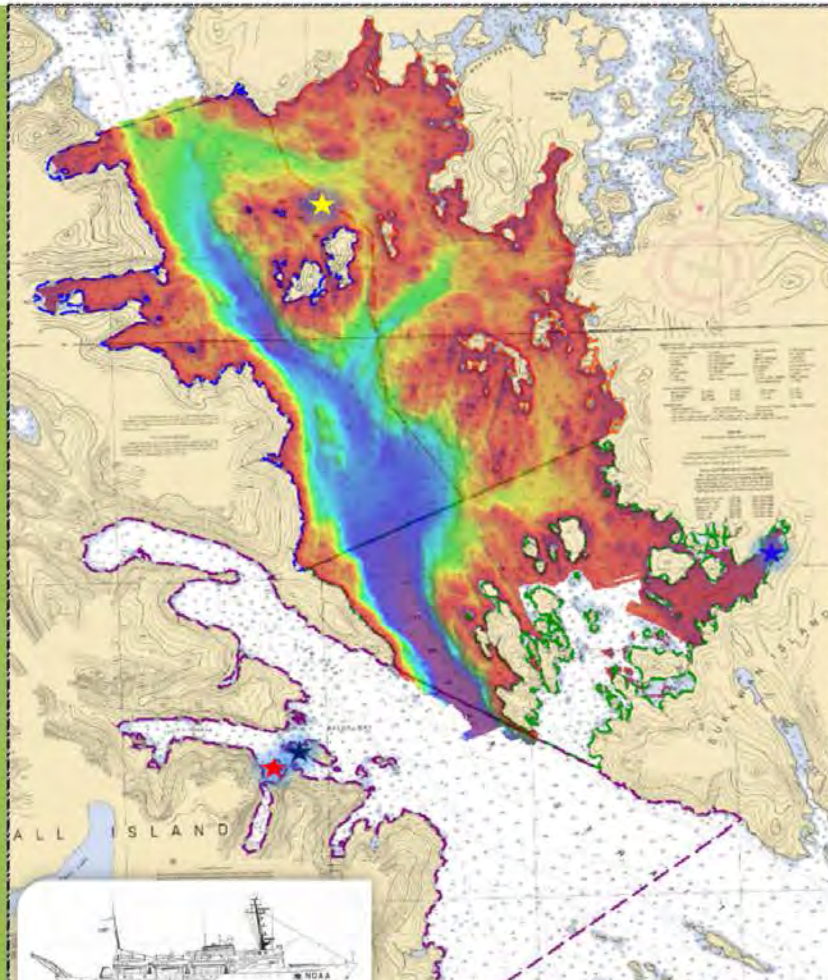
West Of Prince of Wales Is Survey

6/12/2016

NOAA Ship Fairweather (S220)

Legend

- -> Windy Cove Tide Gauge
- -> Sentinels HORCON Station
- -> Baldy Bay HORCON Station
- -> Dunbar Inlet GPS Tide Buoy



OPR-O190-FA-16 West Prince Of Wales

Sheet	Sheet manager	Sheet #	Start ACQ	End ACQ
H12865	Fifield	1	9-May-16	11-Jun-16
	X-line LNM	MS LNM	Ping-- (h:mm)	Calendar Days
	24.91	294.56	57:34	9.00
MS:	Complete		Bottom Samples:	Complete
Shoreline Acquisition:		Complete	% Complete:	100%
SNM:	18.93	# of BS:	9	

Sheet	Sheet manager	Sheet #	Start ACQ	End ACQ
H12880	Sharr	2	8-May-16	11-Jun-16
	X-line LNM	MS LNM	Ping-- (h:mm)	Calendar Days
	20.52	483.30	89:26	14.00
MS:	Complete		Bottom Samples:	Complete
Shoreline Acquisition:		Complete	% Complete:	100%
SNM:	17.38	# of BS:	11	

Sheet	Sheet manager	Sheet #	Start ACQ	End ACQ
H12881	Marcus	3	9-May-16	
	X-line LNM	MS LNM	Ping-- (h:mm)	Calendar Days
	8.96	280.93	52:30	9.00
MS:	Incomplete		Holidays/Bottom Samples:	Incomplete
Shoreline Acquisition:		Complete	% Complete:	100%
SNM:	0	# of BS:	0	

Sheet	Sheet manager	Sheet #	Start ACQ	End ACQ
H12882	Eykelhoff	4		
	X-line LNM	MS LNM	Ping-- (h:mm)	Calendar Days
	1.49	34.25	4:02	1.00
MS:	Incomplete		Holidays/Bottom Samples:	Incomplete
Shoreline Acquisition:		Not Started	% Complete:	0%
SNM:	0	# of BS:	0	

Project Totals

LNM	Start ACQ	End ACQ	Ping-- (h:mm)	Calendar Days
1,148.91	8-May-16		203:33	20.00
SNM:	36.31	# of BS:	20	

Field Season Totals

LNM	Start ACQ	End ACQ	Ping-- (h:mm)	SNM
1,148.91	8-May-15		203:33	36.31

Ship Total Distance Run from Start of Season:	2,193.15
Ship Total Distance Run from start of project:	2,193.15

"Building and Preserving Alaska's Future"

Alaska Coastal Mapping Summit
Girdwood, Alaska
June 14 2016

Thomas Sloan
Chief Geomatics Section
Alaska District
U.S. Army Corps of Engineers

®

US Army Corps of Engineers
BUILDING STRONG®

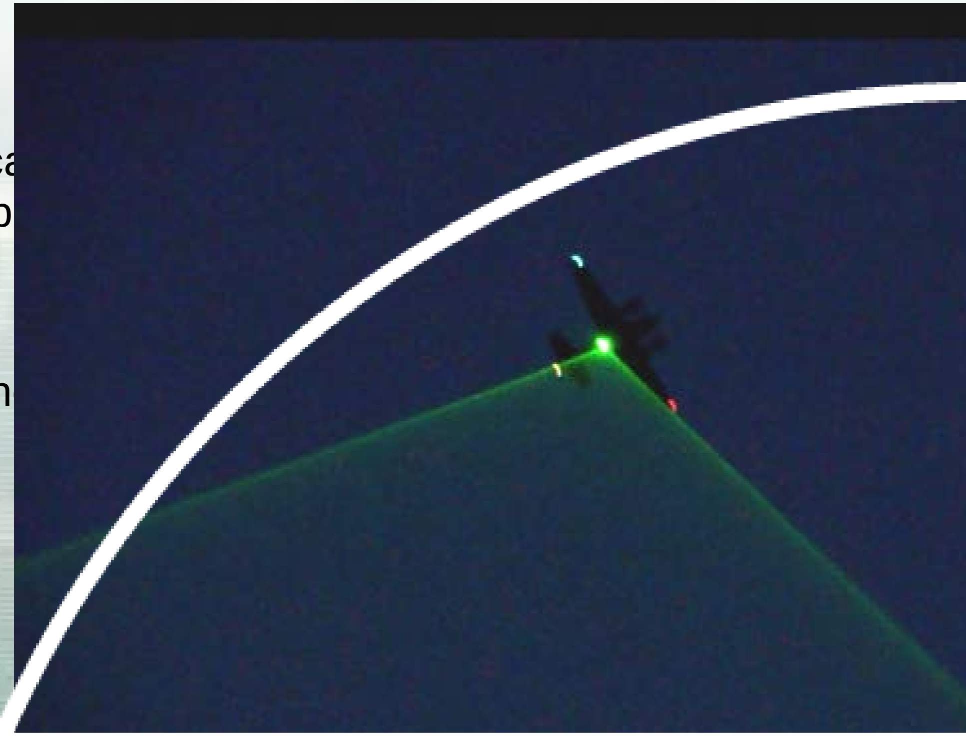
COASTAL & HYDRAULICS LABORATORY

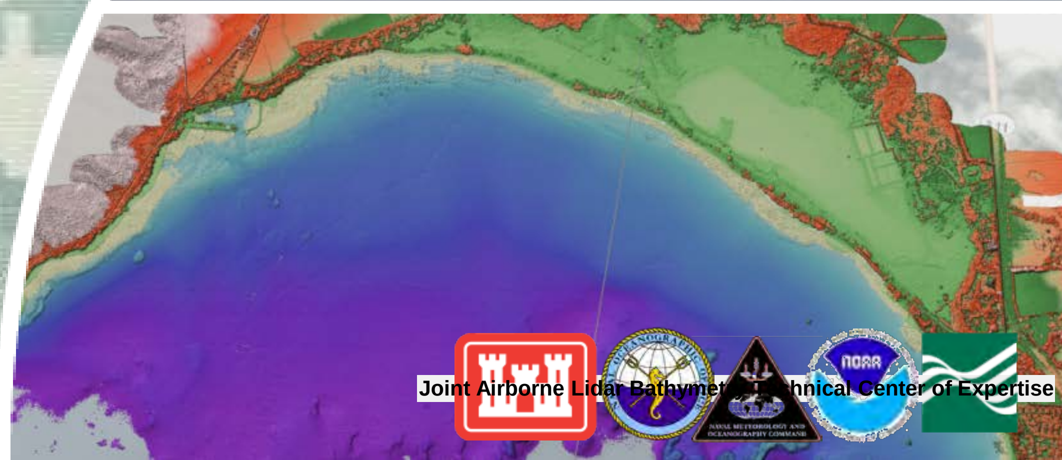
JALBTCX in Alaska

Jennifer M. Wozencraft
Director, Joint Airborne Lidar Bathymetry Technica
Program Manager, USACE National Coastal Map

Chris Macon
Technical Lead, USACE National Coastal Mappin

6 June 2016





US Army Corps of Engineers
BUILDING STRONG®

ERDC
Engineer Research and
Development Center

Joint Airborne Lidar Bathymet
hnical Center of Expertise

Joint Airborne Lidar Bathymetry Technical Center of Expertise

Annual Technical Workshop, 14-16 June 2016

OPERATIONS

Aircraft

Surveys

Procedures

People

Hardware

Software

RESEARCH AND DEVELOPMENT

Algorithms

Data exploitation

Optech

US Army Corps of Engineers MOBILE DISTRICT

CCOM JHC

US Army Corps of Engineers® Engineer Research and Development Center

NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND

NORTHROP GRUMMAN

CB&I

Kenn Borek Air Ltd. Anytime, Anywhere ... Worldwide

NOAA

USGS science for a changing world

ONR Office of Naval Research

AIRBORNE IMAGING

itres

Dynamic Aviation

FUGRO

MAGNOLIA river

UNIVERSITY OF NOTRE DAME

Bowhead

AHAB Airborne Hydrography AB

Pelydryn

TEXAS A&M UNIVERSITY

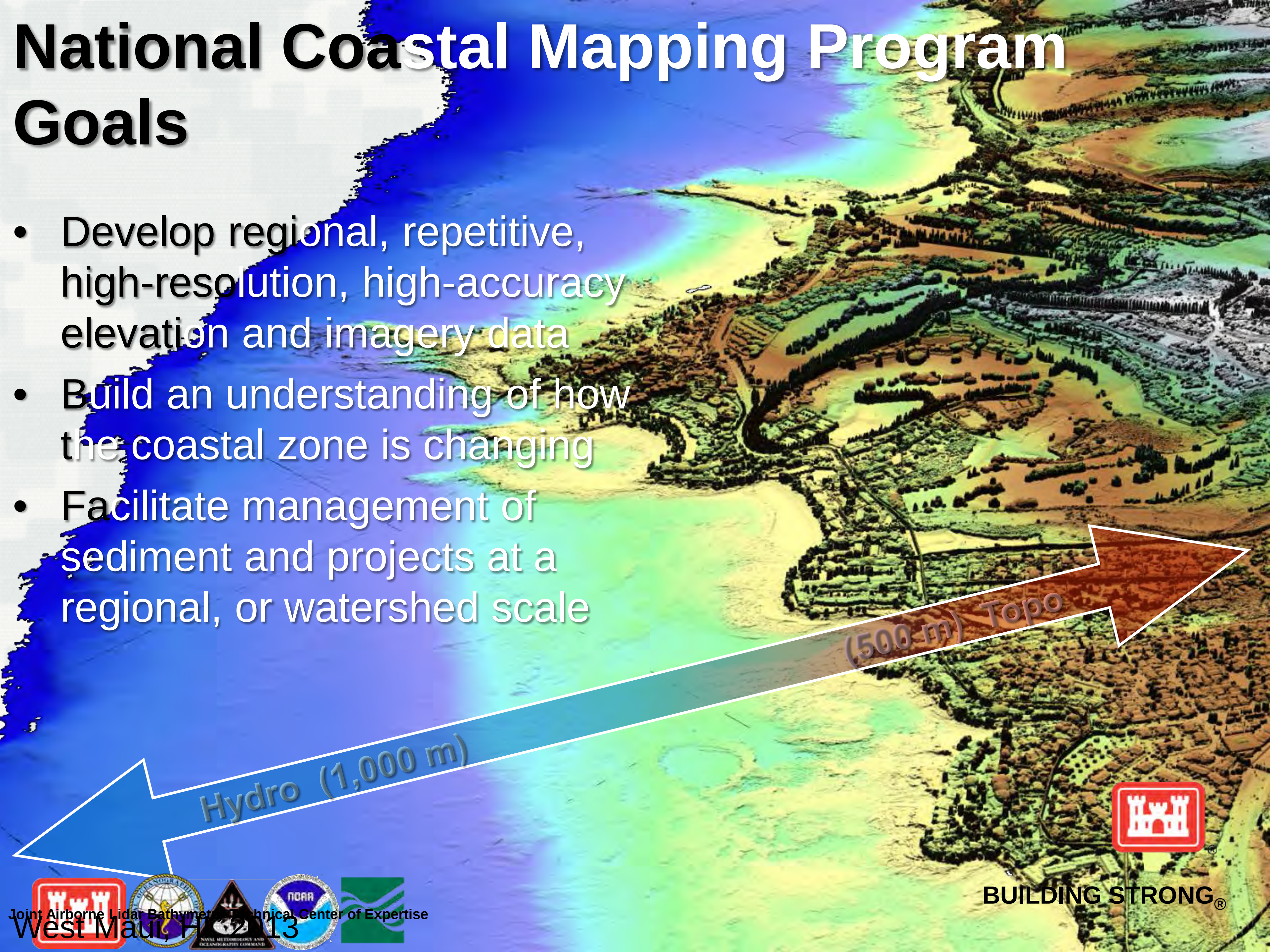
UNIVERSITY of NEW HAMPSHIRE

BUILDING STRONG®

GEOMATICS DATA SOLUTIONS

National Coastal Mapping Program Goals

- Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
- Build an understanding of how the coastal zone is changing
- Facilitate management of sediment and projects at a regional, or watershed scale

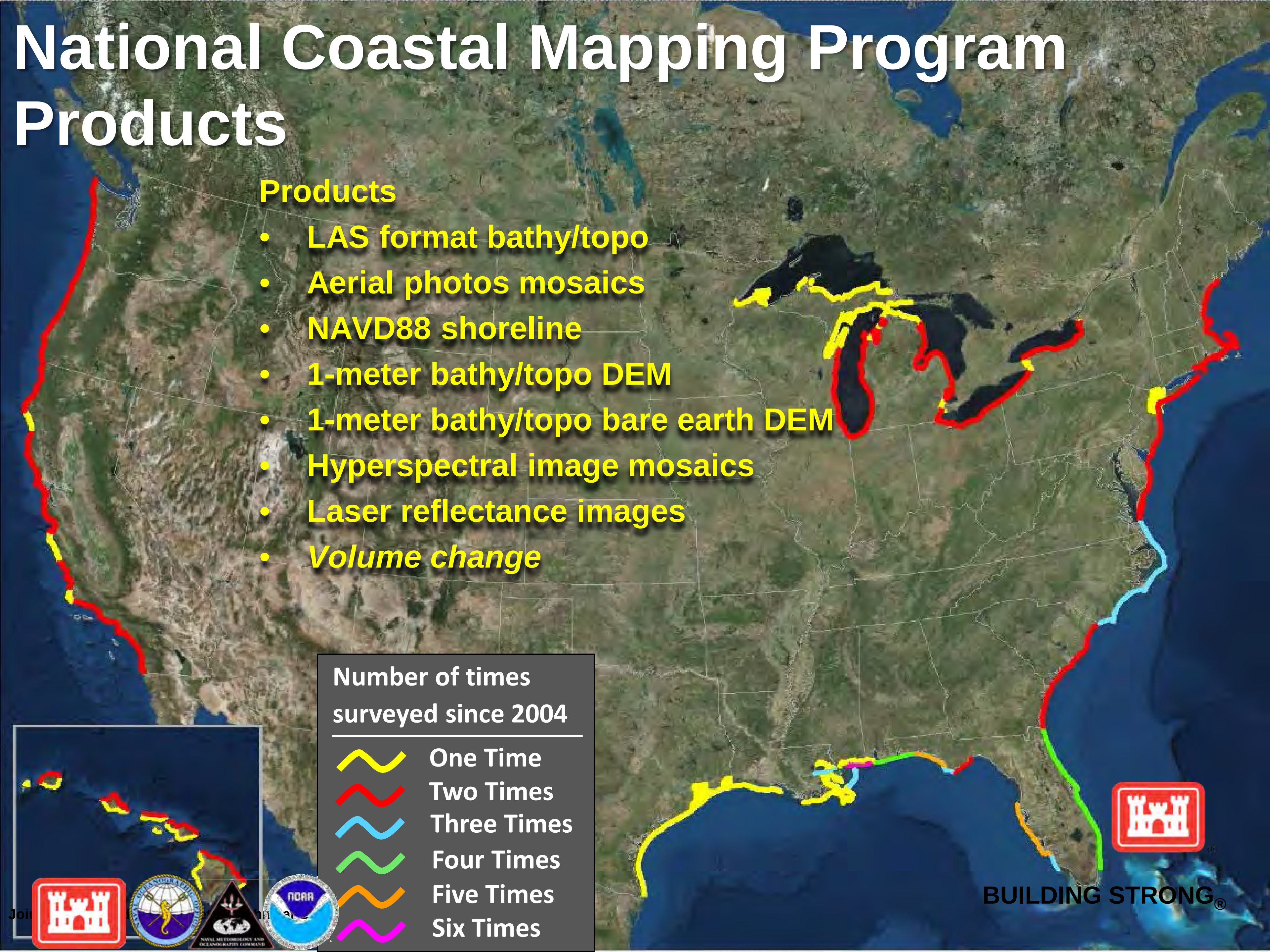


West Maui, HI 2013

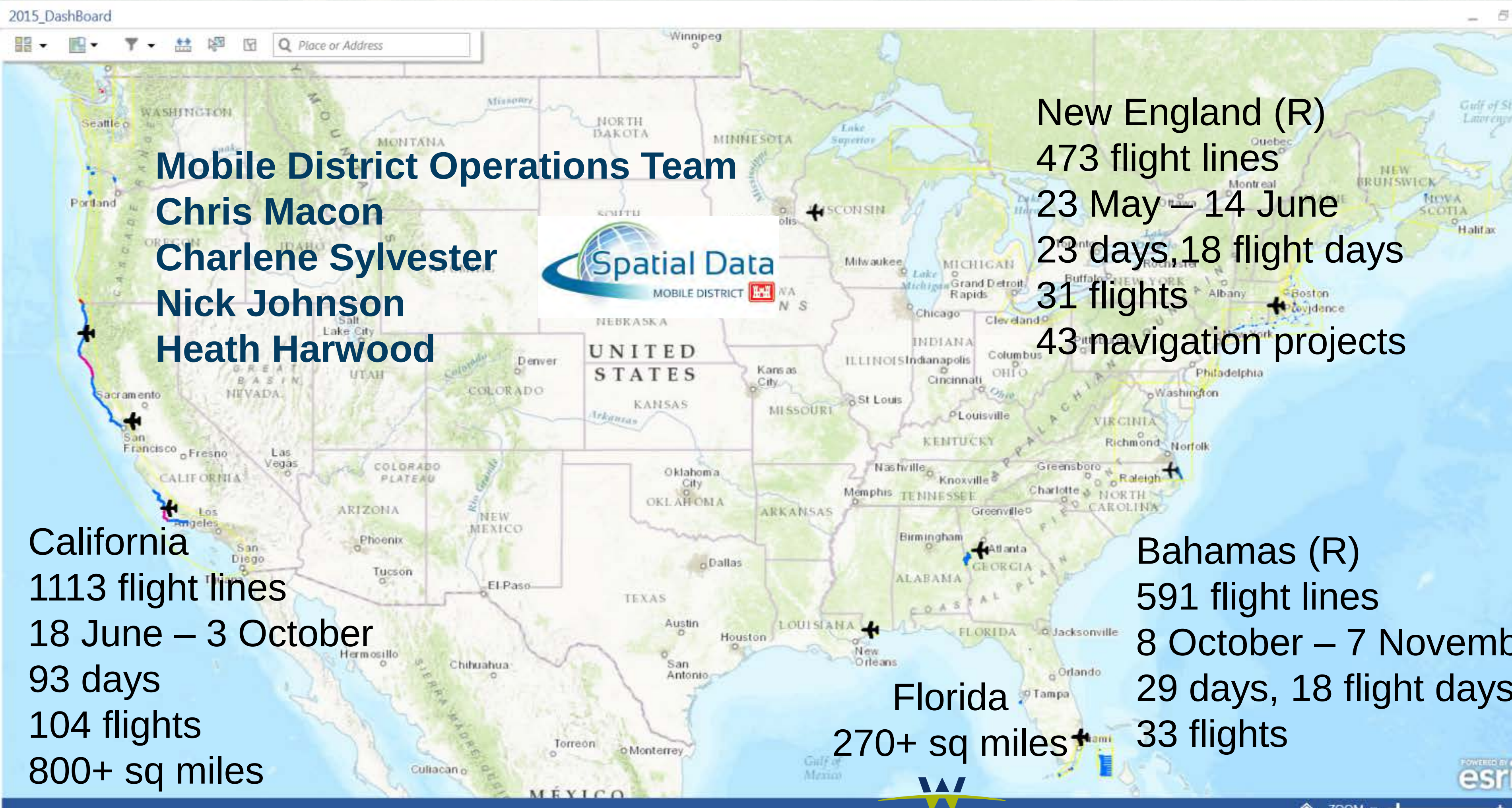
National Coastal Mapping Program Products

Products

- **LAS format bathy/topo**
- **Aerial photos mosaics**
- **NAVD88 shoreline**
- **1-meter bathy/topo DEM**
- **1-meter bathy/topo bare earth DEM**
- **Hyperspectral image mosaics**
- **Laser reflectance images**
- ***Volume change***



2015 JALBTCX Survey Season



Mobile District Operations Team
Chris Macon
Charlene Sylvester
Nick Johnson
Heath Harwood

Spatial Data
MOBILE DISTRICT

New England (R)
473 flight lines
23 May – 14 June
23 days,18 flight days
31 flights
43 navigation projects

California
1113 flight lines
18 June – 3 October
93 days
104 flights
800+ sq miles

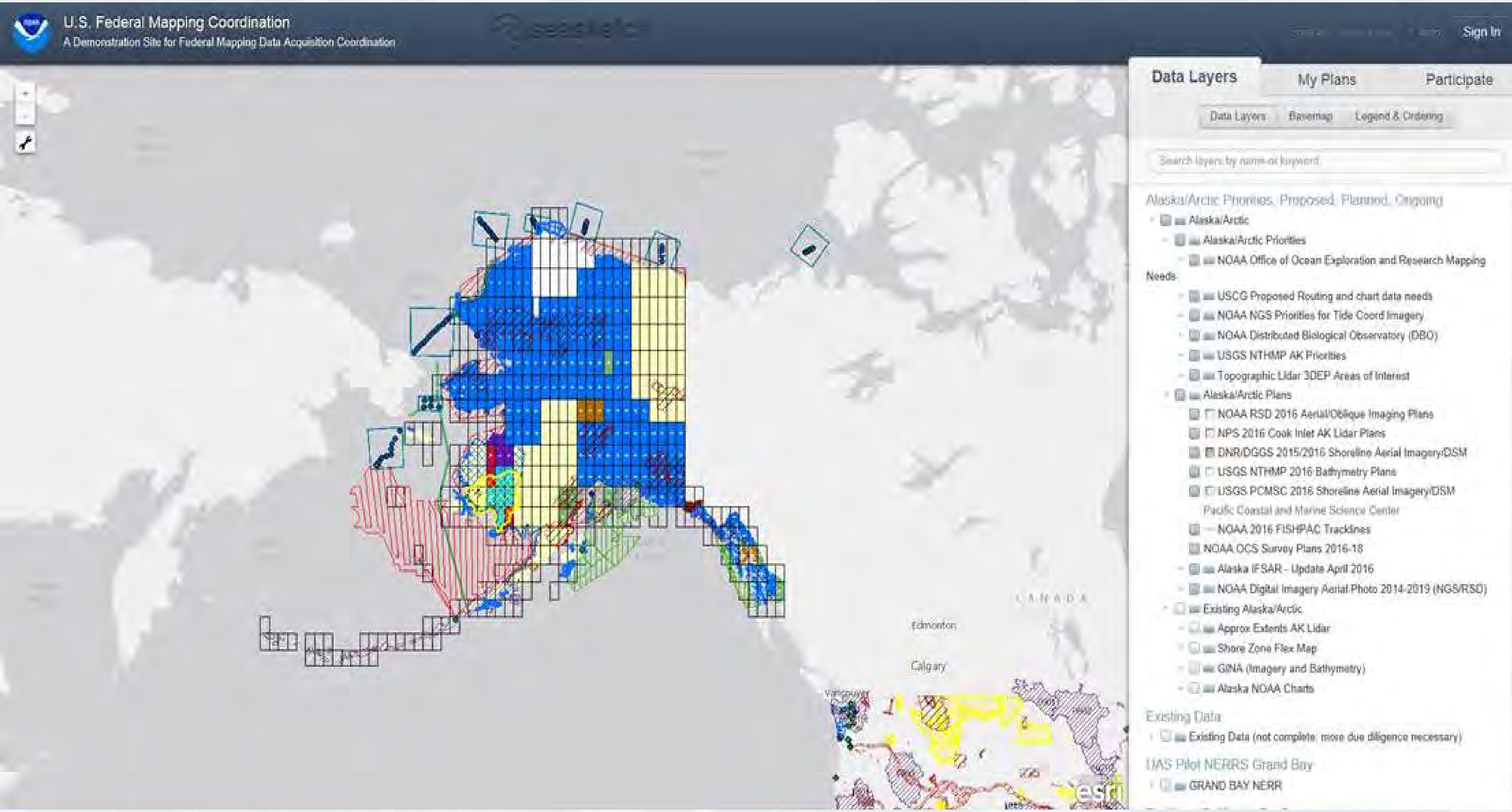
Florida
270+ sq miles

Bahamas (R)
591 flight lines
8 October – 7 Novembe
29 days, 18 flight days
33 flights

WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

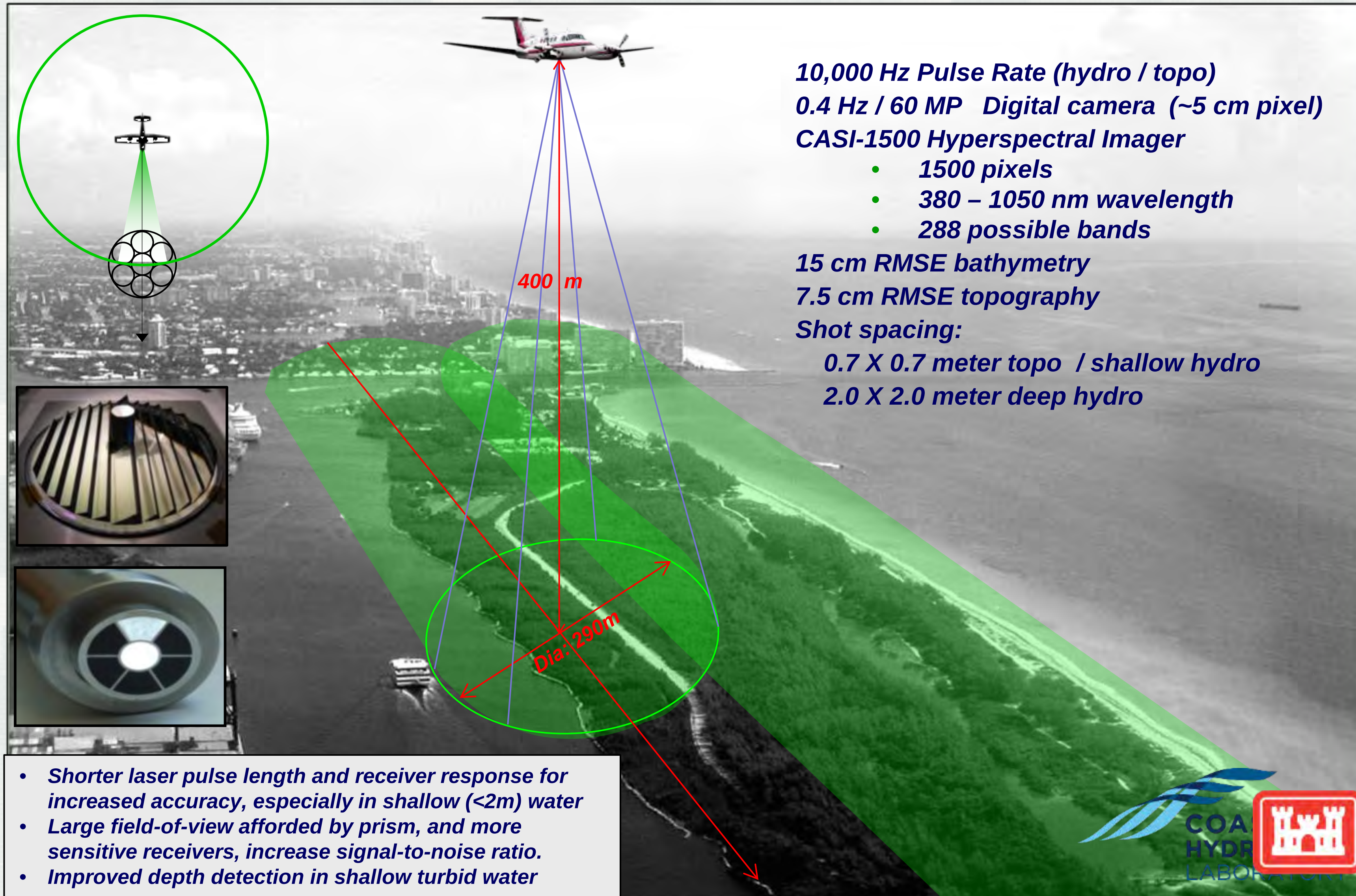
GEOMATICS
DATA SOLUTIONS

Future NCMP collections



http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4

CZMIL Coastal Zone Mapping and Imaging Lidar



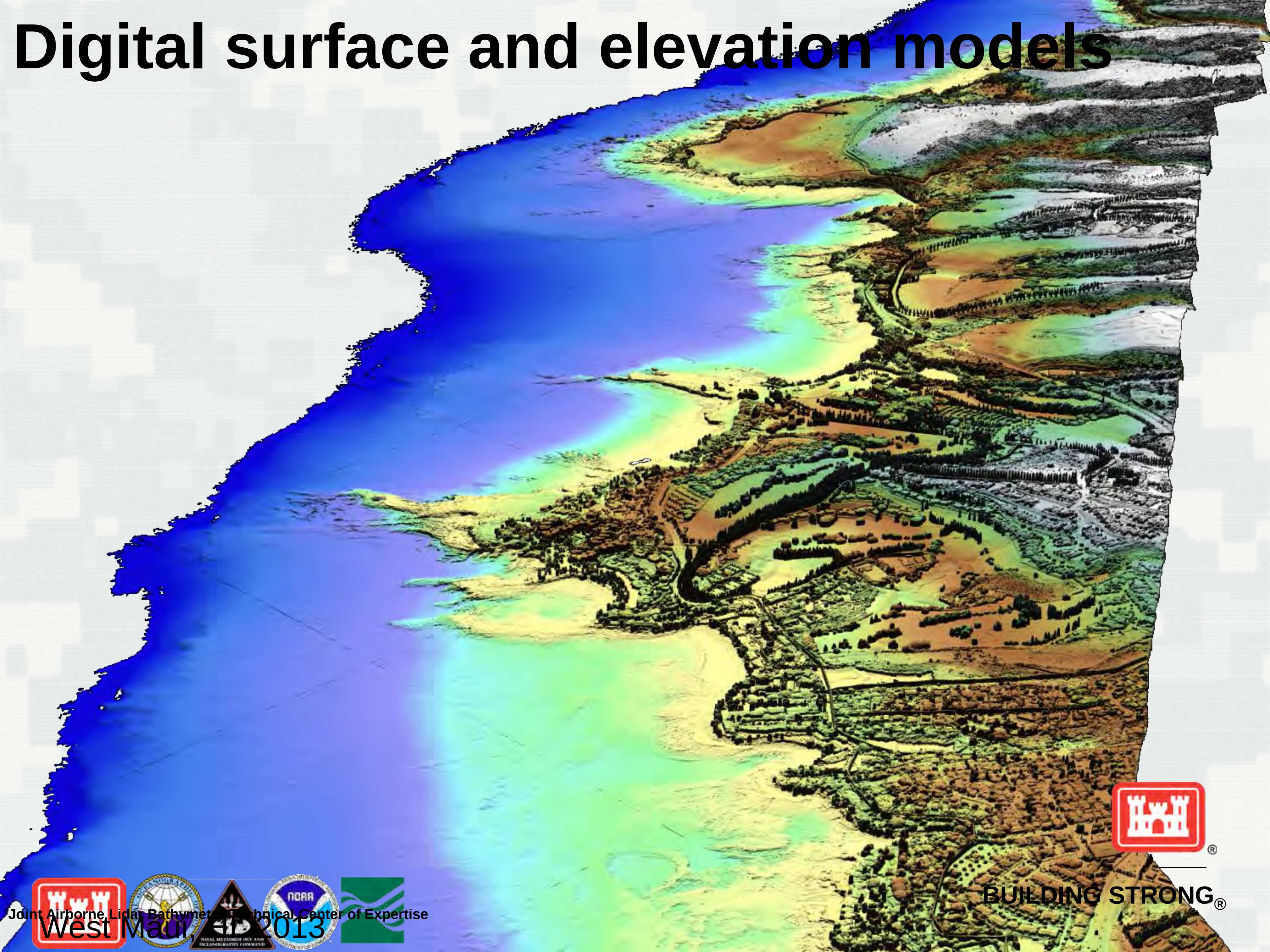
10,000 Hz Pulse Rate (hydro / topo)
0.4 Hz / 60 MP Digital camera (~5 cm pixel)
CASI-1500 Hyperspectral Imager

- *1500 pixels*
- *380 – 1050 nm wavelength*
- *288 possible bands*

15 cm RMSE bathymetry
7.5 cm RMSE topography
Shot spacing:
0.7 X 0.7 meter topo / shallow hydro
2.0 X 2.0 meter deep hydro

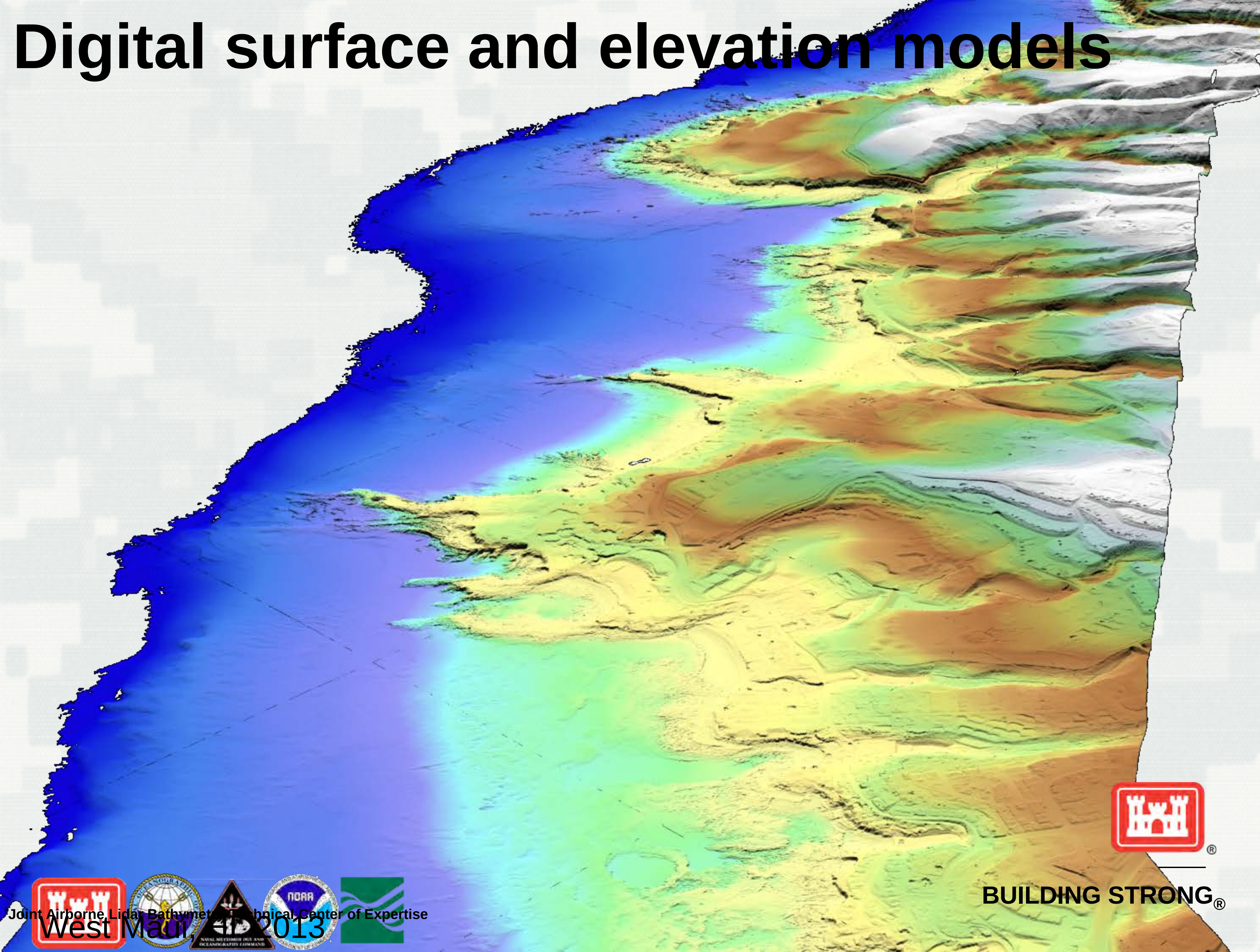
- *Shorter laser pulse length and receiver response for increased accuracy, especially in shallow (<2m) water*
- *Large field-of-view afforded by prism, and more sensitive receivers, increase signal-to-noise ratio.*
- *Improved depth detection in shallow turbid water*

Digital surface and elevation models



West Maui, HI 2013

Digital surface and elevation models



West Maui, HI 2013

Aerial photography/lidar

Siuslaw River Entrance, OR 2014

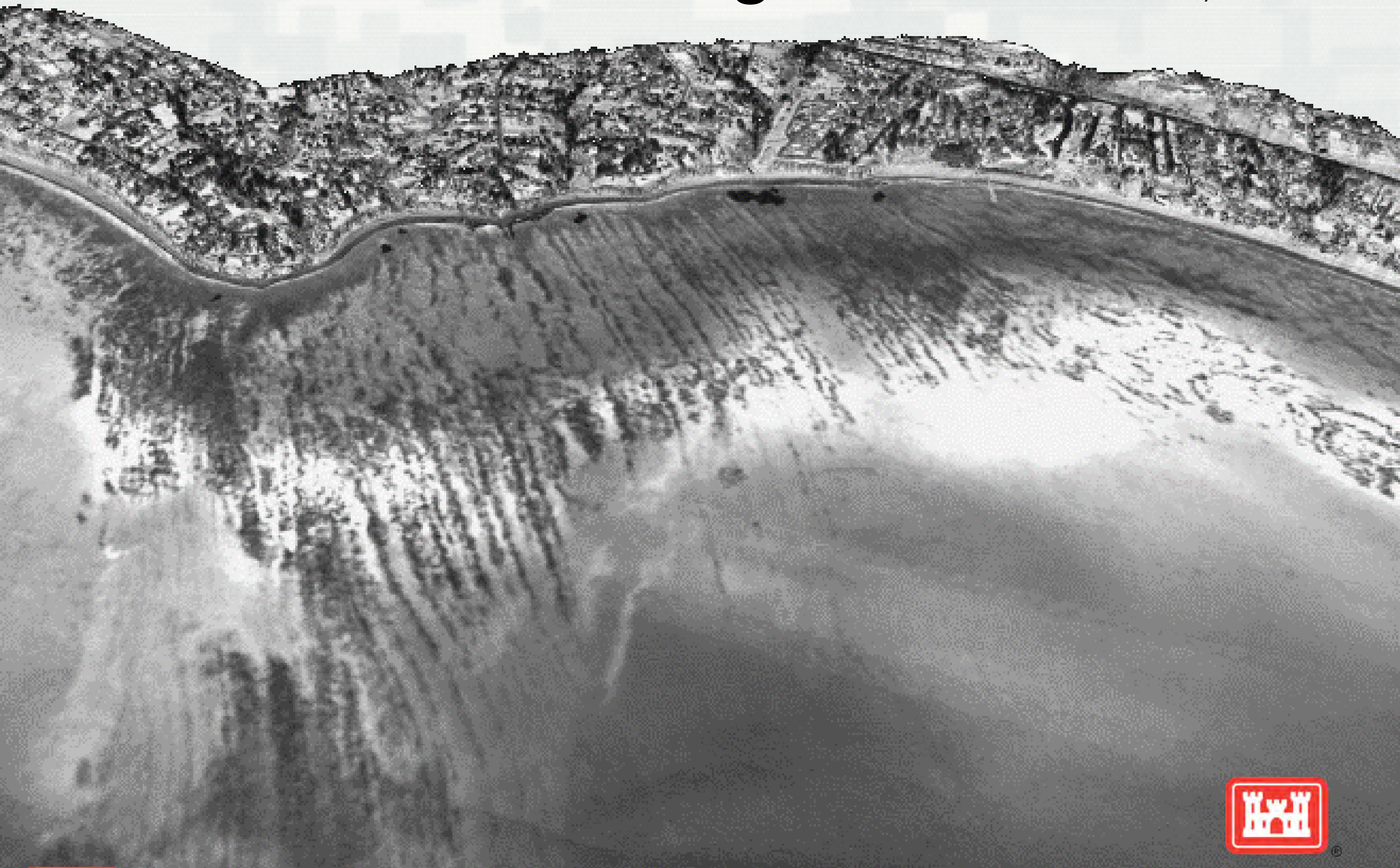
Hyperspectral imagery

1 m pixel resolution, 48 spectral bands
375-1050 nm

Olowalu, Maui, HI
2013

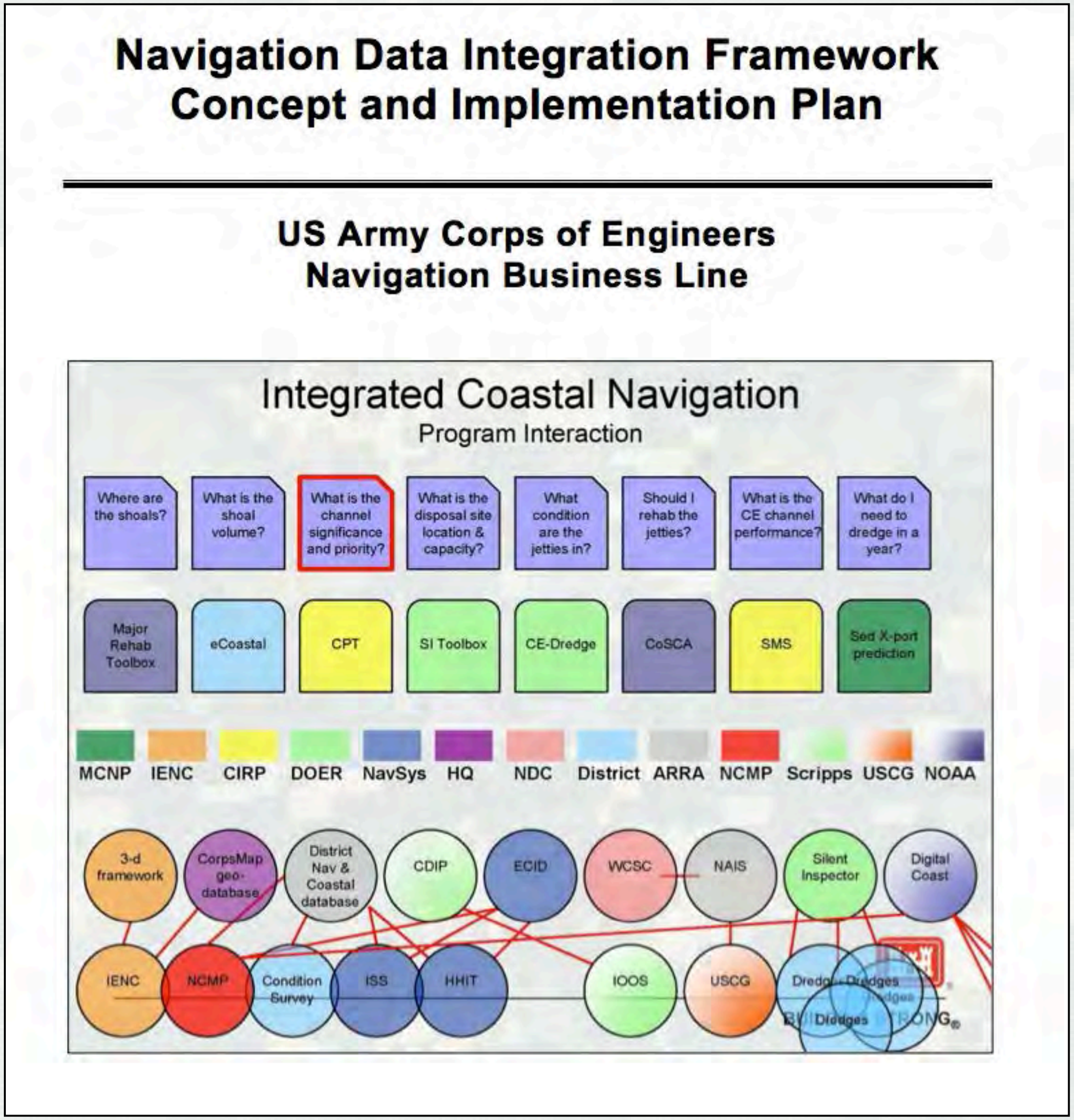
Laser reflectance image

NCMP 2009
Malibu, CA



5-m resolution

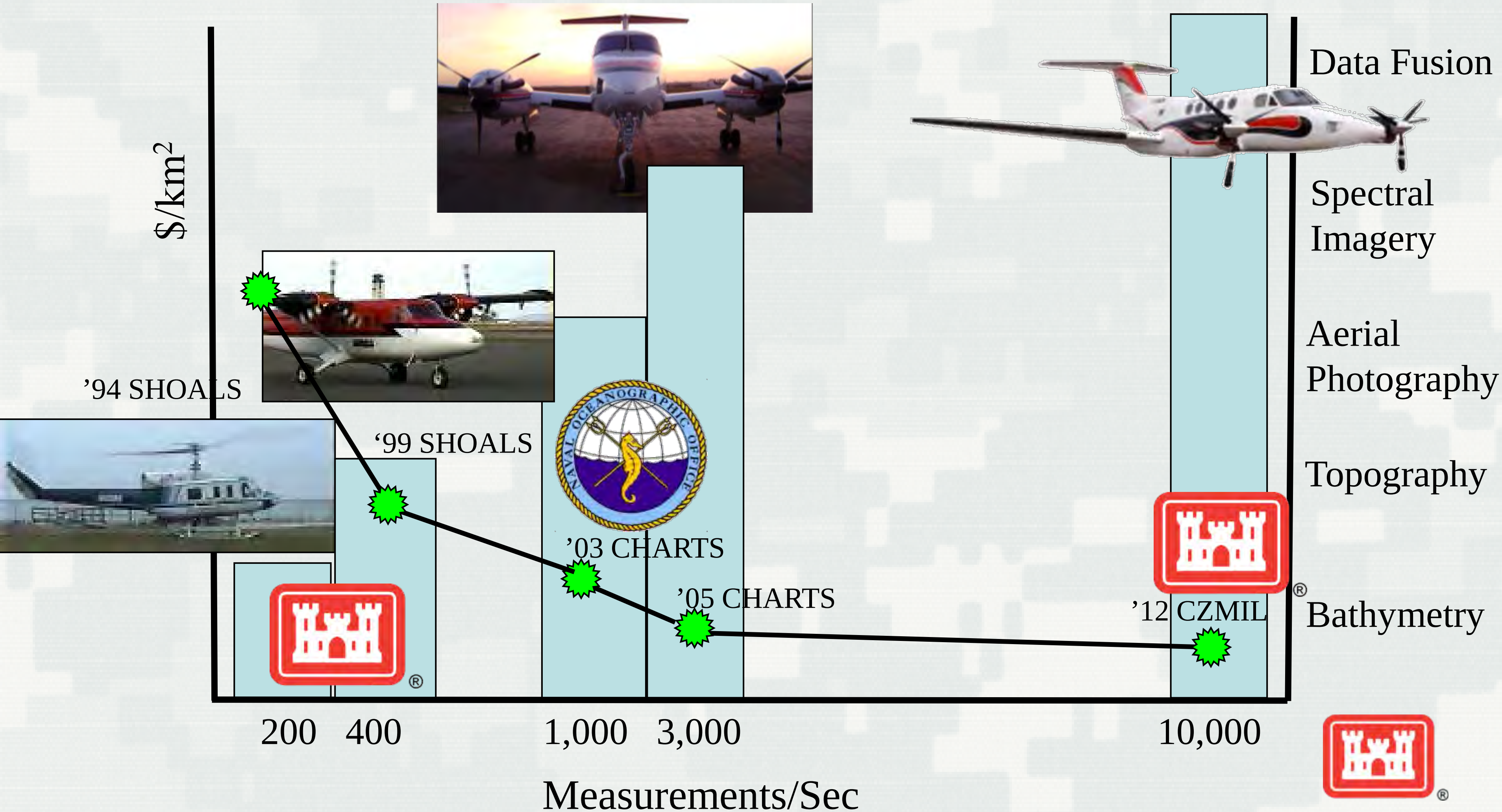
NCMP Data Access


Navigation Data Integration Framework Concept and Implementation Plan

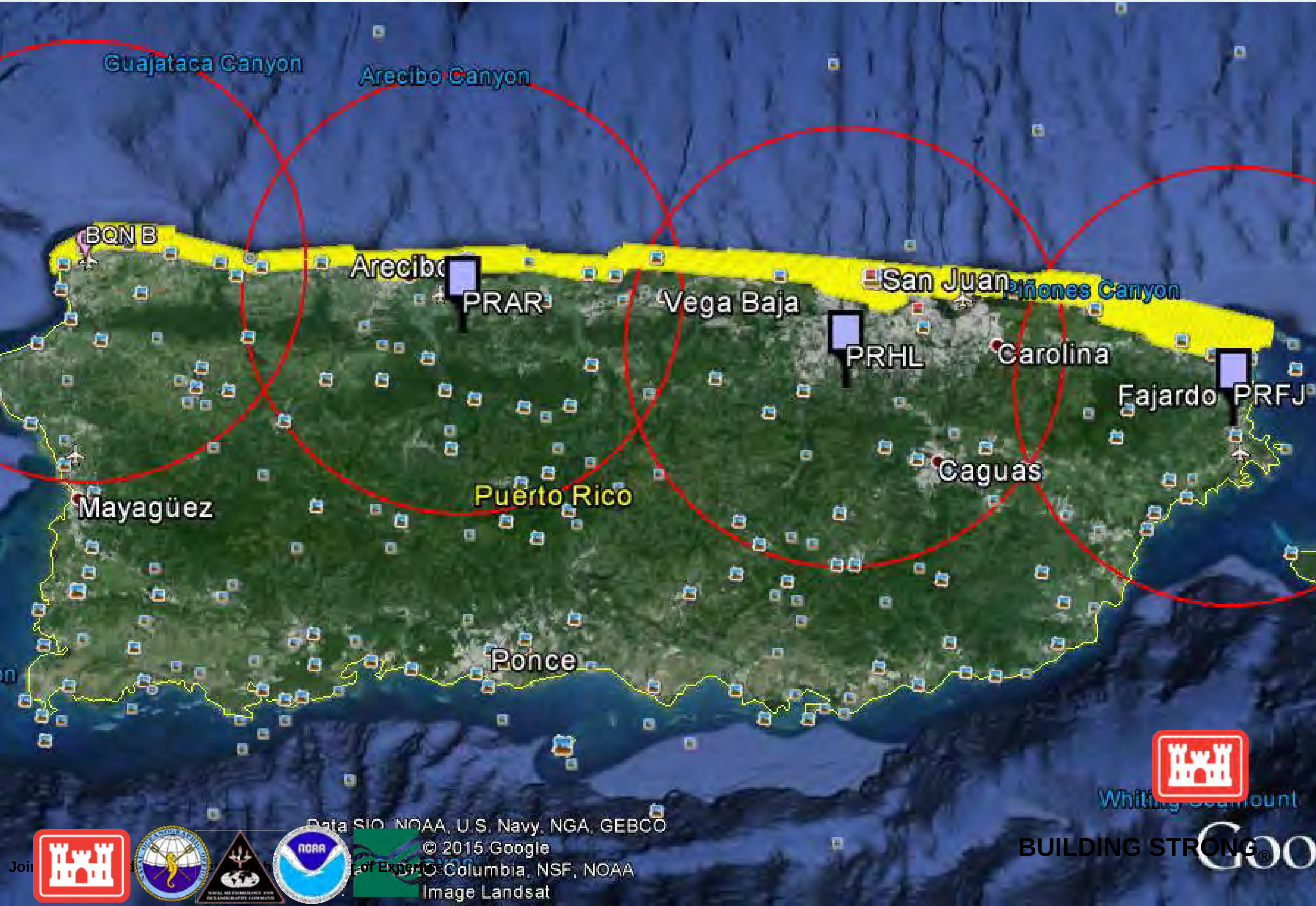
US Army Corps of Engineers Navigation Business Line

- USACE District Office
- NOAA Digital Coast
- USGS St. Petersburg
- USGS EROS
- USACE GRiD
- By request to jalbtcx@usace.army.mil

JALBTCX sensor development history



GPS control



Guajataca Canyon
Arecibo Canyon
BQN B
Arecibo
PRAR
Vega Baja
San Juan
Piñones Canyon
PRHL
Carolina
Fajardo
PRFJ
Caguas
Mayagüez
Puerto Rico
Ponce
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2015 Google
Image Landsat

Questions?

1) *What areas are of highest importance?*
2) *What accuracy level can be accepted?*
3) *What is the best time of year?*
   - *Weather*
   - *Water Clarity*
   - *Ice/Snow Cover*
   - *Vegetation State*
   - *Solar Angle and Availability*
4) *Which vertical datum is required?*
   - *Ellipsoid*
   - *Orthometric (12A, scientific model, experimental model)*
   - *Tidal*
   - *NOAA can assist*
5) *Logistics (Lodging, airfields, fuel, etc.)*

jennifer.m.wozencraft@usace.army.mil

228-806-6044

www.jalbtcx.org

https://shoals.sam.usace.army.mil/

Puerto Rico North Shore, January 2016

“USACE Alaska Districts Mapping Activities and Priorities in Alaska”

Alaska Coastal Mapping Summit
Girdwood, Alaska
June 14 2016

US Army Corps of Engineers
BUILDING STRONG®

CIVIL WORKS PROGRAM

Akutan Harbor

Shoreline Protection at Unalakleet

Current Activities

- Navigation
- Flood Risk Management
- Coastal and Storm Damage Reduction
- Emergency Response
- Hydroelectric Power Generation
- Water Supply
- Recreation

Proposed Subsistence Navigation Improvements at Little Diomede

U.S. ARMY

CIVIL WORKS PROGRAM

Erosion Protection at Shishmaref

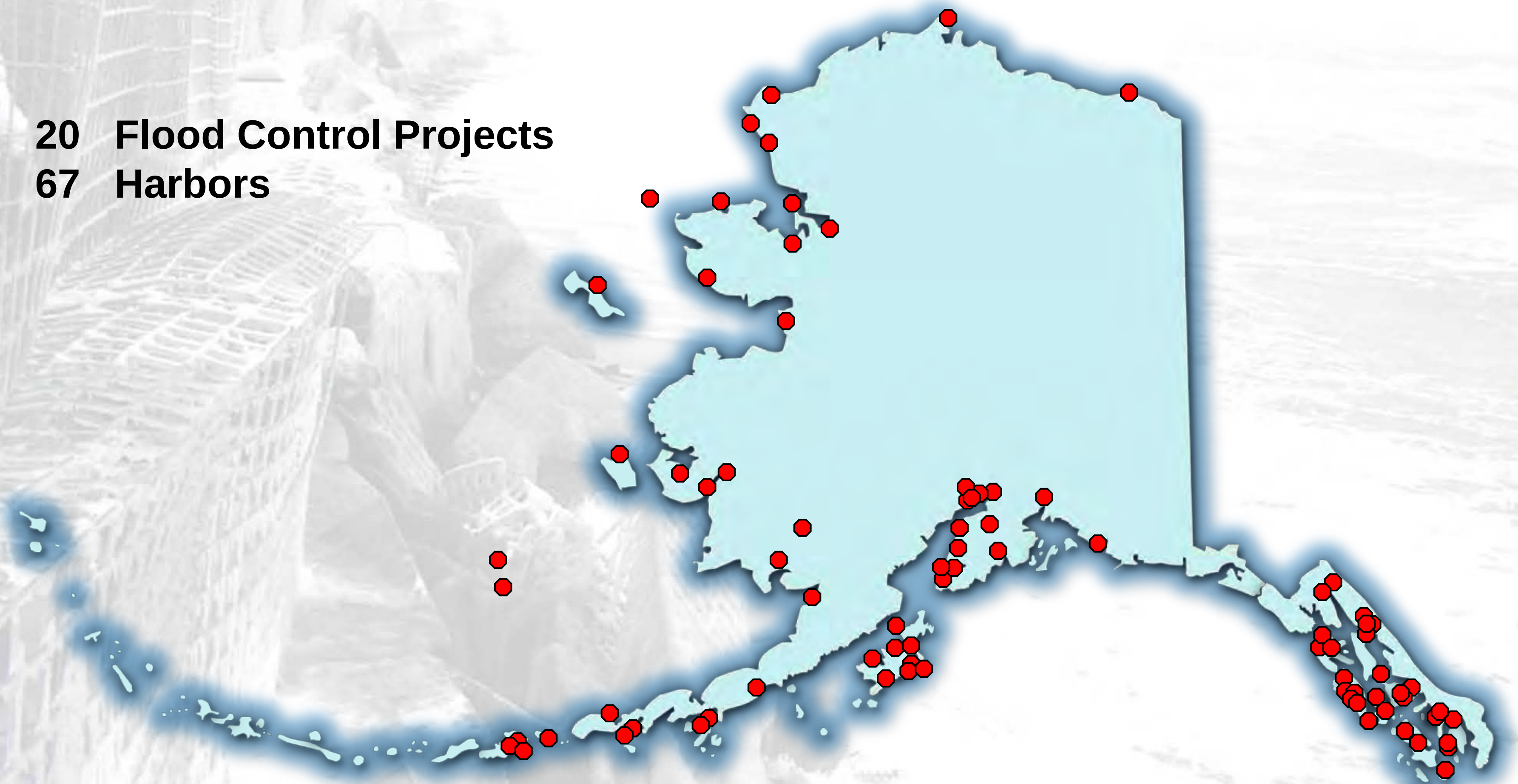
Arctic Deep Draft Port Study

- Authorities
- Process
- Studies and Projects

Storm Damage Protection at Golovin

Coastal Project Locations for the Alaska District

20 Flood Control Projects
67 Harbors



Priority Coastal Mapping Locations for the Alaska District

QUESTIONS?

"Building and Preserving Alaska's Future"

U.S.ARMY

BUILDING STRONG®

NOAA's National Geodetic Survey

Nic Kinsman

Alaska Regional Advisor, Anchorage, AK

nicole.kinsman@alaska; 202-306-5736

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

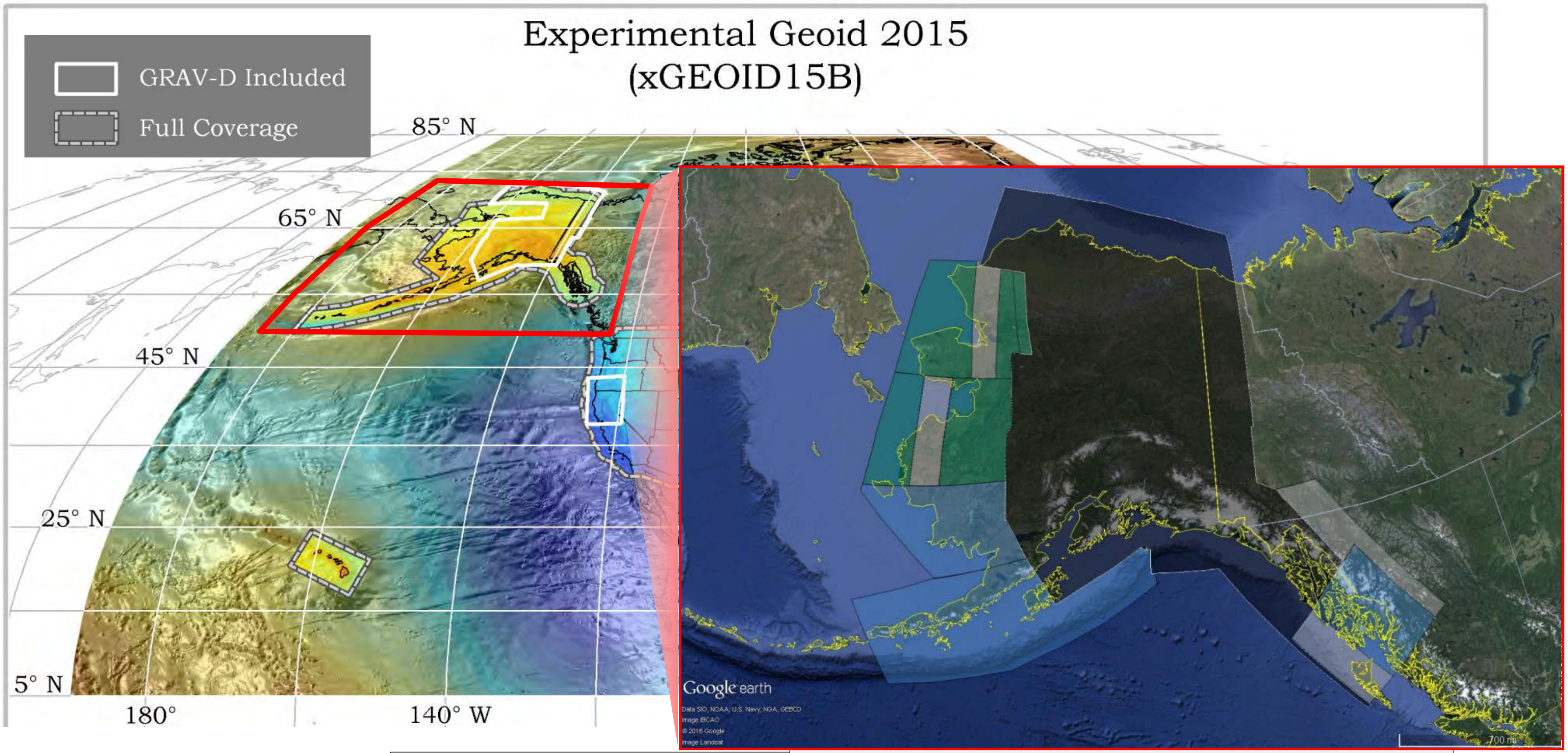
NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

http://iocm.noaa.gov

Map Once, Use Many Times

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

Goal is a refined gravimetric geoid model that enables GPS-derived elevations accurate to 2 cm in the NSRS update of 2022



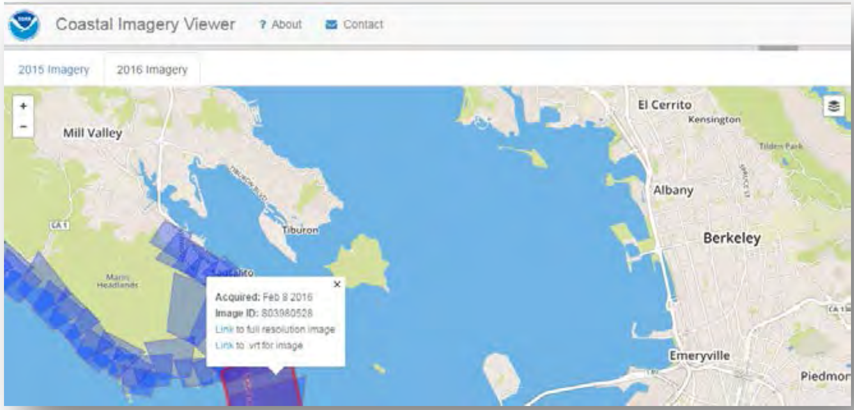
GRAV-D Data Collection Status

Grey areas completed
(light grey completed from April - May FY16)
FY16 Targets in green
Estimated FY17 Targets in blue
White border is total area to be covered by GRAV-D

POC:
[Monica Youngman]

Remote Sensing Division: Coastal Imaging

- Nadir and Oblique Digital Sensing System (DSS) cameras
- Support CSCAP (Coast and Shoreline Change Analysis Program) and Rapid Event/Emergency Response Activities (since 2003 - Hurricane Isabel)

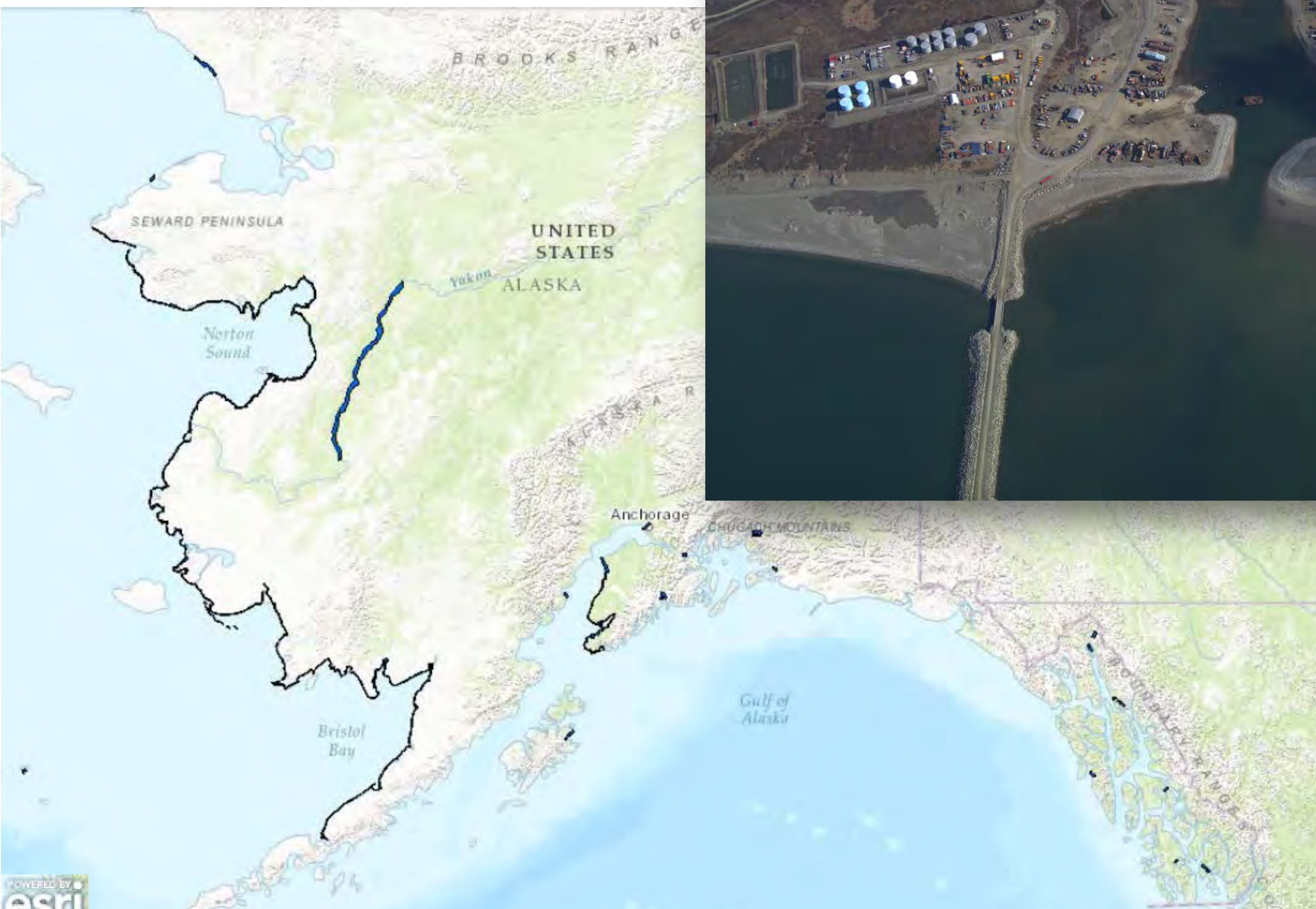


- Nadir:
  - ~10,500 ft AGL at ~160-170 knots
  - Footprint is approximately 2.5 km x 3.5 km
  - Final ortho GSD is ≤ 35 cm
- Oblique: [Coastal Imagery Viewer]
  - ~3,500 – 5,500 ft AGL
  - *Average* GSD (increases with obliquity) approximately 20 cm
  - Very rapid, portable files, has a browser interface
  - Multiple perspective view (SFM testing), "GIS ready"

POC:
Chris Sloan

Remote Sensing Division: 2016 Alaska Imaging

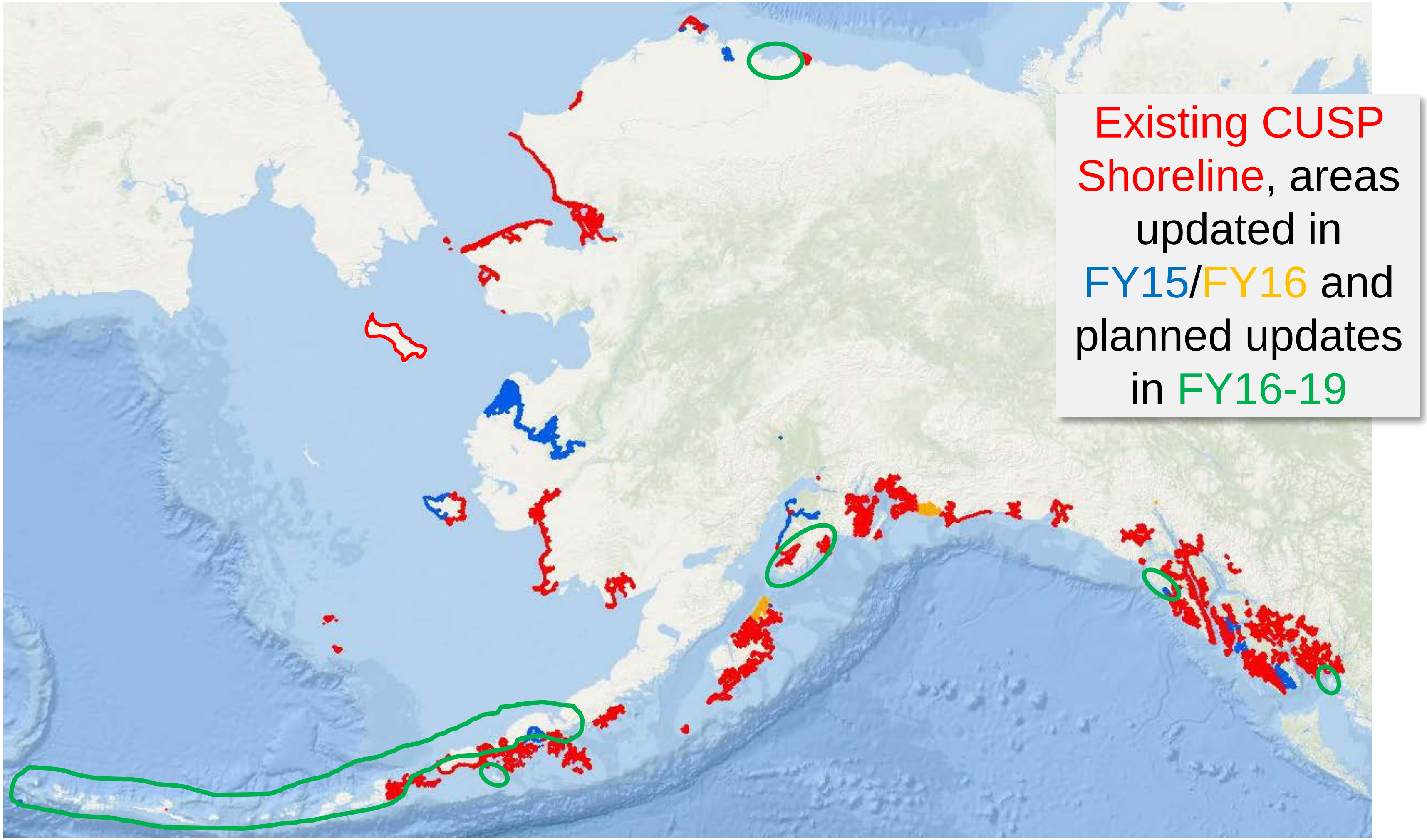
May 2016



POC:
[Chris Sloan]

Remote Sensing Division: Shoreline Mapping

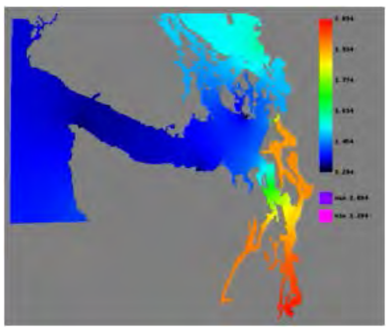
Continually Updated Shoreline Product (CUSP)

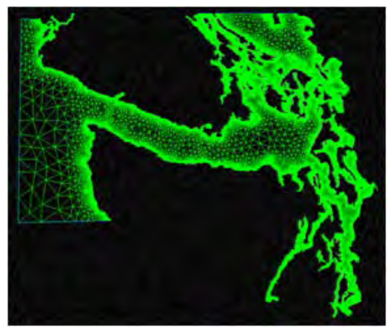


POC: Doug Graham

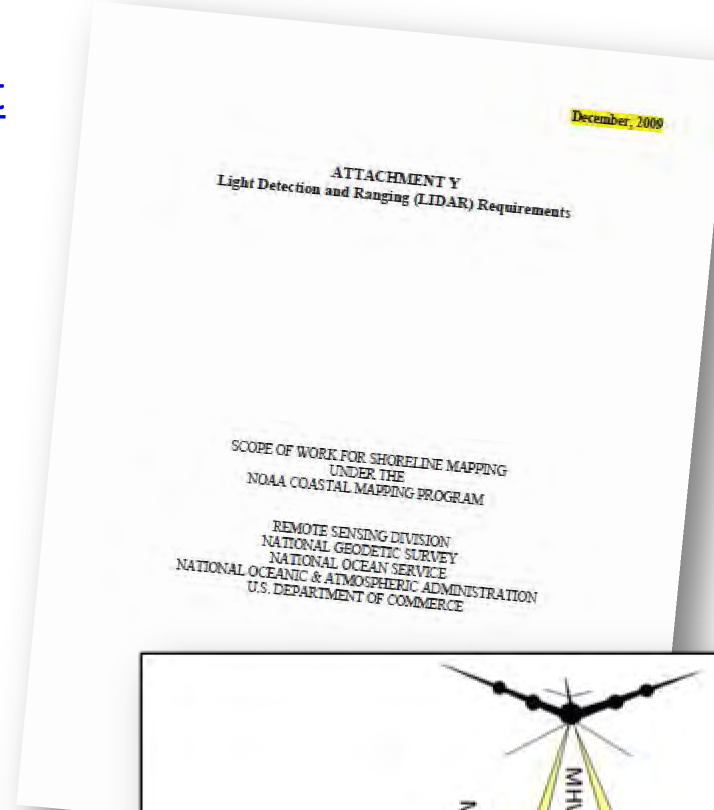
Guidelines, Specifications, and Recommendations

- CO-OPS Shoreline Mapping Survey Support
  - Tide reduction products for tidal coordination:
    - Tidal Constituent and Residual Interpolation (TCARI)
    - Discrete Tidal Zoning
  - NGS/CO-OPS database linkages (Alaska)
  - Tidal datum determinations, geodetic offsets





- Authoritative Shoreline Mapping
  - Scopes of Work, Contracting Guidance
  - New CUSP opportunities in 2016-17
  - Shoreline validation
- Forward-compatibility recommendations
  - Datum transformations
  - Reference system guidance for new data collections

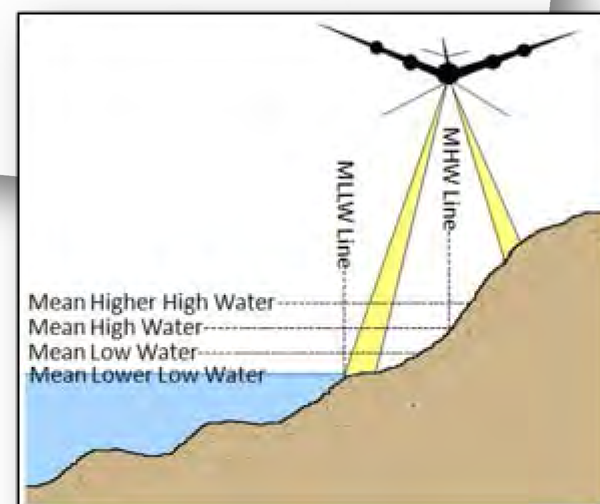


December, 2009

ATTACHMENT Y
Light Detection and Ranging (LIDAR) Requirements

SCOPE OF WORK FOR SHORELINE MAPPING
UNDER THE
NOAA COASTAL MAPPING PROGRAM

REMOTE SENSING DIVISION
NATIONAL GEODETIC SURVEY
NATIONAL OCEAN SERVICE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE



POC: **Steve White**

U.S. Geological Survey

Coastal and Marine Geology Program

Ann Gibbs
Pacific Coastal and Marine Science Center, Santa Cruz, CA
agibbs@usgs.gov; 831-460-7540

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERC

http://iocm.noaa.gov

Map Once, Use Many Times

USGS-CMGP Coastal Mapping Needs

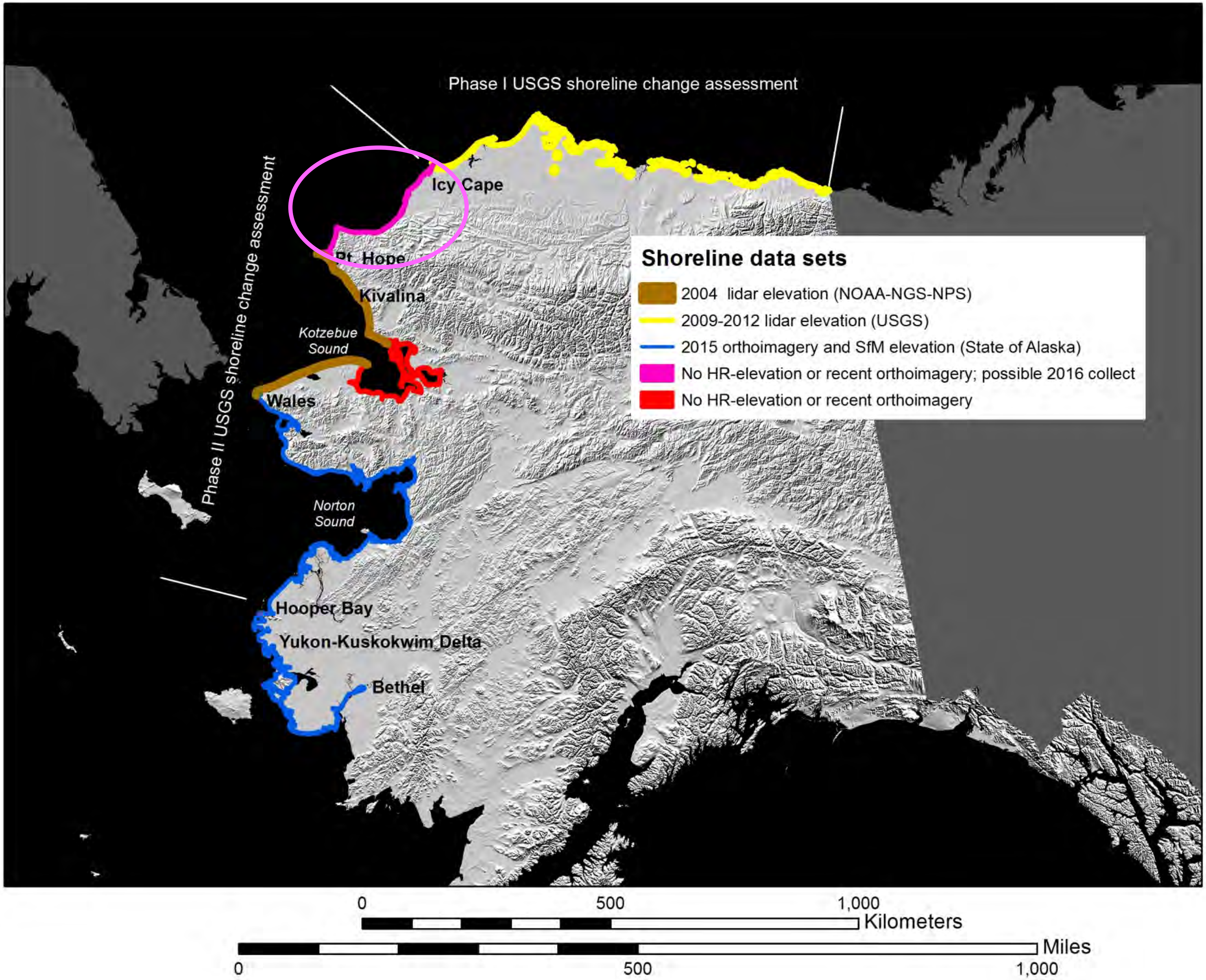
Projects:

- National Assessment of Coastal Change Hazards
- Climate Change Impacts on High-latitude Coasts
  - Determine shoreline change rates
  - Assess and project/model:
    - Shoreline change
    - Coastal vulnerability (erosion/inundation)
- Coastal NED (CoNED)
  - Build hi-res, seamless, topo-bathy products
- Tsunami Hazards
  - Inundation

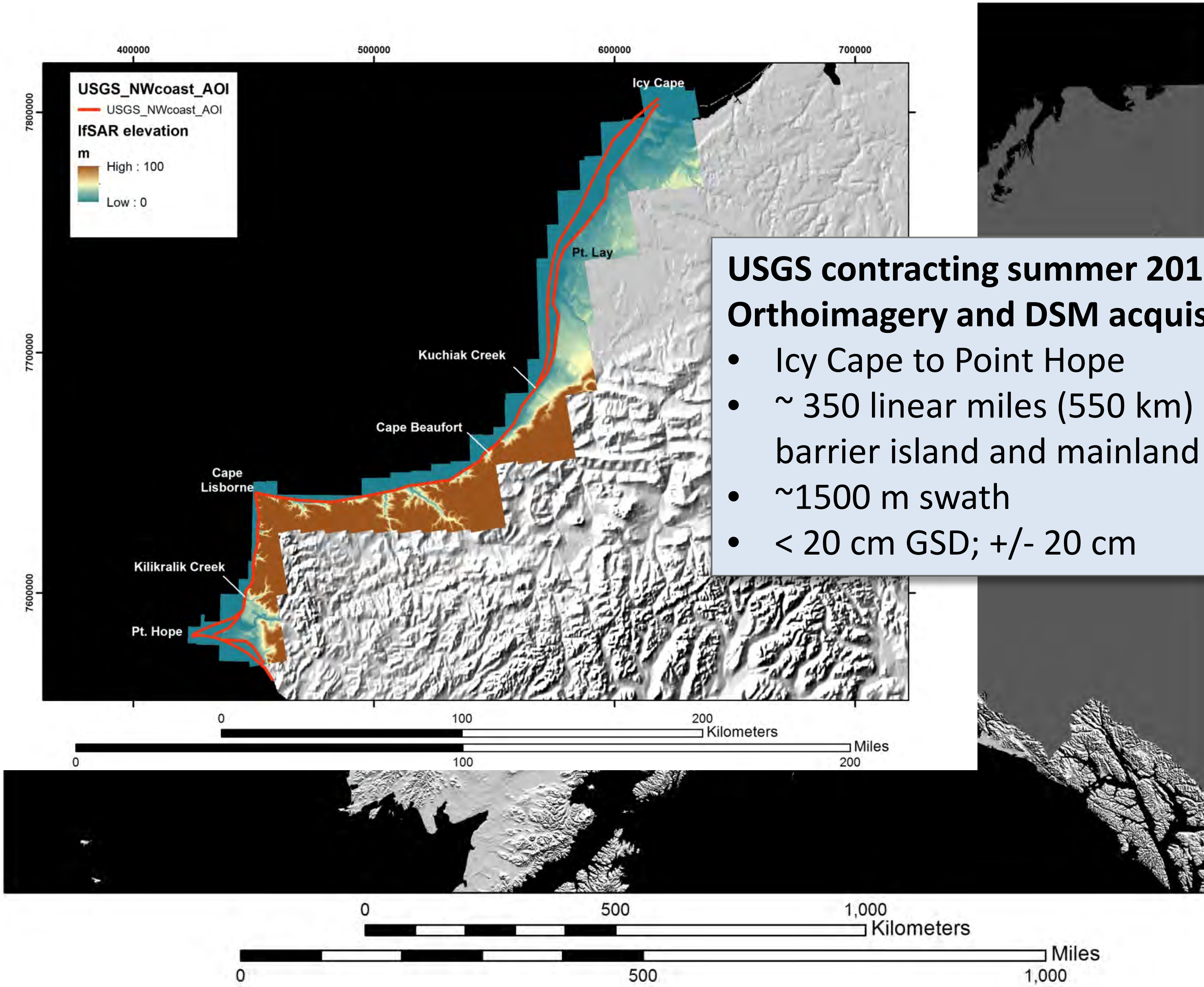
Data required:

- Shoreline position
  - 2D or 3D
  - ~ 1 m horizontal
- Coastal elevation
  - ~MLW to ~1 km inland (? vertical datum)
  - < 30 cm vertical
- Nearshore bathymetry
  - ~40 m water depth to ~MLW
  - < 50 cm vertical
  - 5-10 km buffer on AOI

Modern shorelines and data gaps



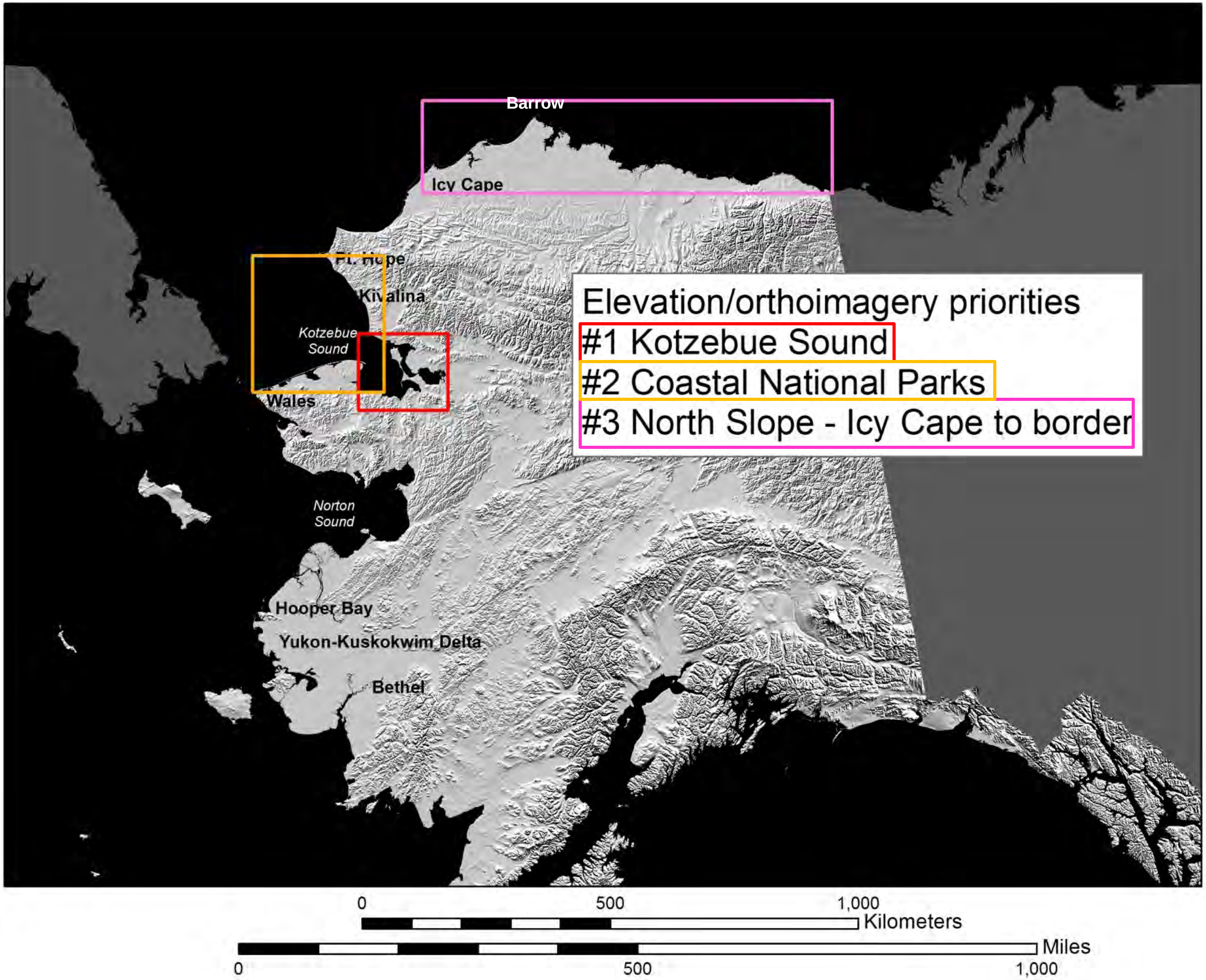
Summer 2016 acquisition

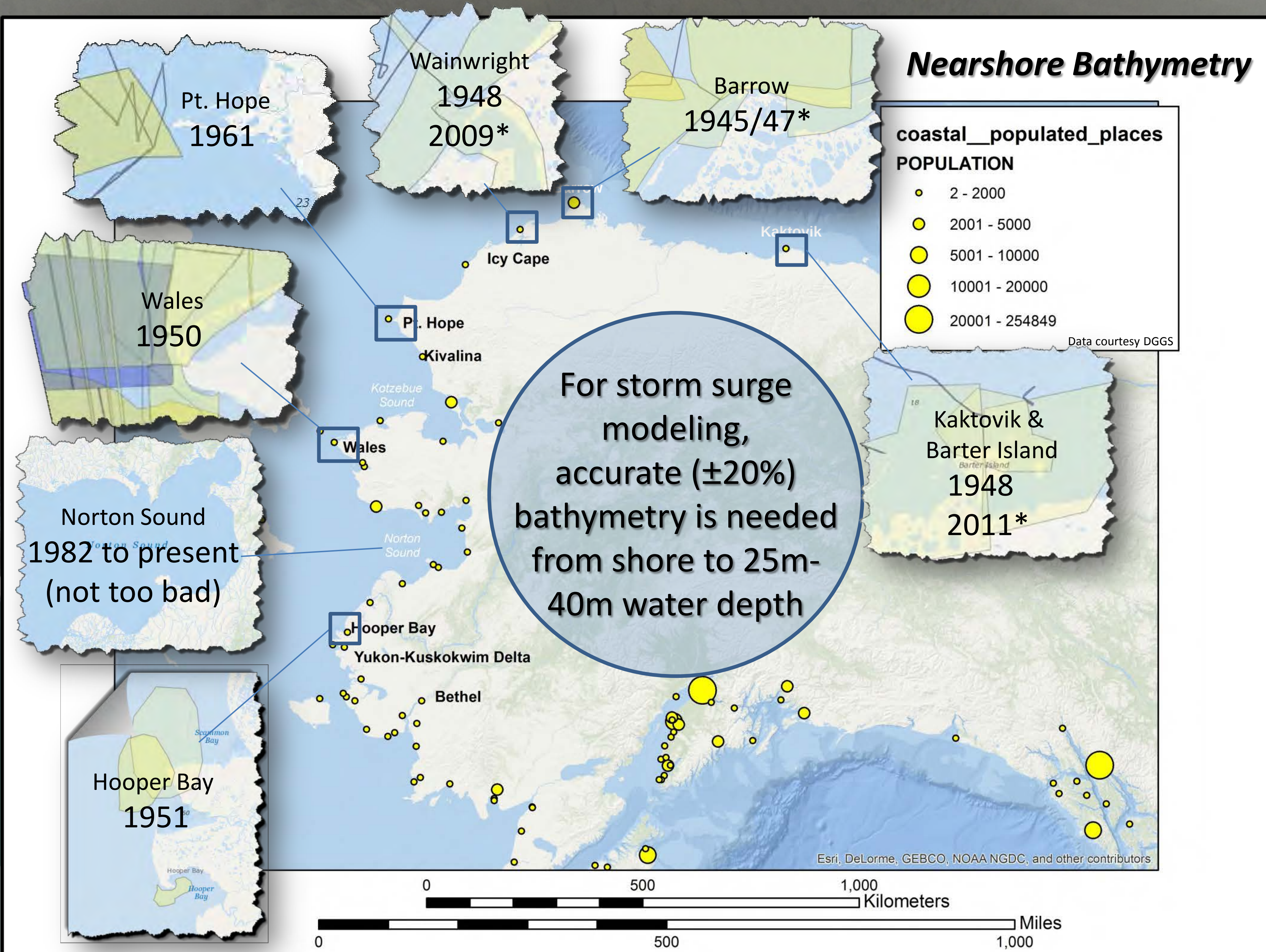


USGS contracting summer 2016 Orthoimagery and DSM acquisition

- Icy Cape to Point Hope
- ~ 350 linear miles (550 km) of barrier island and mainland coast
- ~1500 m swath
- < 20 cm GSD; +/- 20 cm

Future Priority Areas



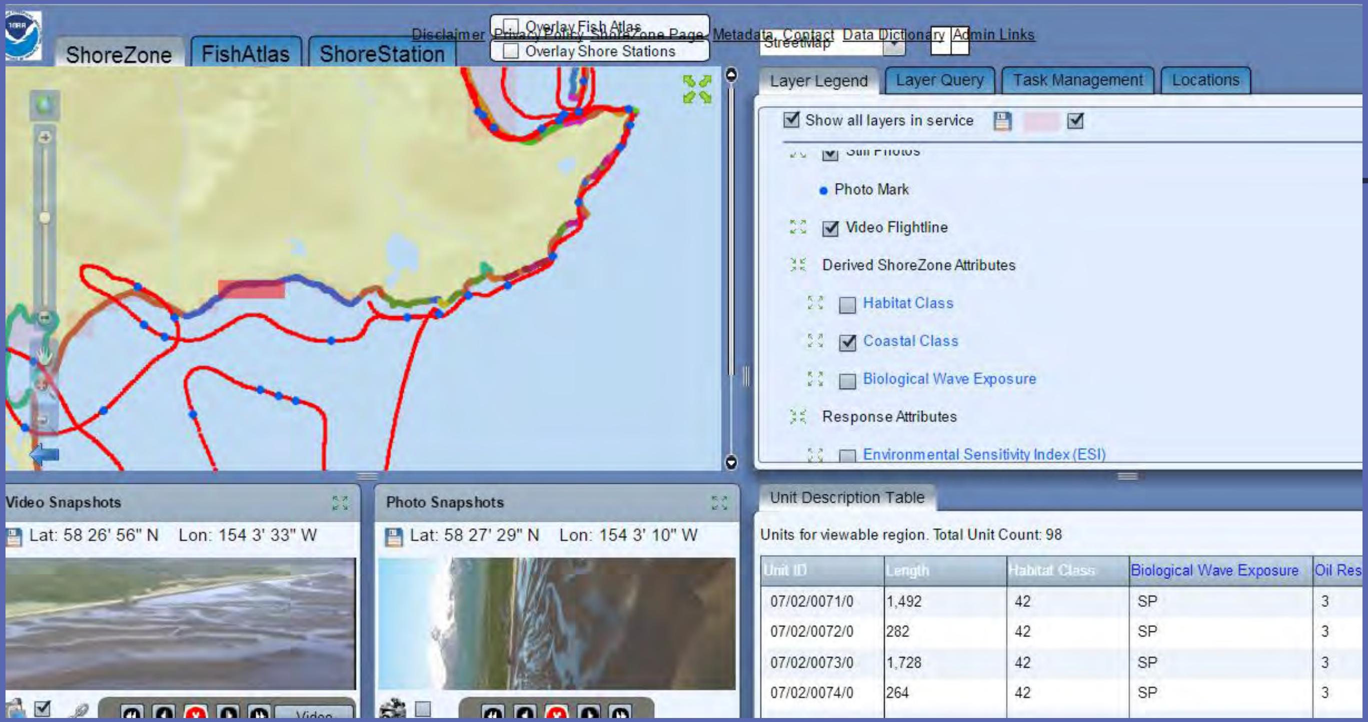

Nearshore Bathymetry
coastal__populated_places
POPULATION
2 - 2000
2001 - 5000
5001 - 10000
10001 - 20000
20001 - 254849
Data courtesy DGGS
Pt. Hope
1961
Wainwright
1948
2009*
Barrow
1945/47*
Wales
1950
Norton Sound
1982 to present
(not too bad)
Hooper Bay
1951
Kaktovik &
Barter Island
1948
2011*
For storm surge modeling, accurate (±20%) bathymetry is needed from shore to 25m-40m water depth
Icy Cape
Pt. Hope
Kivalina
Kotzebue Sound
Wales
Norton Sound
Hooper Bay
Yukon-Kuskokwim Delta
Bethel
Kaktovik
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
0
500
1,000
Kilometers
Miles
0
500
1,000

ShoreZone Data and Apps
Lidar Imaging
and
Bathymetry Processing

Steve G Lewis NOAA Fisheries, Alaska Region

Now includes data
for Alaska, Washington
and Oregon –
and soon BC data.

ShoreZone Apps – Mobile and Web

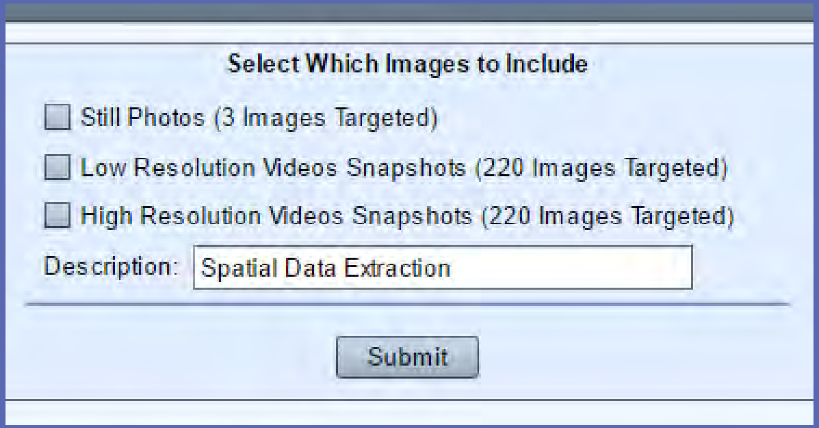


ShoreZone demo maps for the CarryMap app

Map	Approx. Size	Apple iOS / Android	Windows
Ragged Island - with photos	20 MB	Download	Download
Cook Inlet - with photo subset	190 MB	Download	Download
Cook Inlet - photos online	115 MB	Download	Download

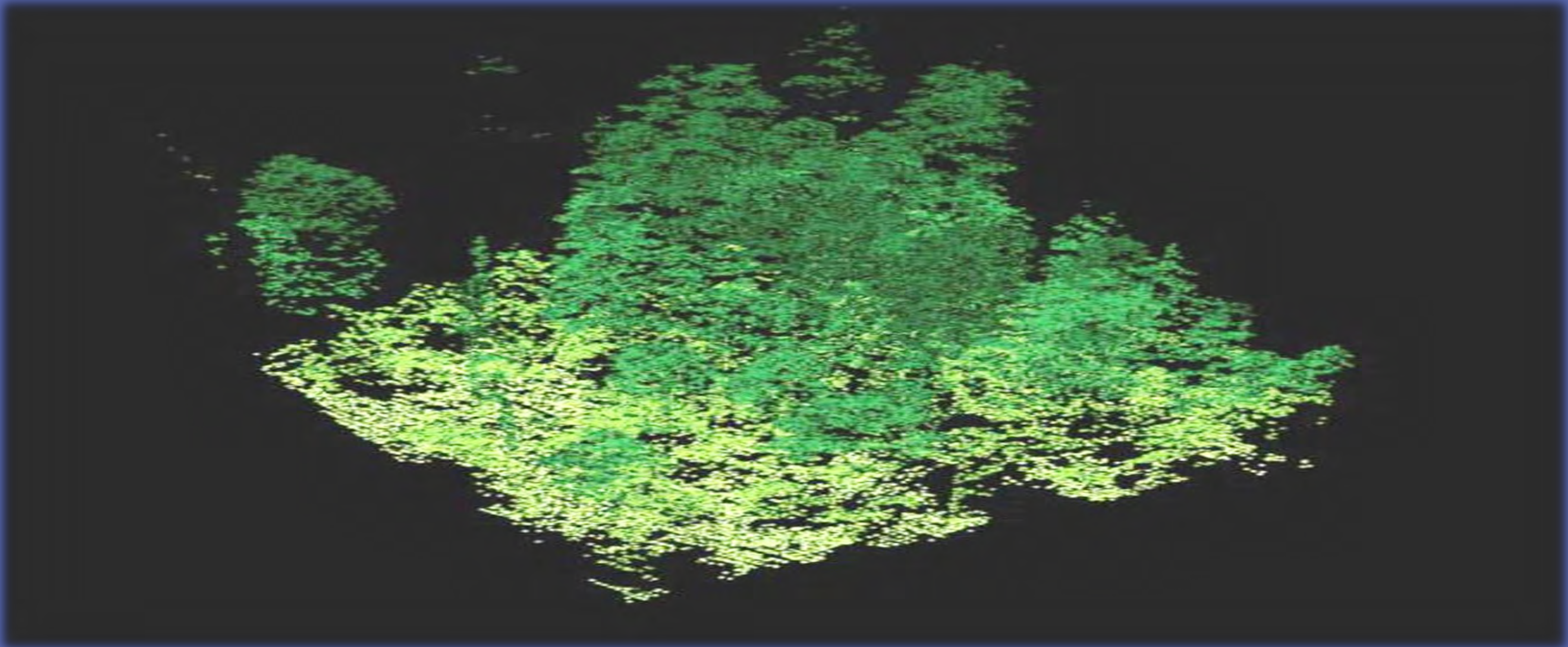
Download the full ShoreZone geodatabase (620 MB)

Download

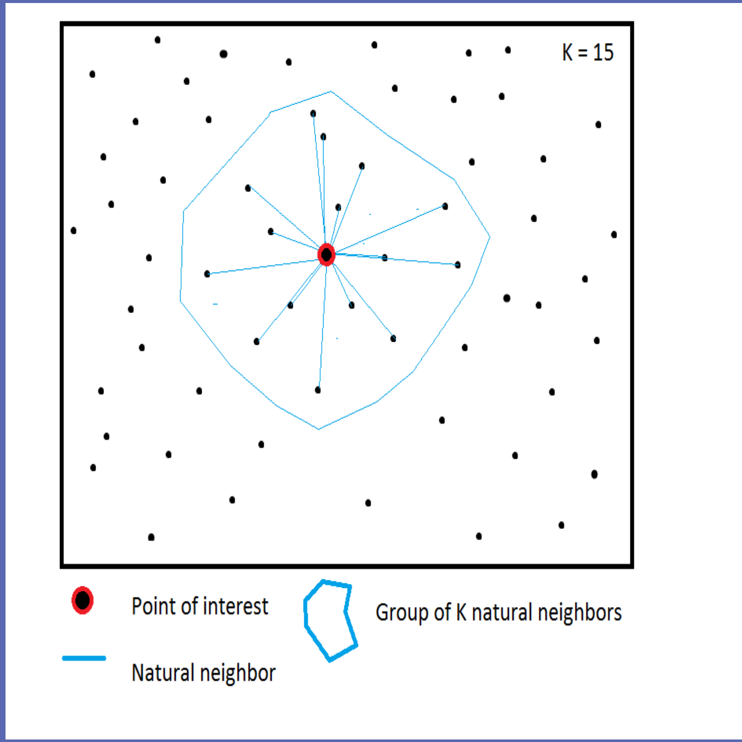


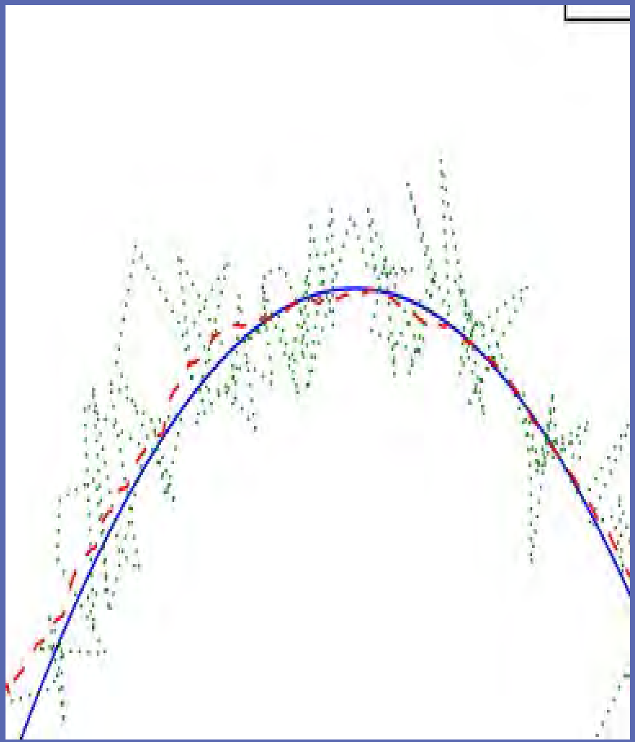
Off-Line ShoreZone Video Player App (CORI)

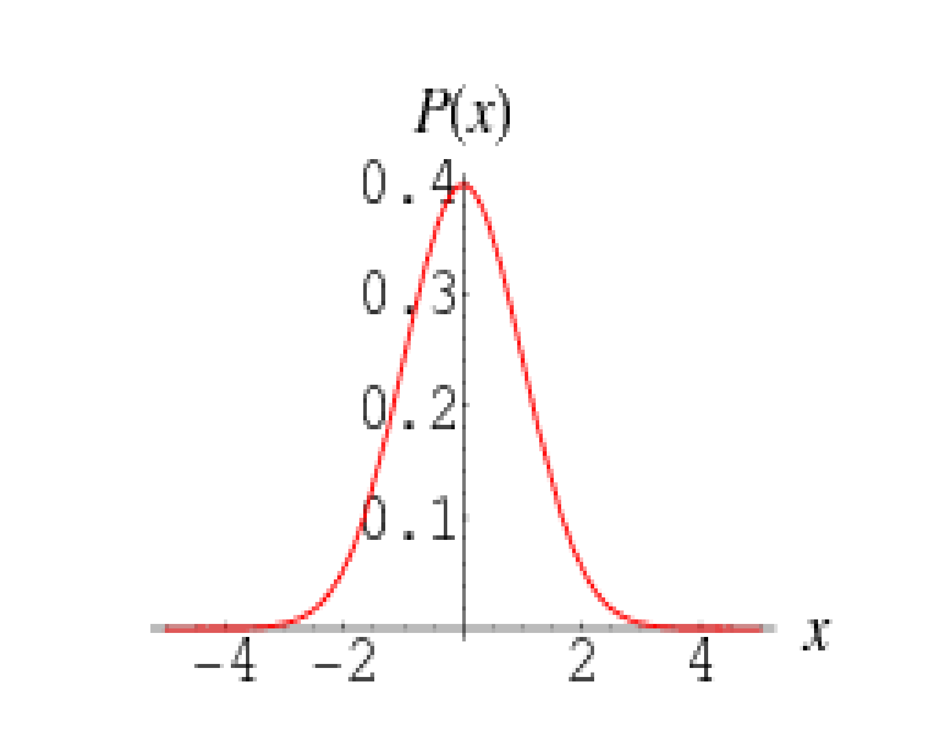
Preview of coming LIDARE Shore LIDAR Imaging



Bathymetry Data Processing: 13.2 billion points using PostGIS, ArcGIS, QGIS, and SciPy (with PyCuda)



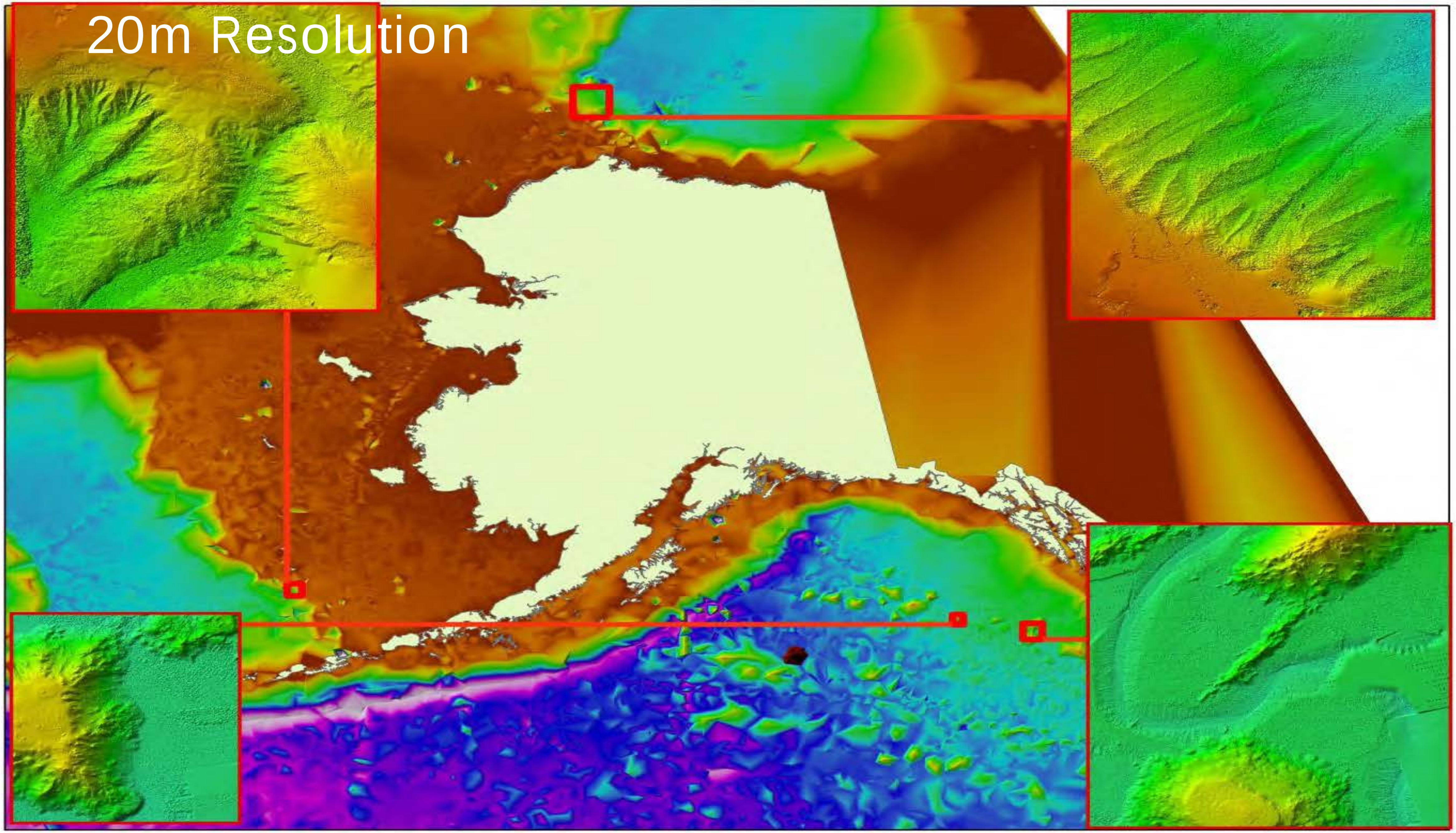




Knn

Kalman

Percentile with Standard Deviation


20m Resolution

U.S. Geological Survey Alaska Mapping Initiative

USGS
science for a changing world

Presenter:
Tracy Fuller
USGS Geospatial Coordinator
tfuller@usgs.gov

In-state POC:
Brian Wright
USGS National Map Liaison - Alaska
bwright@usgs.gov
Office: 907 786 7479

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE
http://iocm.noaa.gov
Map Once, Use Many Times

USGS Alaska Mapping Initiative and 3D Elevation Program

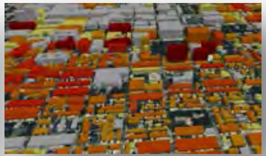
3DEP: The Value of a Coordinated National Program

- Completely refresh national elevation data holdings with new lidar and IfSAR elevation data products and services
- Alaska: Statewide 5m IfSAR (radar), targeted lidar through BAA

Alaska Mapping Initiative

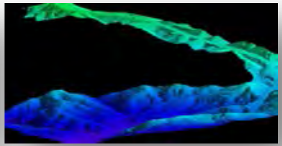
- Generate new 1:25,000-scale map series using new IfSAR elevation data and SPOT imagery as digital map base
- Collaborate with State and federal agencies to update map layers


Natural Resource Conservation


Infrastructure Management


Flood Risk Mitigation

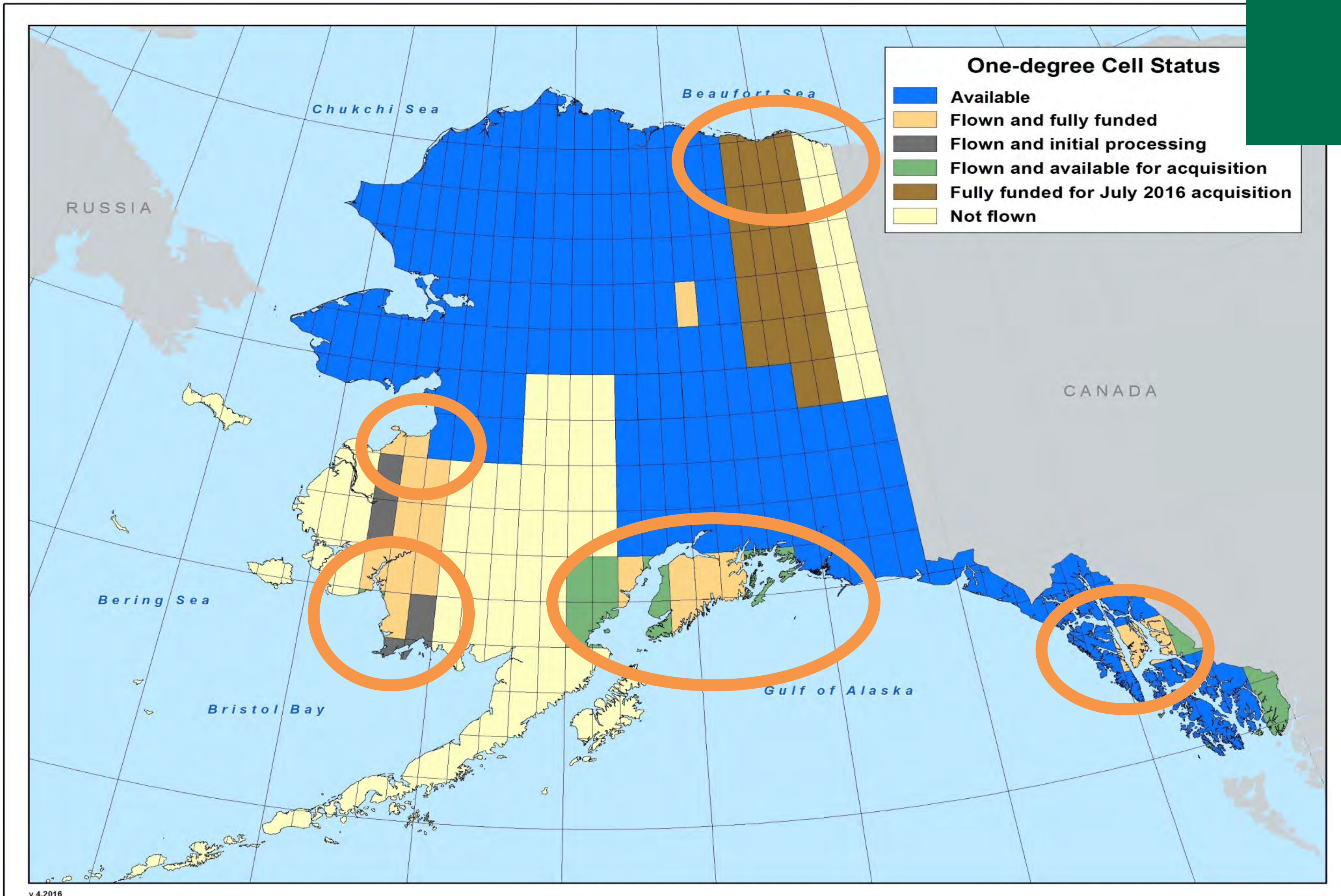

Precision Farming


Land Navigation and Safety


Geologic Resources and Hazards Mitigation

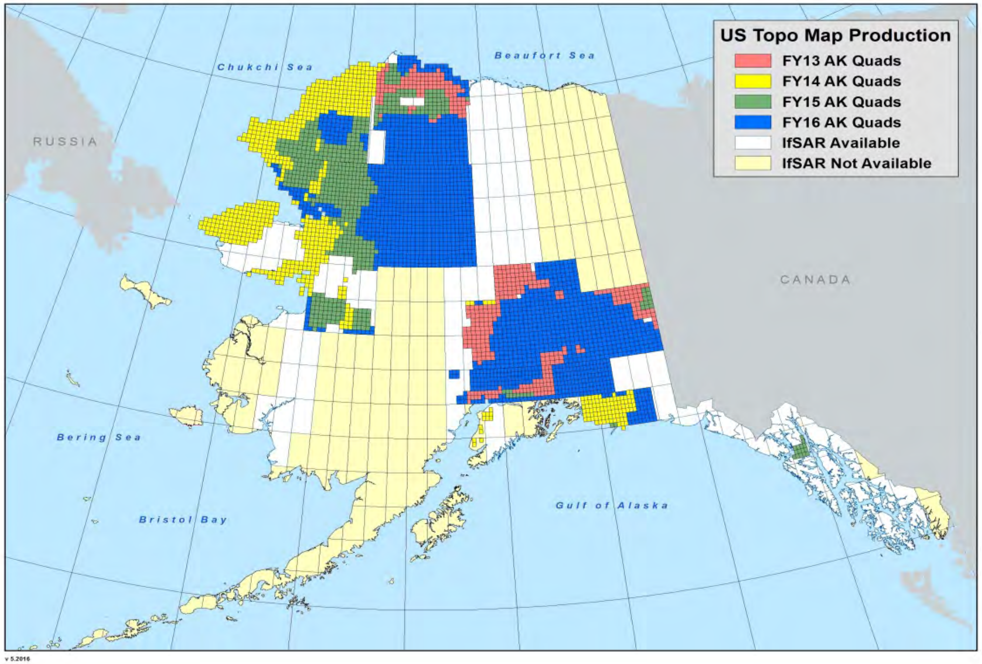
Detailed Alaska IfSAR Status

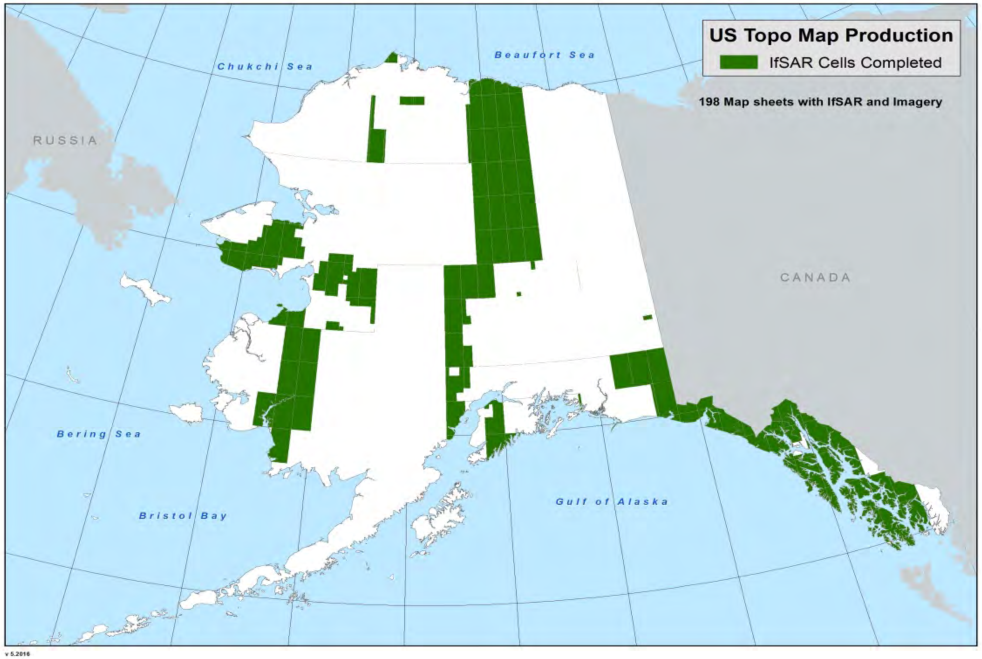
- 69% of the State is available for download or is in work



US Topo Map Production

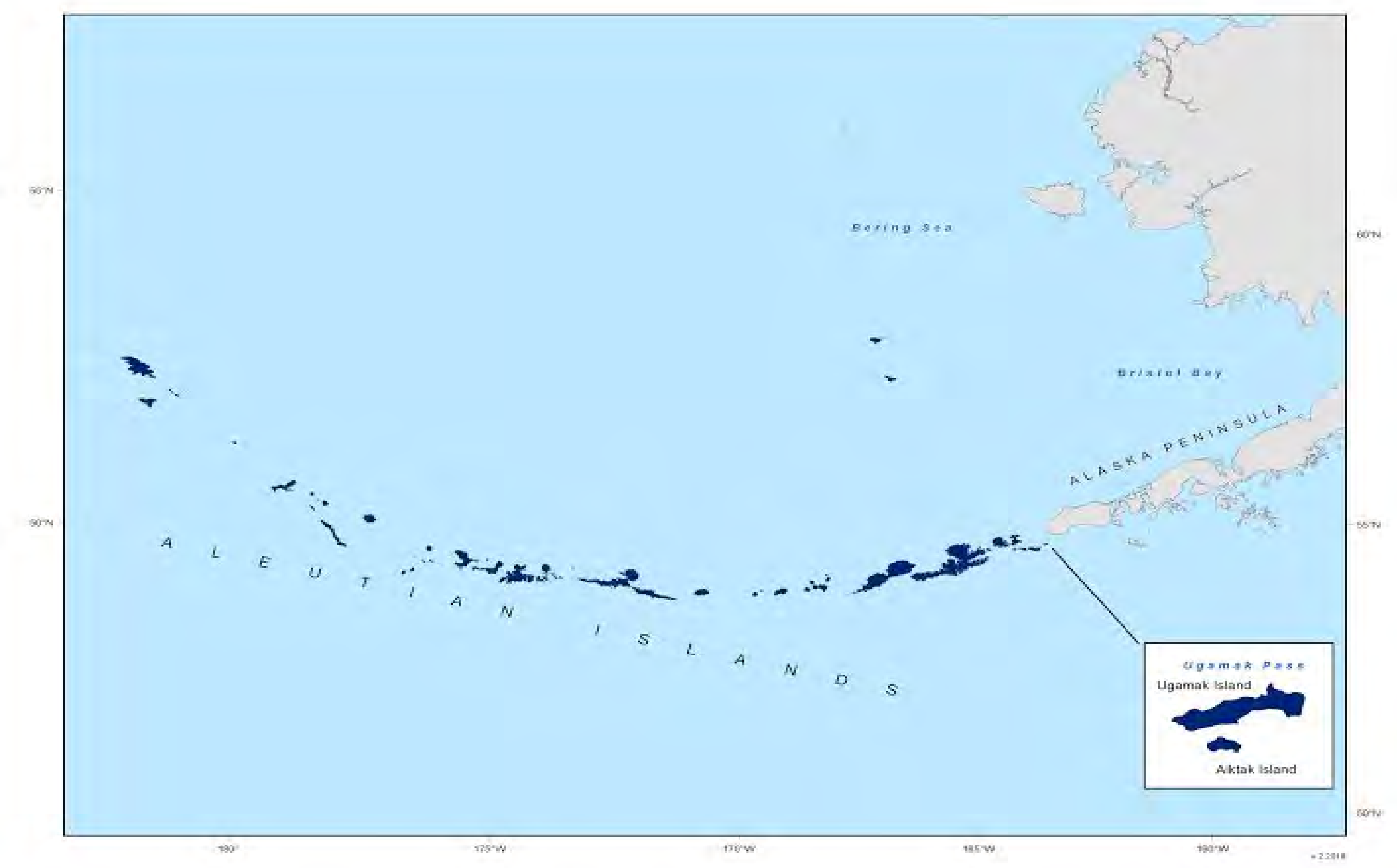
- 33% Complete end of FY16
- 3100 potential quads FY17
- Large potential map production in SE Alaska





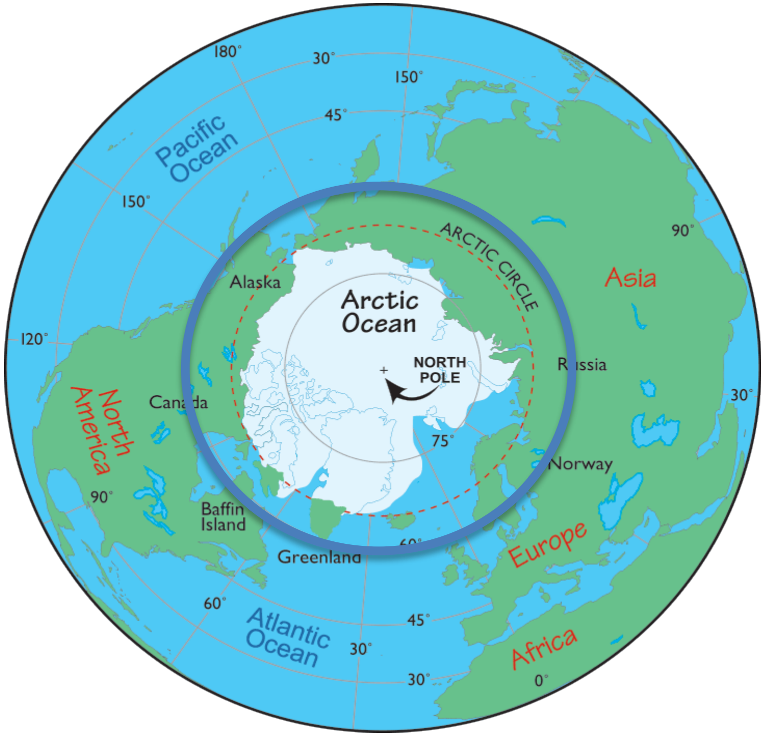
USGS Evaluating Aleutian Imagery and Elevation Options

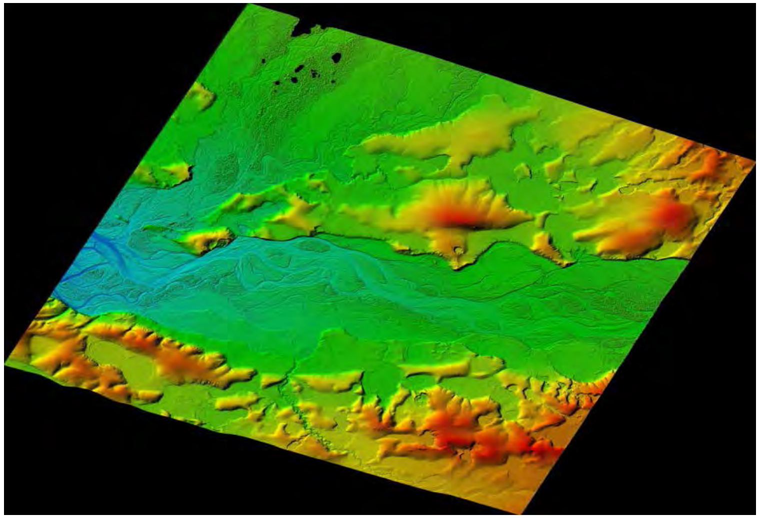
- **Elev: Evaluating WorldDEM, Airborne IfSAR, PGC ArcticDEM**
- **Imagery: SPOT 6/7 1.5m; DigitalGlobe Worldview 0.5m**



Polar Geospatial Center Arctic Elevation Data

- PGC has branded its product 'ArcticDEM'
- 2m elevation data is being created over the entire Arctic 60-degrees and north, and for all of Alaska, Greenland, and the Russian Kamchatka Peninsula
- Alaska delivery summer 2016
- DSM product automatically derived from satellite optical imagery (some known quality issues)
- All data free, unrestricted use
- USGS will evaluate for Aleutians





Tsunami inundation mapping for Alaska communities

Dmitry Nicolsky Elena Suleimani

University of Alaska Fairbanks
Alaska Earthquake Center

cindi preller, NOAA's NWS Alaska Region Tsunami Program Manager

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

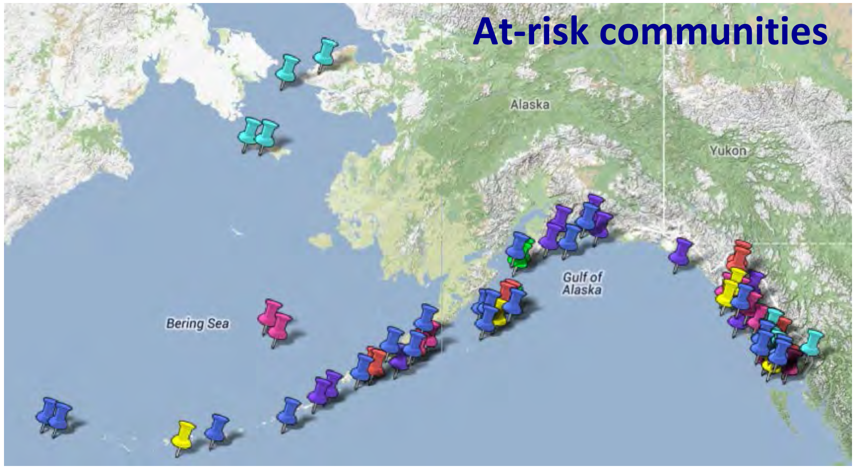
NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

http://iocm.noaa.gov

Map Once, Use Many Times

Alaska State Tsunami Program

- **Goal:** provide community-specific tsunami mitigation products that are based on the best available science, numerical tools and data.
- **Partnership:** NOAA and Alaska State agencies



UAF
UNIVERSITY OF ALASKA FAIRBANKS
ALASKA EARTHQUAKE CENTER

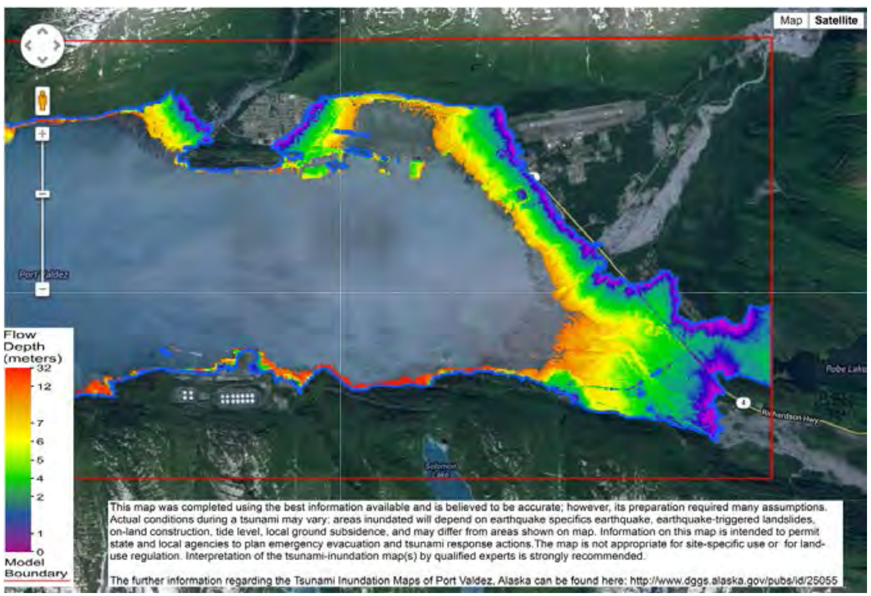
STATE OF ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

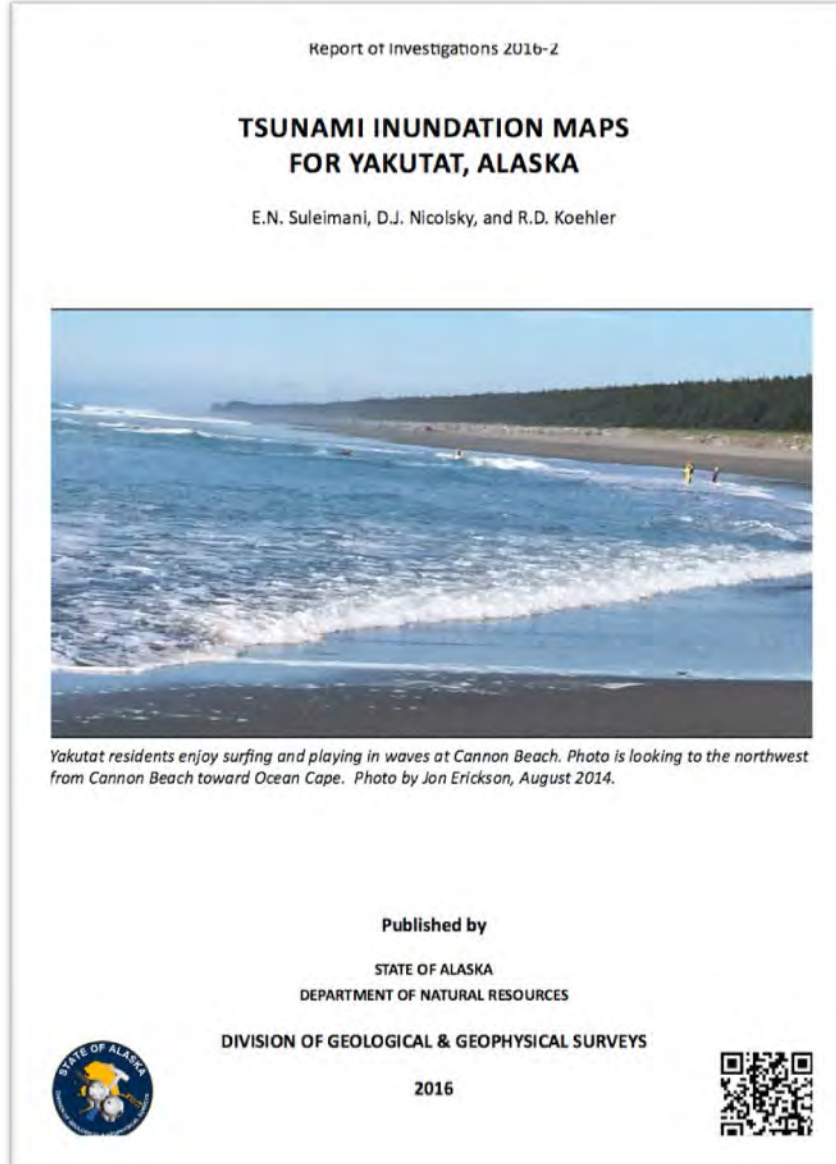
DIVISION OF HOMELAND SECURITY & EMERGENCY MANAGEMENT STATE OF ALASKA

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Our products

- **Products:** tsunami inundation maps and reports
  - **Visualization tools:** we provide inundation modeling results interactively through Google Maps





Report of Investigations 2016-2

TSUNAMI INUNDATION MAPS FOR YAKUTAT, ALASKA

E.N. Suleimani, D.J. Nicolsky, and R.D. Koehler

Yakutat residents enjoy surfing and playing in waves at Cannon Beach. Photo is looking to the northwest from Cannon Beach toward Ocean Cape. Photo by Jon Erickson, August 2014.

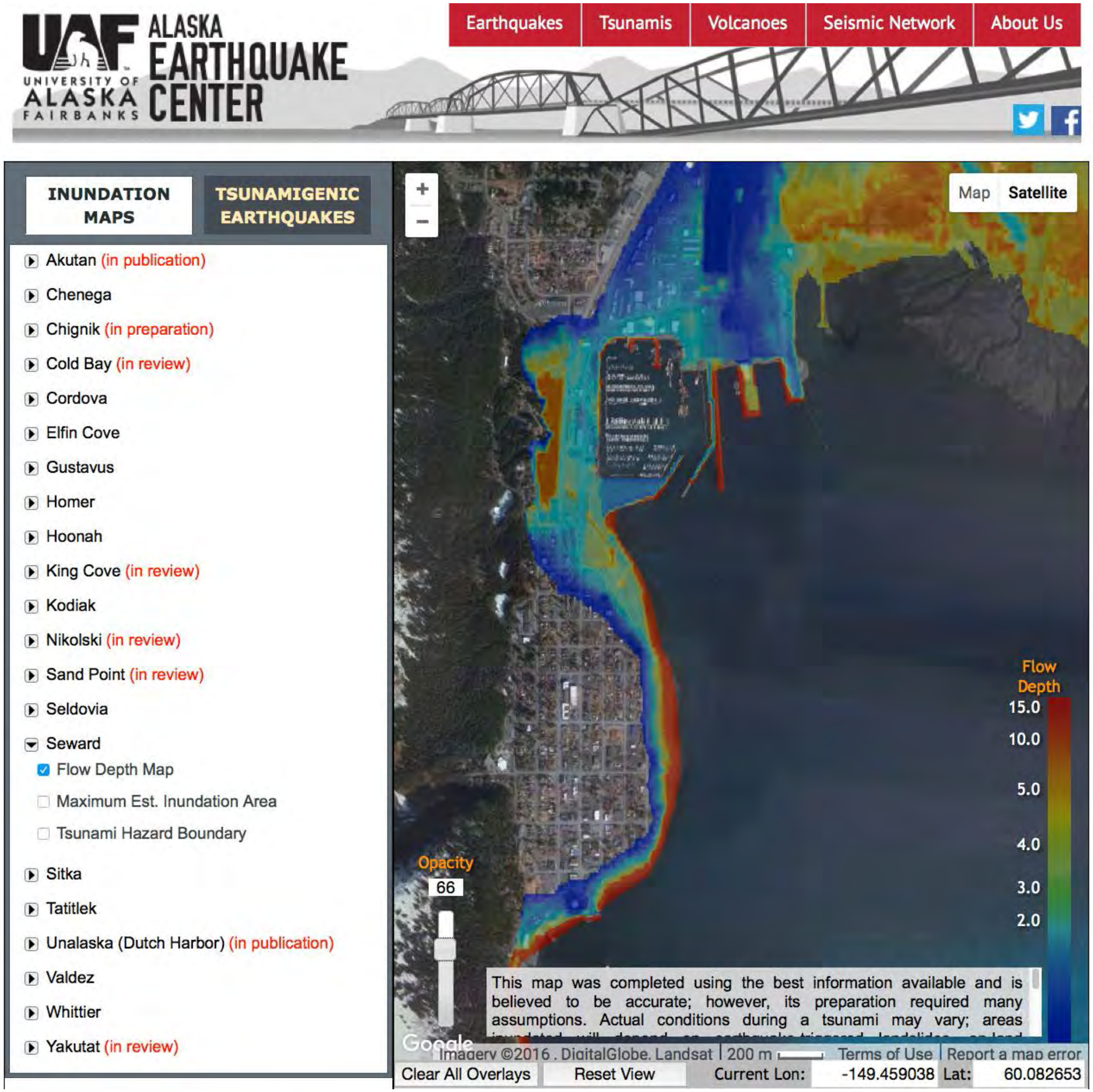
Published by

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

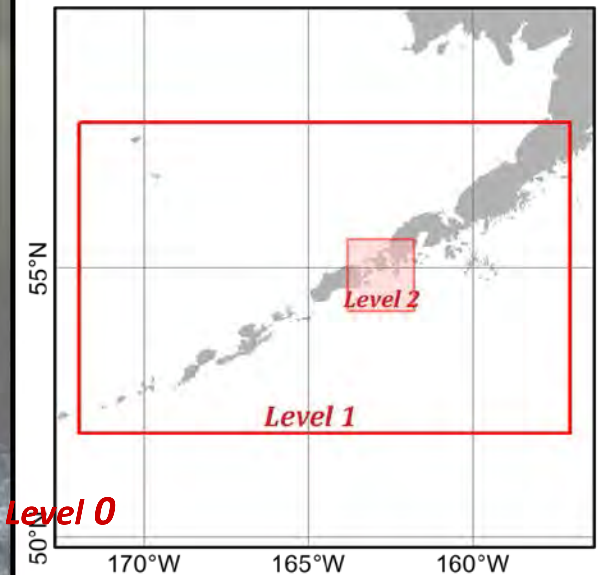
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

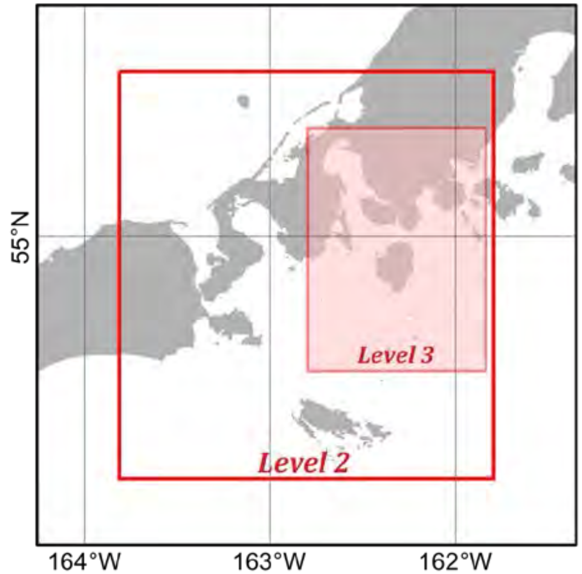
2016

Tsunami maps: earthquake.alaska.edu/tsunamis/atom

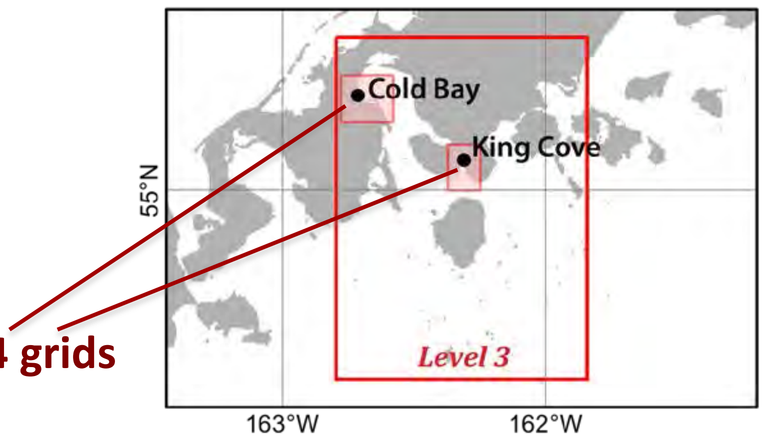


Data sets we use for tsunami modeling





We use telescoping grids (DEMs) of increasing resolution. The highest resolution grids (*Level 4*) have seamlessly combined bathymetry and coastal topography for calculation of tsunami runup.



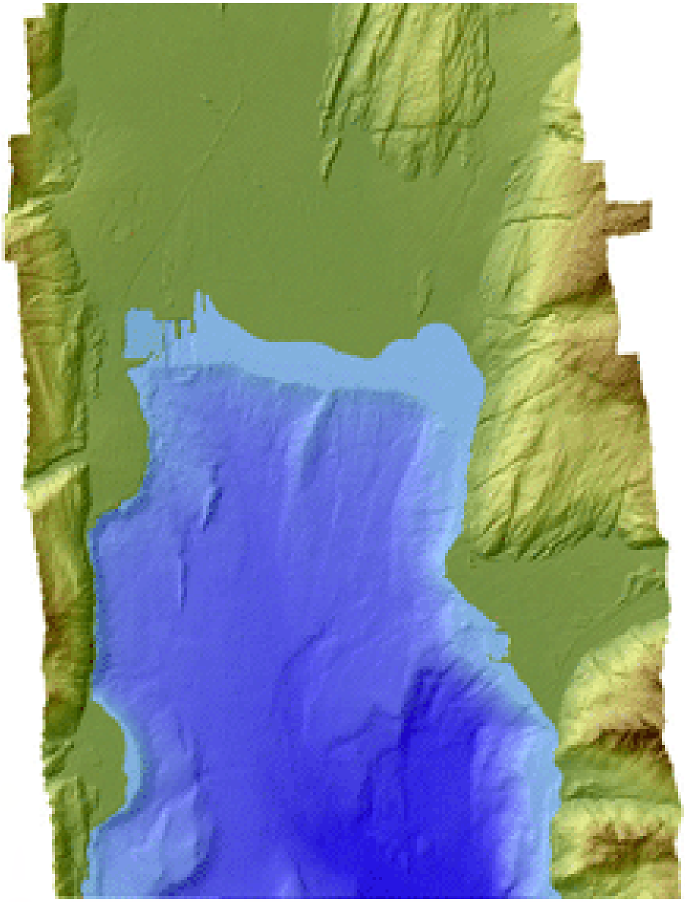
Level 4 grids

Grid resolutions:

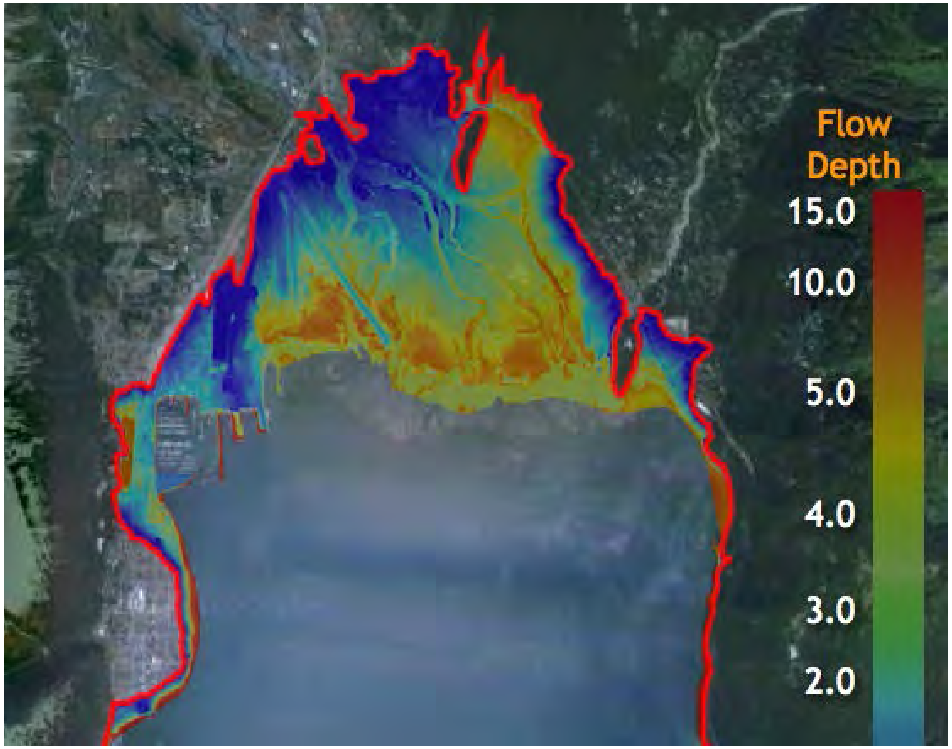
Level 0: 2 arc-minutes
Level 1: 24 arc-seconds
Level 2: ~8 arc-seconds
Level 3: ~3 arc-seconds
Level 4: ~15 meters

Example of the high-resolution grid

Labay, K.A., and P.J. Haeussler. 2008. *Combined high-resolution LIDAR topography and multibeam bathymetry for northern Resurrection Bay, Seward Alaska*. U.S. Geological Survey Data Series 374: 6.



We used this data sets to calculate potential tsunami inundation and flow depths in Seward:



through the Publication section on the ADGGS si

ov/publications/index.php

All Coastal States Tsunami Inundation Maps:

http://nws.weather.gov/nthmp/maps.html

try Nicolsky
ky@alaska.edu

a Suleimani
nani@alaska.edu

ndi Preller
eller@noaa.gov

BOEM: Environmental Studies:

Coastal and Offshore Mapping for the Review of Offshore Exploration and Production Plans submitted for the Beaufort and Chukchi Outer Continental Shelf (OCS)

Speaker: Warren Horowitz

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

http://iocm.noaa.gov

Map Once, Use Many Times

Assimilation of Geohazard Data from Industry High Resolution Seismic Surveys; Beaufort Near Shore Circulation; Wave and Hydrodynamic Modeling

- **Where: (Regional)** Chukchi and Beaufort OCS and central Beaufort coast
- **BOEM's Proposed Projects FY 2017**:

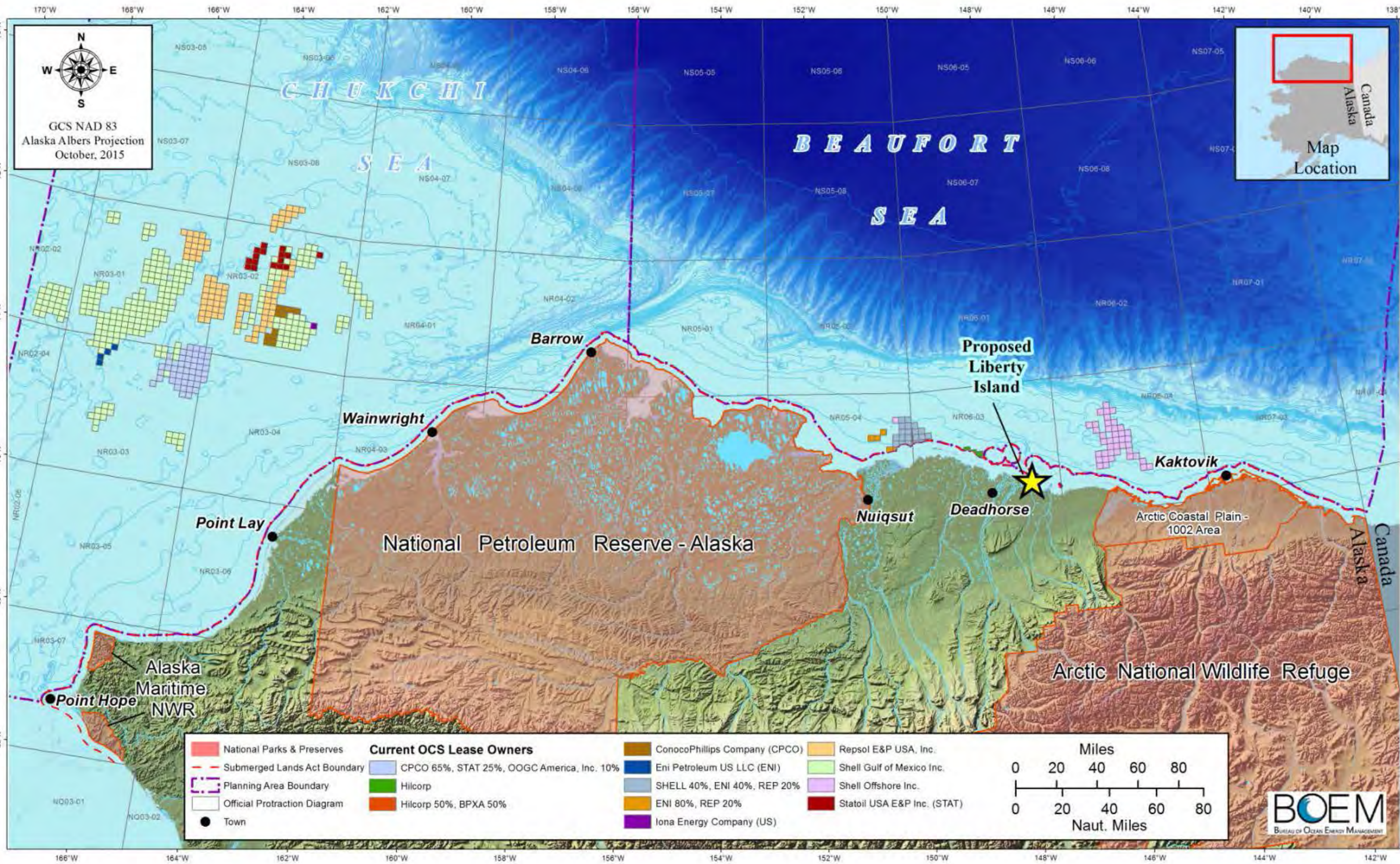
*1) **Synthesis of Sub-Sea Physical Environmental Data for the Beaufort and Chukchi Seas***
Assimilate Industry high-resolution survey data that is currently proprietary

2) Variability in Nearshore Buoyancy-Driven Circulation in the Beaufort Sea

3) Wave and Hydrodynamic Modeling in the Nearshore Beaufort Sea

- **Desired Baseline Data: Other high resolution seismic data, lidar,** bathymetry, ice gouge, strudel scour, stream gauge, waves, currents, sea ice thickness, etc…
- **Formats:** Spatial and temporal GIS data that can be assimilated with other data.
- **Motivations for mapping:** GIS database accessible to BOEM Analysts to respond to future exploration and development plans submitted by industry. NEPA Review and Five Year Planning

Contact: Warren Horowitz: BOEM Environmental Studies, Alaska OCS Region
Warren.Horowitz@BOEM.GOV, 907-334-5285



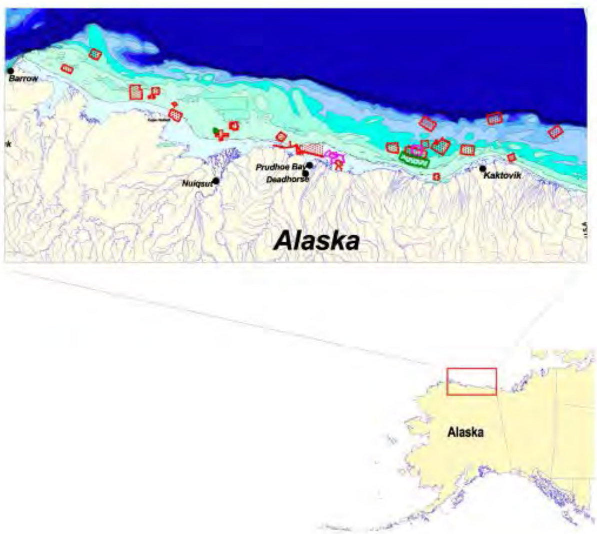
Note: This older map shows the lease blocks as of November 2015. A number of these blocks have been relinquished since then.

BOEM Subsea Physical Environmental Database MMS 2002-017

User Manual for Study Titled

OCS Study MMS 2002-017

Evaluation of Sub-Sea Physical Environmental Data for the Beaufort Sea OCS and Incorporation into a Geographic Information System (GIS) Database



U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region

Beaufort Sea shallow site survey and pipeline route survey data collected between 1982 and 1999:

- Shallow faults
- Subsea channels
- Shallow gas
- Drain cracks
- Strudel scour
- Overflood limits
- Ice gouge
- Boulder Patch
- Bathymetry

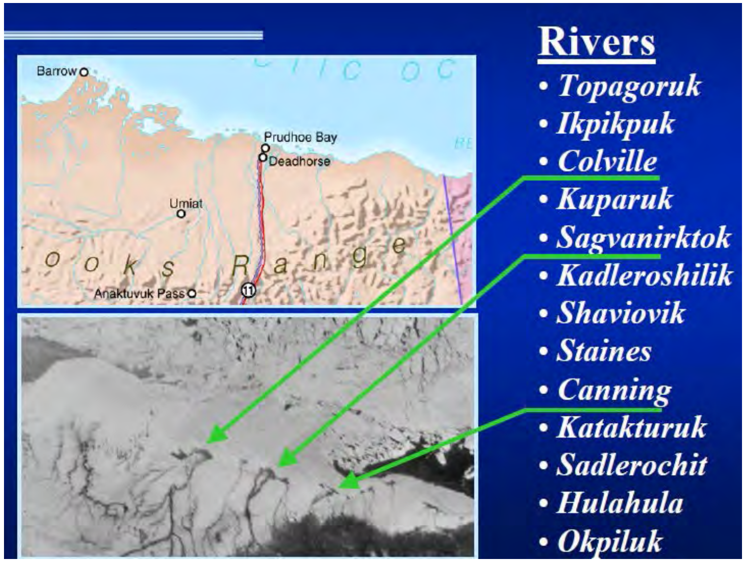
Report and data are available online:

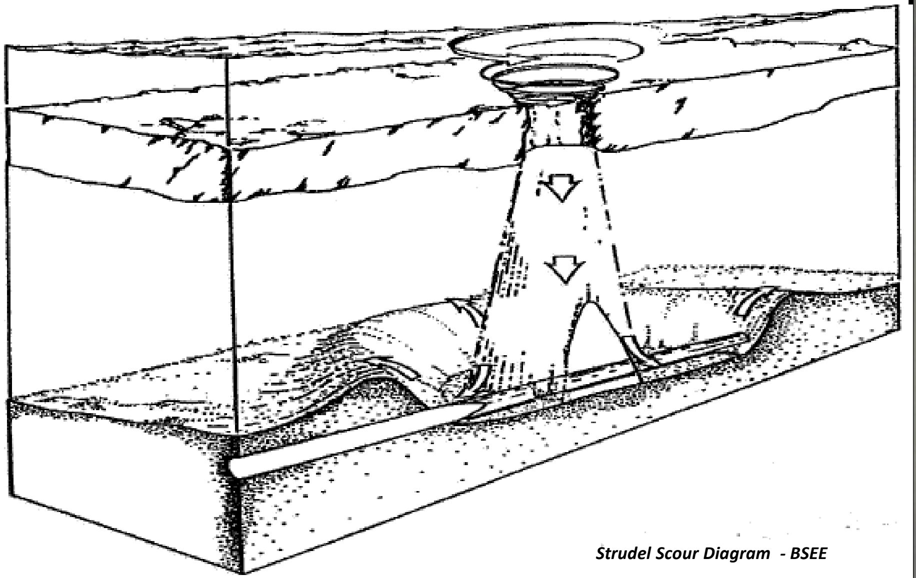
http://www.boem.gov/Alaska-Reports-2002

Similar fault, ice gouge, shallow gas data etc.. has been compiled internally for the Chukchi Sea through 1991.

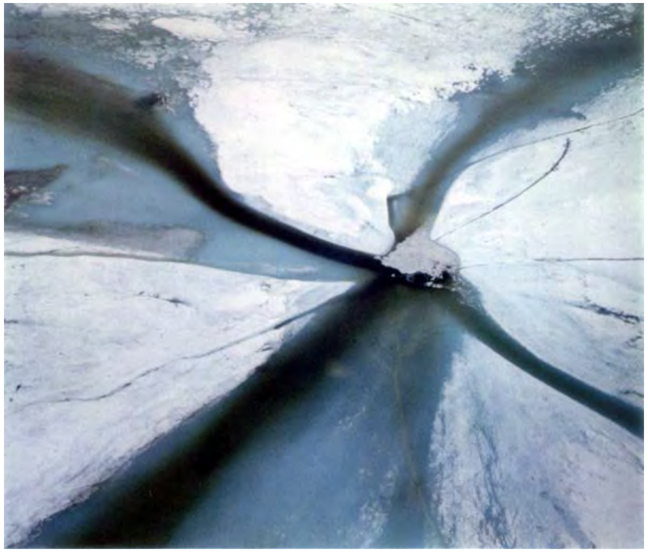
New study planned for FY 2017 will update these data for the Chukchi and Beaufort sea through 2015.

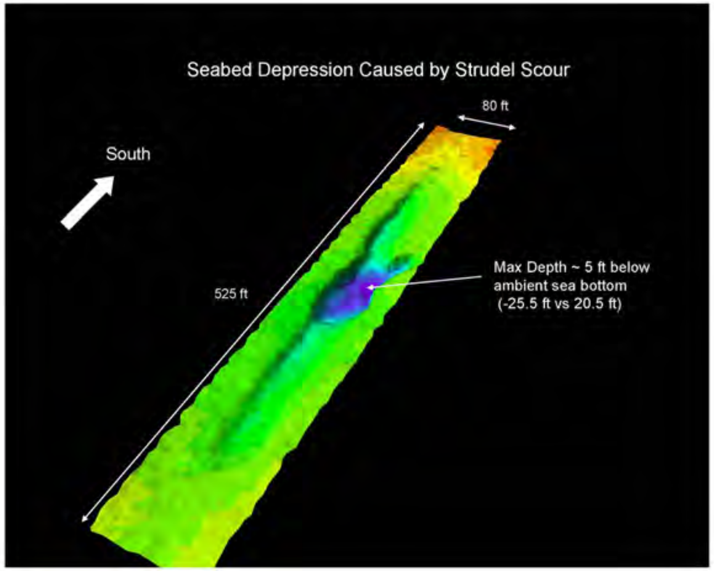
Strudel Scour Locations



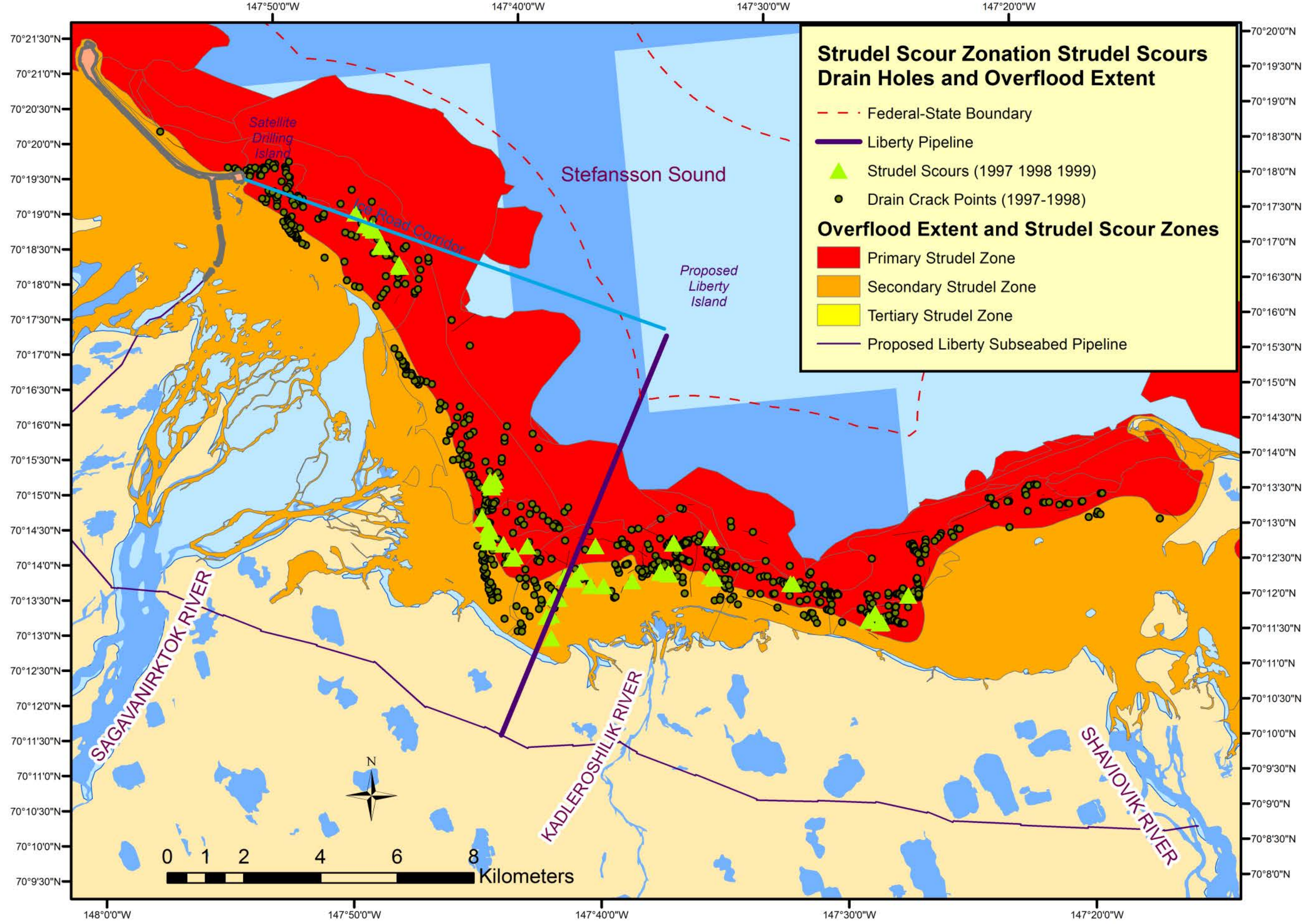


Strudel Scour Diagram - BSEE





Strudel Scour Diagram – Coastal Frontiers


Strudel Scour Zonation Strudel Scours Drain Holes and Overflood Extent
Federal-State Boundary
Liberty Pipeline
Strudel Scours (1997 1998 1999)
Drain Crack Points (1997-1998)
Overflood Extent and Strudel Scour Zones
Primary Strudel Zone
Secondary Strudel Zone
Tertiary Strudel Zone
Proposed Liberty Subseabed Pipeline
Stefansson Sound
Satellite Drilling Island
Ice Road Corridor
Proposed Liberty Island
SAGAVANIRKTOK RIVER
KADLEROSHILIK RIVER
SHAVIOVIK RIVER
N
0 1 2 4 6 8 Kilometers
147°50'0"W
147°40'0"W
147°30'0"W
147°20'0"W
148°0'0"W
70°21'30"N
70°21'0"N
70°20'30"N
70°20'0"N
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70°9'0"N
70°8'30"N
70°8'0"N

Western Alaska
Landscape Conservation Cooperative

Western Alaska LCC

Joel Reynolds

Joel_Reynolds@fws.gov

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

http://iocm.noaa.gov

Map Once, Use Many Times

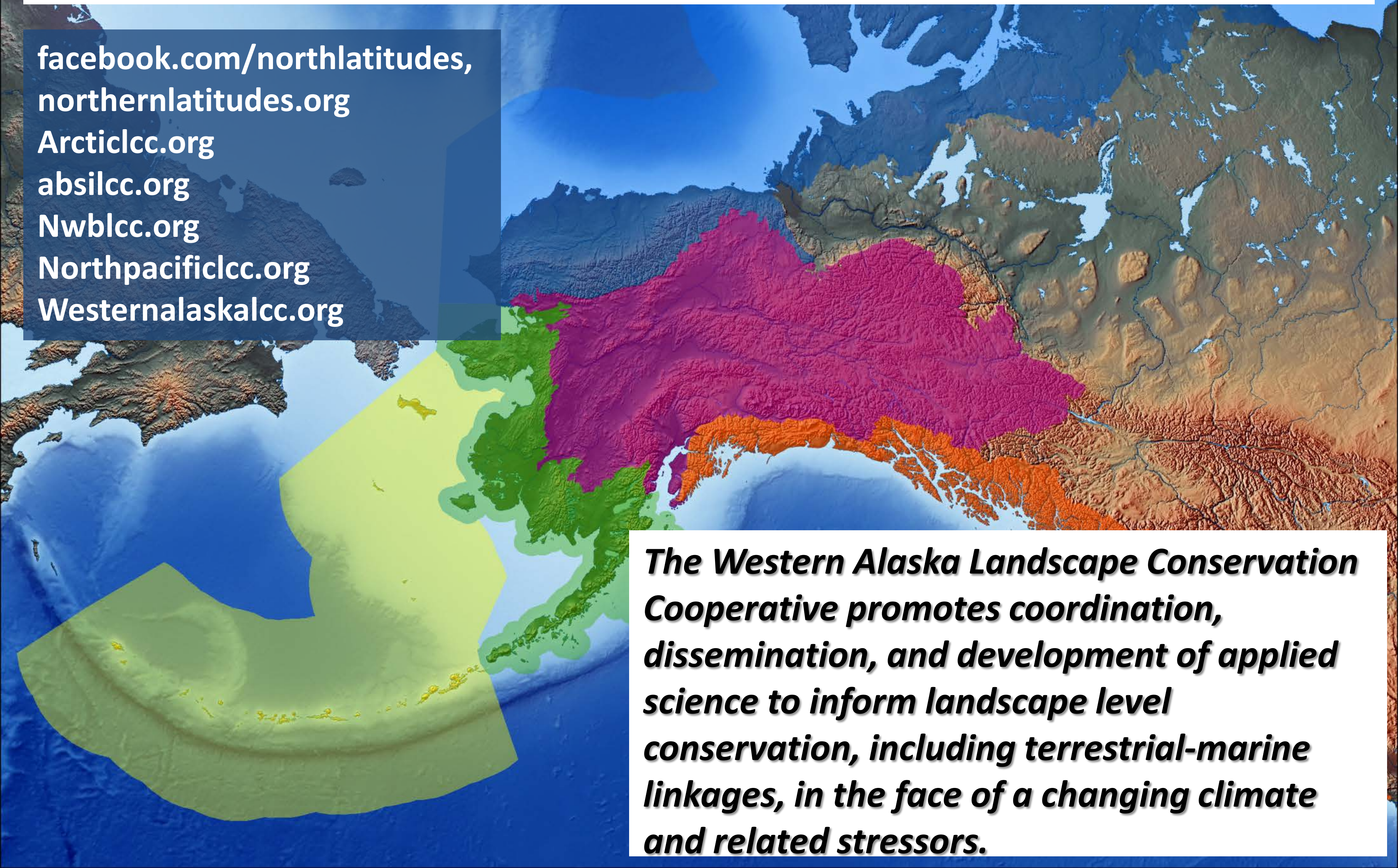
Arctic Landscape Conservation Cooperative

absi
Aleutian and Bering Sea Islands Landscape Conservation Cooperative

Western Alaska LCC

Northwest Boreal
Landscape Conservation Cooperative

North Pacific Landscape
Conservation Cooperative



facebook.com/northlatitudes,
northernlatitudes.org
Arcticlcc.org
absilcc.org
Nwblcc.org
Northpacificlcc.org
Westernalaskalcc.org

The Western Alaska Landscape Conservation Cooperative promotes coordination, dissemination, and development of applied science to inform landscape level conservation, including terrestrial-marine linkages, in the face of a changing climate and related stressors.

Coastal Mapping Projects (FY12/13)

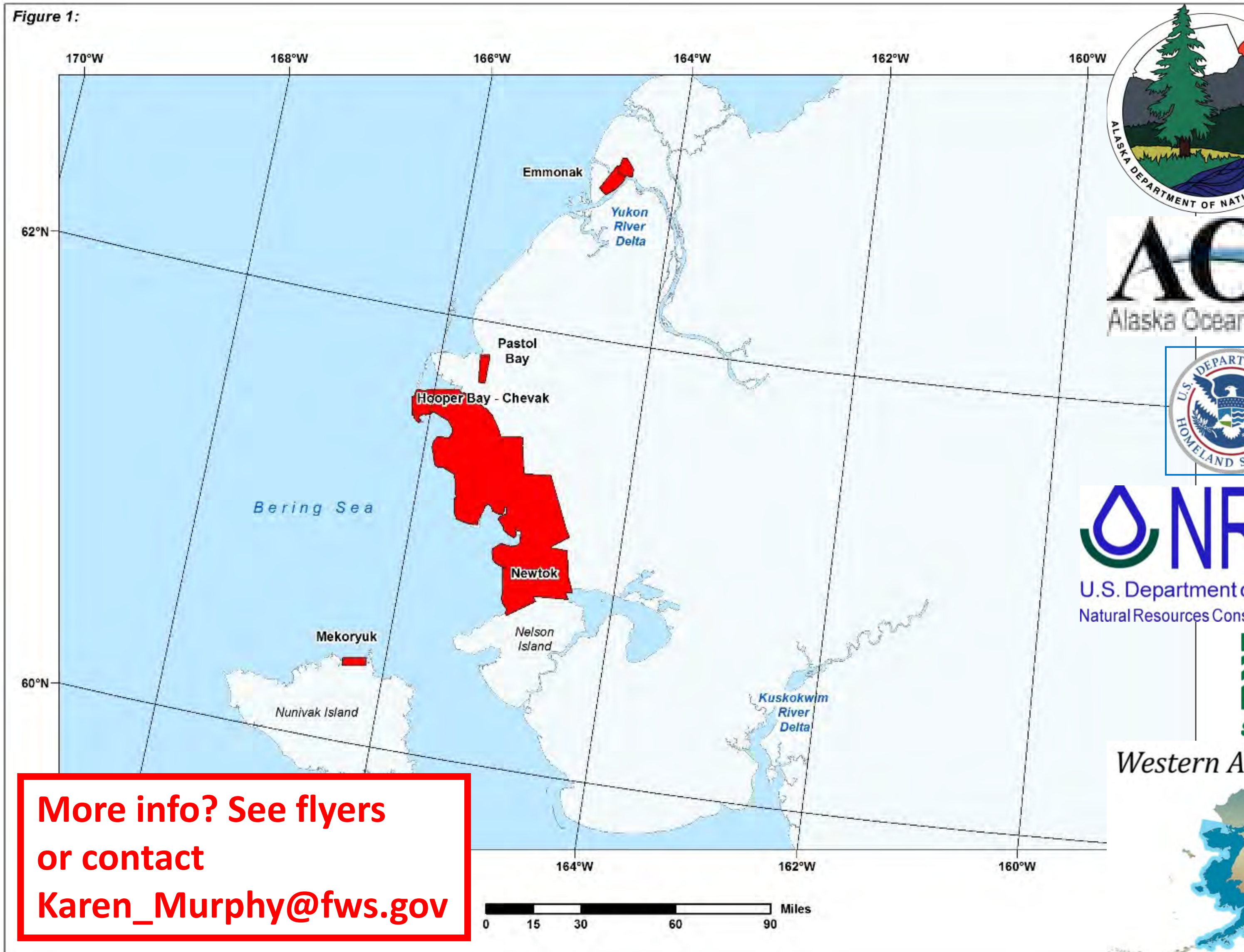
- NHD-compliant shoreline, Cape Prince of Wales to Cape Espenberg (Robertson, SMUM)
- Nearshore Bathymetry (Kinsman, DGGS)
- Re-occupation of tidal benchmarks (Tweet, UAF) => estimates of vertical velocity for w. AK & RSLR for YK Delta
- Extensive Shoreline Change (Macander, ABR)
- Shorezone

Western Alaska LCC

Westernalaskalcc.org/projects

3DEP LIDAR on YK Delta – *Planned* Acquisition

Figure 1:



More info? See flyers or contact Karen_Murphy@fws.gov

ALASKA DEPARTMENT OF NATURAL RESOURCES

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

AOOS
Alaska Ocean Observing System

U.S. DEPARTMENT OF HOMELAND SECURITY
FEMA

NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

USGS
science for a changing world

Western Alaska LCC

Promoting Coastal Resilience & Adaptation in Western Alaska

Nome – 10/11 May
Dutch – 19/20 Aug
King Salmon – 21/22 Sept
Kotz. - mid Nov

More info?
See flyers or contact
Aaron_Poe@fws.gov

4 Hub workshops:

– Share "A Toolbox" of resources to support adaptation efforts
– Two-way dialogue about adapting to changes
– Connecting agencies and communities with common cause

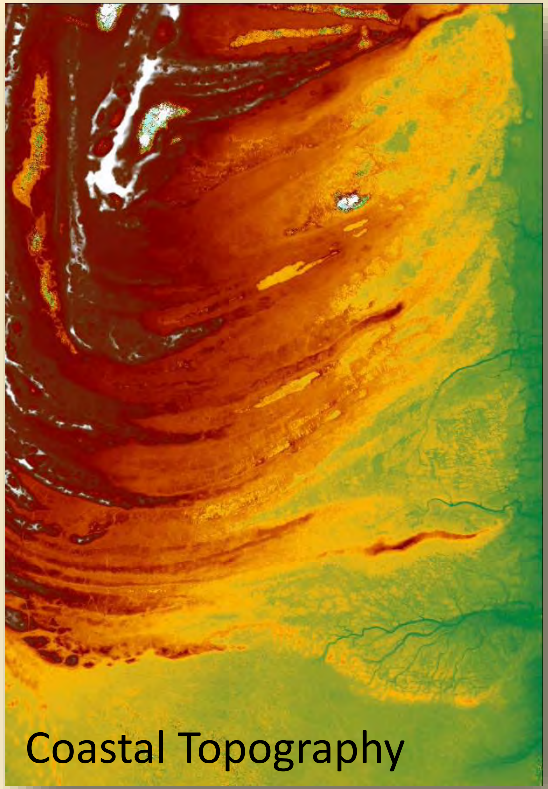
Aleutian Pribilof Islands Association · Kawerak, Inc. · Qawalangin Tribe of Unalaska · U.S. Fish & Wildlife Service · North Pacific Research Board · NOAA · AOOS Alaska Ocean Observing System · Sea Grant Alaska · absi · Arctic Landscape Conservation Cooperative · Western Alaska LCC

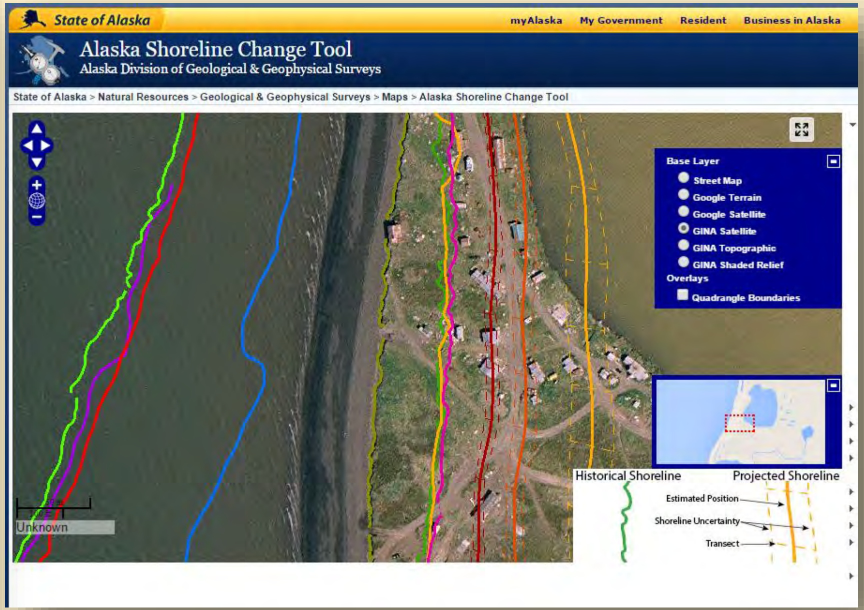
2016 ALASKA COASTAL MAPPING SUMMIT

State of Alaska Coastal Hazards Program Activities

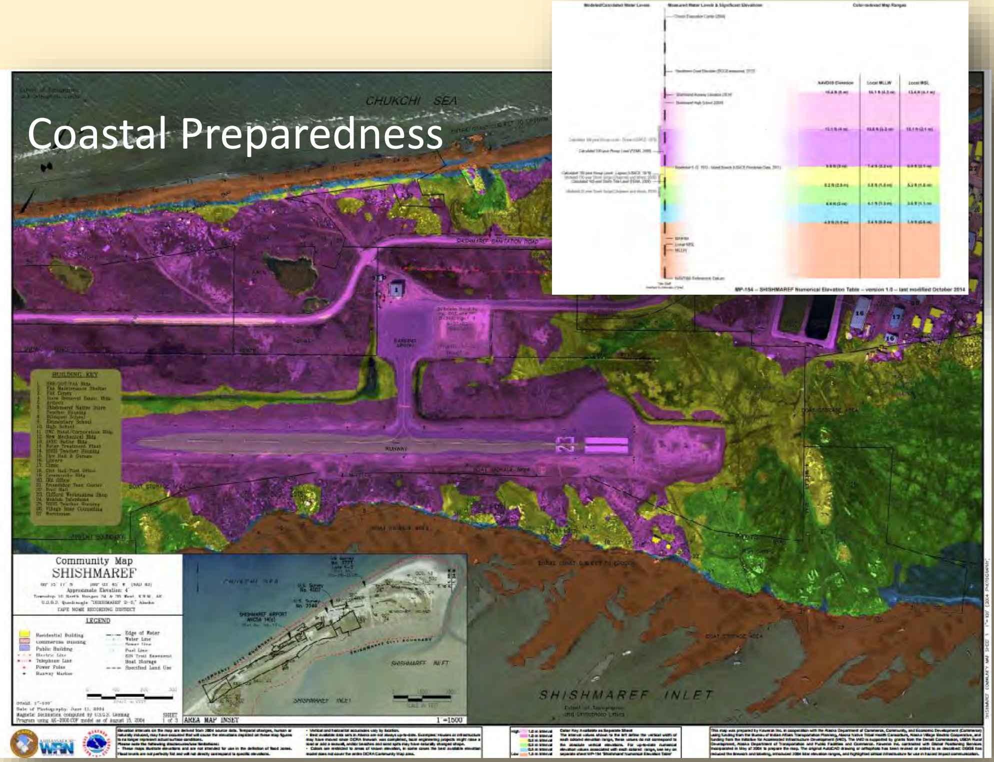
Jacquelyn Overbeck
State of Alaska, Dept. of Natural Resources
Division of Geological & Geophysical Surveys
Coastal Hazards Program Manager

COASTAL HAZARDS PROGRAM


Coastal Topography



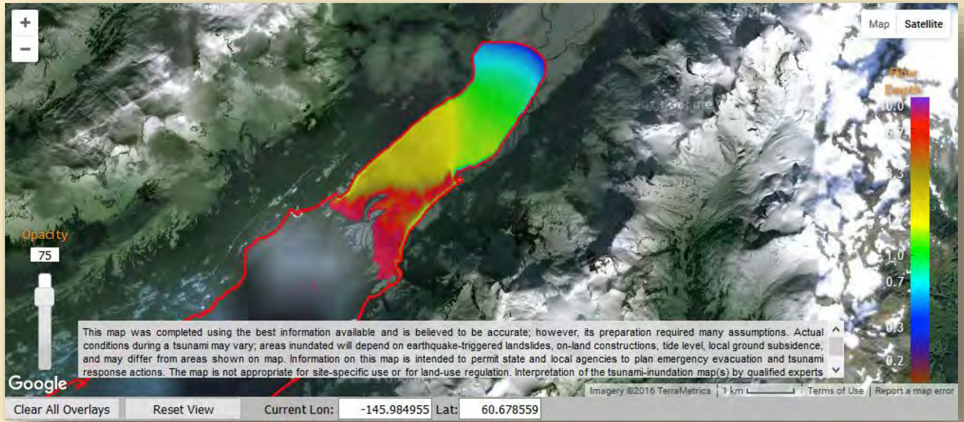
Geohazard Evaluation and Geologic Mapping for Coastal Communities


Coastal Preparedness

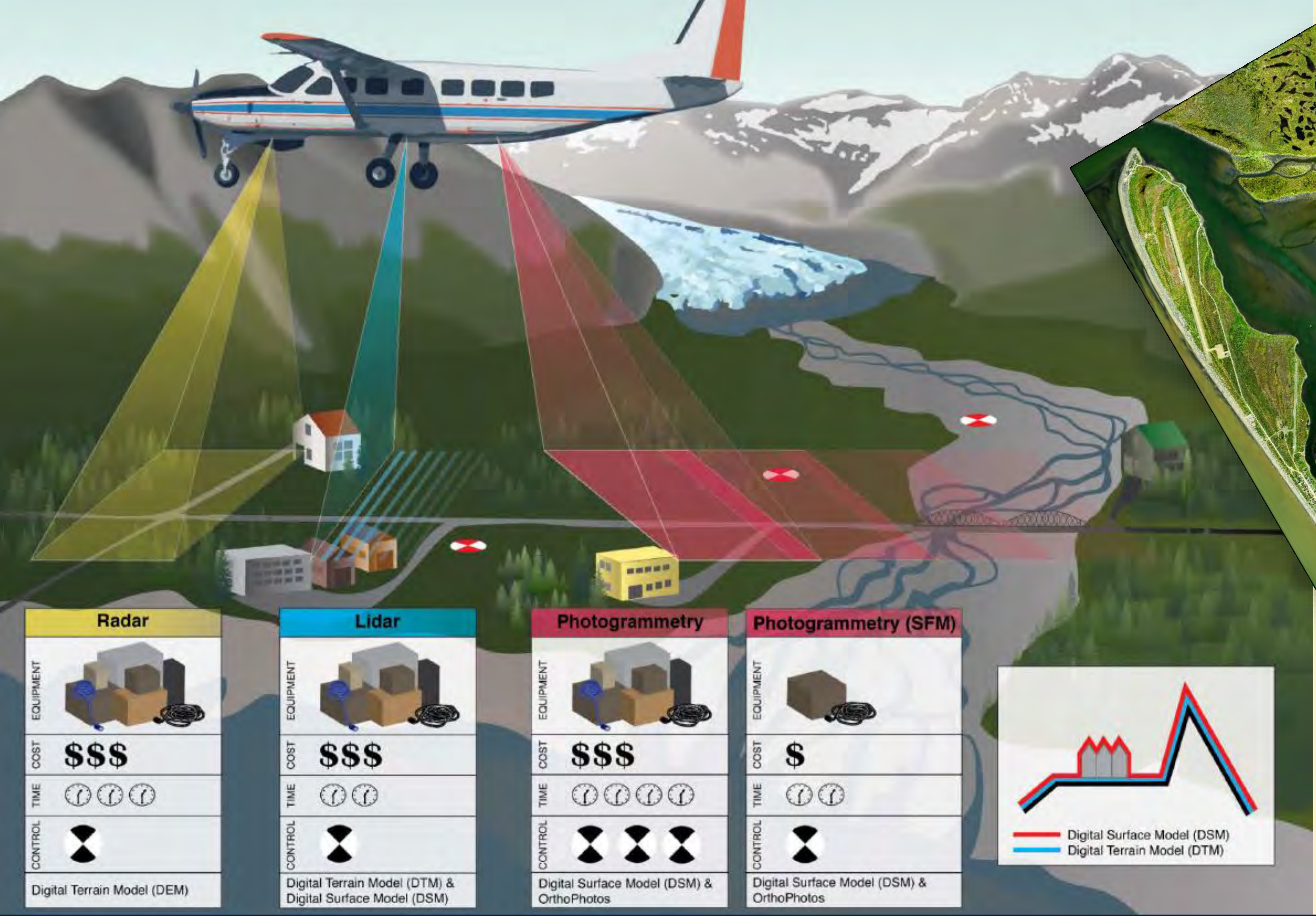
Tsunami Research and Inundation Mapping for Alaska Communities

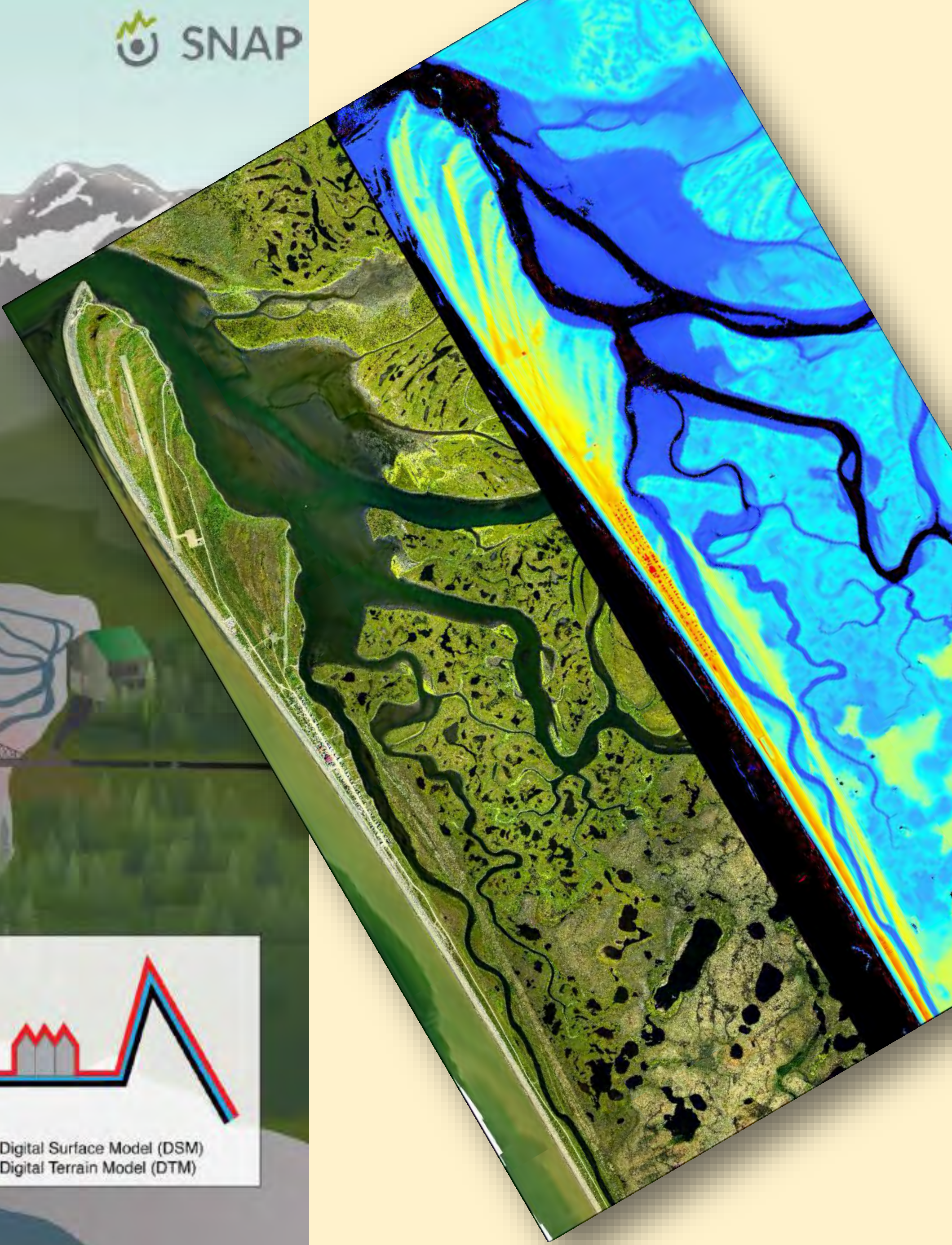

Water Level Investigations

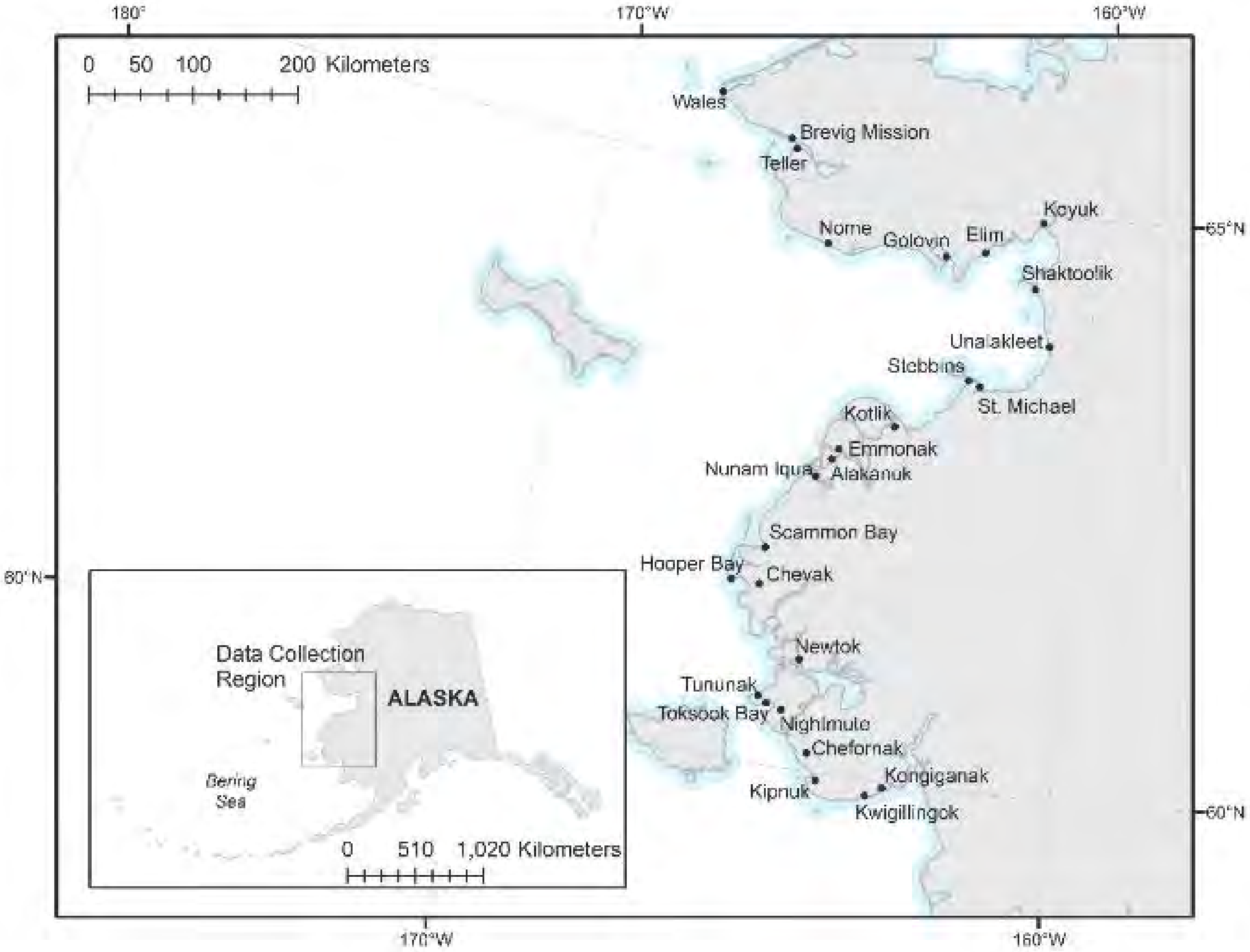
Nearshore Bathymetry



STRUCTURE-FROM-MOTION





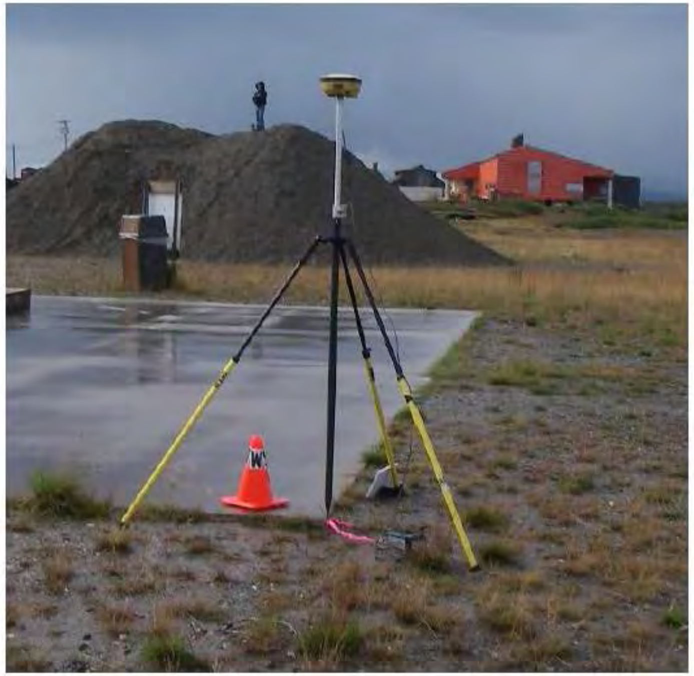


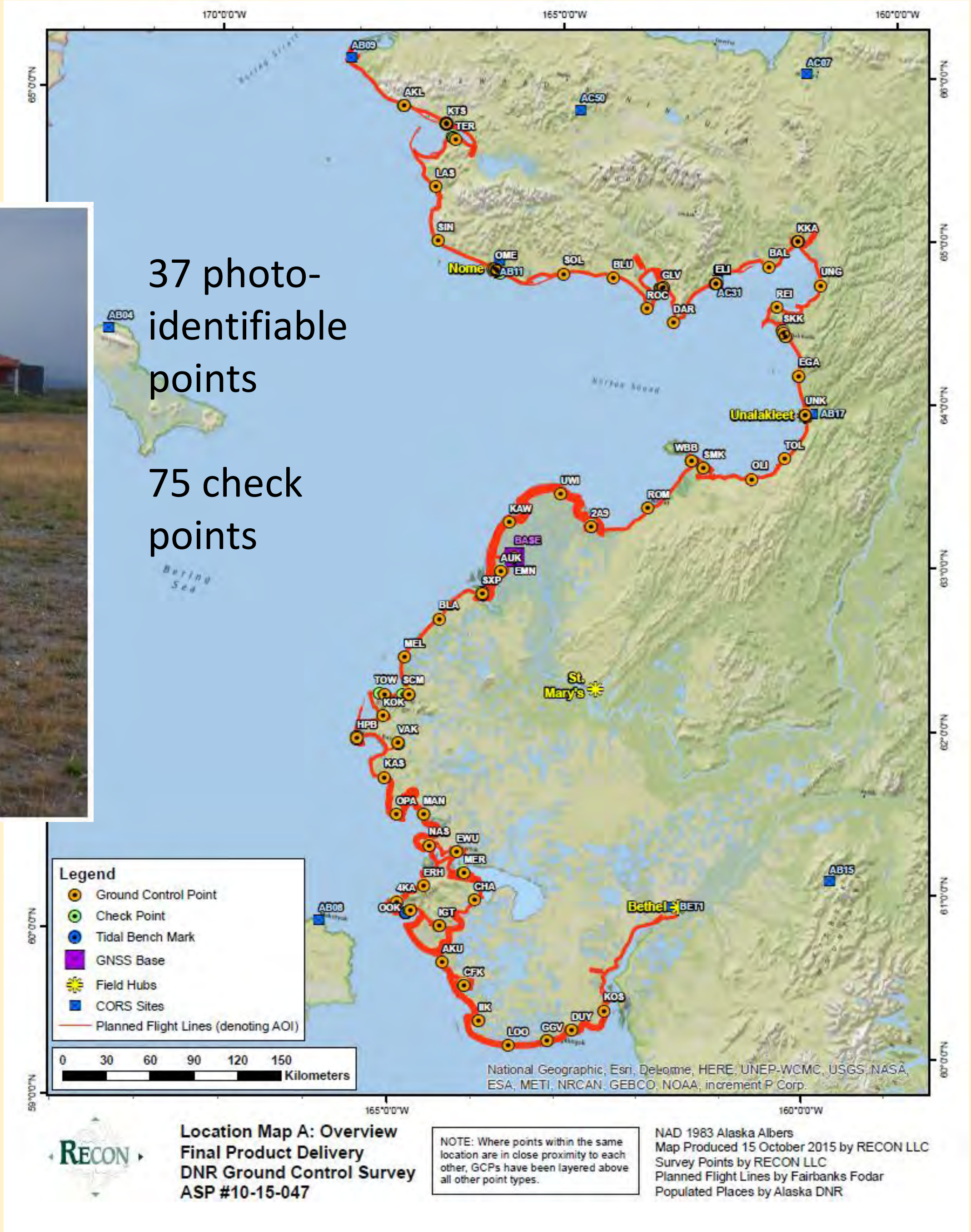
May 2016 coastal community release

June 2016 collect and re-collect

Late 2016 continuous coastal release and additional communities

HORIZONTAL & VERTICAL ACCURACY





37 photo-identifiable points

75 check points

No horizontal transformation at the pixel level

Vertical shift applied to final elevation model
0 – 61 cm

2016 planned Lidar collection

USGS 3DEP program

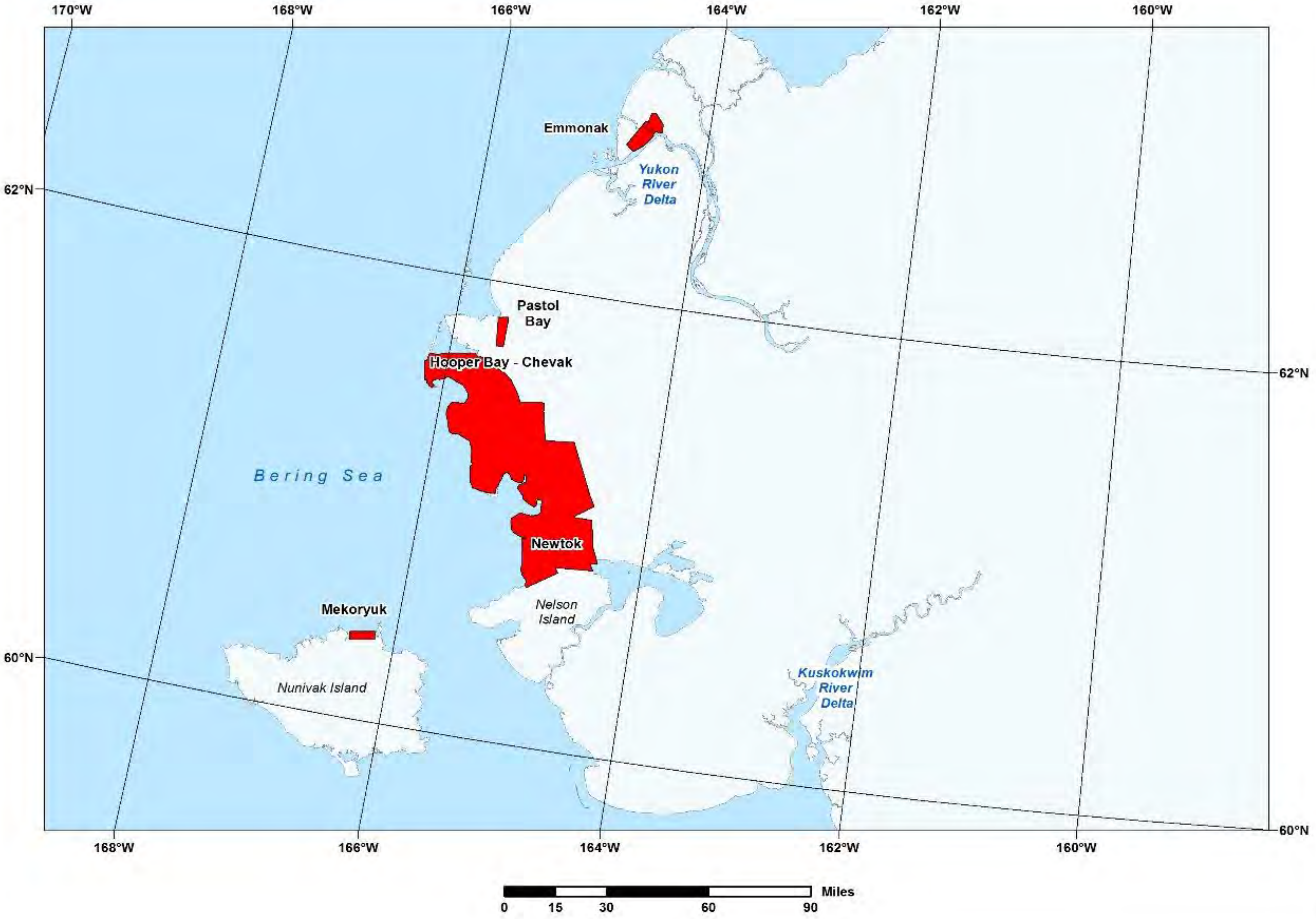
Contributors

Natural Resources Conservation Services

FEMA

USFWS

State of Alaska, DNR, DGGS



THANK YOU

CONTACT INFORMATION

Jacquelyn Overbeck
Coastal Hazards Program Manager
Ph: 907-451-5026
Fax: 907-451-5050
jacquelyn.overbeck@alaska.gov

AK HYDRO

Alaska Hydrography Database

Kacy Krieger
AK Hydro Coordinator
Co-Chair AHTWG
kekrieger2@uaa.alaska.edu

Mike Plivelich
AK Hydro Technical Steward
mtplivelich@uas.alaska.edu

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

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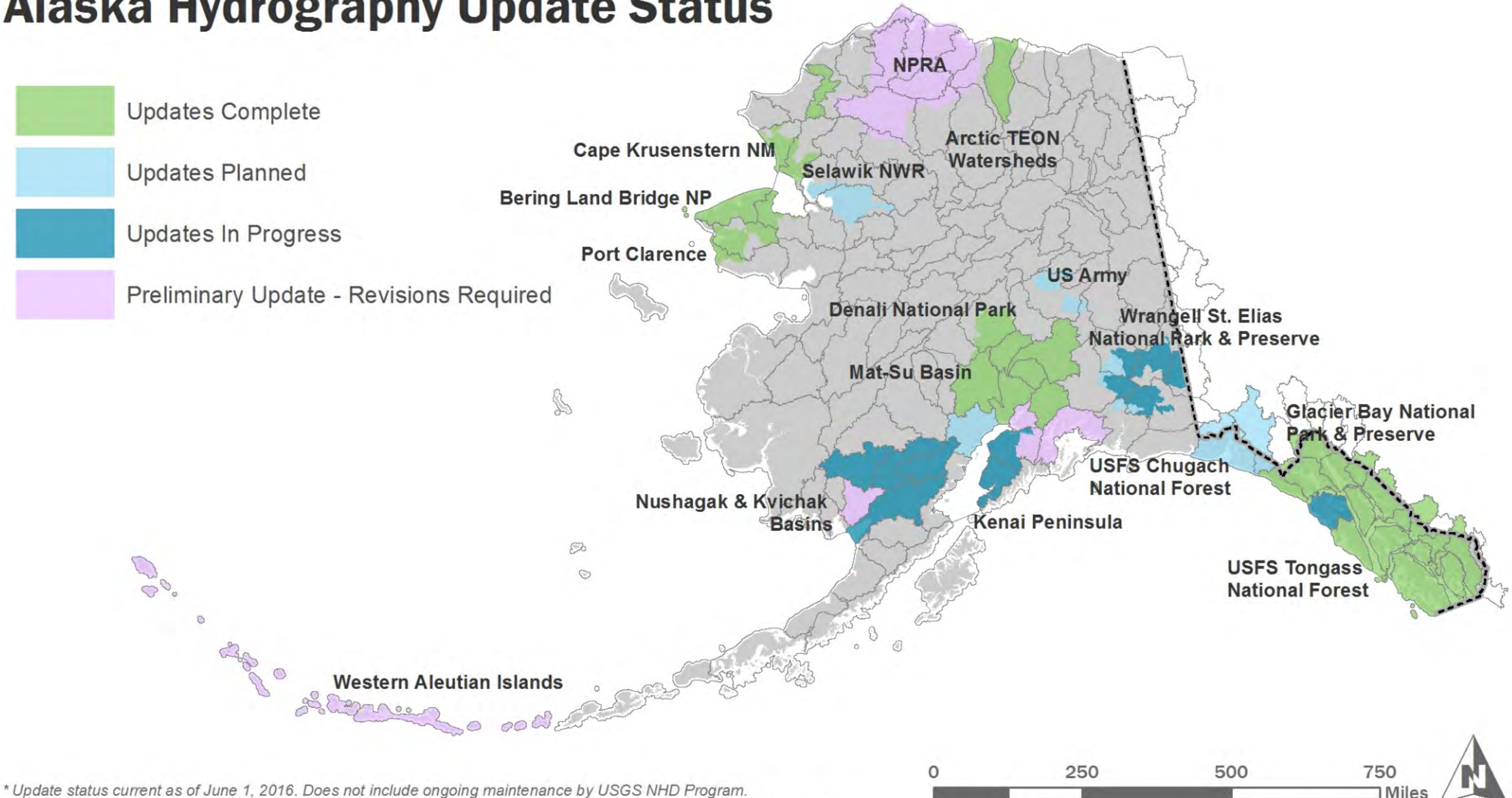
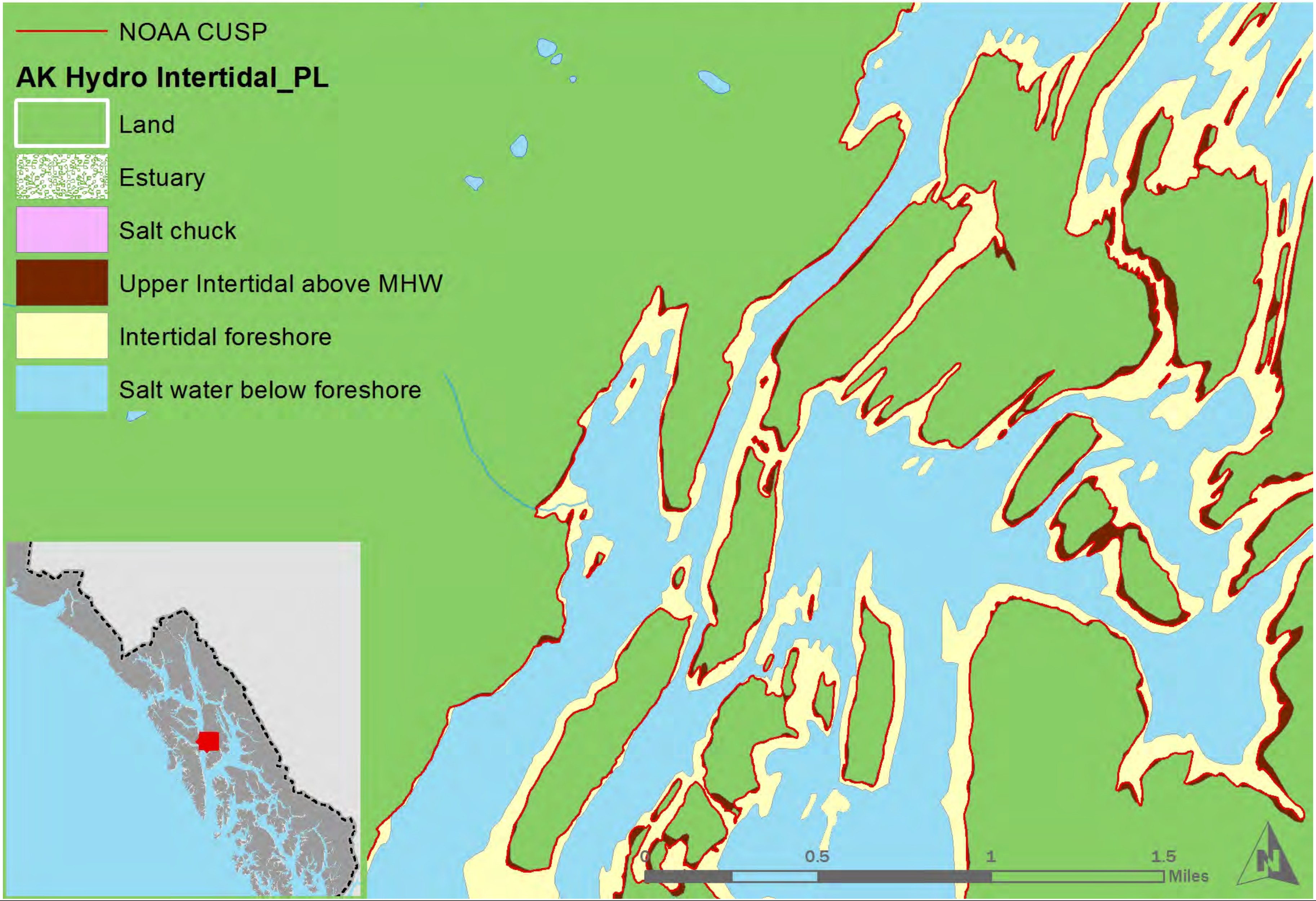
Alaska Hydrography Update Status

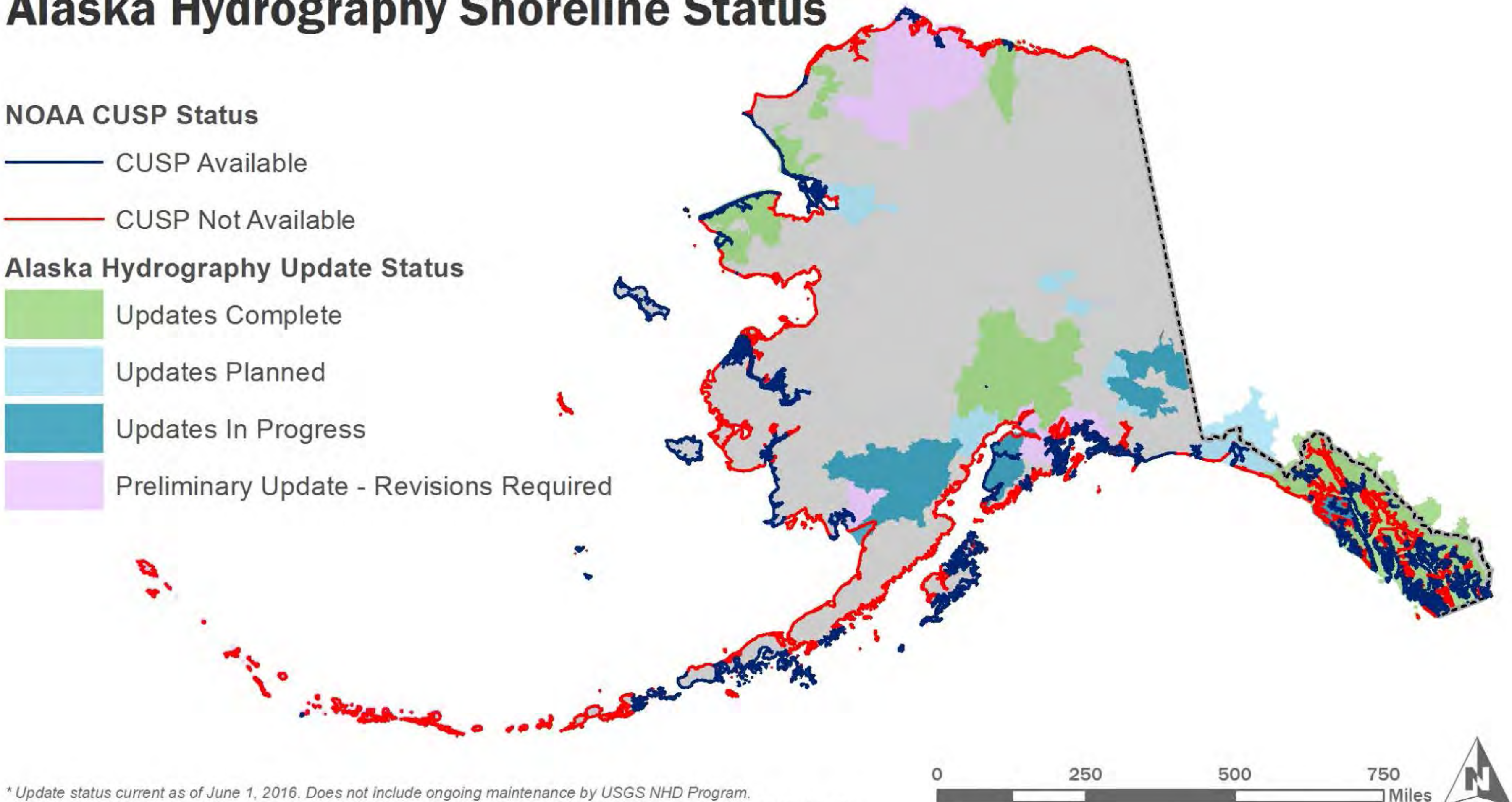


** Update status current as of June 1, 2016. Does not include ongoing maintenance by USGS NHD Program.*
For more information, contact Kacy Krieger, Alaska Hydrography Coordinator, (907) 786-7749, kekrieger2@uaa.alaska.edu

Alaska Hydrography Shoreline Products



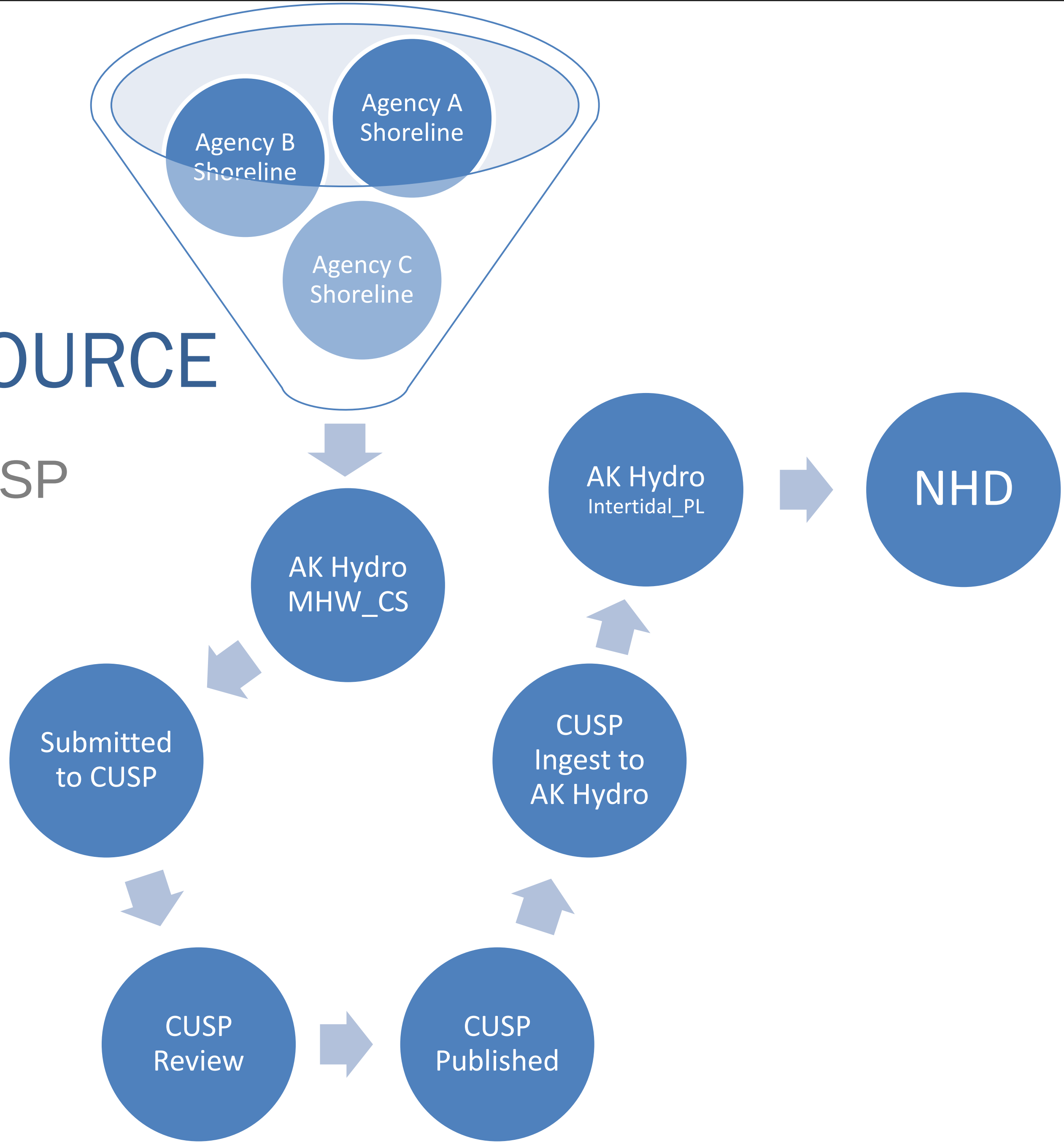
Alaska Hydrography Shoreline Status



** Update status current as of June 1, 2016. Does not include ongoing maintenance by USGS NHD Program.*
For more information, contact Kacy Krieger, Alaska Hydrography Coordinator, (907) 786-7749, kekrieger2@uaa.alaska.edu

AK Hydro
MHW
COMBINED SOURCE

Crowd sourcing CUSP updates in Alaska



GeoNorth LLC

GEONORTH
A Wholly Owned Subsidiary of The Tatitlek Corporation

Jon Heinsius
Director, U.S. Federal Programs
jheinsius@geonorth.com / 202.361.7447

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE
http://iocm.noaa.gov
Map Once, Use Many Times

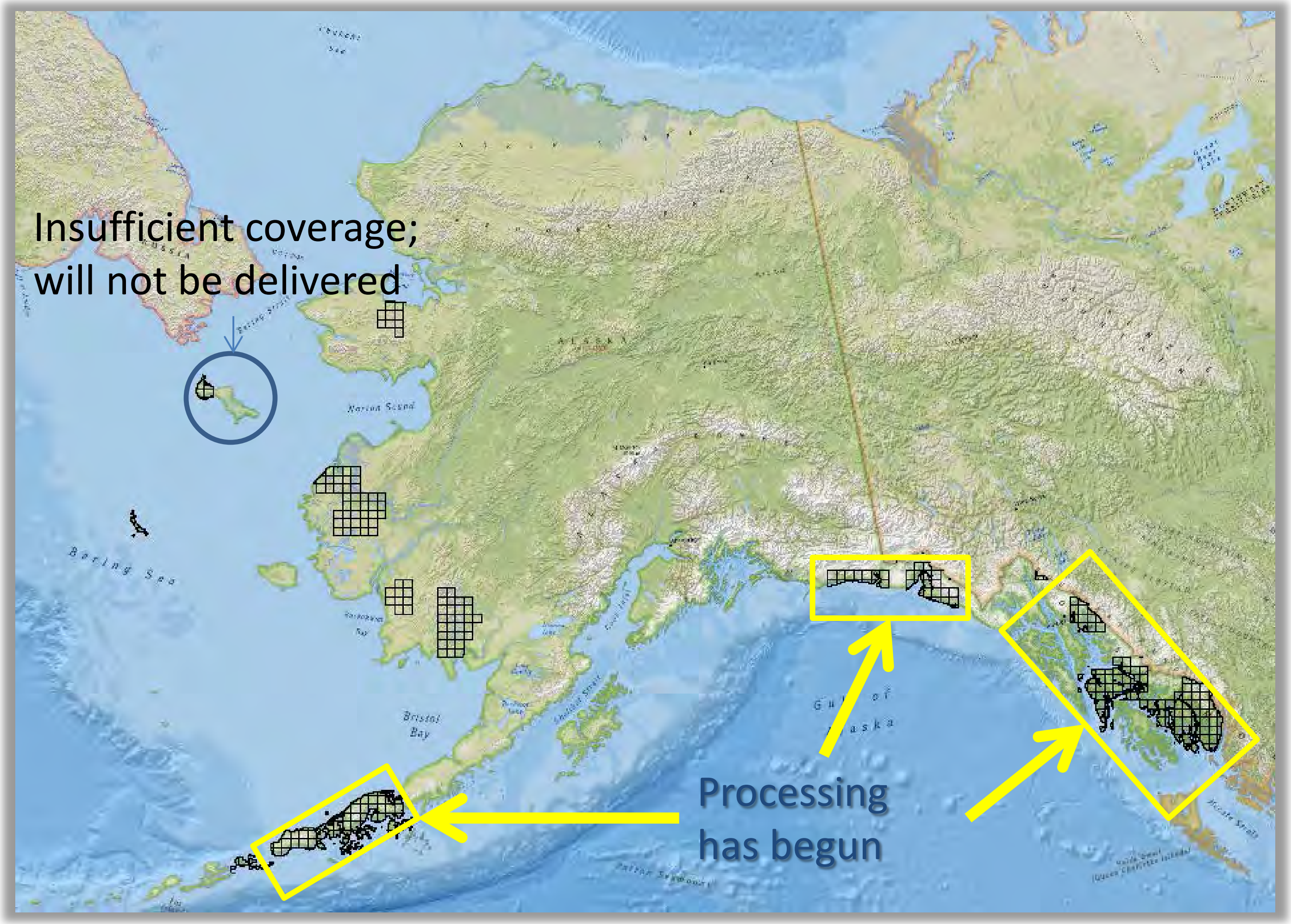
Where & When

- Utilize recent archive SPOT 6 & SPOT 7 imagery to update and replace 96,000km2 of the State of Alaska's existing 2.5m SPOT 5 SDMI imagery.

- AOIs determined by priority of Coastal Impact Assessment Program (CIAP)

Where & When (cont.)

All 96,000 sqkm will be delivered to AK DNR no later than Q4 2016.



What

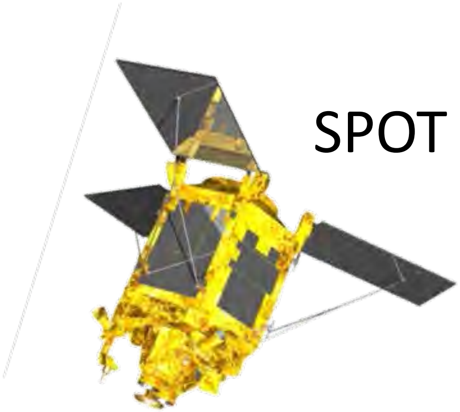
- Source SPOT 6 & 7 data
  - 1.5m Pan & 6m 4-Band Multispectral Data
  - Associated Metadata
- Finished Ortho Tiles
  - Three 1.5m resolution images: 1) Pan Only; 2) Natural Color; 3) False Color
  - Associated Metadata
- Licensing
  - Fed, State, Local, Tribal & Academic use
  - Web-Viewing (Hosted by GINA)

Why

Key Benefits:

- Refresh *CIAP* Focus Areas
- Provide higher resolution 1.5m imagery
- Incorporate improved control sources
- Reduction in cloud cover

How



SPOT 6/7

- 6,000,000 km² per day – 60km swath
- 1.5 m resolution
- Improved weather forecasting
- Very High Agility
- Single pass stereo and tri-stereo acquisitions

Rada Khadjinova
Alaska Division Manager
rada@fugro.com
907-561-3478

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

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http://iocm.noaa.gov
Map Once, Use Many Times

Alaska Experience

- **Nautical charting** projects for NOAA: 15+ years
- **Offshore and nearshore surveying** projects for private sector: 40+ years
- **Habitat survey** projects for public sector: 5+ years
- **Geospatial** projects including lidar, IFSAR, and imagery services for private and public sector: 5+ years

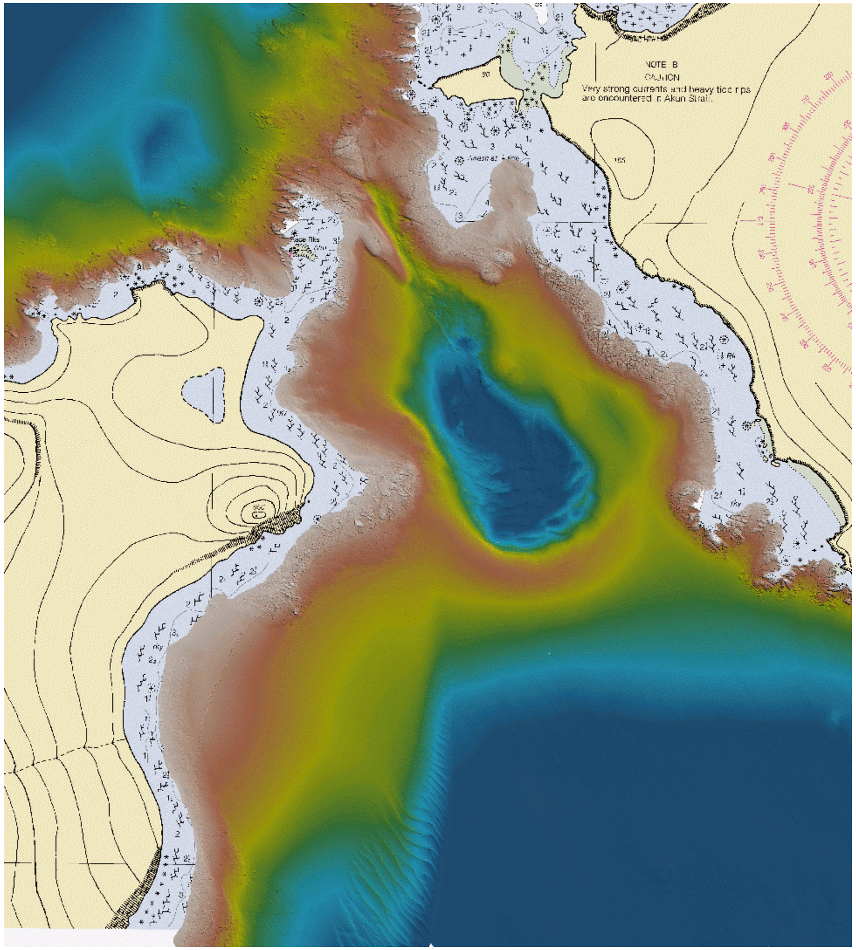


Image courtesy of NOAA

Coastal Mapping Capabilities

- Seafloor mapping services
  - Acoustic-based bathymetry
  - Airborne lidar bathymetry
  - Satellite derived bathymetry
- Geospatial services
  - Terrestrial lidar
  - Mobile laser scanning
  - Aerial and satellite imaging
- Coastal mapping products
  - Tsunami/coastal inundation maps
  - Coastal & nearshore geologic maps
  - Land-use/land-cover & habitat maps
  - Erosion baseline & change detection
  - Sea-level baseline analysis
  - Geologic hazard maps

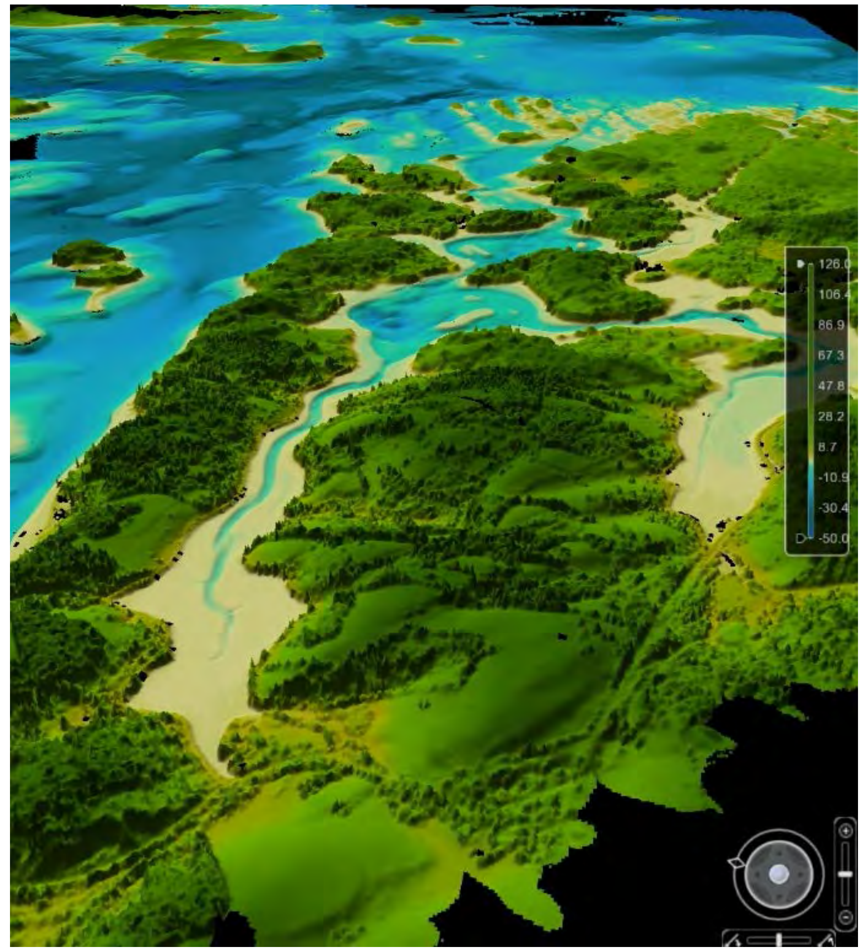


Image courtesy of Canadian Hydrographic Service

Case Study: California Seafloor Mapping Project

- Multi-year effort made possible through a **partnership model** with academia, government, and industry
- Dedicated to producing high-resolution **geologic and habitat base maps** for all California state waters while also updating **nautical charts**
- Resulting in baseline datasets that benefit **multiple stakeholder applications**

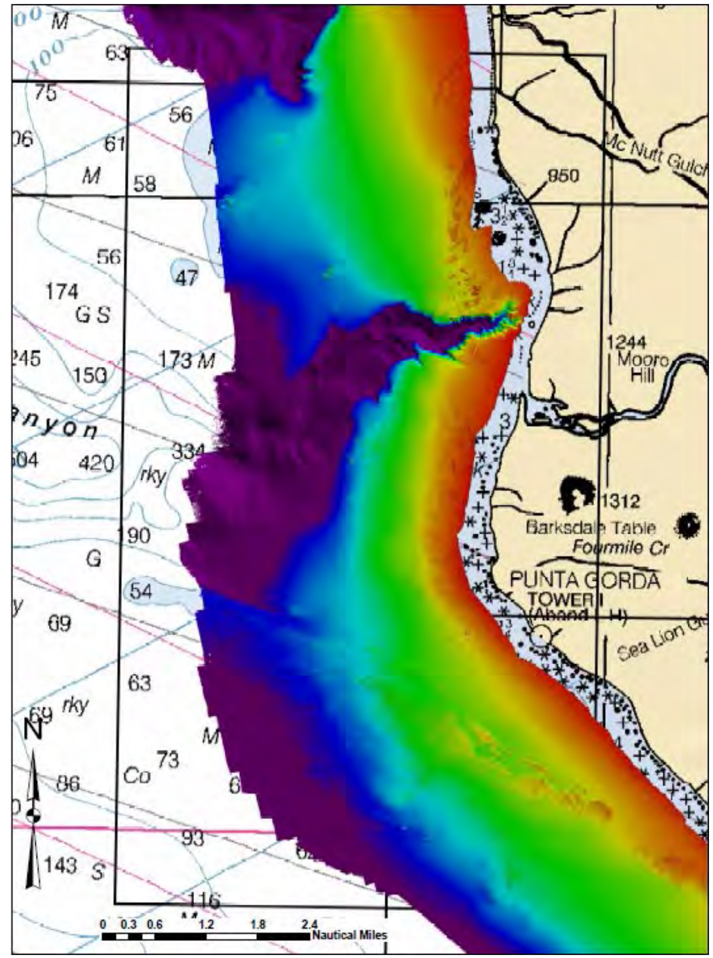


Image courtesy of the California Seafloor Mapping Project

Alaska Coastal Mapping Program

Suggested Planning Strategies Based on Past Experience

- Apply the partnership model
- Take inventory of existing data
- Prioritize stakeholder needs
- Develop specifications that deliver maximum value

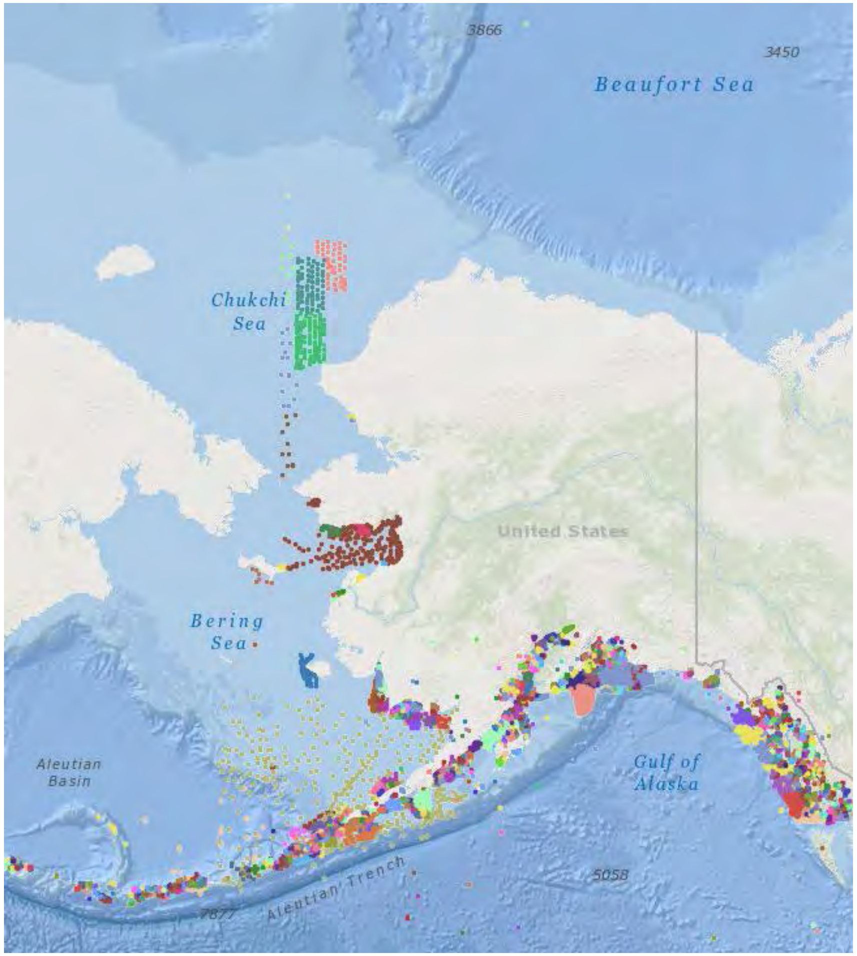


Image courtesy of NOAA

Maximizing Value Through Technology Integration



Integrated satellite, airborne, vessel-based technologies can yield significant time and cost savings, increase acquisition safety, and improve the variety of deliverables available to the stakeholder community.

Application of Topo-bathymetric Laser Scanning for Mapping Coastal Environments

Alaska Coastal Mapping Summit

Girdwood, AK - June 14, 2016

Russell Faux & Adam McCullough
(faux@quantumspatial.com) (amccullough@quantumspatial.com)

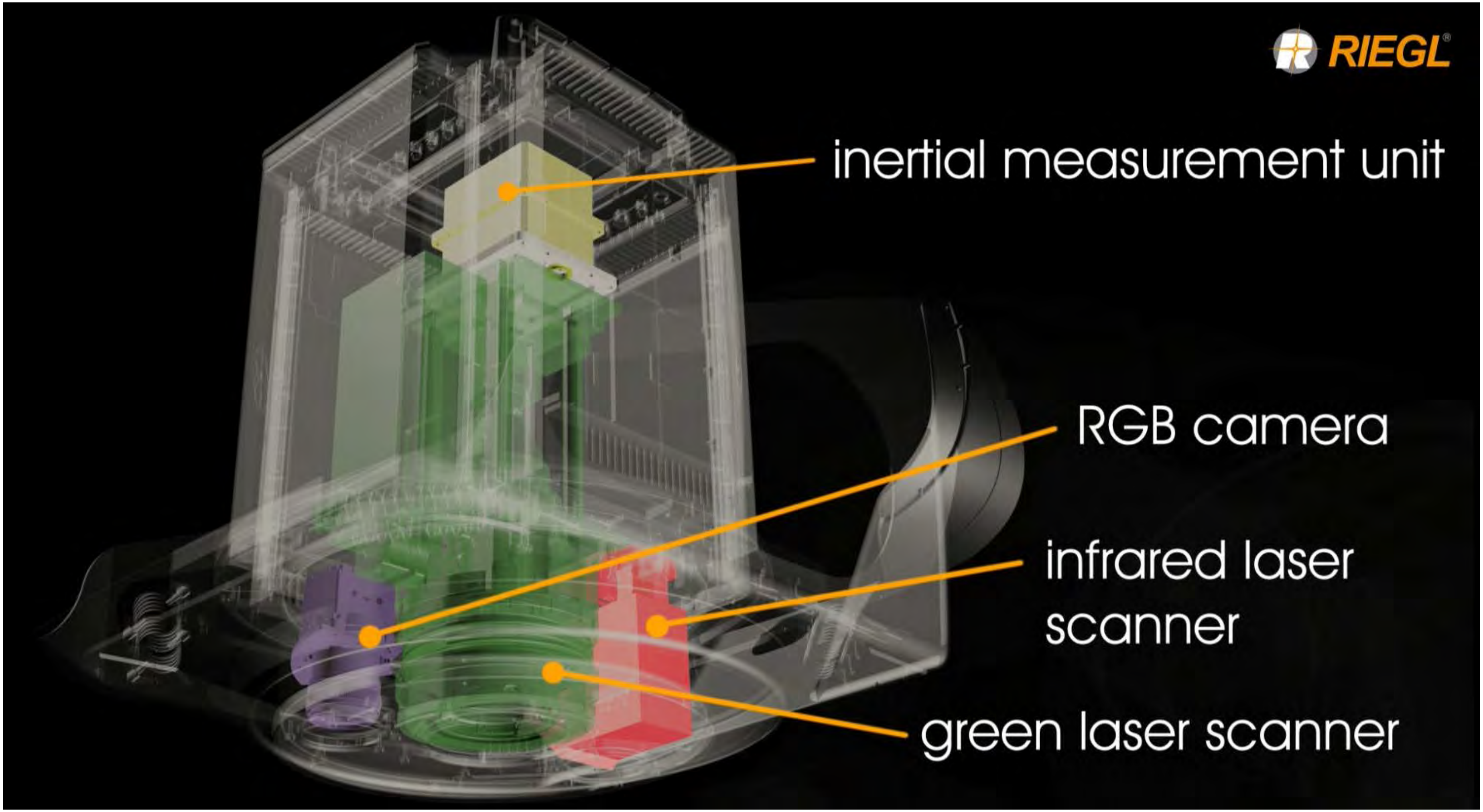
Full-Service Airborne Remote Sensing & Geospatial Firm

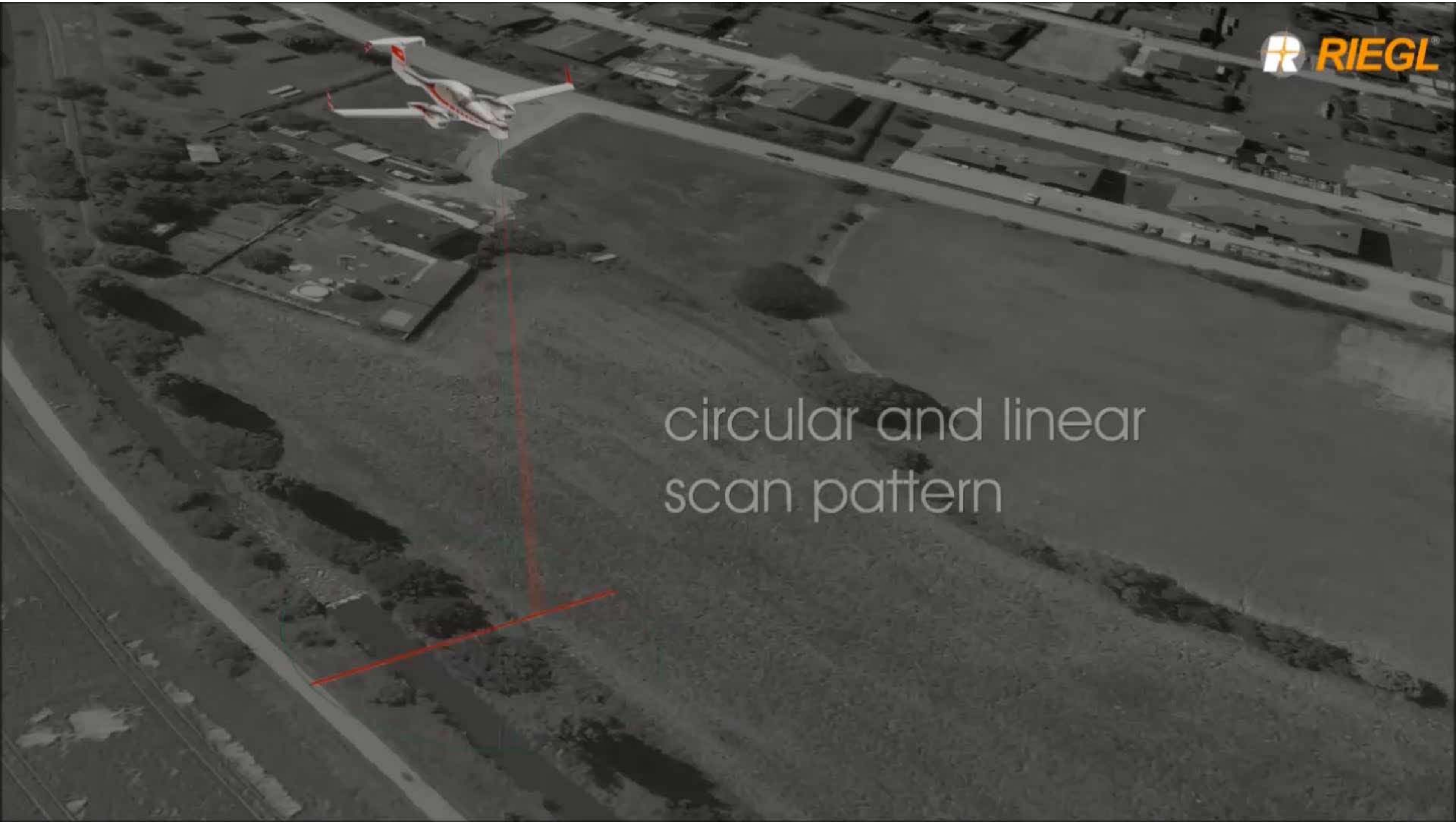
- QSI formed in 2013 through the merger of Watershed Sciences, Aerometric and PhotoScience.

- QSI provides remote sensing services nationally under the following contracts:
  - ✓ NOAA NGS Shoreline Mapping
  - ✓ USGS Geospatial Product and Service Contract(GPSC) III
  - ✓ USACOE JALBTCX (AE) Survey and Mapping Support Services

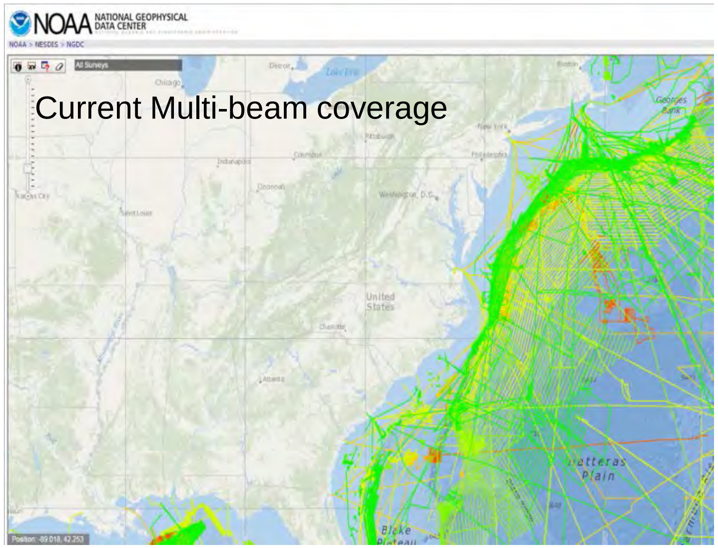
- Airborne topobathymetric LiDAR is an emerging technology for mapping the coastal/nearshore environment.

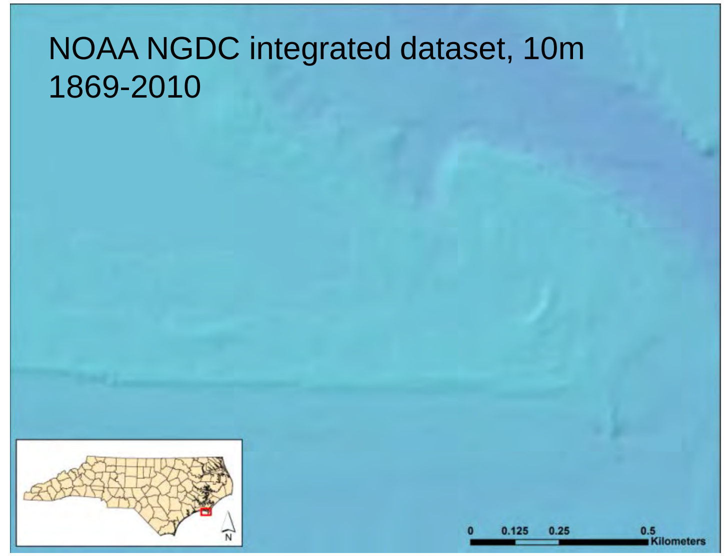
Topobathymetric LiDAR Sensor (Riegl VQ-880G)



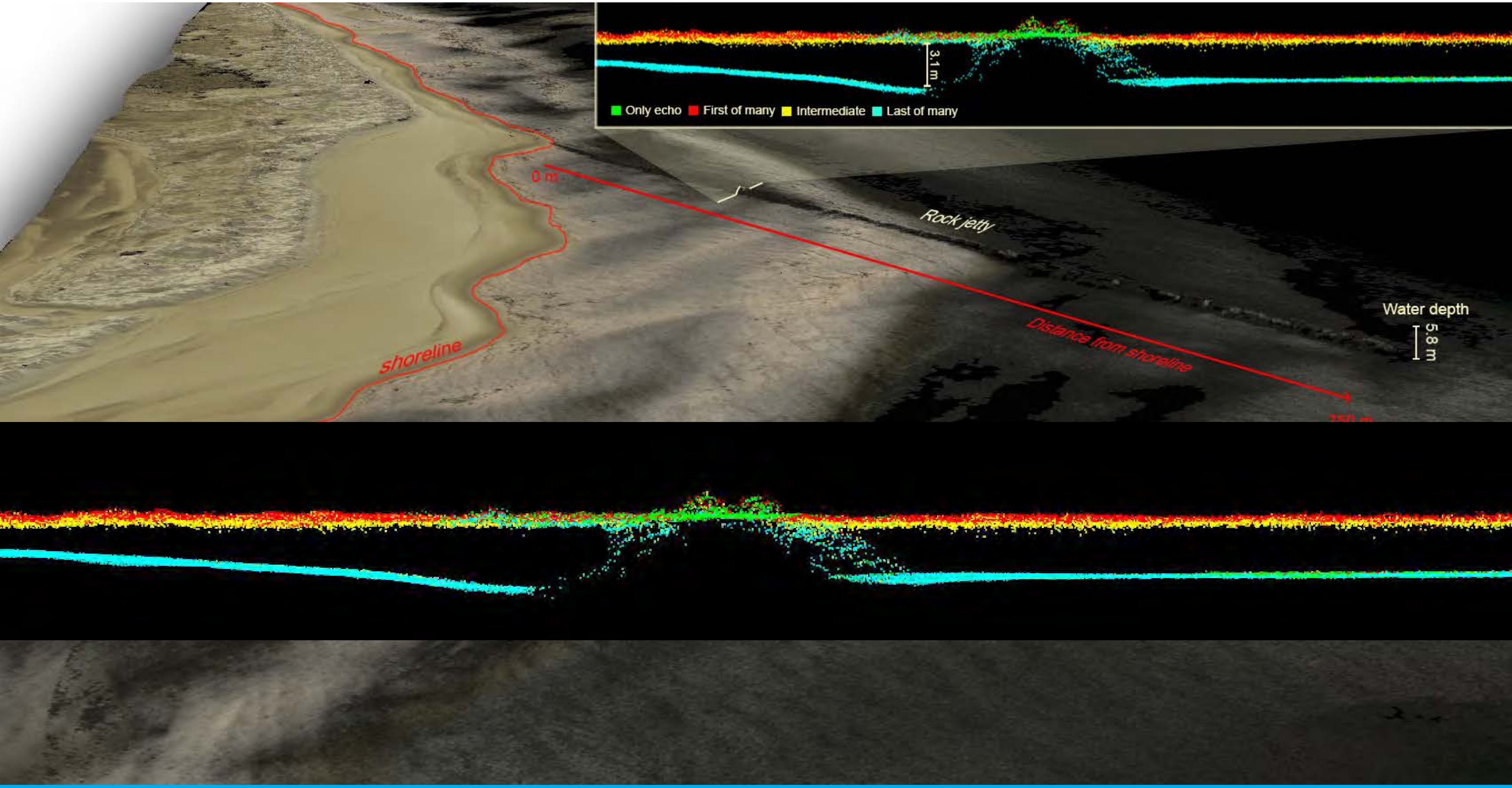

RIEGL
circular and linear
scan pattern

Coastal/Near Shore



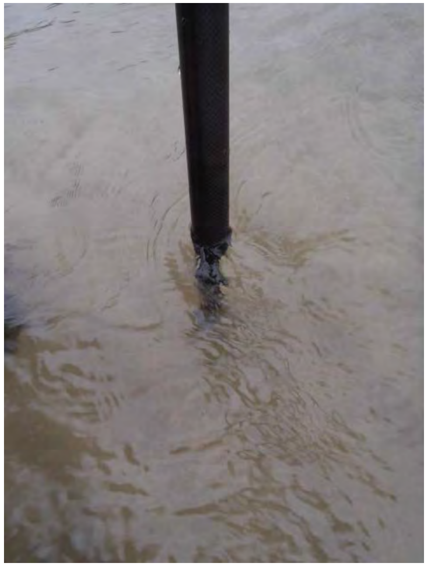


Sample Results/Profiles



Topo-Bathymetric Challenges

- Depth performance is a function of sensor, **water clarity**, and bottom reflectivity
- Predicting suitable water clarity is a challenge.
  - Qualitative water clarity assessments based on MODIS
  - Site observations of local conditions and trends
  - Quick look analysis of topo-bathymetric data



Summary

- Shallow water topo-bathymetric sensor and processing technology has advanced rapidly.
  - Sensor Selection: Know your area and intent

- How Deep? Depends on turbidity and bottom reflectivity

- Strong demand for seamless topo-bathymetric data in both coastal, near shore, and riverine environment.
  - Consortium model to achieve economies of scale and cover larger area

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ADAC's Leadership

Douglas Causey, PhD, Principal Investigator, University of Alaska, Anchorage (UAA)

Larry Hinzman, PhD, Research Director, University of Alaska Fairbanks (UAF)

Randy Kee, Maj Gen (Ret) USAF, Executive Director (UAA)

Heather Paulsen, MBA, Finance Director (UAA)

LuAnn Piccard, MSE PMP, Project Management Director (UAA)

Elyce Hackley, Associate Director, (UAA)

ADAC is hosted by the University of Alaska, *with work conducted at UA campuses in Anchorage and Fairbanks…and across a community of academic centers*

ADAC's mission

- *develop and transition technology solutions, innovative products, and educational programs*
- *improve situational awareness and crisis response capabilities related to emerging maritime challenges posed by the dynamic Arctic environment*

ADAC's principal customer: *United States Coast Guard (District 17, Arctic)*

- *Search and Rescue, Humanitarian Assistance and Disaster Response*

ADAC seeks *to connect with an array of federal, state, local, tribal, industry and academic partners to collectively advance domain awareness of the Arctic region.*

ADAC seeks to serve **as a Hub of Arctic Domain Awareness connected to an array of Arctic related academic research**

ADAC's primary focus **is to collaborate and conduct basic and applied research to address DHS Science and Technology Directorate's visionary goal** ***to Enable the Decision Maker***

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DHS Expectations…

Build partnerships…

ADAC is constructing a network approach with academics, Industry, State and other Federal Departments, Significant “mutual interests” with NOAA/NWS

Address gaps and operational deficiencies…

ADAC’s work improves USCG preparedness and responsiveness…contributing to safer Arctic operations.

Develop future workforce…

Creating ADAC Fellows Program…Mentoring Students

ADAC's current partners

Academic Partners:

- Embry Riddle University
- Maine Maritime Academy
- University of Idaho
- University of Washington
- Woods Hole Oceanographic Institute
- US Coast Guard Academy and their Center for Arctic Study and Policy

Industry Partners:

- Axiom Data Science
- Alaska Marine Exchange
- Dubay Business Services

Cooperative Organizations:

- Alaska Ocean Observation System
- USCG Headquarters, Research & Development Center, and District 17
- NOAA & National Weather Service
- DoD Alaska Command and Alaska NORAD Region
- NASA Arctic Collaborative Environment

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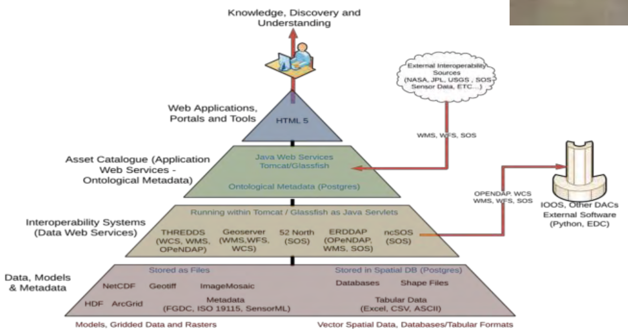
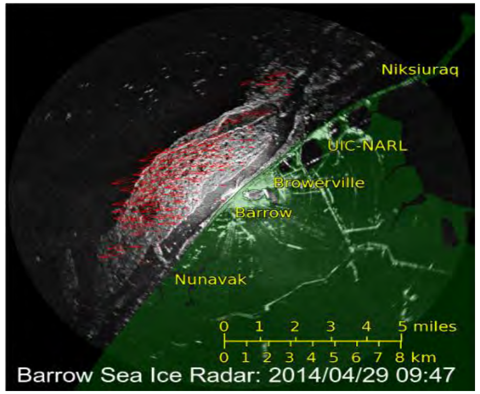
ADAC's Projects "at a glance"

- Sensors…both machine and people
  - People…via Community based observers applied research
- Autonomous Platforms
  - In order to put "sensors on scene"
- Modeling...(principally environmental factors)
  - Storm Surge, Sea Ice Forecasts, Coastal Erosion and Oil plume
- Fusion of Arctic related data and information for Agile Decision Support
- Professional Arctic Mariner Development
- Education Outreach and Workforce Development
- Arctic-Related Incidents of National Significance Workshops





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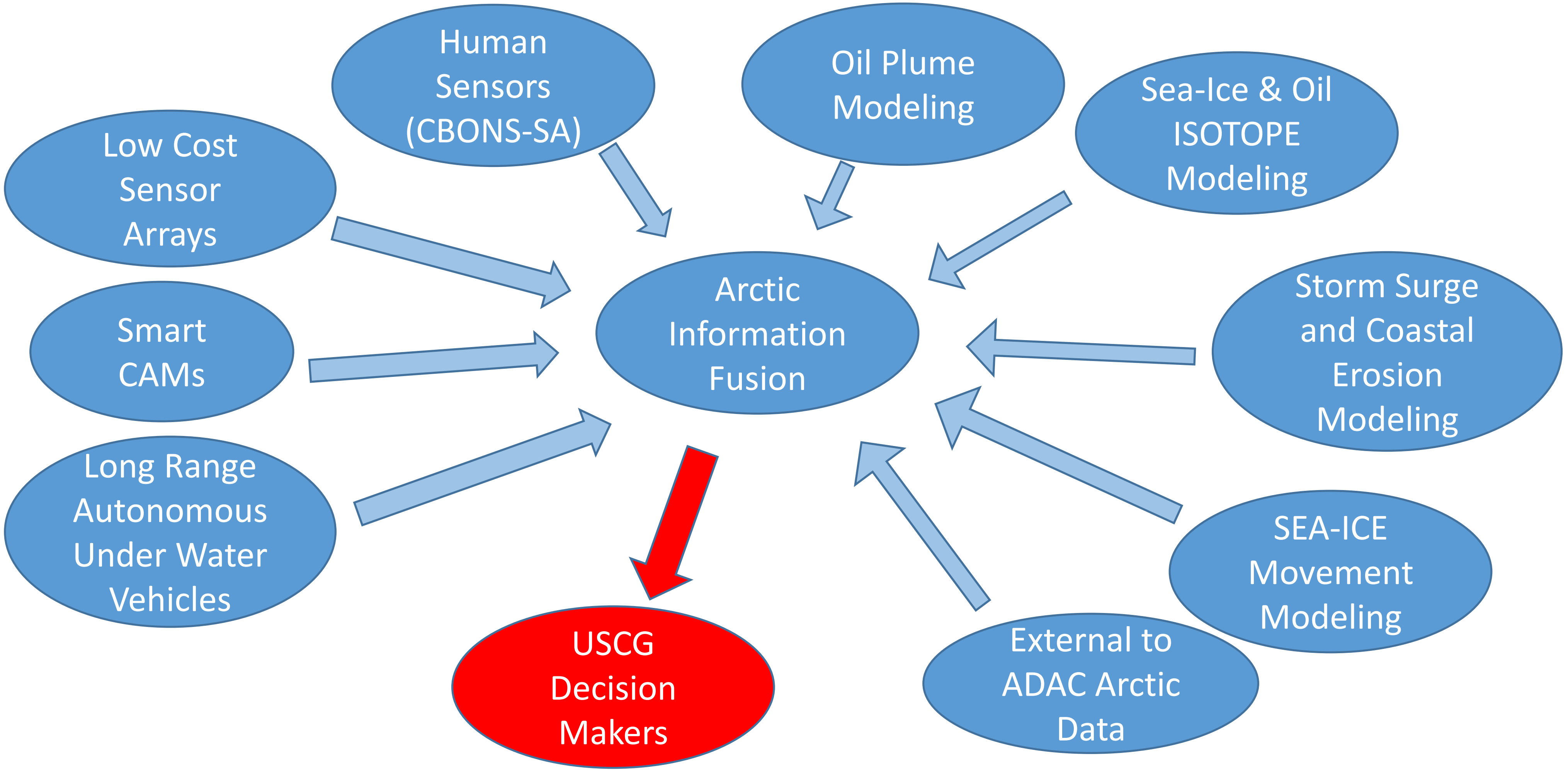
ADAC Project Inter-relation



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ADAC's additional partners for 2016-2017

Additional Academic Partners:

- Texas A&M University
- University of New Mexico *
- University of Texas El Paso *

Additional Industry Partners:

- NOVA DINE-Kestrel **
- ASRC Federal Solutions **

Additional Collaborative Organizations:

- DHS Centers of Excellence at Rutgers University, Stevens Institute and University of Houston
- National Science Foundation

* Federally Designated Minority Serving Institutions (MSI)
** Federally Designated Tribal Organizations (FDTO)

Arctic-related Incidents of National Significance (IONS) & Arctic-Focused Medium and Long Term Environment (MaLTE) Workshops

Partnerships:

IoNS: Canada and US Operators and researchers

MaLTE: Canada and US researchers

Goal: to advance deep thinking and to tackle tough problems with academic rigor

Workshop format: Joint Canada-US collaborative forum hosted by University of Alaska

Context:

IoNS: Operator driven research by USCG Arctic mariners to provide research and development ready solutions

MaLTE: Addressing Science and Technology in future scenarios 10-20 years distant

ADAC …Seeking opportunity

- ***ADAC is working to advance partnerships across the Arctic, to include Canadian professionals, in Arctic response & preparedness and academia communities.***
- ***Collaborating in the advance of Arctic related science and technology.***

…in support of the operator and to the benefit of the public good.

More to come…

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Backup Slides

Current focus areas…

Arctic Information Fusion Capability (AIFC)

AIFC is a two step approach oriented in the near term to gain two dimensional geographic orientation of precision mapping data, near real time and high resolution satellite imagery incorporated with available modeling, sensors, web based communications and appropriate social networking feeds to gain domain awareness in support of operational decision making and interface with humans and responders in the field. AIFC also seeks to identify elements of domain awareness from a 3 dimensional "column view" to gain insights vertically from seabed to surface and surface skyward. Accordingly, AIFC is seeking to achieve a near real time and forecast decision support, that can transition to intelligent decision support in later developments. As data science matures, AIFC will integrate and analyzing data from developed remote sensors, event modeling, community based observer networks, databases, unmanned autonomous vehicles, and communication devices. AIFC will also provide predictive models that can be used for preparing and planning for such events. For example, it will enhance the U.S. Coast Guard's (USCG's) ability to prepare for and respond to oil spills in the Arctic Ocean, to more safely and reliably conduct search and rescue missions, and to support DHS efforts to prepare and plan for disasters caused by large coastal storms.

Arctic Sea Ice and Storm Surge Modeling

This project is developing new real-time, higher-resolution models for now-casting and forecasting of sea ice (e.g., concentrations, thickness, flow) and ocean currents in the Northwest Passage that can be used to assist in navigation for search and rescue missions. Models will build on the Hybrid Coordinate Ocean Model developed by the U.S. Naval Research Laboratory, and the University of Washington's Marginal Ice Zone Modeling and Assimilation System. This will support DHS efforts to prepare and plan for disasters caused by large coastal storms and to more safely and reliably conduct search and rescue missions.

Education Outreach

Led by Maine Maritime Academy, who provides US Coast Guard professional Ice Navigation instruction and courseware to prepare the next generation of Arctic region mariners.

Current focus areas…

Community Based Observer Networks (CBONS)

CBONS is integrating an indigenous knowledge-based approach with technology to systematically observe and document Arctic environmental and globalization changes — vessel tracking, incursions, and arctic sea ice. The initial location will be Alaska's St. Lawrence Island, which has demonstrated integration of community-based sea ice observations with the Arctic Environmental Response Management Application (ERMA) — a web based GIS tool for emergency responders. ADAC will expand on the existing CBONS framework and methodology to include additional observation categories and to incorporate unmanned aerial vehicles, remote sensing networks, and new communication devices.

Long Range Autonomous Underwater Vehicles

ADAC through Woods Hole Institute is working in applied research to develop a long range autonomous underwater vehicle, capable of under ice pack navigation in order to support on scene sensors in support of US Coast Guard missions.

Low-Cost Wireless Sensors for Arctic Monitoring

ADAC is developing low-cost, wireless sensors that do not require batteries for remote Arctic monitoring. These low-power sensors can form ad-hoc sensor networks for remote vessel tracking, surveillance, and monitoring of climate change (e.g., ice flow, depth). These sensors can collect, transmit, and store data for long periods of time without external power. They can then transmit the data to unmanned aerial sensors or vessels of opportunity.

Smart Cams to support for Arctic Monitoring

Low-cost, software-defined, smart "Go-Pro" style device with visible and multi-spectral image fusion, readily deployable to austere and rugged Arctic environments. Specific efforts to develop efficient energy use with image analysis on the device itself; GPU or FPGA processing Emphasis on software intelligence for automatic detection, tracking, and visual data fusion.

Current focus areas…

Continuous, Real-time Sea Ice Monitoring, Petroleum Detection & Food Web assessment from Ships, USVs & Shore

ADAC is testing and developing real-time, continuous stable isotope detection systems (CSIDS) that are ship, USV and shore-based. These systems reflect sea ice categories (none, lite, moderate and dense), recognize unusual C-based compounds ($\delta 13CO_2$ & $\delta 13CH_4$) from surface oil and vehicle emissions and provide tracers on food web patterns and processes. These continuous data acquisition systems collect, transmit and based on calibrations, provide sea ice visualizations that complement infrequent satellite sea ice categories, and alert ship or shore based stations to irregular petroleum events and will provide a means by which food web (fisheries) security can be strengthened. In addition, these systems strengthen our fundamental understanding of the changing Arctic water cycle, ocean productivity, ocean acidification, food web dynamics and potentially real-time ocean current traits.

Arctic Oil Spill Modeling

This project is developing a new General National Oceanic and Atmospheric Administration (NOAA) Oil Modeling Environment (GNOME) based oil spill response model to enhance capabilities to assess, predict, and monitor the effects and development of oil spills in the Arctic. The new model will provide real-time, high-resolution models that incorporate sea ice, temperature, ocean currents, and storm surges to enhance USCG's ability to prepare for and respond to oil spills in the Arctic.

ADAC Key Engagement Forums

Customers & Partners Roundtable	**Bi-Monthly**	**Operator Input and Technical Exchange**	**Videoconference & webinar**
ADAC Advisors Forum	**Annual**	**Wide array of academic, government and industry attendees, Chaired by UA President**	**In-person Immediately following Annual ADAC Partners Meeting**
ADAC Executive Counselor's Board	**Annual**	**Small, executive panel to critically examine ADAC Projects and overall Program**	**In conjunction with a ADAC Quarterly Review Group**

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ADAC Transition Plan

ADAC Review Group

- Comprehensive TRL review of all ADAC Projects
- If project or subproject capability reaches appropriate TRL , “Go” decision to initiate

ADAC Transition Task Group (led by ED and PMD)

- Task organized to work in partnership with DHS S&T OUP PM, USCG Acquisition and USCG RDC (as determined) to affect transition of research to capability
- Technology transfer affected, , documentation completed and patents, etc submitted as appropriate

DHS/USCG End User

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BAID

BARROW AREA INFORMATION DATABASE

barrowmapped.org

Baseline datasets & Web Apps funded by CIAP for decision support

Alaska Coastal Mapping Summit

June 13, 2016

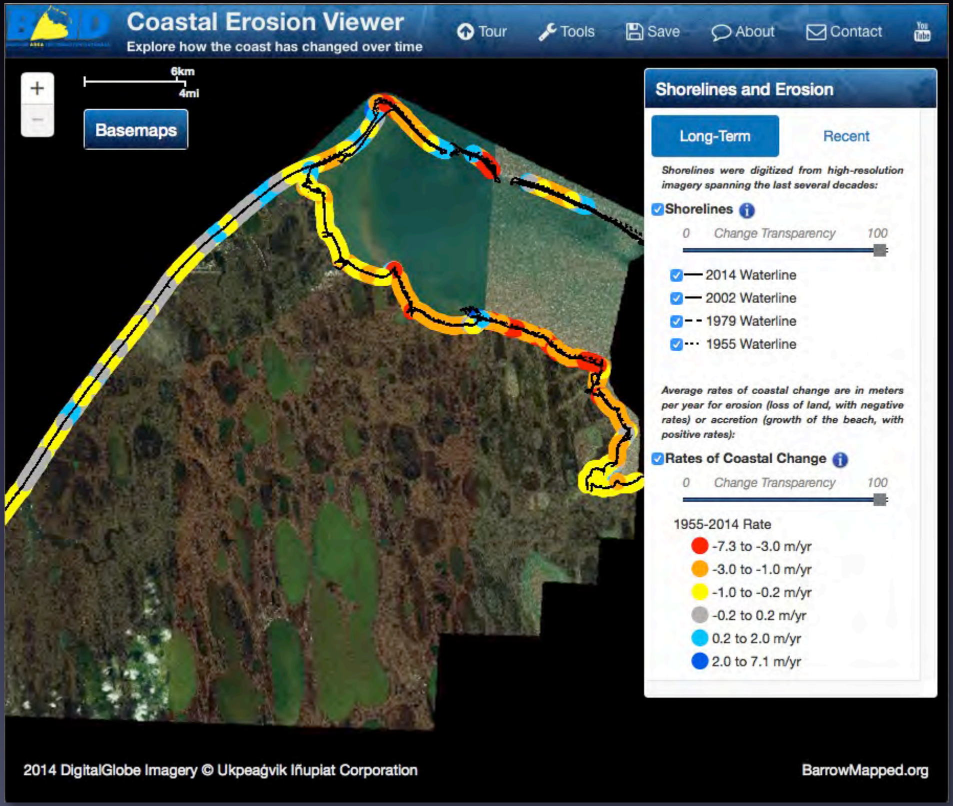
NSF CIAP U.S. FISH & WILDLIFE SERVICE THE SEAL OF THE STATE OF ALASKA NORTH SLOPE BOROUGH UMIAQ UTEP NUNA TECHNOLOGIES INSTAAR University of Colorado Boulder

This study is funded with qualified outer continental shelf oil and gas revenues by the Coastal Impact Assistance Program, Fish and Wildlife Service, U.S. Department of the Interior, and by the National Science Foundation. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the USFWS or NSF.

Where: Barrow area, 84 mi of coastline

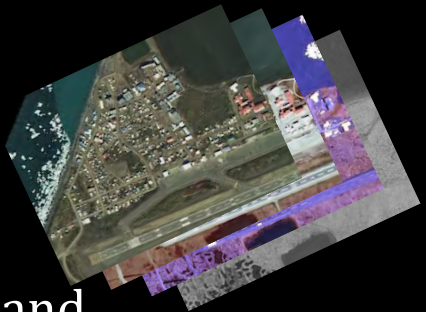
Ukpeaġvik Iñupiat Corporation (UIC) lands in the coastal zone near Barrow, Alaska.

When: Recently compiled (2013-16)

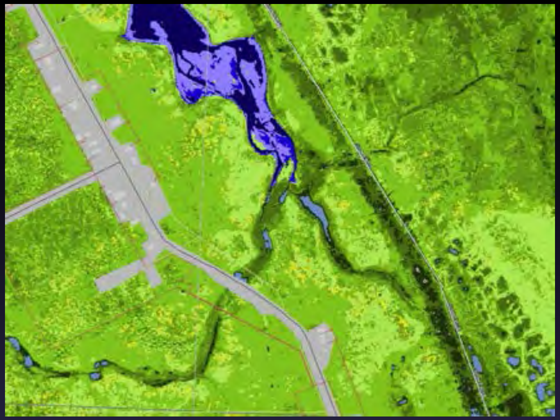


barrowmapped.org

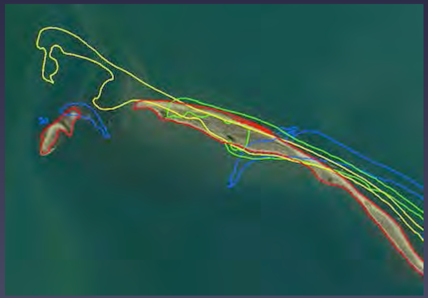
What:

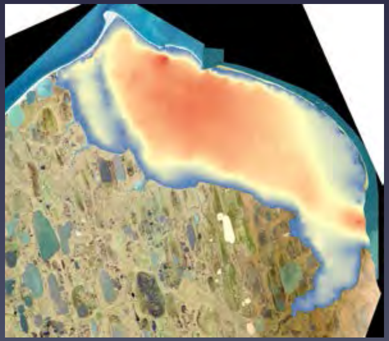


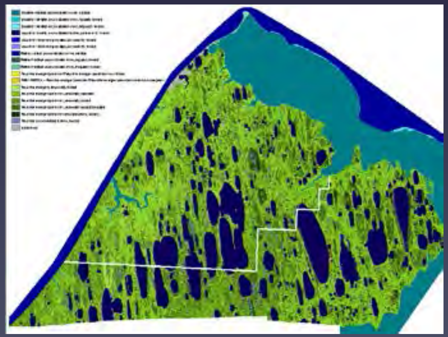
- Time-series imagery (1948/49, 1955, 1979, 2002, 2014)
- Coastal erosion data (shorelines and DSAS erosion rates)
- Shoreline monitoring (Differential GPS surveys for 2013, 2014, 2015)
- Detailed wetlands map layer (.5 meter resolution mapped to NWI standard)
- Time-lapse video
- Nearshore Bathymetry



Why: CIAP funded collection of baseline data, enhancing local capacity & decision support tool development







BARROW AREA INFORMATION DATABASE

barrowmapped.org

How:

Standard tools

Trimble DGPS, Agisoft, ESRI, Digitial Shoreline Analysis System, National Wetlands Inventory

Local expertise based in Barrow

- for DGPS Surveys
- Repeat photo points
- Repeat monitoring via Kite based photography
- Zodiak, four wheeler or snow machine based surveys
- Wetlands delineation

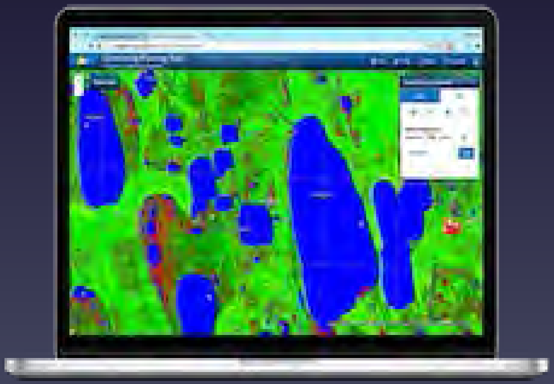
Web based apps

barrowmapped.org

Tools for a Sustainable Barrow:

View Coastal Erosion, Landscape Change, Wetlands, and More

- See how the village has changed over time
- Explore how the coast has eroded
- Create maps for planning and development



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Coastal and Ocean Resources

Coastal habitat mapping with ShoreZone

Dr. G. Carl Schoch

carl@coastalandoceans.com

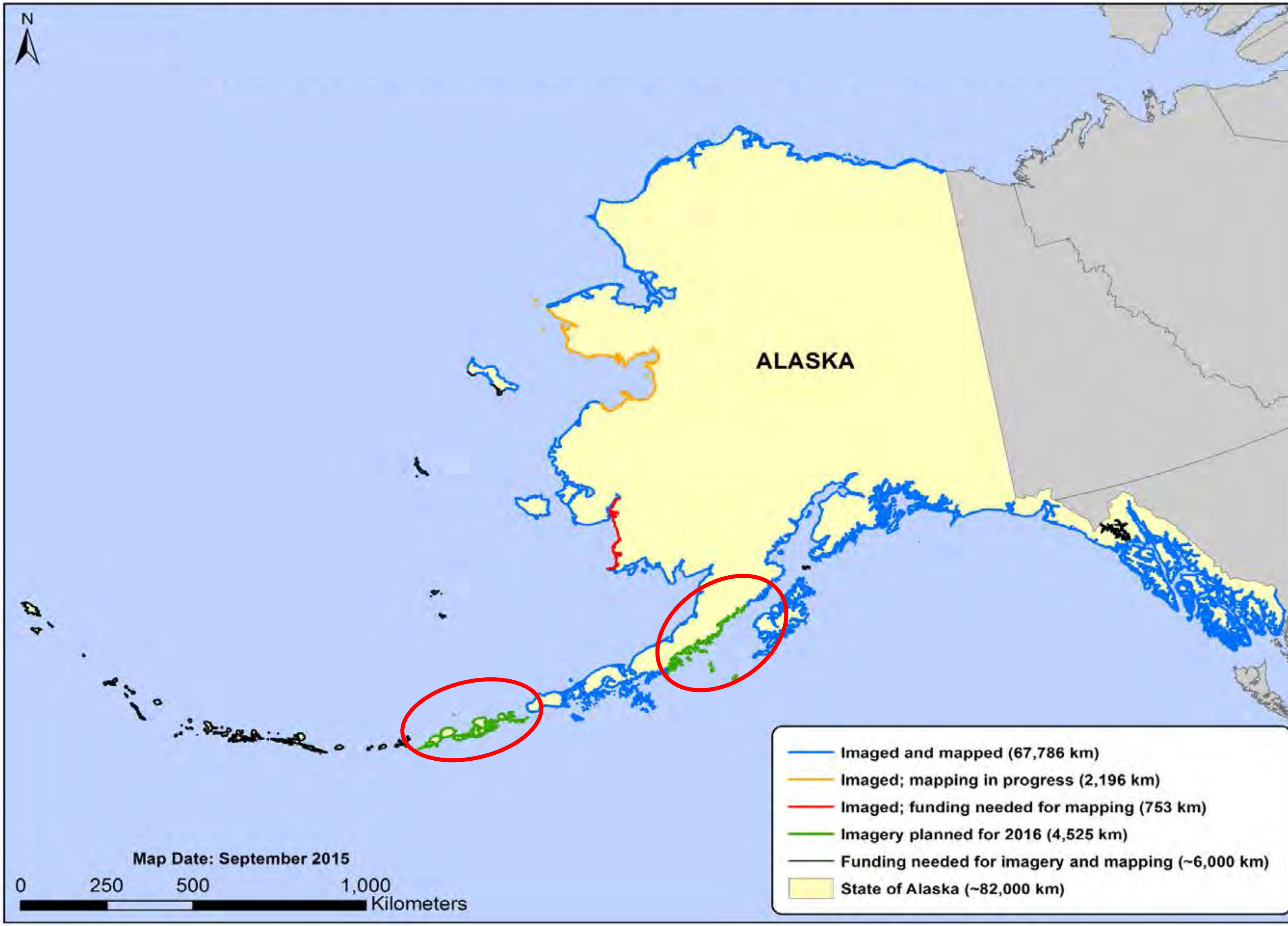
Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

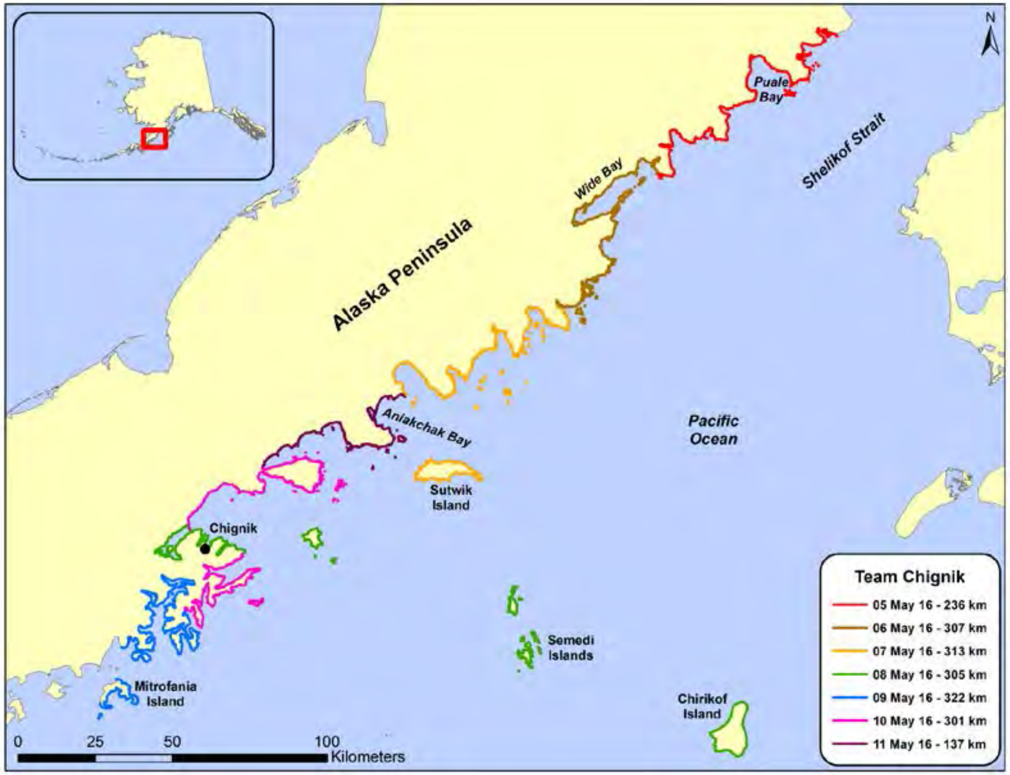
NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

http://iocm.noaa.gov

Map Once, Use Many Times

The status of Alaska ShoreZone: circled areas were recently imaged





Current Projects

- 4800 km of ShoreZone imaging surveys completed in 2016
- 2200 km of mapping in Norton Sound funded by NOAA
- 600 km of mapping in Kuskokwim Bay funded by Alaska DNR
- 800 km of mapping in Unimak Pass funded by OSRI

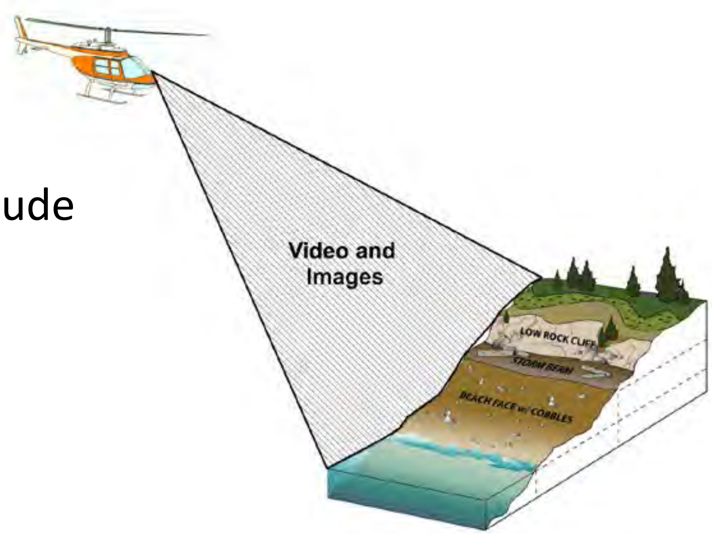
Products

<u>Imaging</u>

- Flightlines: 100 m horizontal offset and 100 m altitude
- Continuous HD or 4K video
- HD still images (~1 every 100 m)

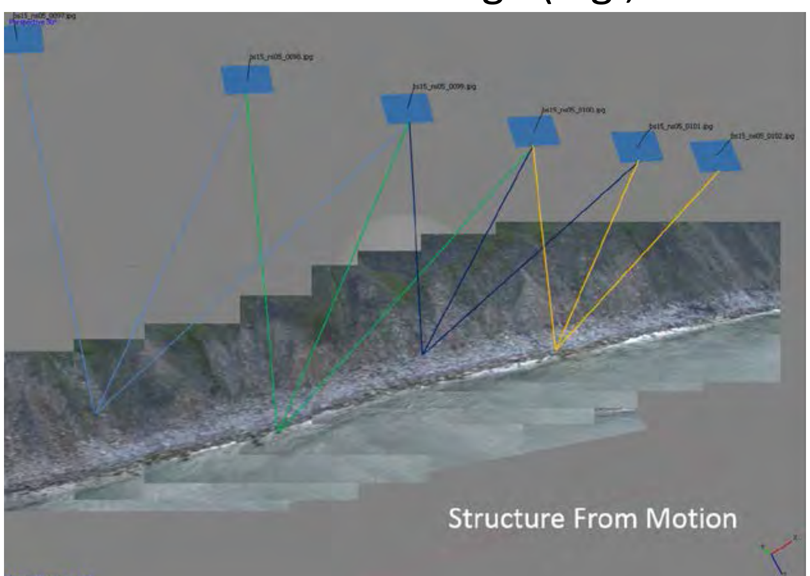
<u>Mapping</u>

- Geodatabase of habitat attributes

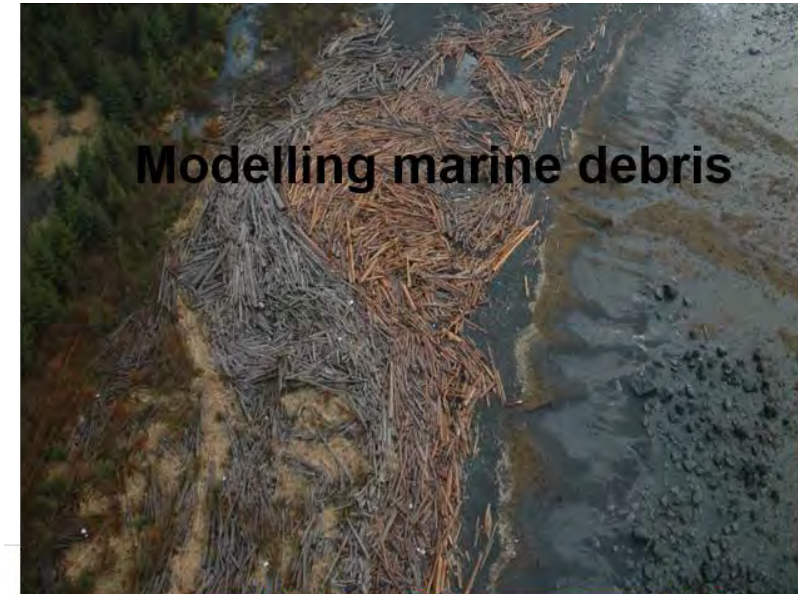


ShoreZone delineates alongshore units based on physical homogeneity

- 10 m minimum resolution (but varies with quality of digital shoreline)
- Physical attributes include geomorphology, coastal vulnerability to flooding, sediment characteristics, wave exposure, Iribarren # (wave dynamics), quantitative metrics of length, width slope, percent cover.
- Biological attributes include percent cover of biobands that represent repeatable plant and animal groups.
- Structure from Motion for quantitative metrics of length, width slope, percent cover, and volumetric change (e.g., from erosion or accretion).



How is ShoreZone used?



***a database for managing the shore**

ShoreZone Partners

A growing partnership of over 60 organizations has made ShoreZone happen on over 100,000 km of shoreline in Alaska, British Columbia, Washington, and Oregon

For more information:

http://www.shorezone.org

https://en.wikipedia.org/wiki/ShoreZone

https://www.facebook.com/ShoreZone

http://www.coastalandoceans.com/

Dewberry Consultants LLC

David F. Maune, PhD, CP, CFM, PSM, GS, PS, SP

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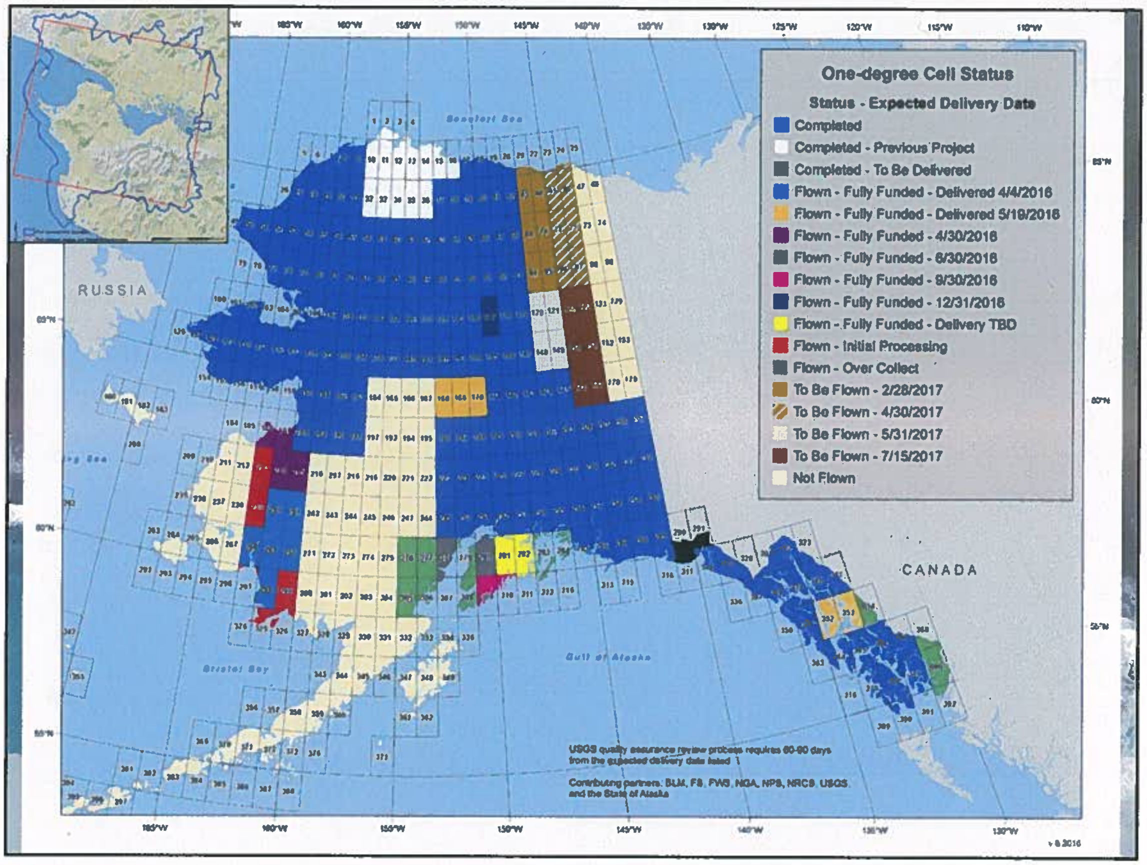
Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE
http://iocm.noaa.gov
Map Once, Use Many Times

Dr. Dave Maune is a member of NOAA's Hydrographic Services Review Panel (HSRP).
Since 1998, he has continuously managed all Dewberry contracts with USGS, including the ongoing statewide IFSAR mapping of Alaska.
Since 1998, he has also managed NOAA contracts, to include the following:

1. For NOAA/NGS: Height Modernization Study and Height Modernization Surveys: 1998 through 2004
2. For NOAA/OCM: Coastal Geospatial Services Contract (CGSC): 2005 to present
3. For NOAA/NGS: Remote Sensing, Mapping and Charting Services: 2013 to present

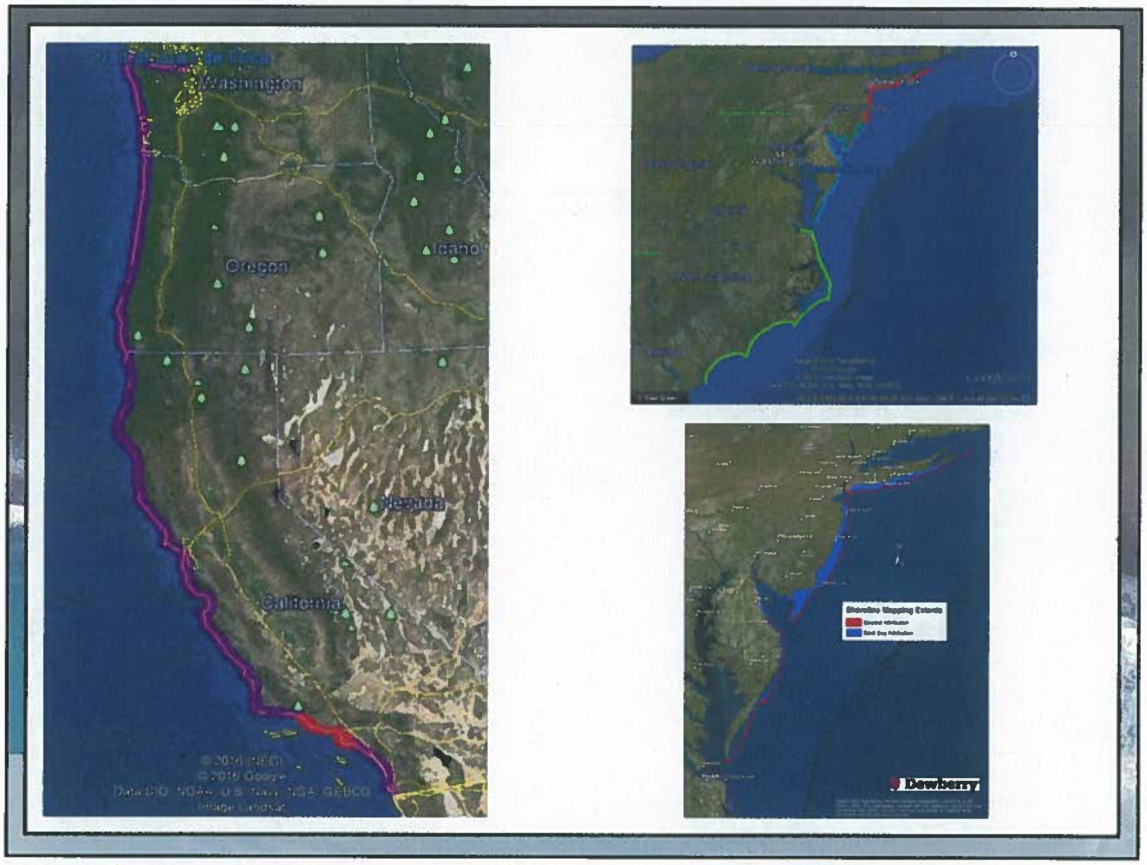


Alaska is the only state without statewide digital orthophotos because it is the only state where DEMs in the National Elevation Dataset (NED) are not accurate enough to orthorectify imagery to established accuracy standards.

In 2008, Dewberry prepared the *Alaska DEM Whitepaper* that recommended statewide mid-accuracy IFSAR DEMs; and in 2012 we authored the *National Enhanced Elevation Assessment* (NEEA) report that documented the dollar benefits of statewide IFSAR, with benefits that essentially pay for this statewide IFSAR mapping within three years.

<u>Main Map</u>: This map shows that nearly 75% of the state will have airborne IFSAR acquired by the end of 2016, acquired by two Dewberry subcontractors, i.e., Intermap Technologies and Fugro EarthData, with deliverables rigorously QC'd by Dewberry and using QA/QC checkpoints surveyed by JOA Surveys. We expect the remainder of the state to be acquired by 2019, including TerraSAR-X DEMs (from GeoNorth) for the western end of the Aleutian Islands.

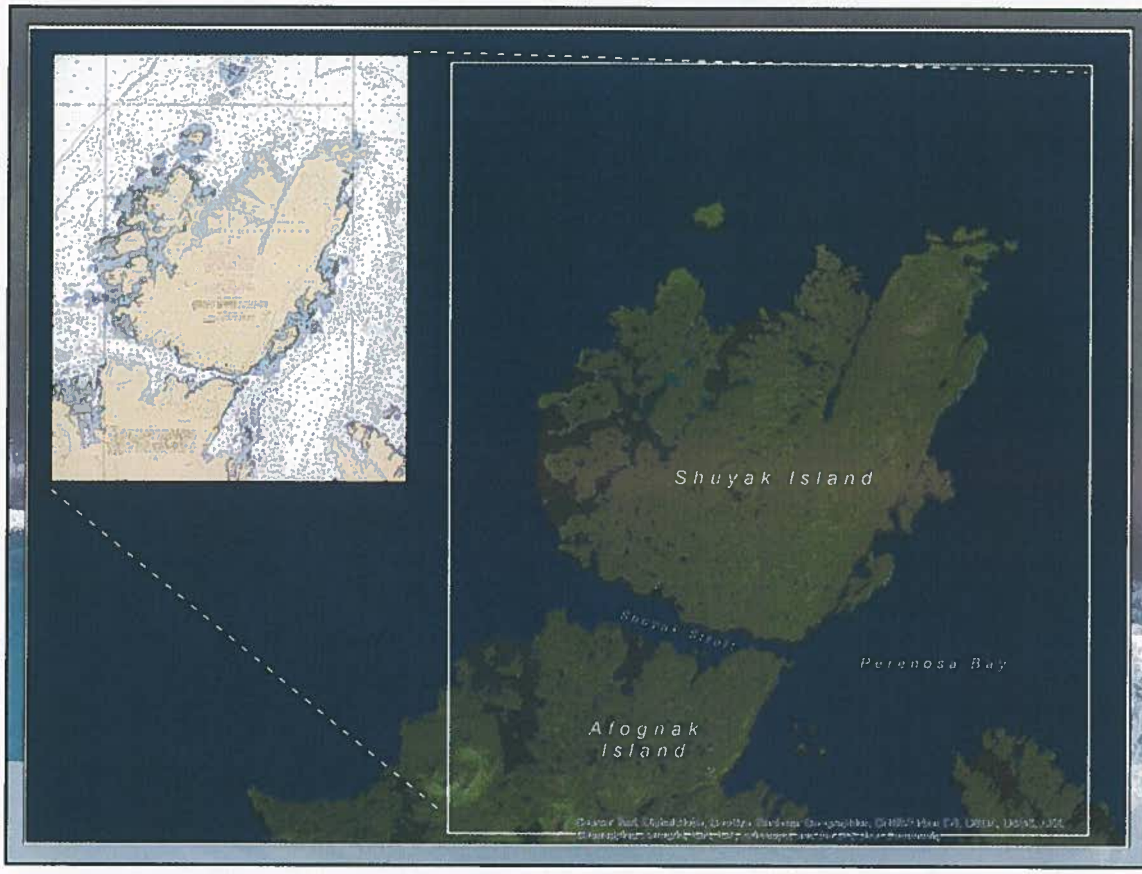
<u>Inset</u>: Port Clarence is a potential new Arctic port of refuge. For a pilot project, Dewberry used its IFSAR Ortho-rectified Radar Imagery (ORI), and hydro-enforced Digital Terrain Model (DTM) to: (1) merge gray-scale ORIs (62.5-cm) with natural color RapidEye satellite imagery (5 m) to produce pan-sharpened (62.5-cm) color orthoimagery; (2) update the NHD and NHDPlus for the hydrologic units bounded in blue (inset image); and (3) update the transportation network. In doing so, these four major mapping layers (elevation, hydrography, orthoimagery and transportation) are geo-registered and fit correctly together.



Top Right. Following Superstorm Sandy in 2012, Dewberry was tasked by NOAA to acquire and process topobathymetric LiDAR and digital orthoimagery covering the land/water interface along the Atlantic coast from Myrtle Beach, SC to Long Island, NY. The data helped NGS to remap the official shoreline and was made available for various applications within the entire coastal community, as well as to support other mapping, charting, geodesy services, marine debris surveys and coastal shoreline modeling for coastal states impacted by Hurricane Sandy. We received the LCDR Peter Johnson Best Practices Award for this project.

Bottom Right. Dewberry subsequently validated the MHW and MLLW (shorelines) derived from the topobathy LiDAR (red areas) and attributed 3,883 miles of the larger back bay alongshore features (blue areas), including wetlands and benthic habitat.

Left. For an El Nino study in 2016, USGS, NOAA and USACE pooled funds for Dewberry to collect and process QL1 topographic LiDAR for the complete west coast of the United States from the US-Mexico border to Port Townsend, WA -- approximately 1,700 linear miles or 486 square miles for the Washington, Oregon and California coasts as well as an additional 44 square miles for the USACE-defined harbors and other areas of interest. These LiDAR data are required to be collected within ± 2 hours of the predicted low tide. For highest efficiency, we used a helicopter to follow the coastline generally with 1 pass at 800 meters. The average width of the swath being collected is 500 meters from the low tide water line to the top of the cliffs. Dewberry will be delivering USGS standard QL1 LiDAR deliverables at the end of September, 2016.



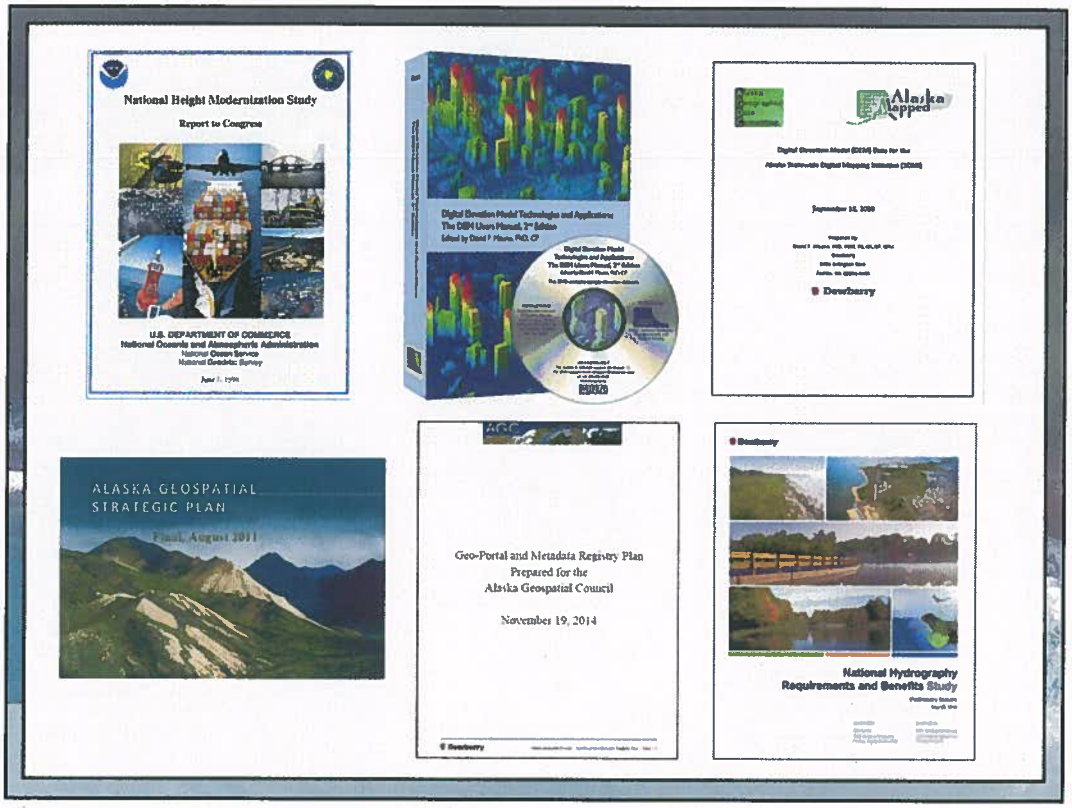
For NOAA/NGS in 2015, Dewberry used classified, NGS-provided satellite imagery along 340 miles of shoreline for Shuyak and Northern Afognak islands in Alaska to stereo-compile and validate the feature attributes of the MHW shoreline and adjacent coastal features. We used multiple tide stations within the project area to aid in determining the approximate position of the MHW line. The MHW shoreline and alongshore features such as navigational aids, offshore rocks, and small islands were compiled using stereographic imagery and attributed in accordance with NOAA's Coastal Cartographic Object Attribute Source Table (C-COAST). These data will be used to update NOAA's nautical charts and digital shoreline products.

For NOAA/NGS, Dewberry is currently collecting gravity data of Alaska for NGS' Gravity for the Redefinition of the American Vertical Datum (GRAV-D) program. We are managing a contractor aircraft (from Dynamic Aviation) that has been conducting the gravity measurements of multiple states using NGS equipment, including a turnkey airborne gravity system gravimeter and GNSS technology that provides continuous 3-D position, velocity, and altitude information. A key goal of the project is to create and maintain an accurate geoid model of the U.S. to serve as the basis for a new vertical datum.

To help NOAA's National Marine Fisheries Service and other conservation professionals respond to environmental impacts of oil and gas activities and climate change, Dewberry is currently acquiring advanced thermal imagery and high-resolution digital imagery along 20,000 km track line of Alaska's North Slope to identify areas of significant wildlife presence and gather data for abundance estimates of ice-dwelling arctic seals and polar bears.

Dewberry was selected by the NOAA Office for Coastal Management (OCM) as the prime contractor to perform a comprehensive inventory and merger of all topographic LiDAR, bathymetric LiDAR, and acoustic surveys for the entire coast of California. The project area stretched the length of the coast from the 10 meter contour interval on land, offshore to the 3 mile nautical limit. The data are used by multiple partners for performing tasks such as: (1) sea level rise analyses, (2) tsunami and storm surge forecasting and modeling, (3) sediment management, (4) coastal and marine spatial planning, and (5) shoreline delineation.

In all, over 200 datasets were utilized in the merge process with all datasets being converted to LAS format with consistent horizontal and vertical datums. Final DEMs were produced with two separate use cases in mind. The first is a seamless DEM that has been smoothed along the topographic/bathymetric boundary and between bathymetric datasets to create a visually pleasing DEM. The second deliverable is a DEM with voids greater than 225 square meters identified and masked as "no-data" in the DEM product; this DEM is meant to be a true representation of the data with no interpolation or smoothing.



Dewberry has authored numerous books and studies relevant to NOAA and Alaska for coastal mapping:

<u>Top Left</u>: In 1998, we authored NOAA's *National Height Modernization Study* on how to modernize the National Height System in the U.S. based on GPS, CORS, LiDAR and IFSAR; heights were previously based on differential leveling and photogrammetry.

<u>Top Center</u>: In 2001 and 2007, we authored and edited the 1st and 2nd editions of *Digital Elevation Model Technologies and Applications: The DEM Users Manual* that documented advantages and disadvantages of DEMs from photogrammetry, IFSAR, sonar, topographic and bathymetric LiDAR; the 3rd edition in 2017 will also feature the newer Geiger mode and single photon LiDAR.

<u>Top Right</u>: In 2008, Dewberry authored the *Alaska DEM Whitepaper* that documented the need for statewide IFSAR hydro-enforced DTMs as the base for orthophotos, NHD, transportation and other mapping layers.

<u>Bottom Left</u>: In 2011, we authored the *Alaska Geospatial Strategic Plan* and *Geospatial Business Plan*, providing the State with recommendations for growing and sustaining a mature geospatial capability.

<u>Bottom Center</u>: In 2014, we authored *Alaska's Geo-Portal and Metadata Registry Plan*, establishing an architecture and solution recommendations for geospatial data sharing.

<u>Bottom Right</u>: In 2012, we authored the *National Enhanced Elevation Assessment* (NEEA) that documented the dollar benefits of statewide IFSAR in Alaska, followed by the *National Hydrography Requirements and Benefits Study* (NHRBS) in 2016 which documented requirements for and benefits from an improved hydrography program in Alaska and elsewhere.

Resource Data Inc.
PEOPLE • TECHNOLOGY • RESULTS

Contact: Howard Earl
howard@resdat.com
907-770-4134
www.resdat.com

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERC
http://iocm.noaa.gov
Map Once, Use Many Times

Ways RDI can assist with coastal mapping

- Provide GIS staff to augment existing projects or provide discrete GIS services:
  - GIS Analysis
  - Geodatabase creation
  - Data management
  - Data conversion and loading
  - Geoprocessing
  - Cartography

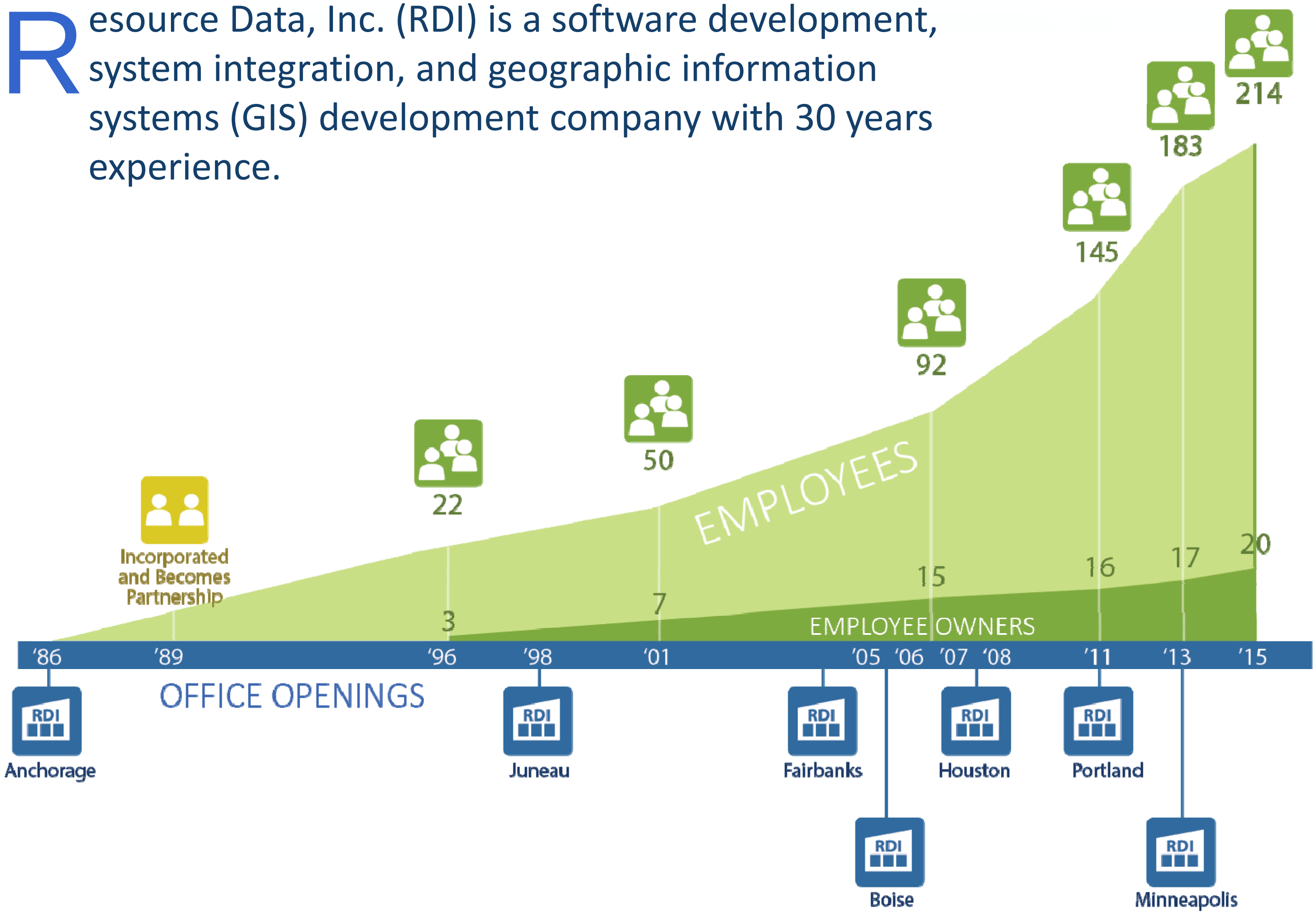
RDI

Resource Data, Inc.

PEOPLE • TECHNOLOGY • RESULTS

Resource Data, Inc. (RDI) is a software development, system integration, and geographic information systems (GIS) development company with 30 years experience.

Our History



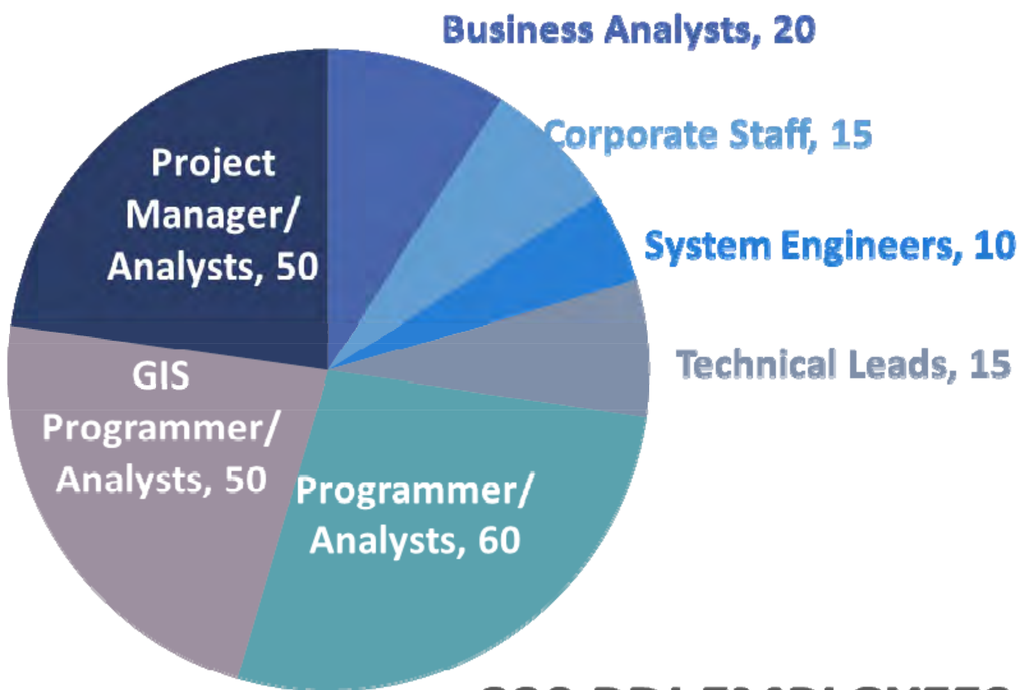
Our Services

We solve business problems through software solutions.

- Geographic Information Systems
- Custom Software Development
- Mobile Development
- Project Management
- Business Analysis
- IT Consulting
- Enterprise Solutions
- IT Services

Our People

Our motto is Best People, Best Technology, Best Results. We focus on recruiting and retaining the best in the industry. We stress a healthy work/life balance, continual professional development, and long-term careers. The net result is a happy, productive workforce that makes for successful projects and many long-term clients.



220 RDI EMPLOYEES

Geographical Information Systems (GIS)

We've been a leader in GIS since 1986. Not only have we received national awards for our work, but we've also been recognized by our clients for repeated success at large GIS deployments.

- Custom system development
- Enterprise deployments
- Mobile GIS
- Data management
- Spatial analysis
- Cartography (custom maps)

TerraSond 2016 Alaska Field Availability

Alaska Coastal Mapping Summit
Girdwood, AK
June 14, 2016

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERC

http://iocm.noaa.gov

Map Once, Use Many Times

TERRASON

PRECISION GEOSPATIAL SOLUTI

terra \terə\ n. [Latin]
the planet earth; land or territory

sond \sänd\ n.f. [French]
an instrument for measurement

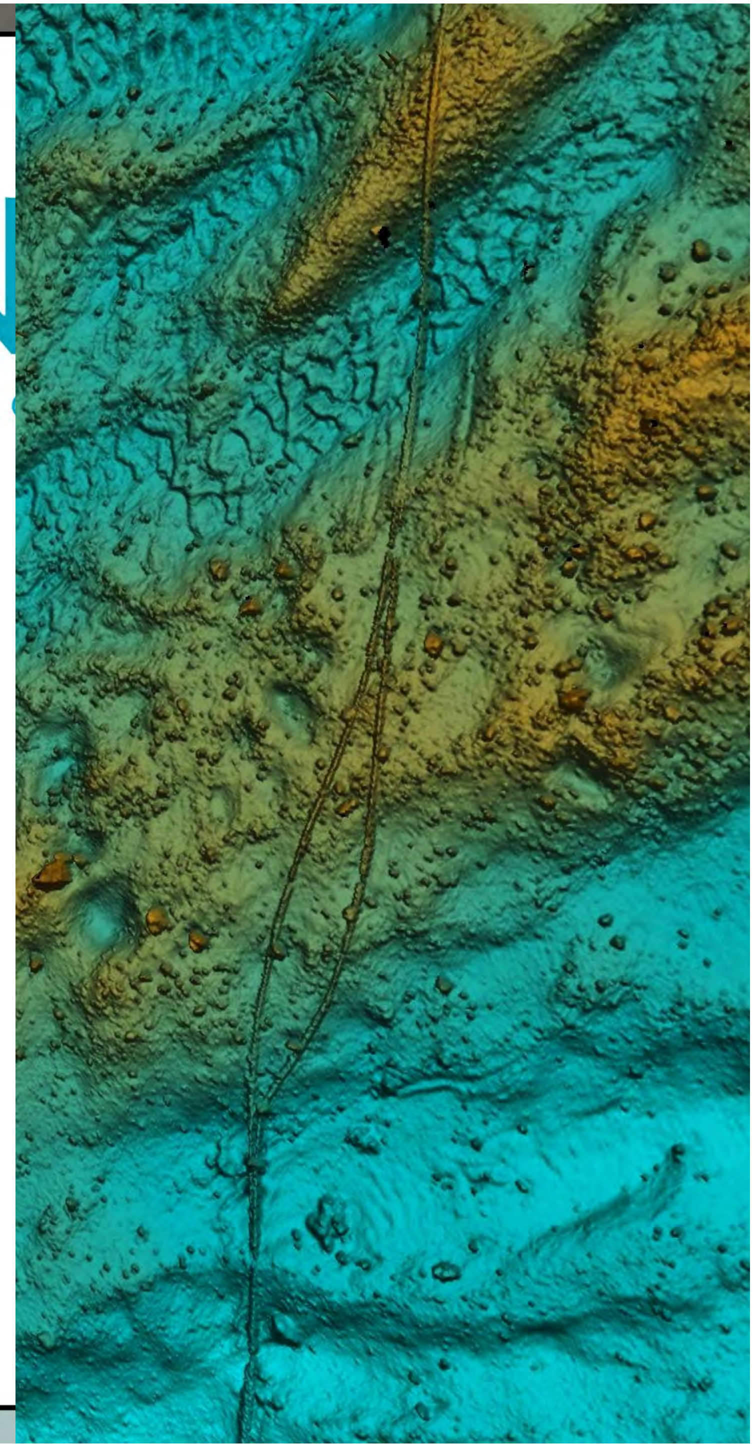
For additional information or discussion please contact our Alaska office at 907-745-7215 or by email.

Thomas Newman
tnewman@terrasond.com

Cody McCrary, General Manager
cmccrary@terrasond.com

Thane Humphrey, Opportunity Manager
thumphrey@terrasond.com

www.terrasond.com



TerraSond is a multidisciplinary organization providing clients geospatial solutions grounded on the company’s core values.
Integrity, Excellence, and **Service**.

Established in Palmer, AK in 1994

- Three Branch Offices
  - Seattle, WA
  - Houston, TX
  - Corpus Christi, TX

60 Employees

- Accredited Hydrographers
- Licensed Land Surveyors
- Geologists
- Geophysicists
- Oceanographers
- GIS, CADD, and IT Specialist
- Professional Mariners

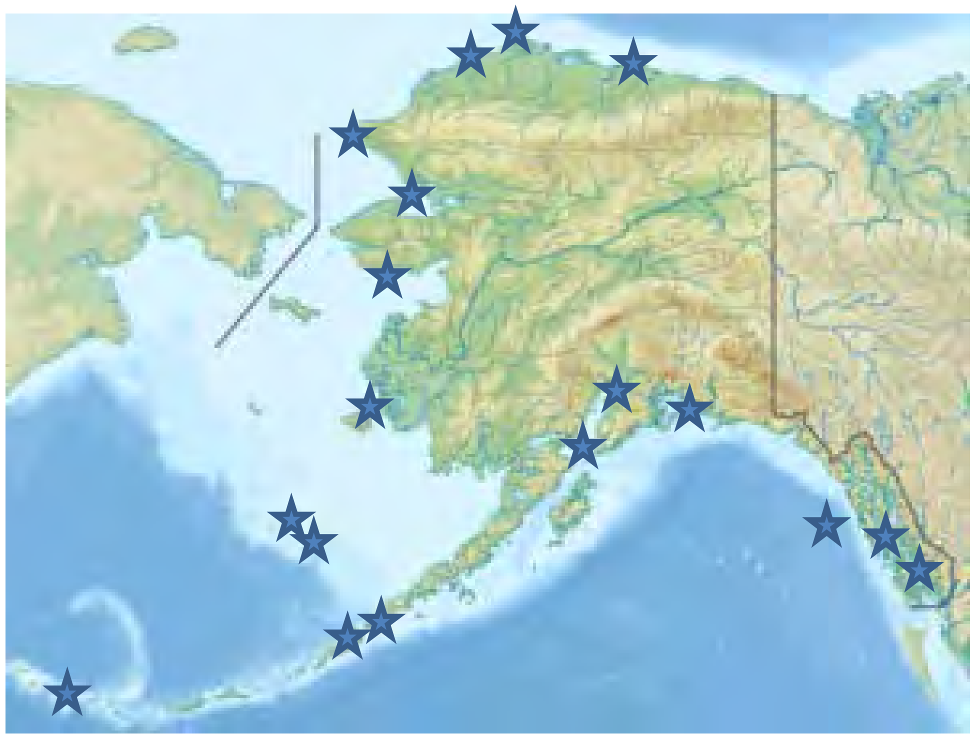
Core Services

- Hydrographic Survey
- Oceanographic Survey
- Marine Positioning Survey
- Offshore Inspection
- Orthophotography
- Geophysical Survey
- Land Survey
- Cartography and Data Analysis

Clients

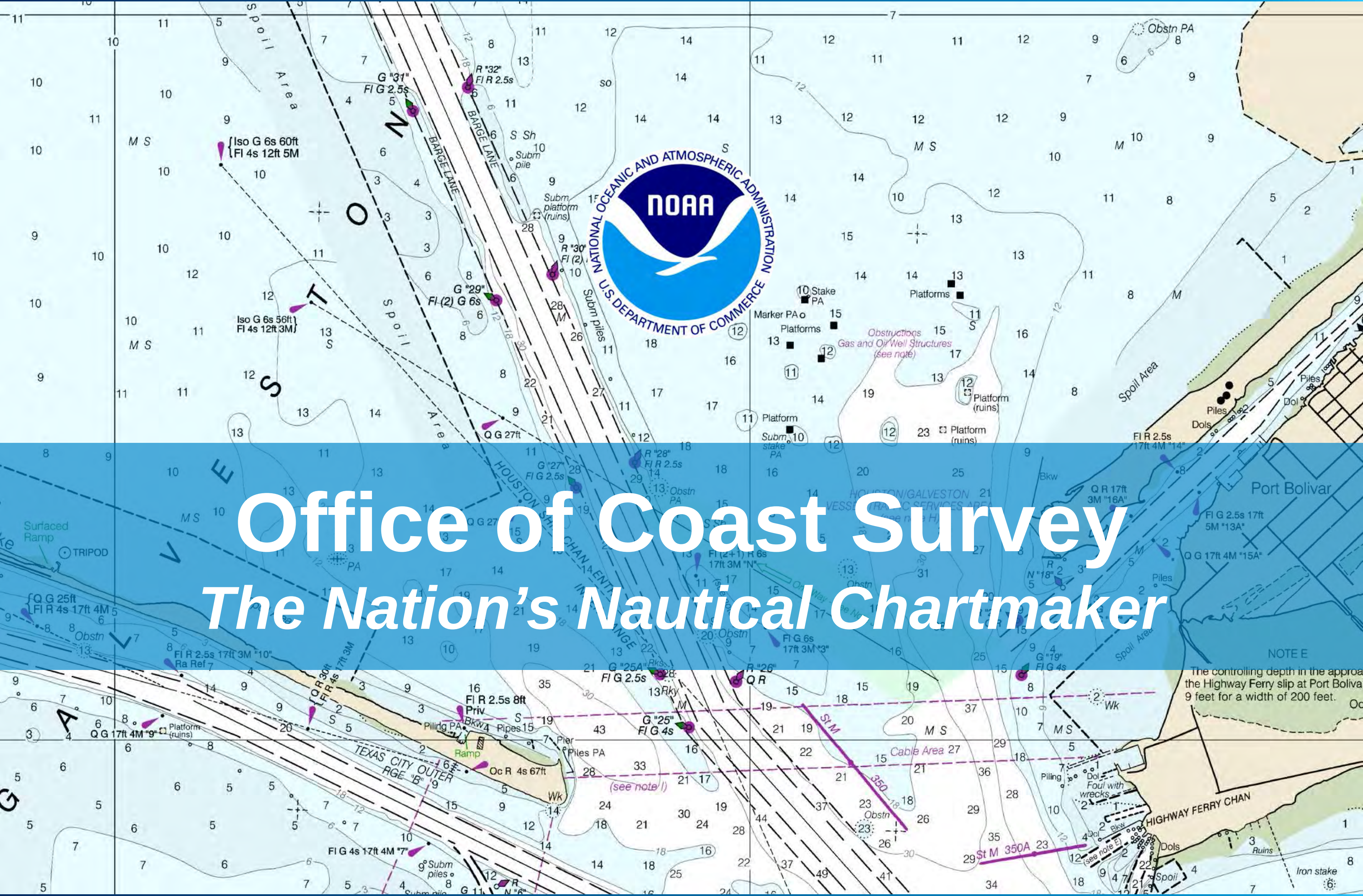
- Academic
- Construction
- Engineering
- Environmental
- Governmental
- Resource Extraction
- Service Companies
- Transportation
- Utility

TerraSond will have ongoing operations in the 2016 Alaskan survey season in the following areas:



2016 Operations vary in scope but include bathymetry, mobile laser scanning, shallow geophysics, sediment sampling, tides operations and aerial imagery.

A 105’ vessel equipped with multibeam, high speed sidescan sonar and carrying a 6 meter autonomous vessel also equipped with multibeam and high speed sidescan sonar will be operating in the Bering Sea and has availability after early August.



Office of Coast Survey

The Nation's Nautical Chartmaker

INTRODUCTIONS

AGENDA

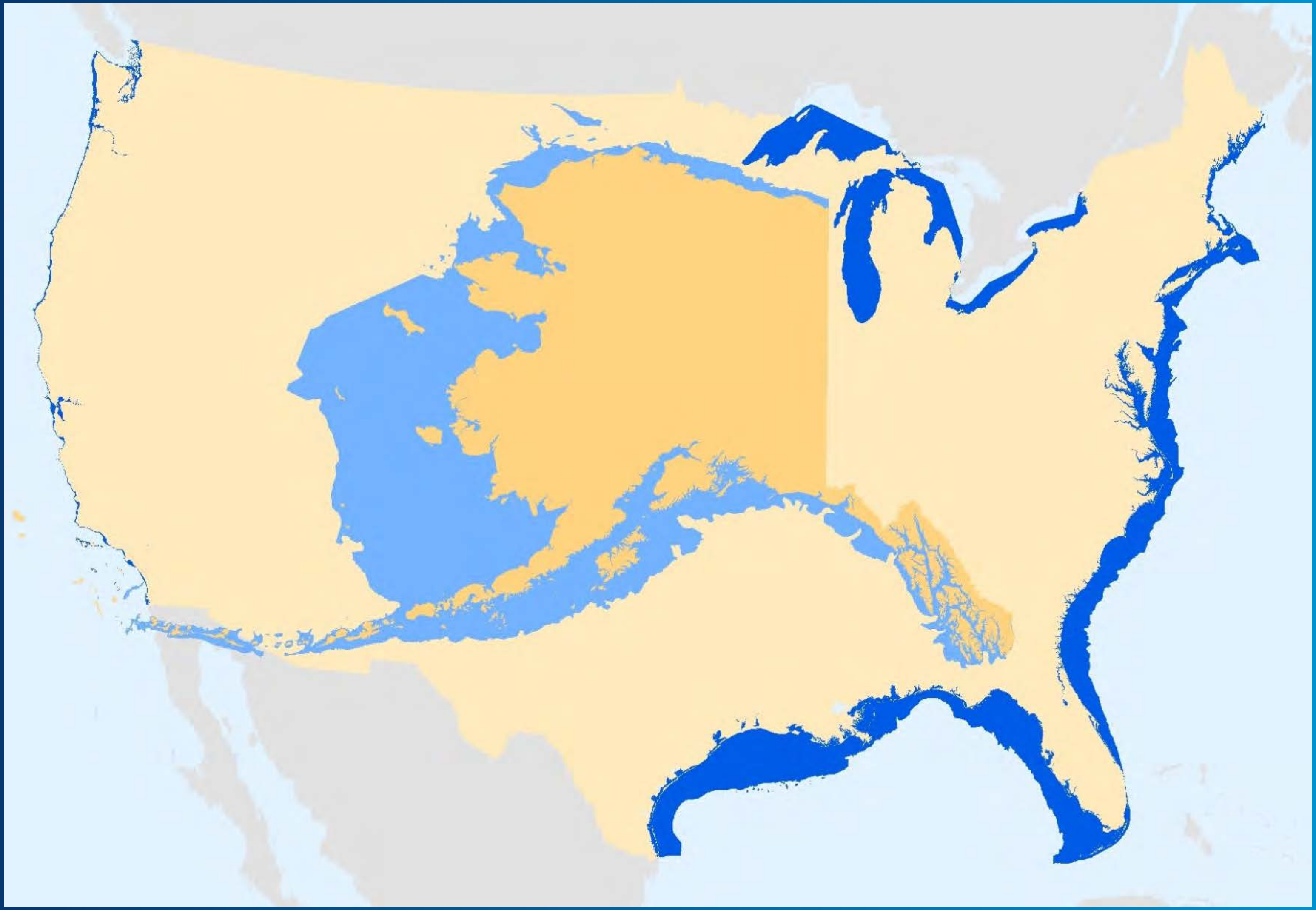
Open discussions follow each topic

- Overview
  - Rear Admiral Gerd Glang, director
- Survey plans
  - Corey Allen, Hydrographic Surveys Division
- ENC coverage
  - Andrew Kampia, Marine Chart Division
- Yukon River Provisional ENC
  - Andrew Kampia, Marine Chart Division
- U.S. Arctic Nautical Chart Plan
  - Colby Harmon, Marine Chart Division
- Arctic Navigation Planning Guide
  - Rachel Medley, Navigation Services Division

OVERVIEW:
COAST SURVEY CHARTS

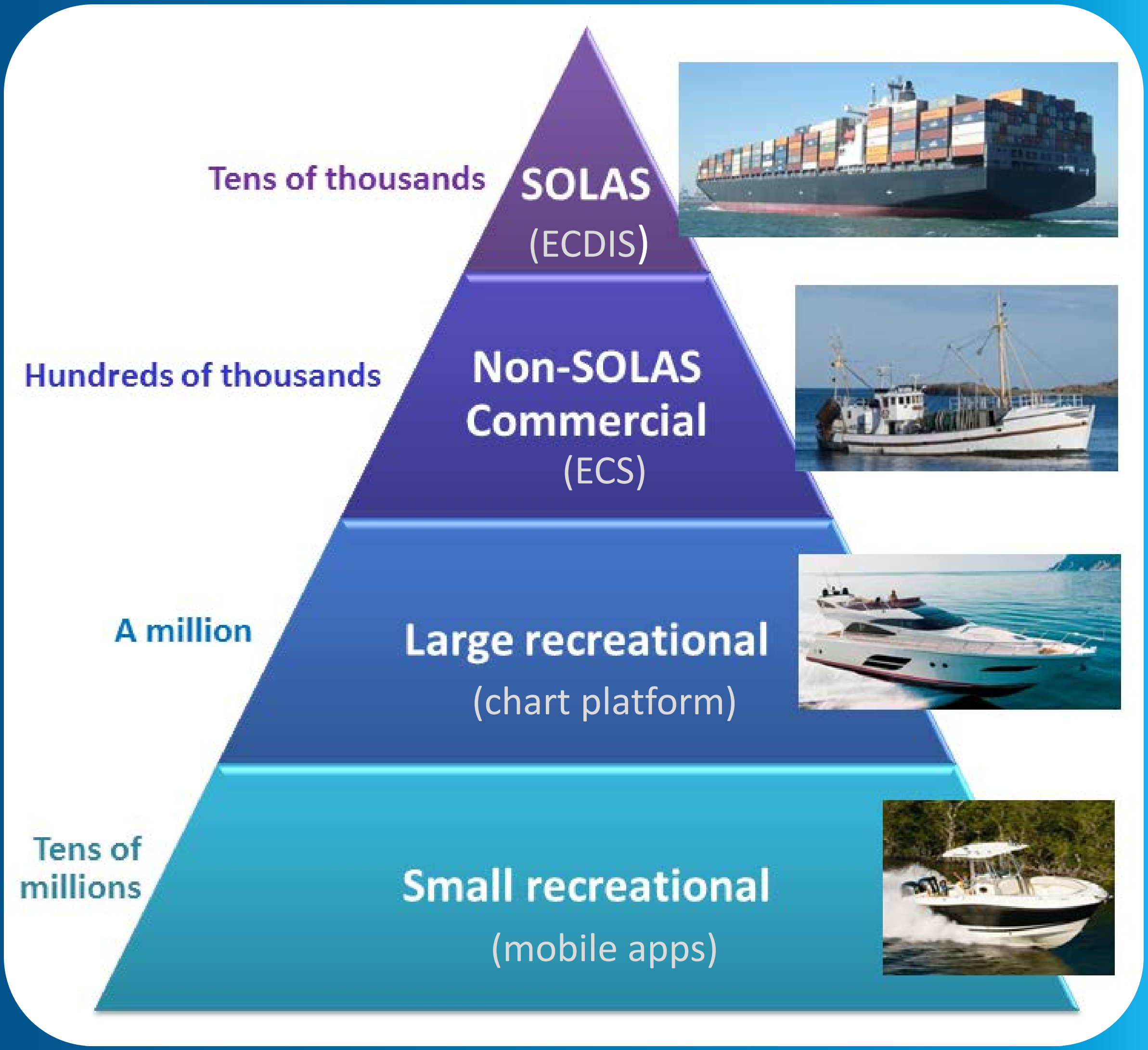

Alaska
United States
Midway Islands
Hawaiian Islands
Northern Mariana Islands
Wake Island
Guam
Johnston Atoll
Howland Island
Palmyra Atoll
Kingman Reef
Baker Island
Jarvis Island
American Samoa
Navassa Island
Puerto Rico and the U.S. Virgin Islands

Alaska’s navigationally significant waters



Expanding chart user base

(new modes of use)

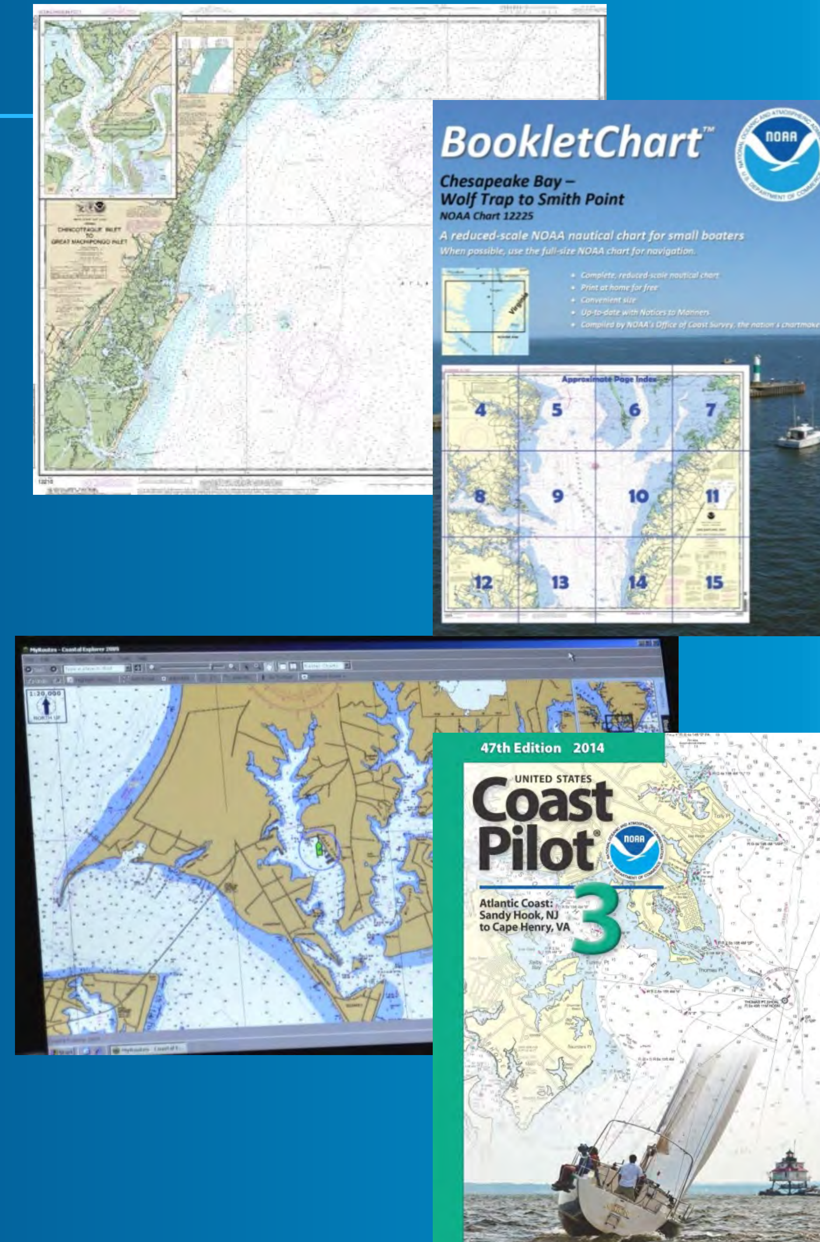


**A SOLAS ship is any ship to which the International Convention for the Safety of Life at Sea (SOLAS) 1974 applies; namely, a passenger ship engaged on an international voyage, or. a non-passenger ship of 500 tons gross tonnage or more engaged on an international voyage.*

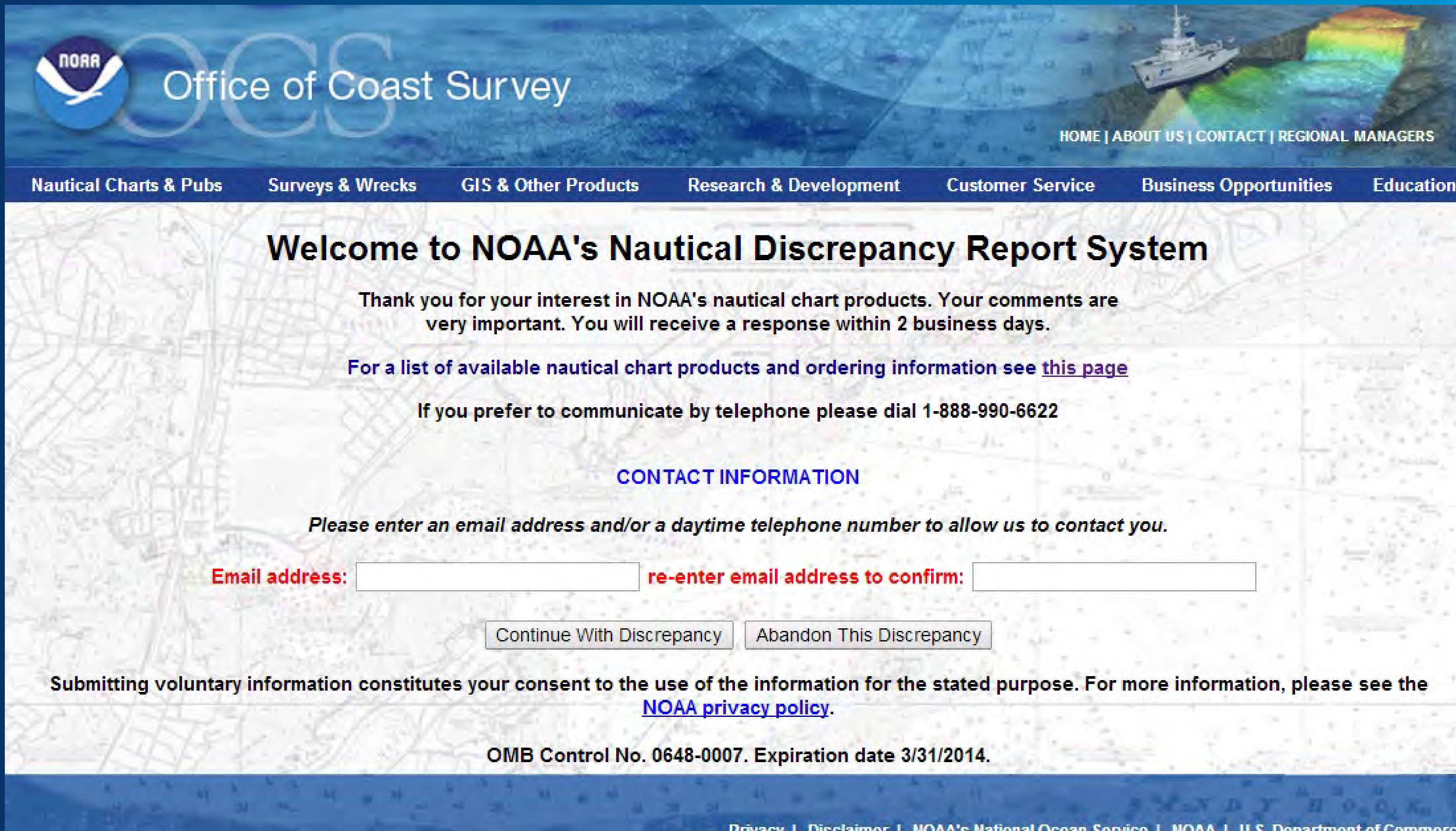
Different users need different products

Navigational products

- Paper nautical charts
    - Sold commercially
- PDF charts
    - Free download
- Raster navigational charts
    - NOAA RNC®
- Electronic navigational charts
    - NOAA ENC®
- NOAA BookletChart™
    - Free download
- U.S. Coast Pilot
    - HTML, print, PDF



Report chart discrepancies – for *any* chart



Office of Coast Survey

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Nautical Charts & Pubs | Surveys & Wrecks | GIS & Other Products | Research & Development | Customer Service | Business Opportunities | Education

Welcome to NOAA's Nautical Discrepancy Report System

Thank you for your interest in NOAA's nautical chart products. Your comments are very important. You will receive a response within 2 business days.

For a list of available nautical chart products and ordering information see this page

If you prefer to communicate by telephone please dial 1-888-990-6622

CONTACT INFORMATION

Please enter an email address and/or a daytime telephone number to allow us to contact you.

Email address: re-enter email address to confirm:

Continue With Discrepancy | Abandon This Discrepancy

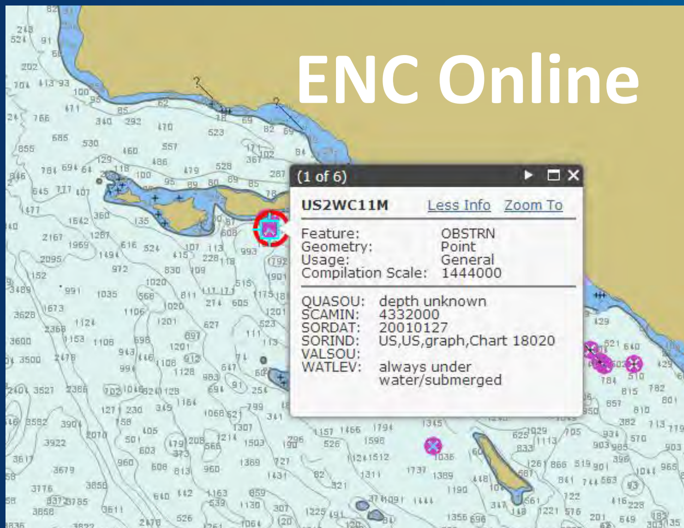
Submitting voluntary information constitutes your consent to the use of the information for the stated purpose. For more information, please see the NOAA privacy policy.

OMB Control No. 0648-0007. Expiration date 3/31/2014.

Privacy | Disclaimer | NOAA's National Ocean Service | NOAA | U.S. Department of Commerce

nauticalcharts.noaa.gov/discrepancy

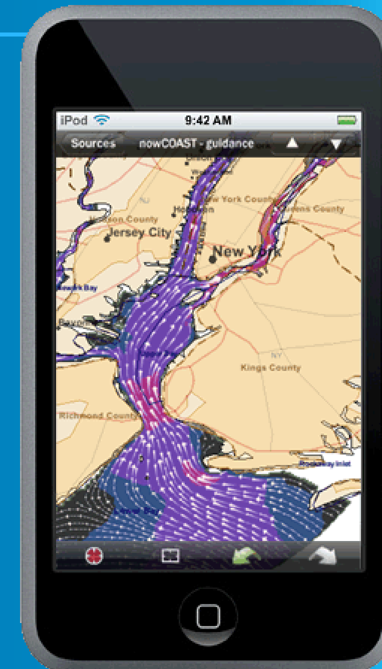
Information at your fingertips



- Can view ENC without ECDIS
- Useful for planning voyages

nauticalcharts.noaa.gov/ENCOnline

nowCOAST
(nowcoast.noaa.gov)
ocean and weather observations and forecasts



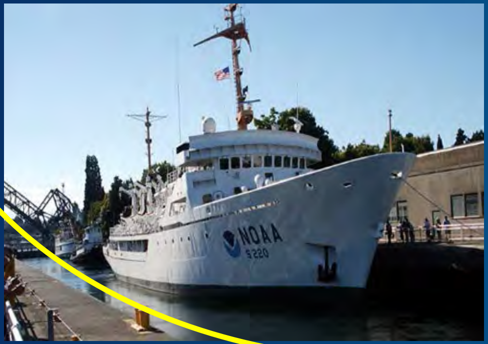
NOAA CHART TILE SERVICE

Data service providing fast chart updates to electronic charting systems

NOAA survey assets

ALASKA

Rainier
Newport, Oregon
1968



Fairweather
Ketchikan, Alaska
1968, 2010

Thomas Jefferson
Norfolk, Virginia
1992

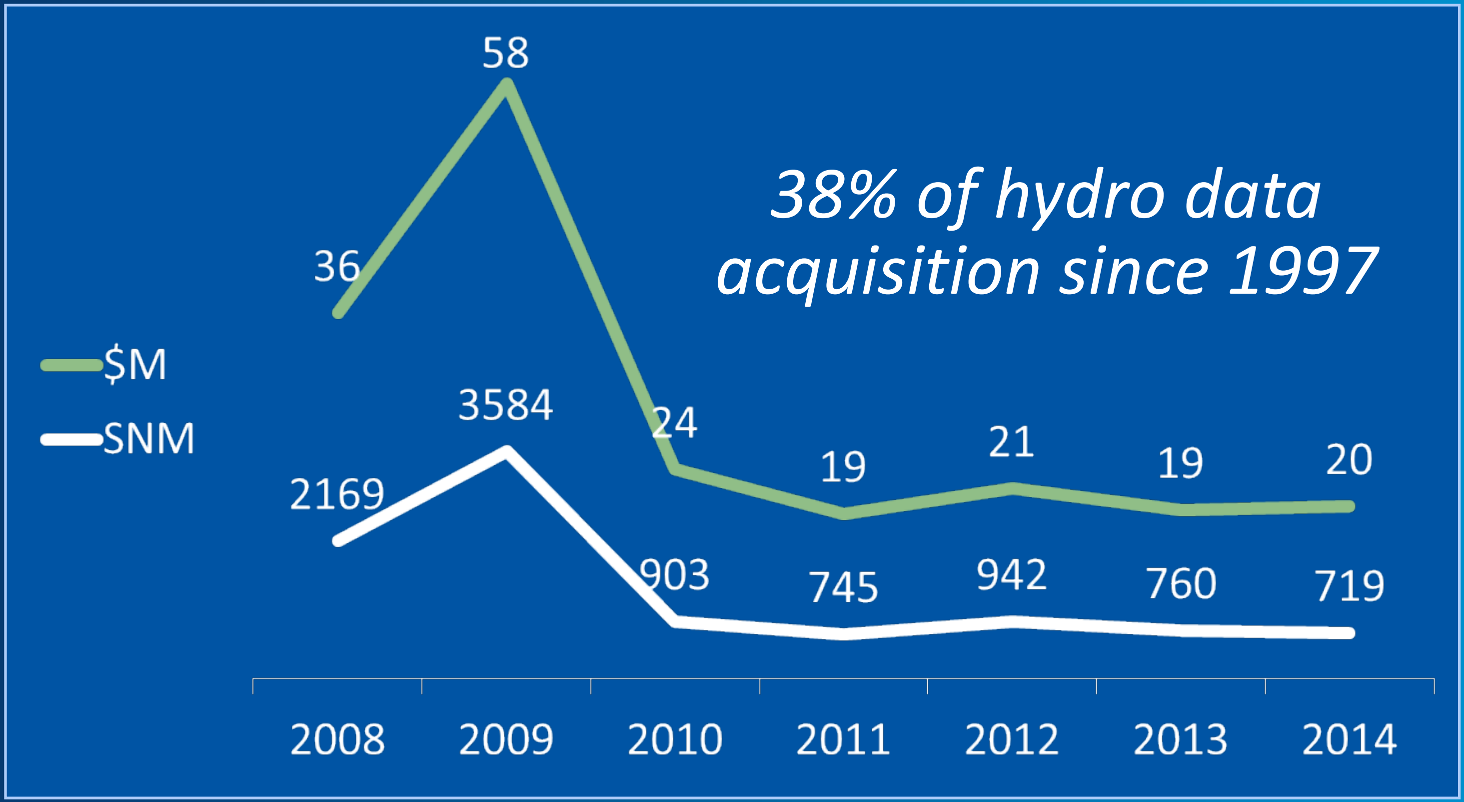
Bay Hydro II
Silver Spring, Maryland
2008

Ferdinand R. Hassler
New Hampshire
2012

6 Navigation
Response Teams

King Air
2009

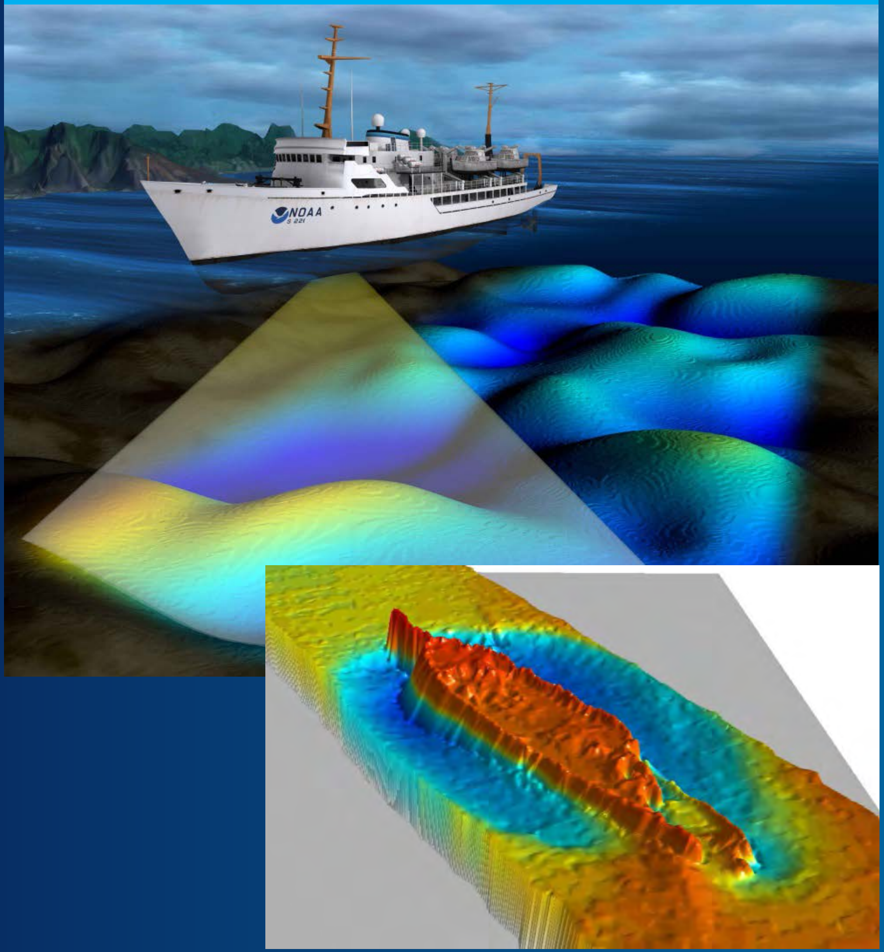
Contracting partners



- Eight vendors under Coast Survey’s hydrographic services contract (FY15 – FY19)
- Six task orders anticipated for FY16

Data acquisition

Multibeam echo sounder



Side scan sonar

New technologies for more data

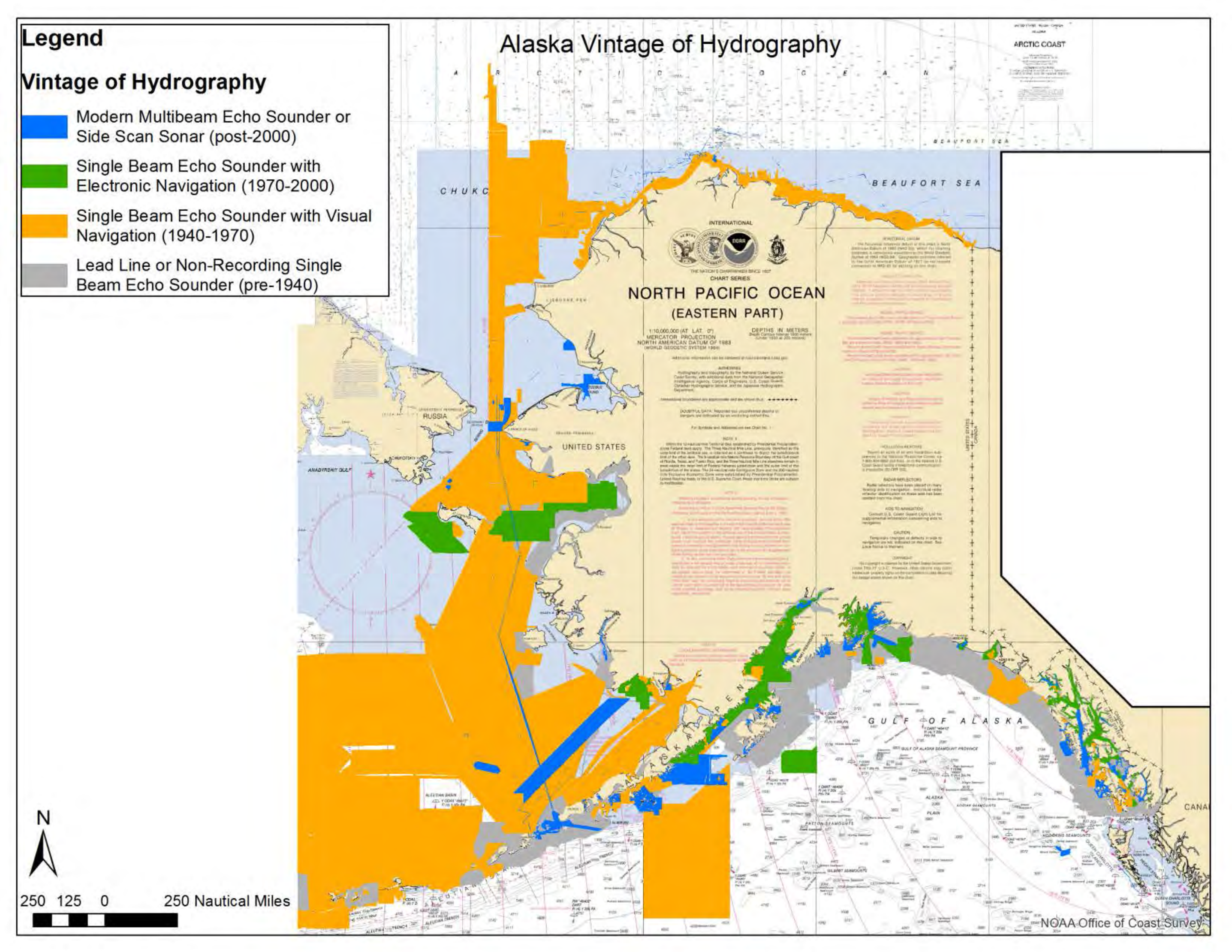
Autonomous underwater vehicles

Satellite-derived bathymetry

Autonomous surface vehicles

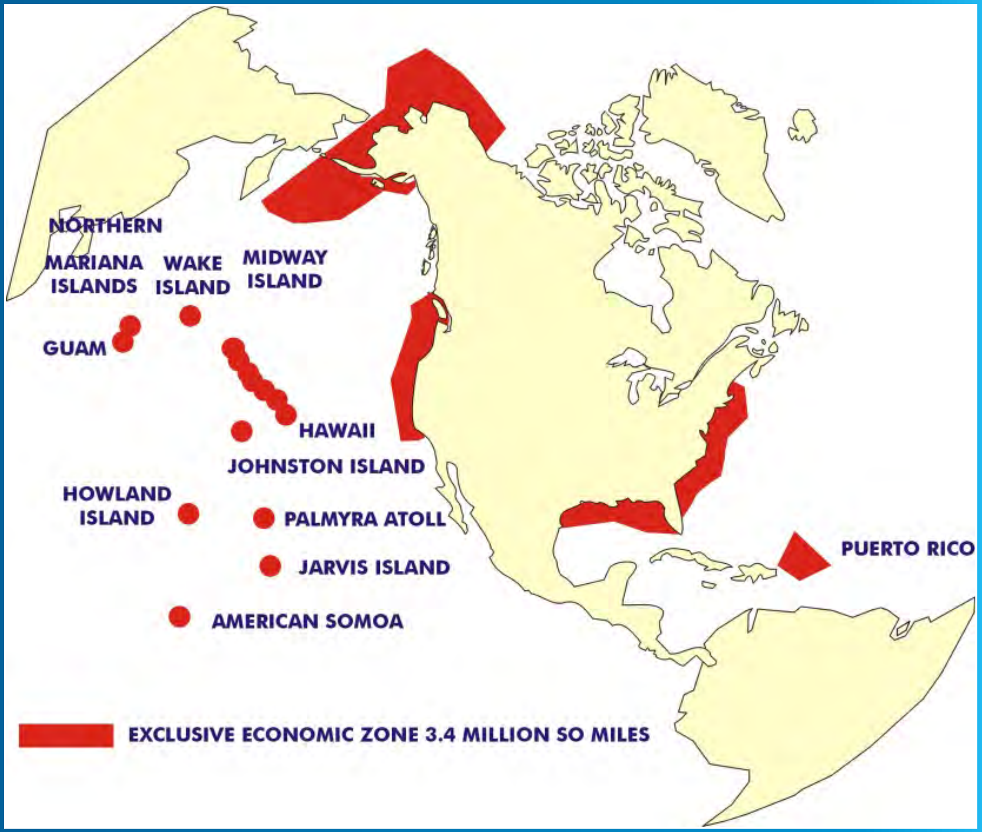
WHAT DOES THIS MEAN FOR ALASKA?

Modern survey data is lacking



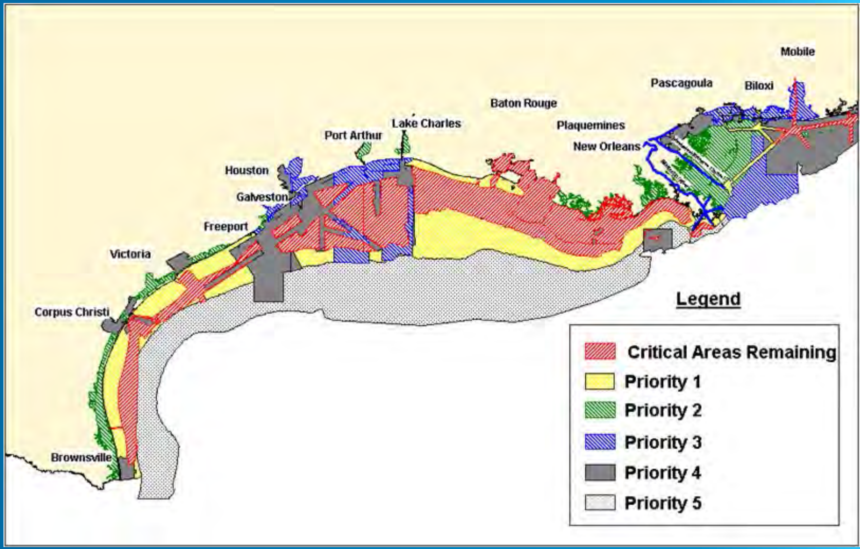
Redefining survey priorities

- 3,400,000 snm within U.S. Exclusive Economic Zone
- 500,000 snm is considered to be navigationally significant…
- … of which only ~44,000 snm has been surveyed to modern standards



- In a given year, NOAA ships and contractors acquired ~3,000 snm
- At that rate, it will require 150 years to complete

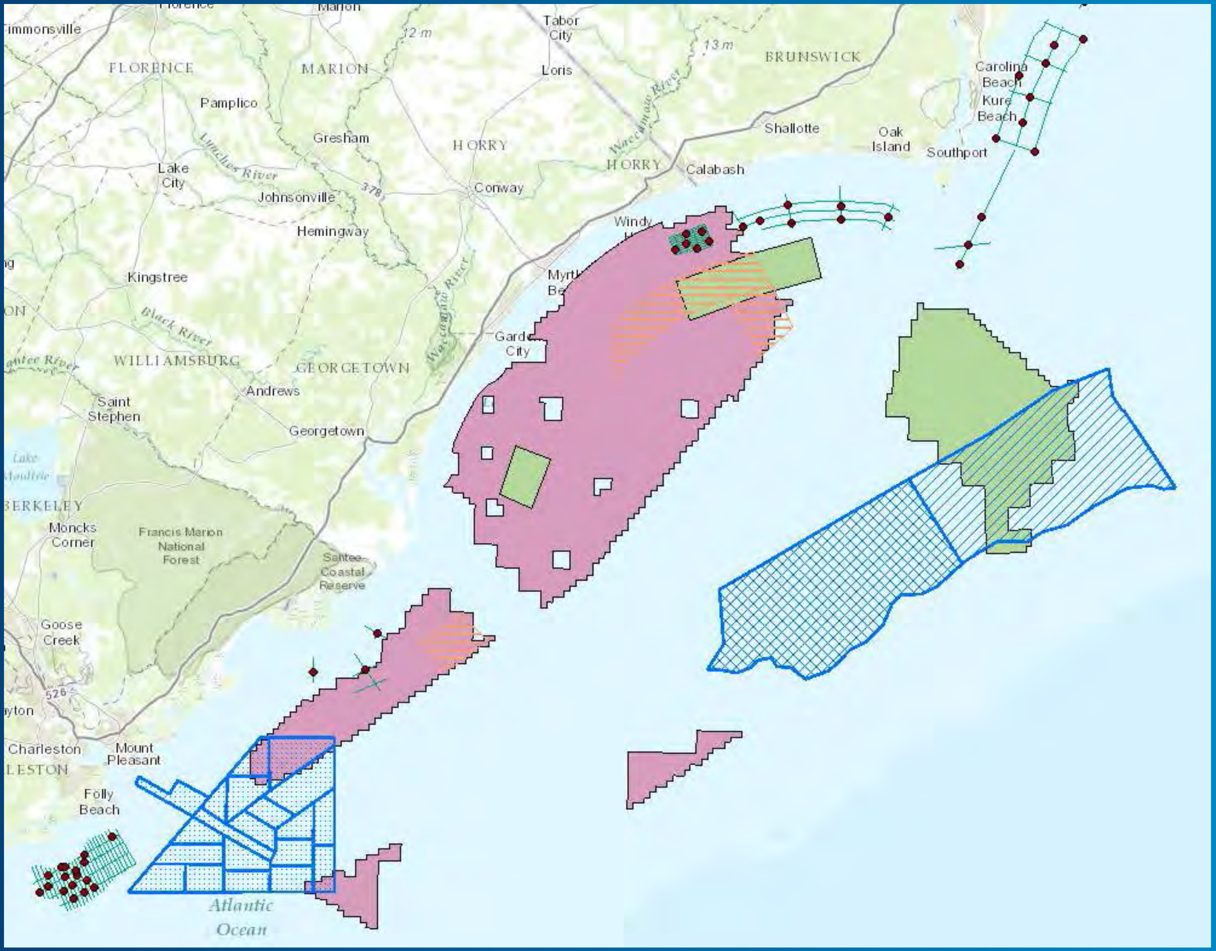
- Areas prioritized in 1994
- Ranked from "Critical" to "Priority 5"
- Limited to computing power, software and datasets of the era



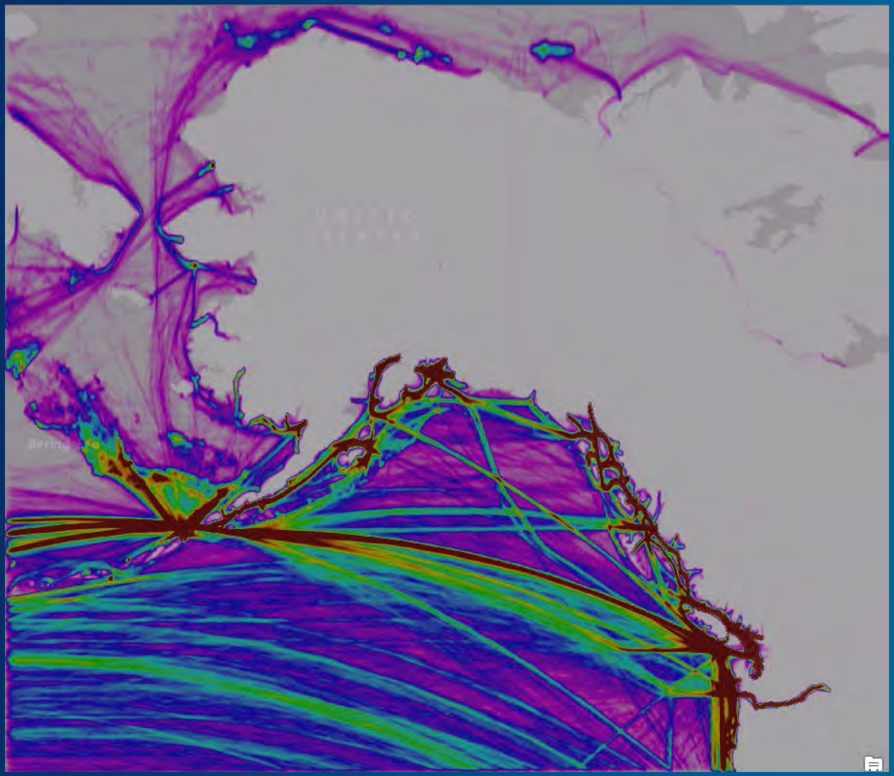
- Did not account for a changing seafloor
  - e.g. hurricanes and dynamic inlets
- Did not account for change in use
  - e.g. deeper draft vessels, emerging ports and recreational community

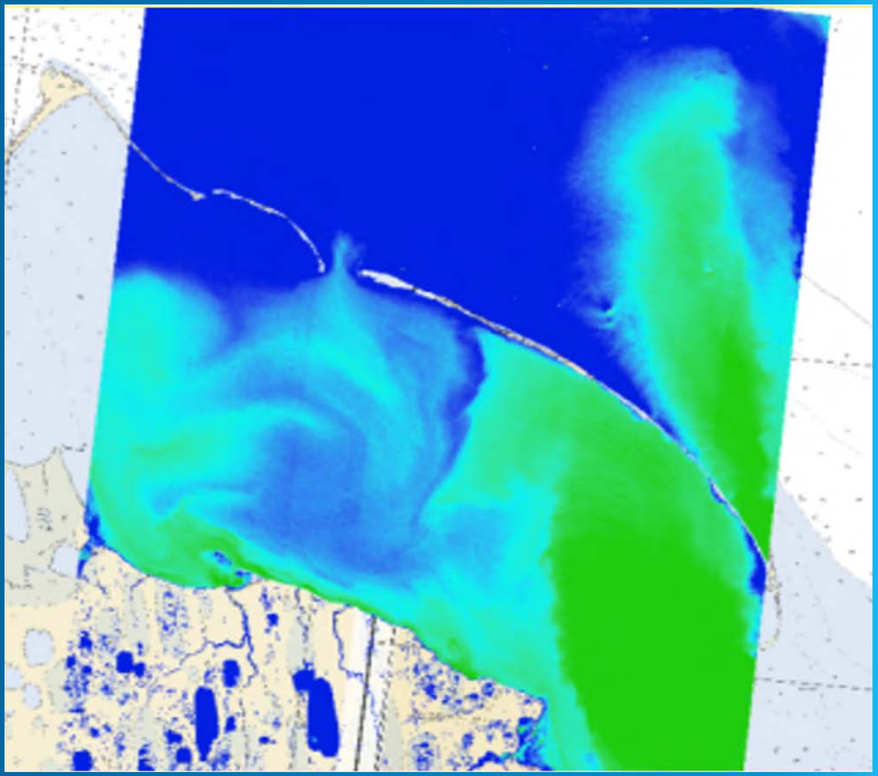
Facilitating coordination

between federal, state & local agencies

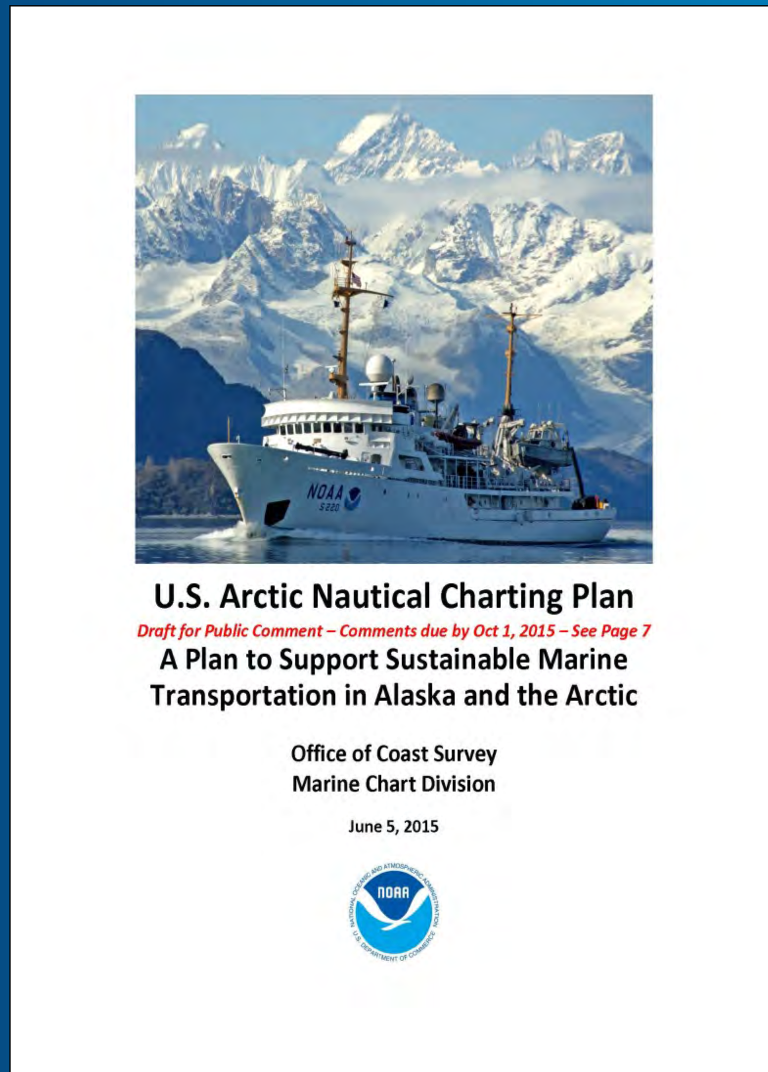


Using new technologies for data





We are revising our charting scheme



U.S. Arctic Nautical Charting Plan

Draft for Public Comment – Comments due by Oct 1, 2015 – See Page 7

A Plan to Support Sustainable Marine Transportation in Alaska and the Arctic

Office of Coast Survey
Marine Chart Division

June 5, 2015

Your thoughts?

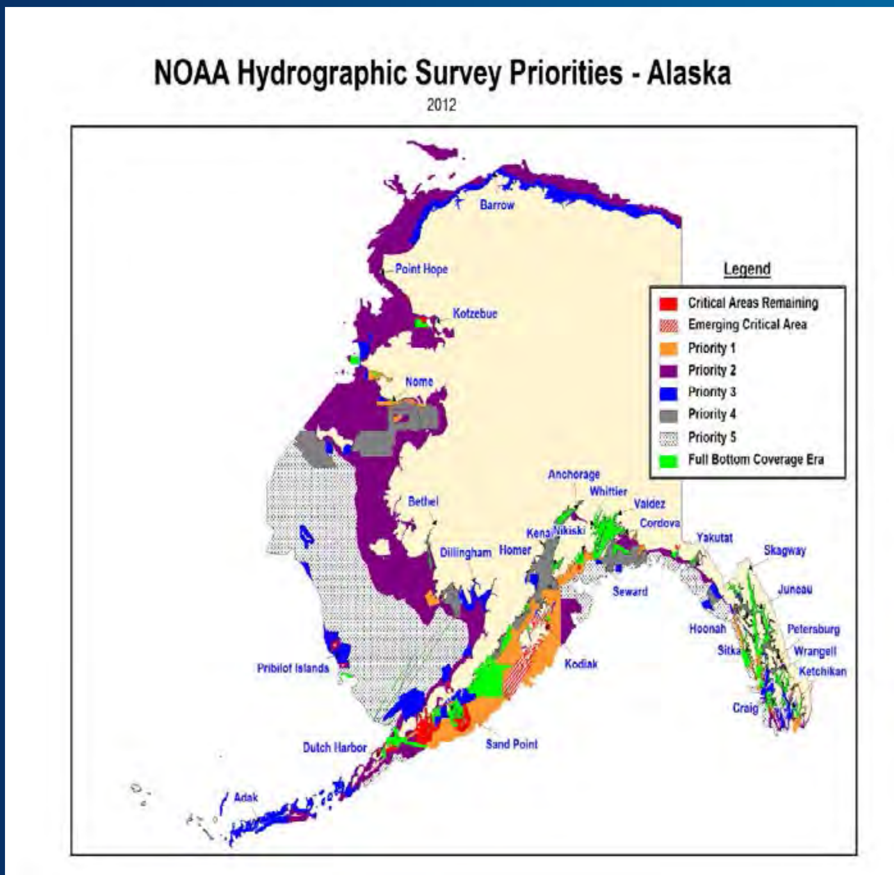
- What do Alaskan mariners need from NOAA's navigation services?
- What are the primary products you rely on for navigation?
- Is there a navigational product/service that is not currently meeting your needs? How can we improve our products and services?
- Other stakeholder issues?

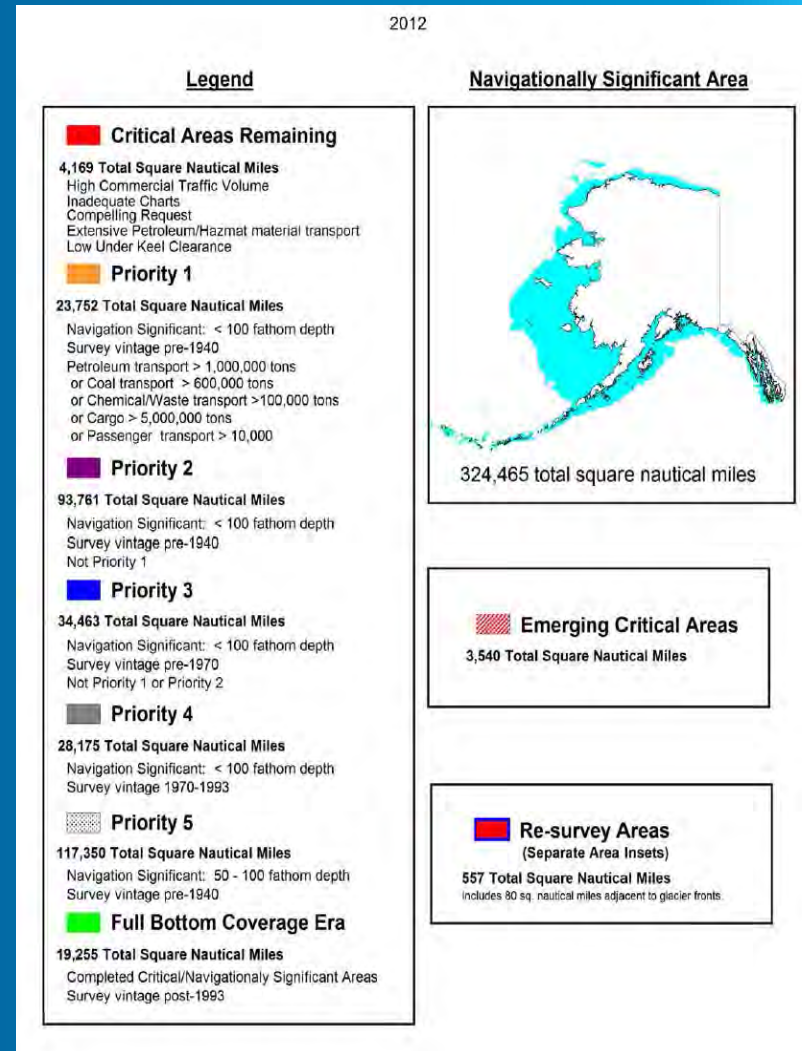
Corey Allen, Hydrographic Survey Division, Operations

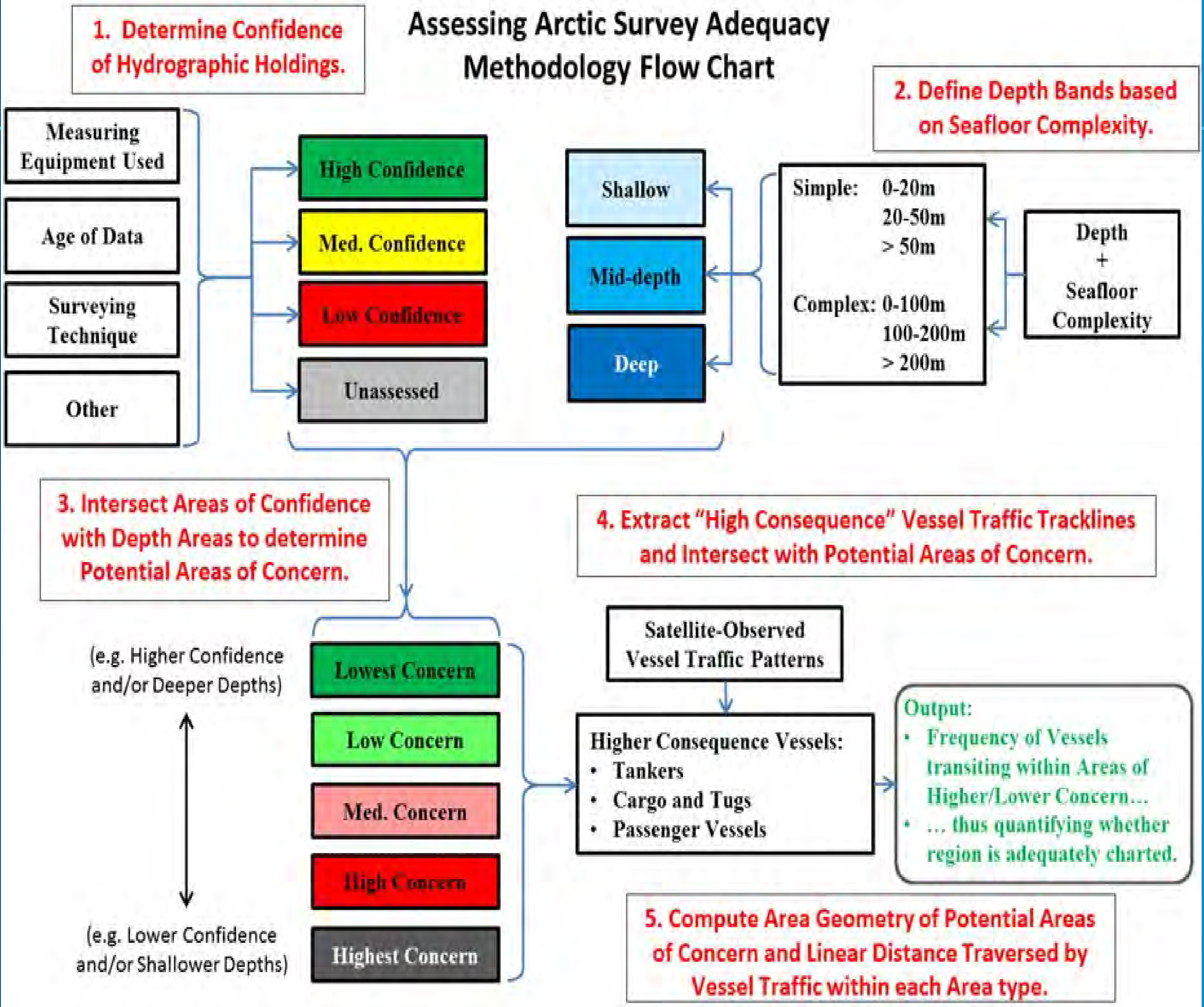
HYDROGRAPHIC SURVEY PLANS

NOAA hydrographic survey priorities (2012)

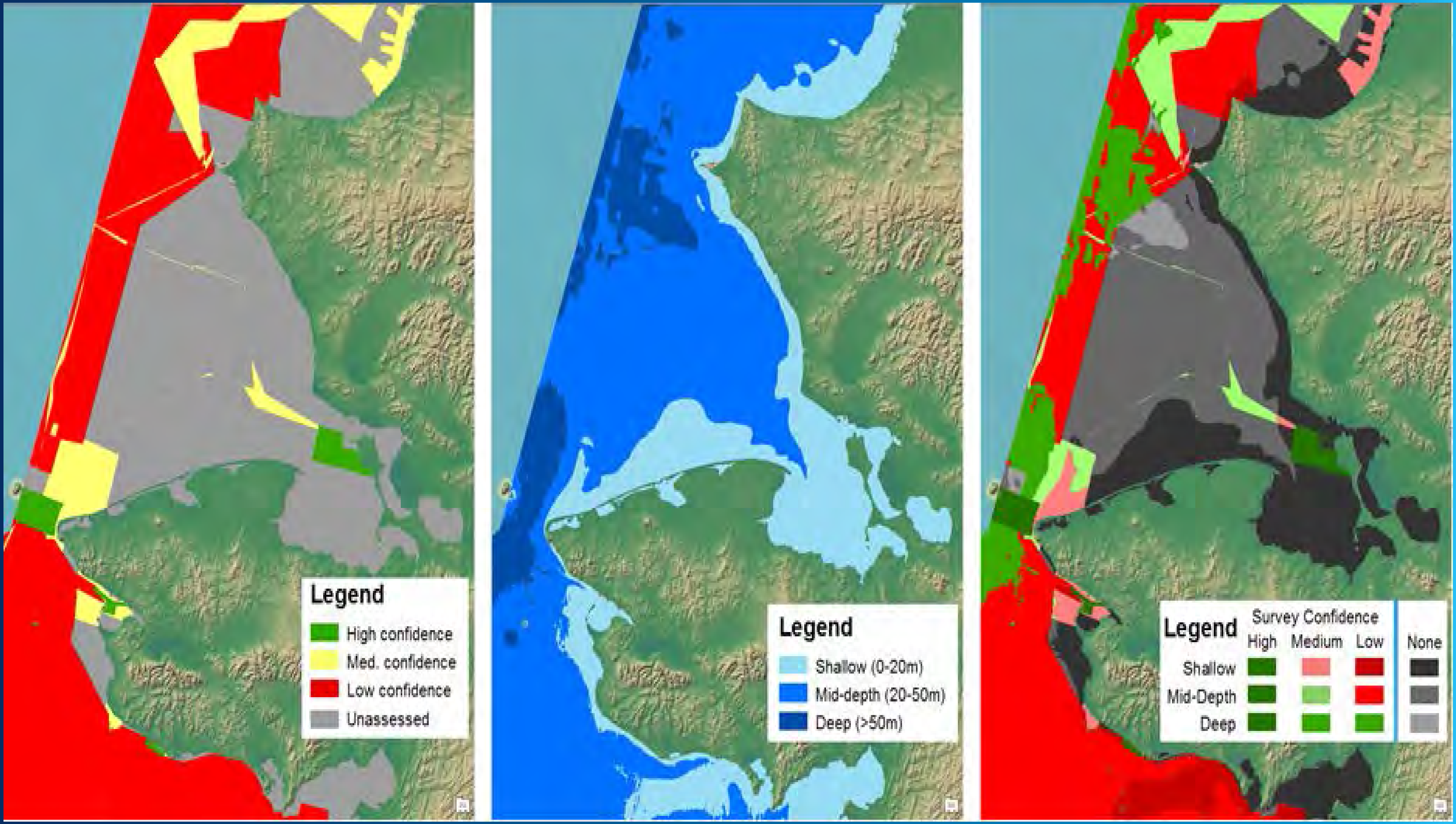
Priorities are static (save “emerging critical”) and non-dynamic



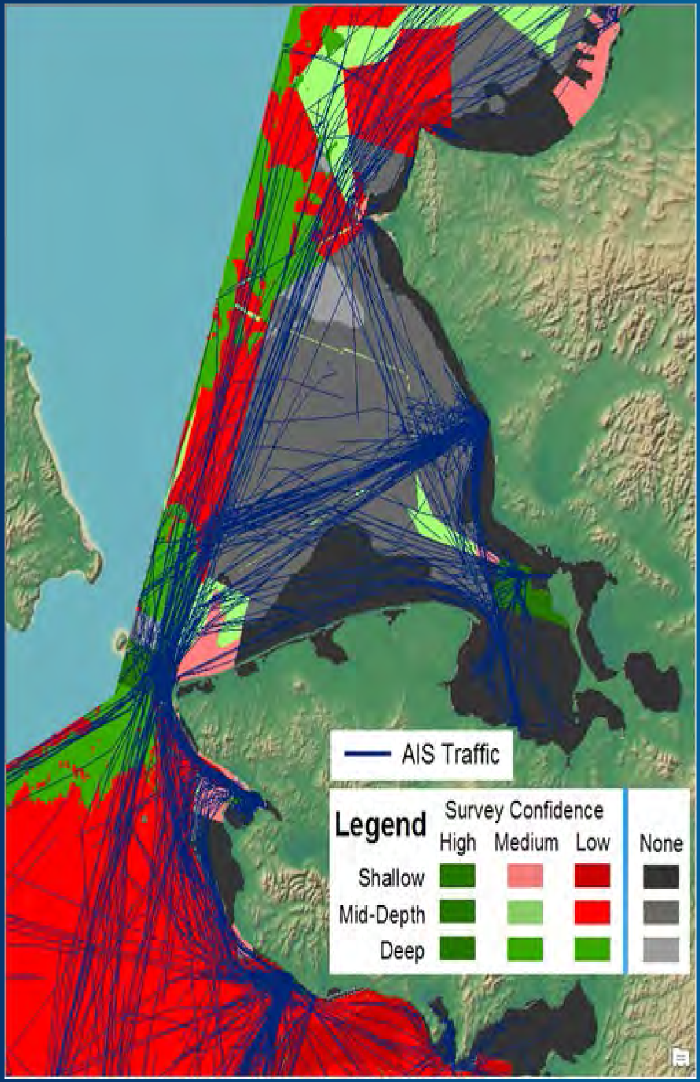


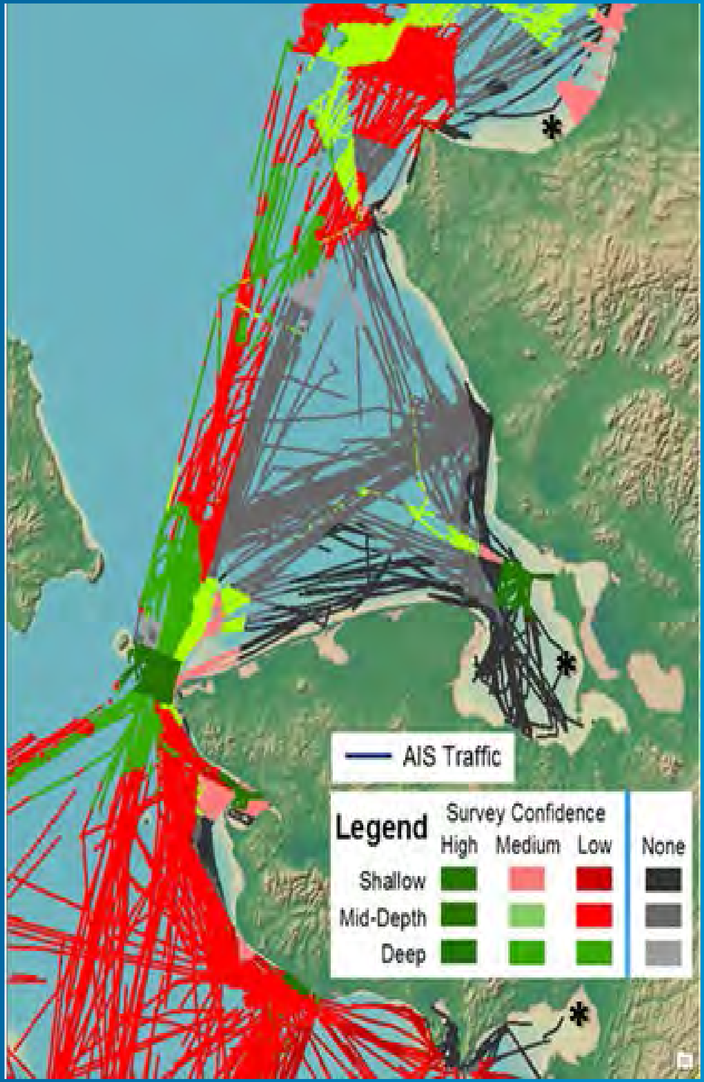

Assessing Arctic Survey Adequacy
Methodology Flow Chart
1. Determine Confidence of Hydrographic Holdings.
Measuring Equipment Used
Age of Data
Surveying Technique
Other
High Confidence
Med. Confidence
Low Confidence
Unassessed
2. Define Depth Bands based on Seafloor Complexity.
Shallow
Mid-depth
Deep
Simple: 0-20m
20-50m
> 50m
Complex: 0-100m
100-200m
> 200m
Depth
+
Seafloor Complexity
3. Intersect Areas of Confidence with Depth Areas to determine Potential Areas of Concern.
(e.g. Higher Confidence and/or Deeper Depths)
(e.g. Lower Confidence and/or Shallower Depths)
Lowest Concern
Low Concern
Med. Concern
High Concern
Highest Concern
4. Extract "High Consequence" Vessel Traffic Tracklines and Intersect with Potential Areas of Concern.
Satellite-Observed Vessel Traffic Patterns
Higher Consequence Vessels:
• Tankers
• Cargo and Tugs
• Passenger Vessels
Output:
• Frequency of Vessels transiting within Areas of Higher/Lower Concern…
• … thus quantifying whether region is adequately charted.
5. Compute Area Geometry of Potential Areas of Concern and Linear Distance Traversed by Vessel Traffic within each Area type.

Intersection of confidence & depth



Incorporate vessel traffic





NOAA hydrographic survey priorities (2012)

EEZ - 1 million SNM*
Navigationally significant : 300k SNM
Critical survey area: 3.6k SNM
Emerging critical: 3k SNM
Priorities 1-5: 60k SNM

1994-2015
Completed in Alaska - 22k SNM

Entire U.S.
Complete ~ 2.5k SNM annually
(includes NOAA ships and contracts)

**square nautical miles*

The Office of Coast Survey is developing a comprehensive requirements model that will supersede the 2012 NHSP and the methodology used to determine priorities. These below statistics reflect the status of NHSP as of September, 2015.

SNM of US EEZ in the Arctic	426,400[1]
SNM of Navigationally Significant area in the US Arctic	242,400
SNM of Critical Survey area in the US Arctic	1,449
SNM of Emerging Critical Survey area in the US Arctic	0[2]
SNM of Priority 1-5 area in the US Arctic	228,600
SNM in "PARS" Arctic corridor	3,490
SNM of US EEZ in Alaska (including Arctic)	1,112,950
SNM of US EEZ in Alaska (not including Arctic)	686,550
SNM of Navigationally Significant area in Alaska (including Arctic)	324,465
SNM of Navigationally Significant area in Alaska (not including Arctic)	82,065
SNM of Critical Survey area in Alaska (including Arctic)	3,649
SNM of Critical Survey area in Alaska (not including Arctic)	1,680
SNM Emerging Critical survey area in Alaska (not including Arctic)	2,940
SNM of Priority 1-5 area in Alaska (not including Arctic)	60,290
SNM completed to date in US Arctic (including PARS)	6,084[3]
SNM completed to date in PARS Arctic corridor	1,425[3]
SNM completed to date in Alaska (including Arctic)	22,210[3]
SNM completed to date in Alaska (not including Arctic)	17,460[3]

(1) ARPA defined Arctic includes land area; region was modified to eliminate land area from calculation.
(2) No areas in the US Arctic have been designated as Emerging Critical areas.
(3) Totals include completed surveys from 1994 to 2015, but do not include incomplete surveys. Totals do not include the 2013 reconnaissance surveys completed by *Fairweather*.

The US EEZ limits are available for download on the Office of Coast Survey (OCS) web site at: http://www.nauticalcharts.noaa.gov/csdl/mbound.htm. The limits of the Arctic Research and Policy Act (ARPA) are available as an image at http://www.arctic.gov/maps/ARPA_Alaska_only.pdf.

Surveying is difficult and expensive

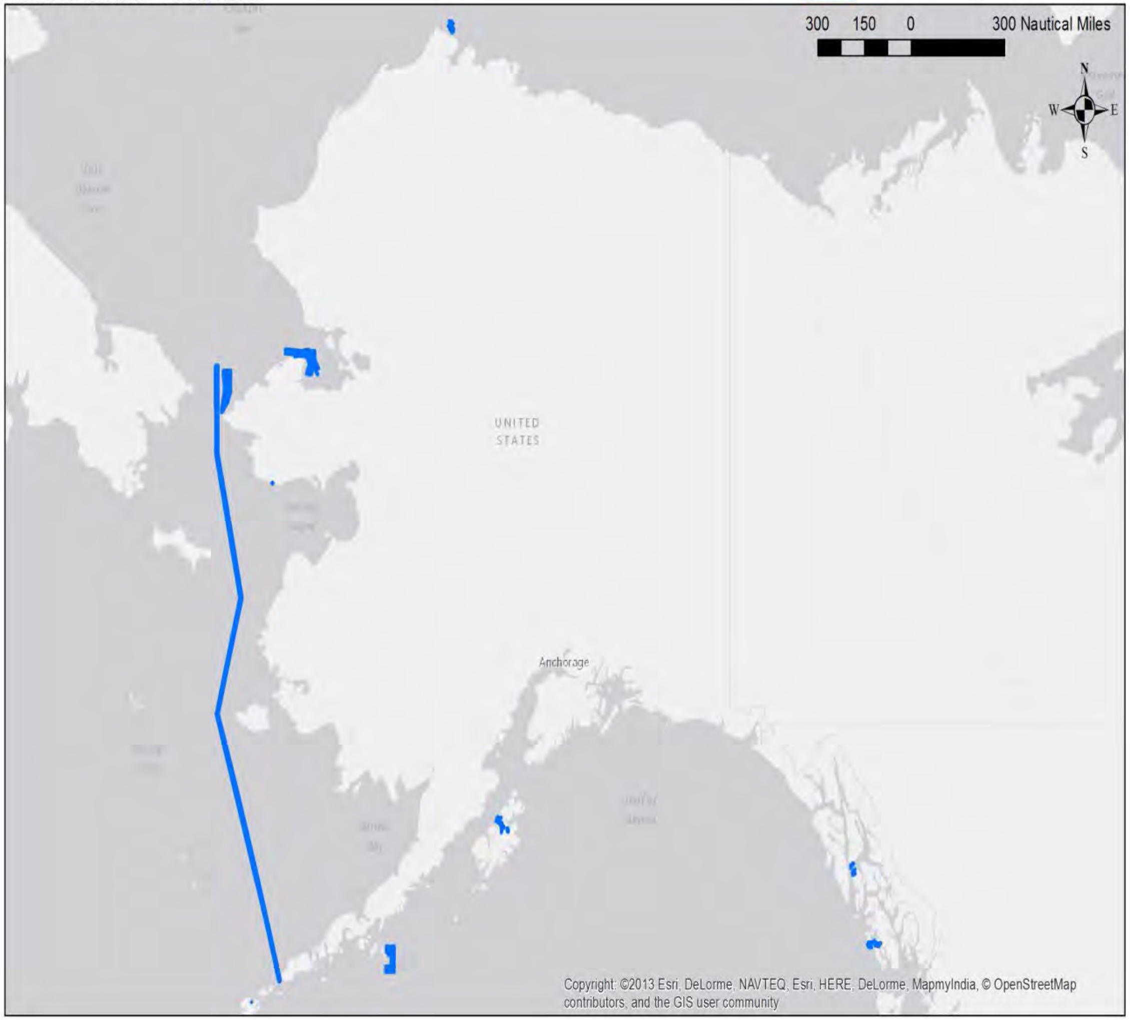
Surveying in Alaska is even *more* difficult and expensive

2010-2015

- average cost of a contracted hydrographic survey: \$23k/SNM
- average cost of a contracted hydrographic survey in Alaska: \$29k/SNM
- average Alaskan task order : \$4.5M or ~150/SNM
  - \$4.5M outside of Alaska: 200 SNM (difference of 50 SNM)

2015 Alaska Hydrographic Surveys (NOAA & Contractor)

Fully Surveyed: 1088 nm^2
Transit Data: ~1500 nm



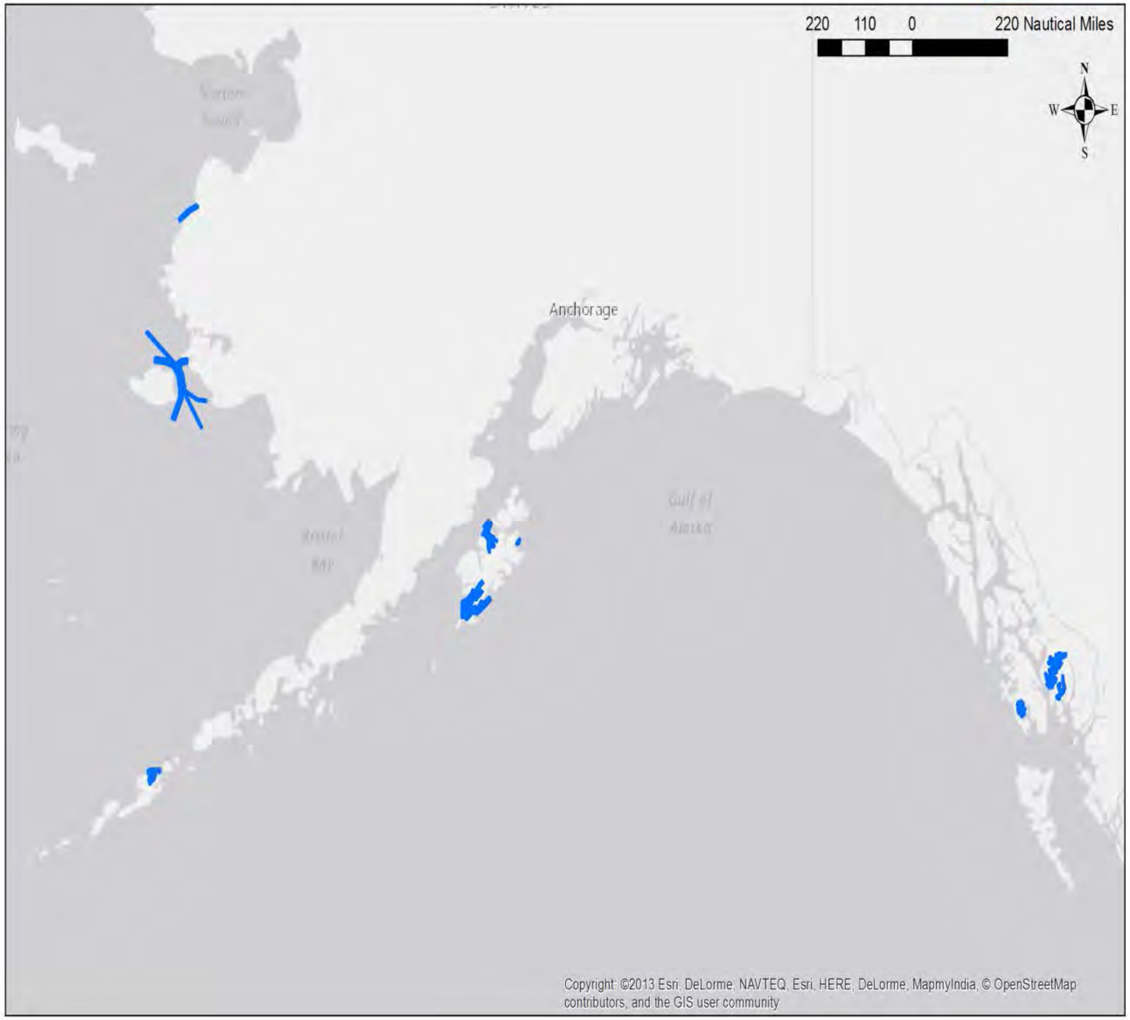
2016 Planned Alaska Hydrographic Surveys (NOAA & Contractor)

Planned Surveys: ~1500 nm^2

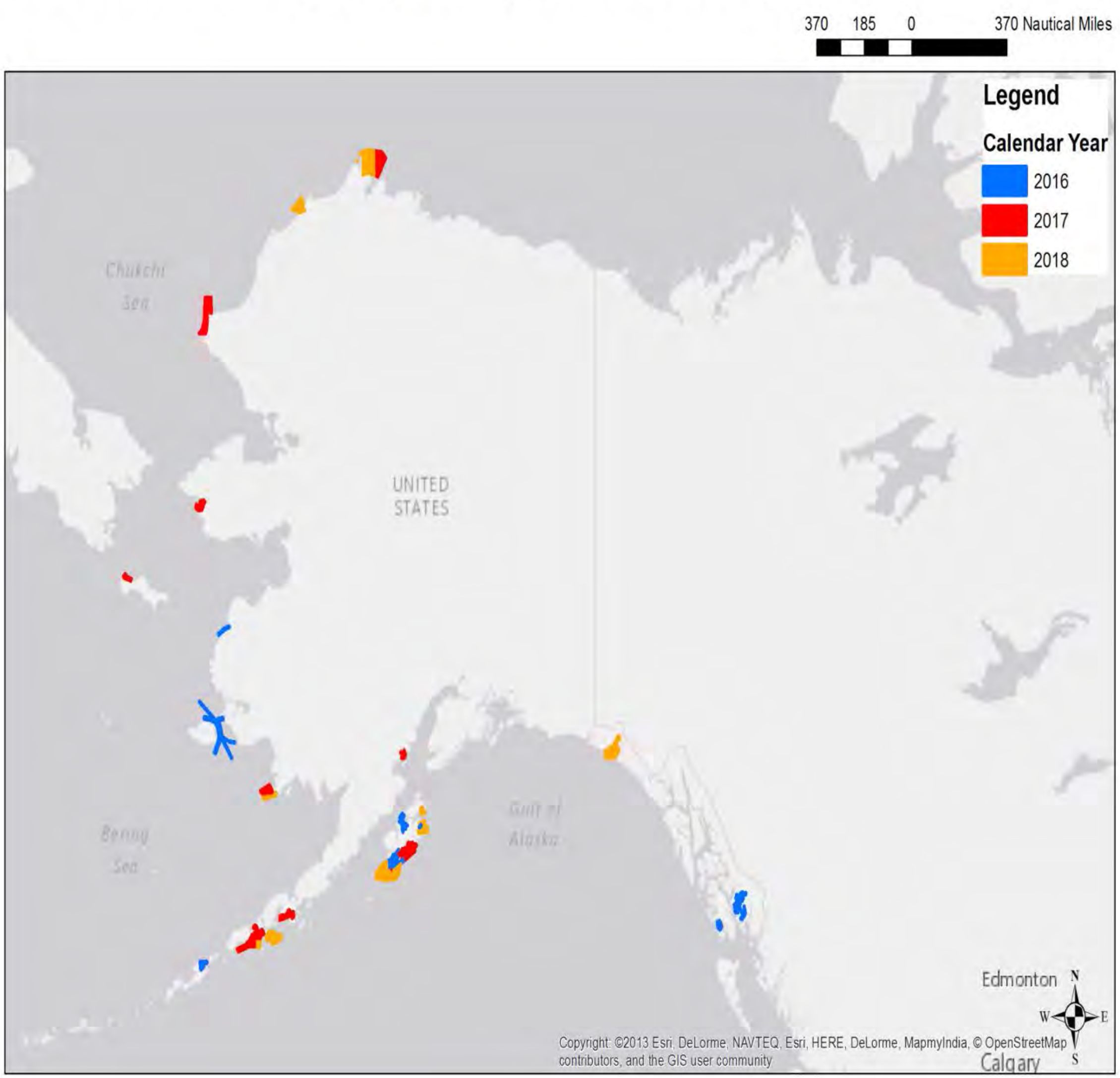
Legend

Calendar Year

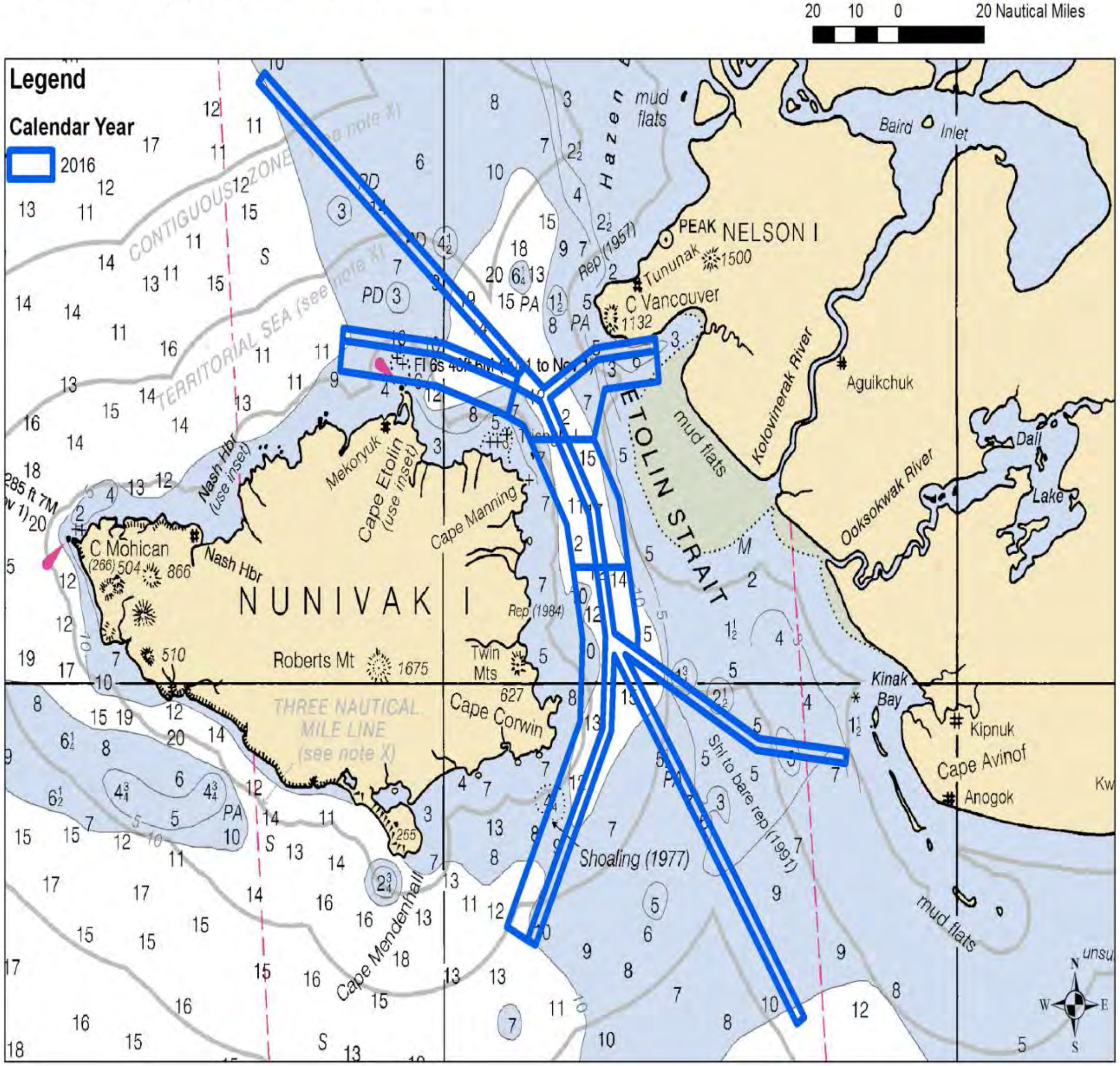
2016



2016-18 Planned Alaska Hydrographic Surveys (NOAA & Contractor)



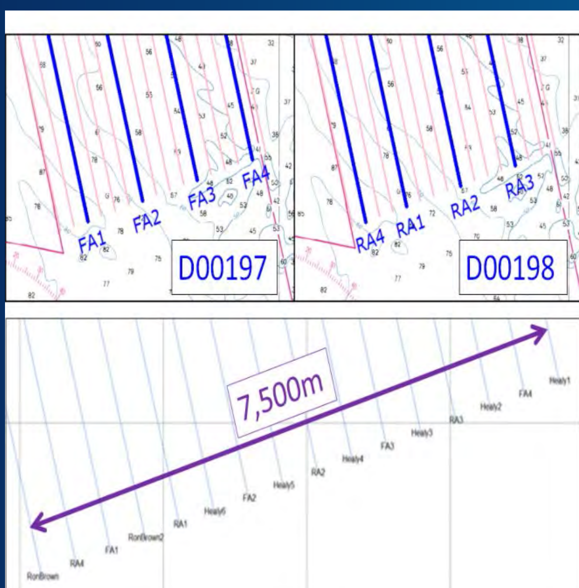
Corridor Approach: Etolin Strait

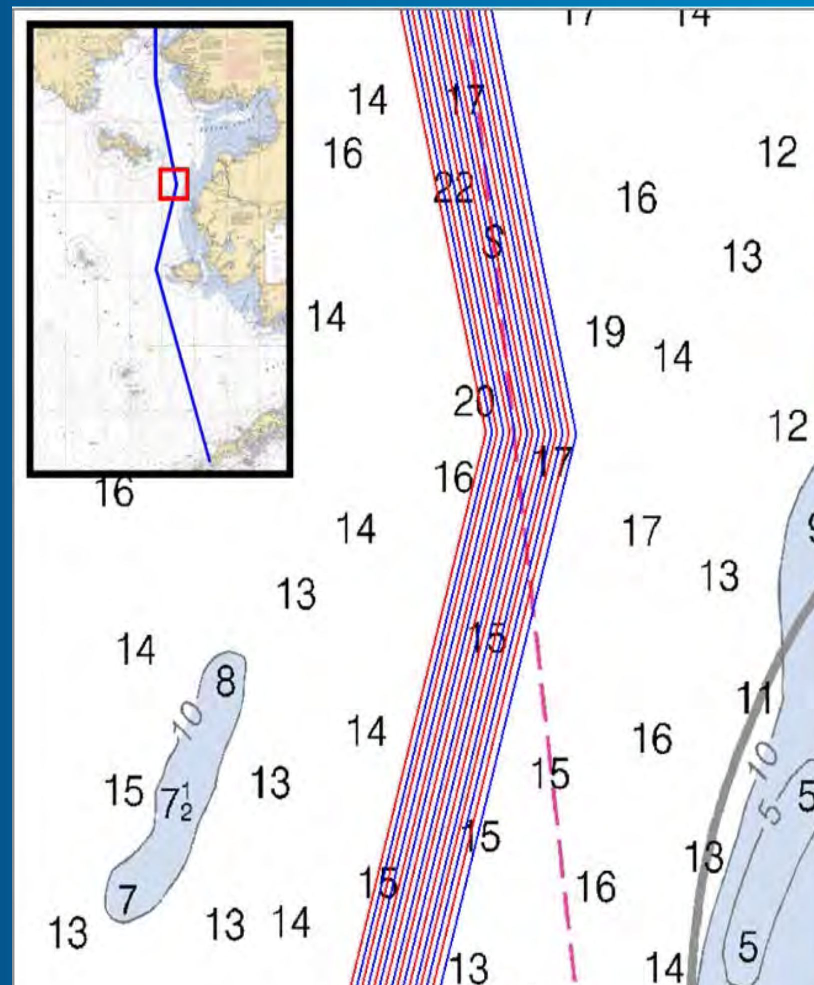


Corridor approach

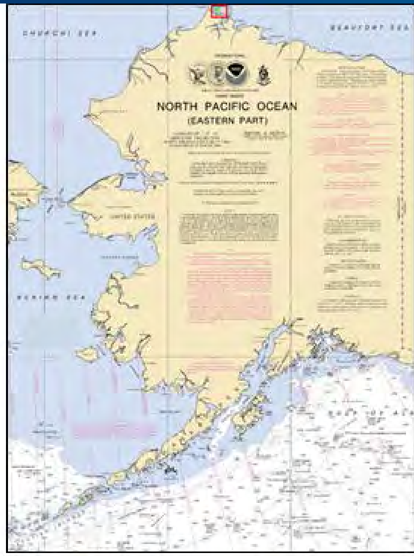
Port Access Route Study (PARS)

Collaborative Effort
NOAA & USCG



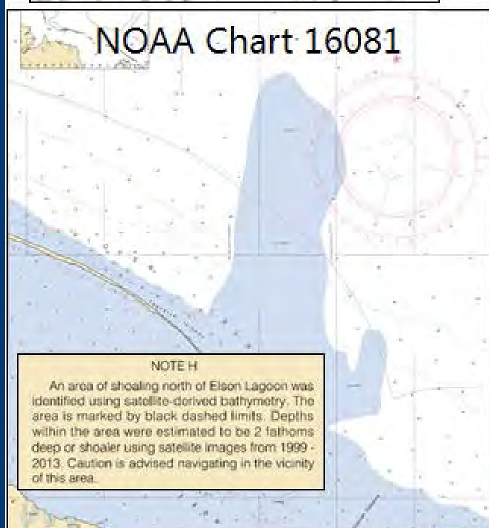


Satellite-derived bathymetry

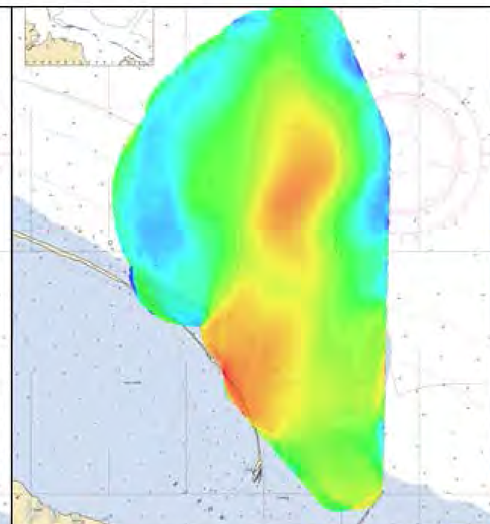


Useful tool for determining change and chart adequacy.

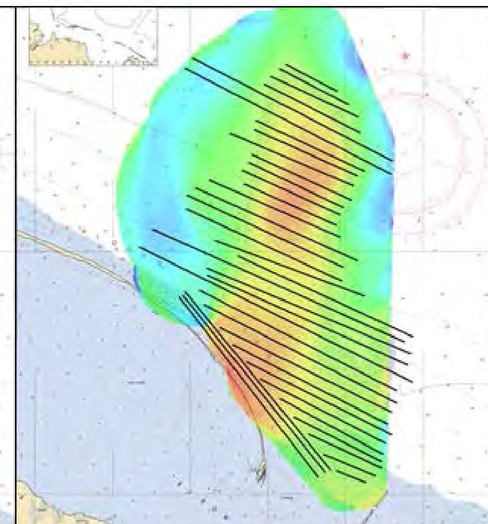
Efficacy limited by depth and oceanography



Estimated Bathymetry



Fairweather Validation Plan



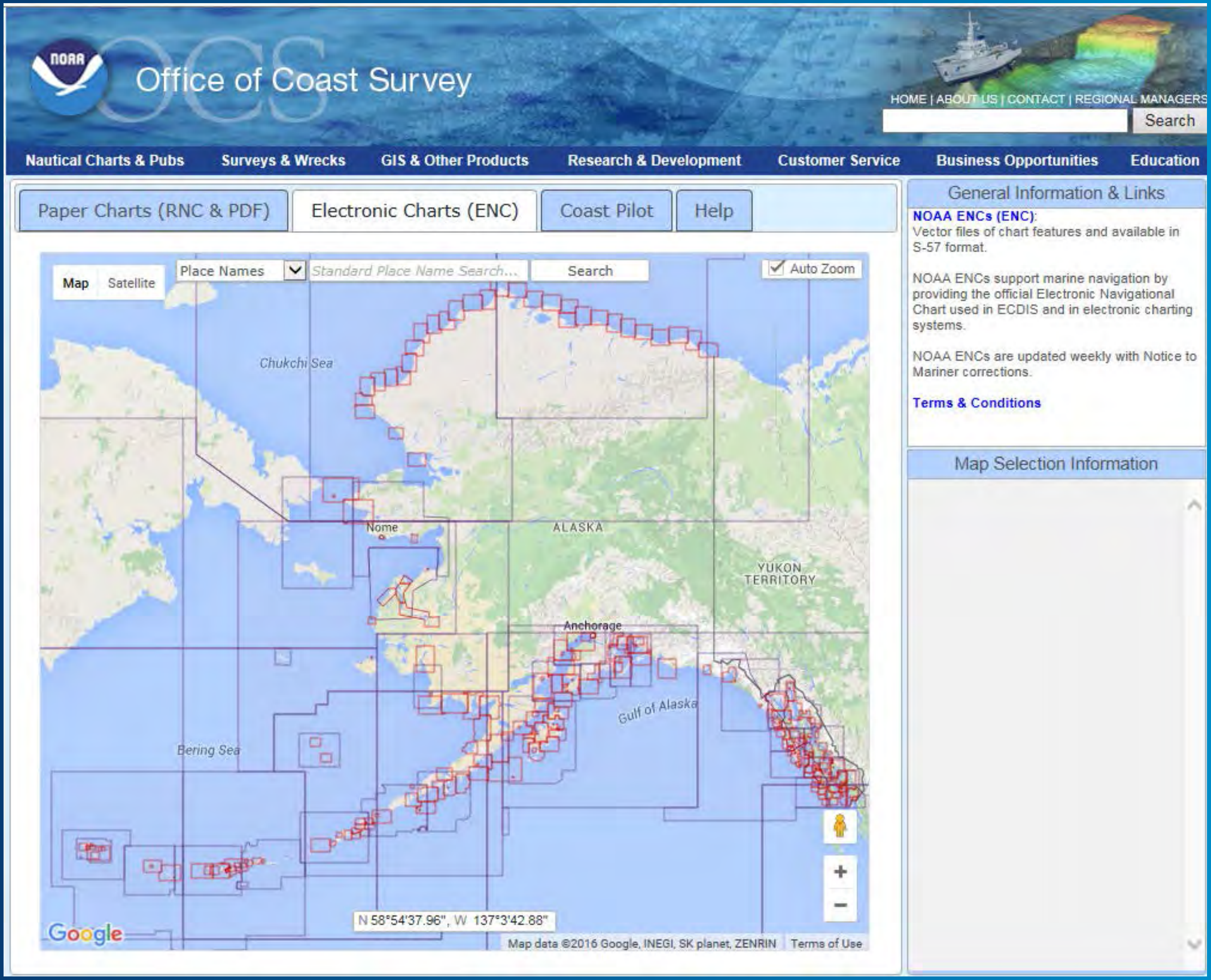
Your thoughts?

- What additional locations should we consider for additional/updated bathymetric coverage?
- Conversely, are there regions that have adequate coverage, adequacy standards?
- After seeing the "corridor approach" to Alaska and the Arctic (not doing complete end-to-end coverage), is this a reasonable compromise for attaining bathymetric info?
- Or, is there a specific inshore limit that best suits needs?
  - i.e., survey to the 8m curve
- Other stakeholder issues

Andy Kampia, chief, Alaska Chart Production Branch

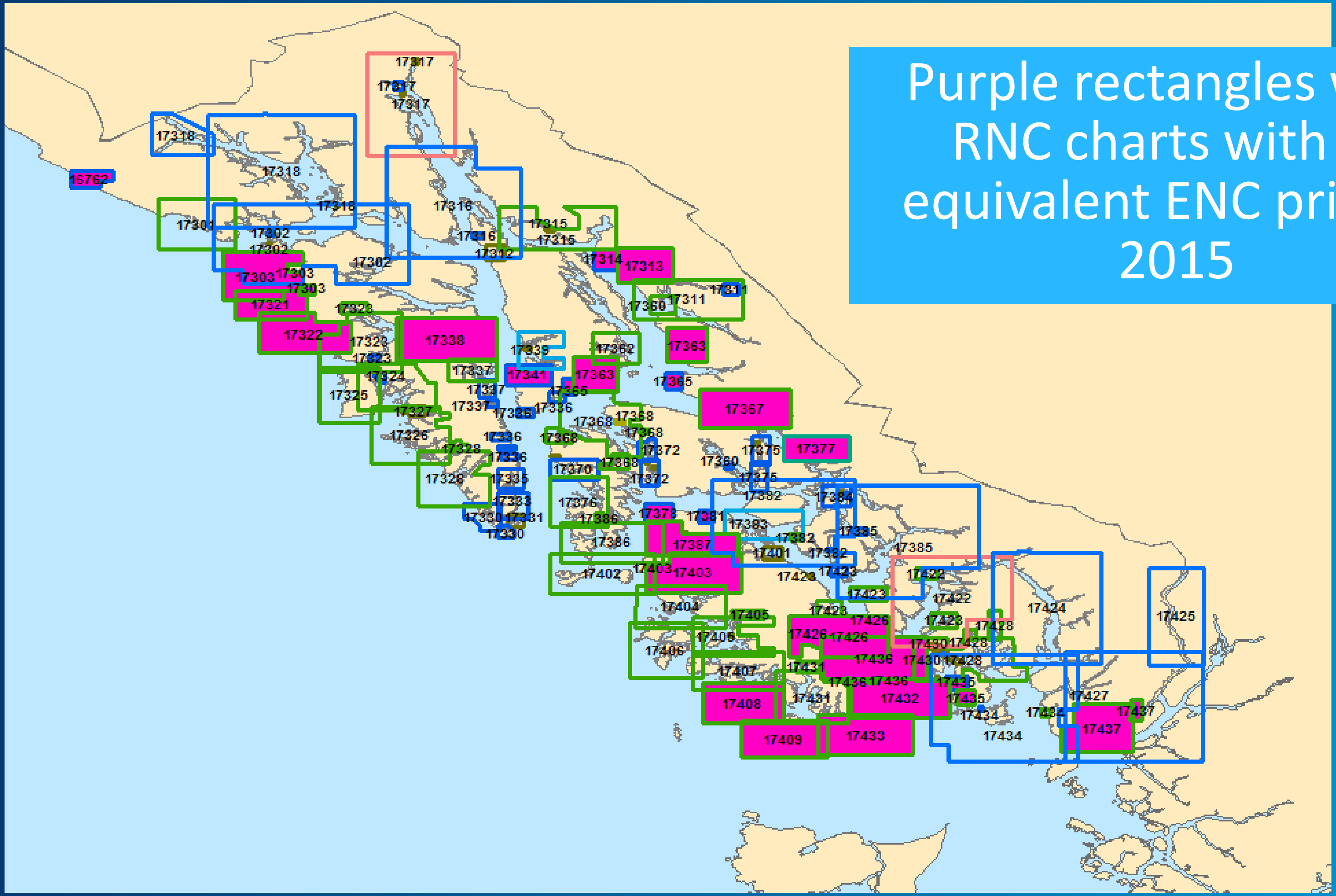
2015 ALASKA ELECTRONIC NAVIGATIONAL CHART PROJECT

301 new edition ENCs



65 – 1st edition ENCs

Example: Southeast Alaska



Purple rectangles were RNC charts with no equivalent ENC prior to 2015

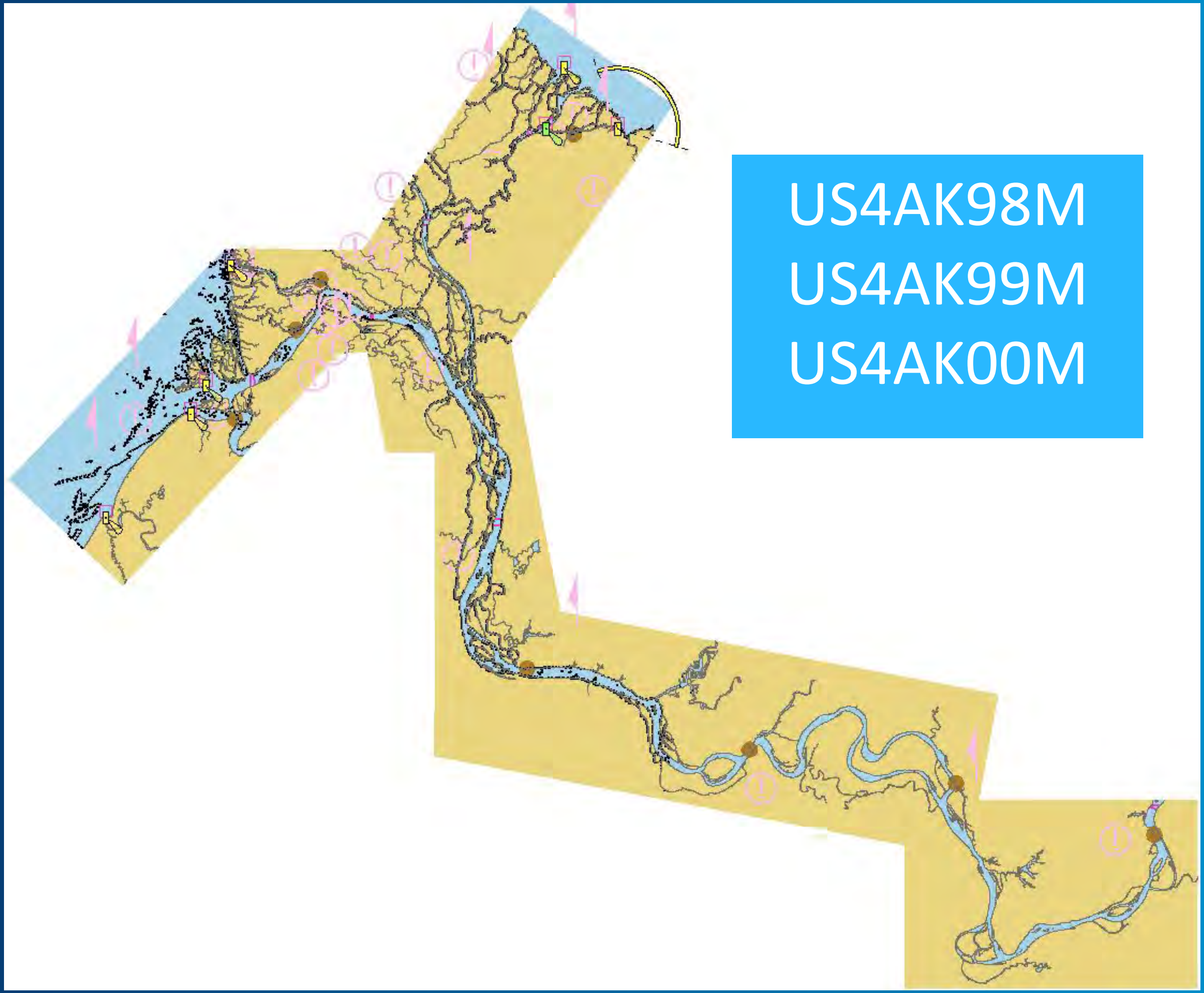
Alaska charts are “ENC-first”

Your thoughts?

- Are people using our ENCs?
- If you don't use ENCs, why not?
- Do you intend to use ENCs in the future?
- How can we increase confidence in our product?
- What systems are you using to plan/navigate? What charting format?
- Other stakeholder issues

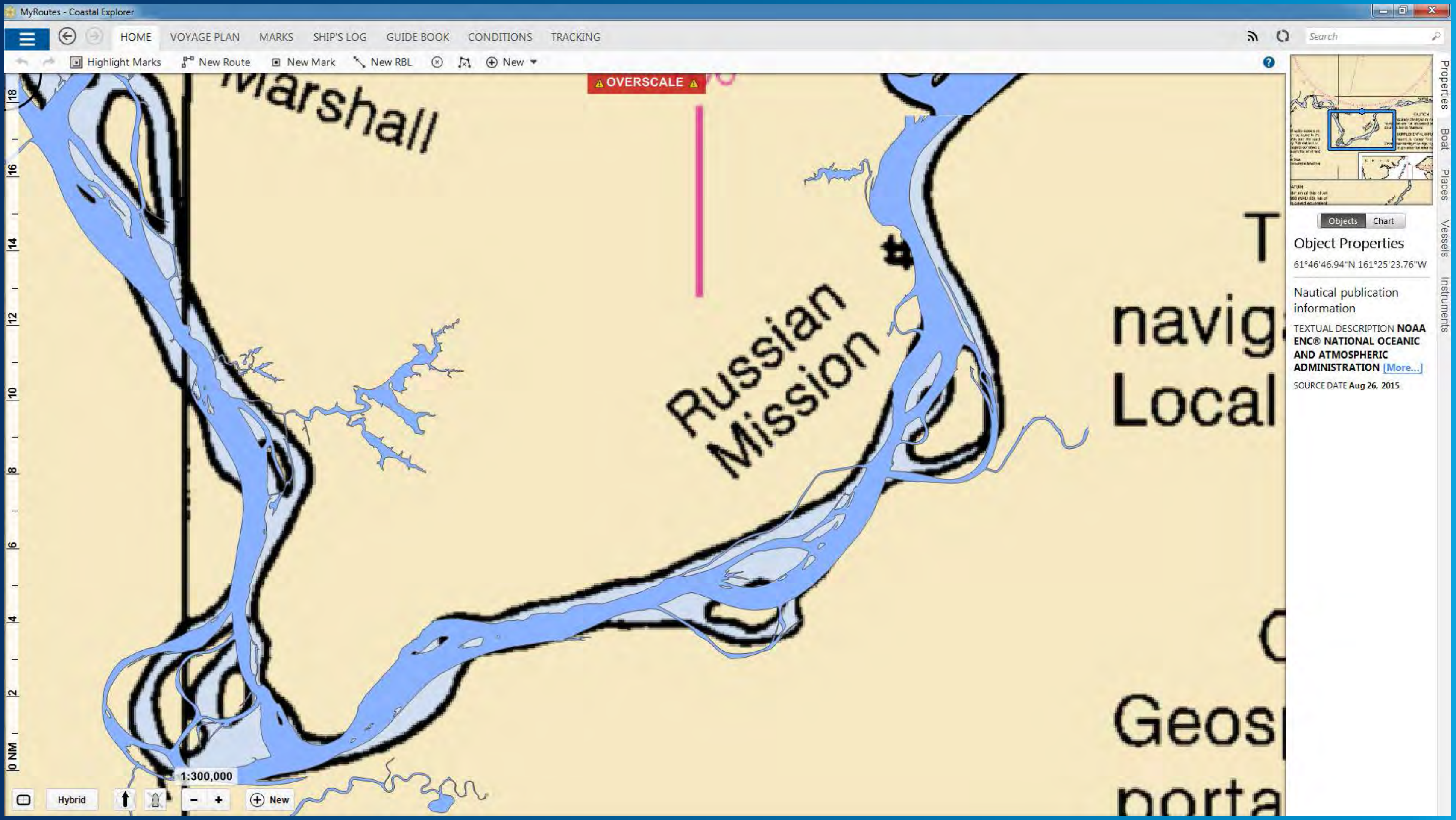
Andy Kampia, chief, Alaska Chart Production Branch ,

YUKON RIVER PROVISIONAL ENCS

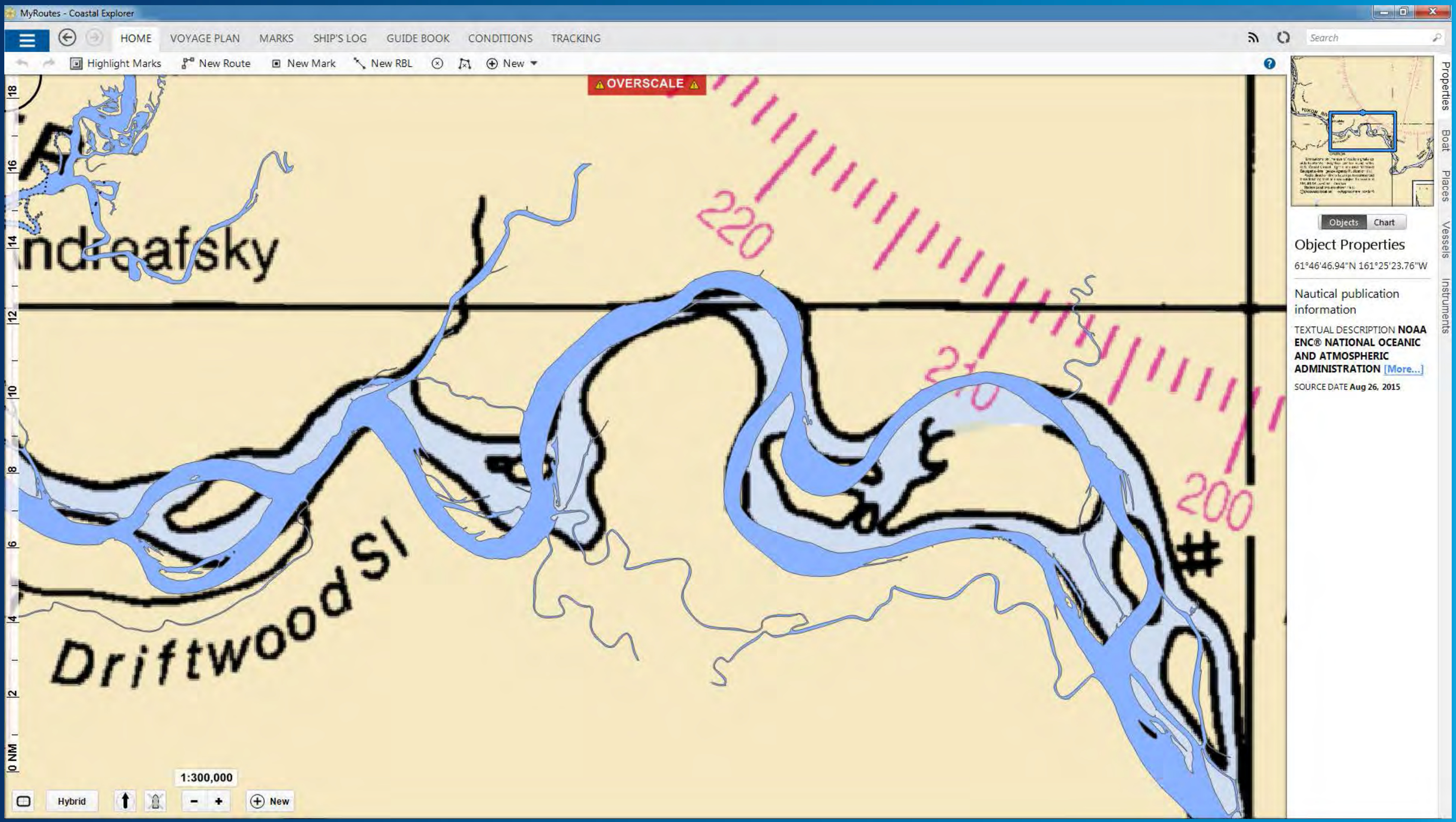


US4AK98M
US4AK99M
US4AK00M

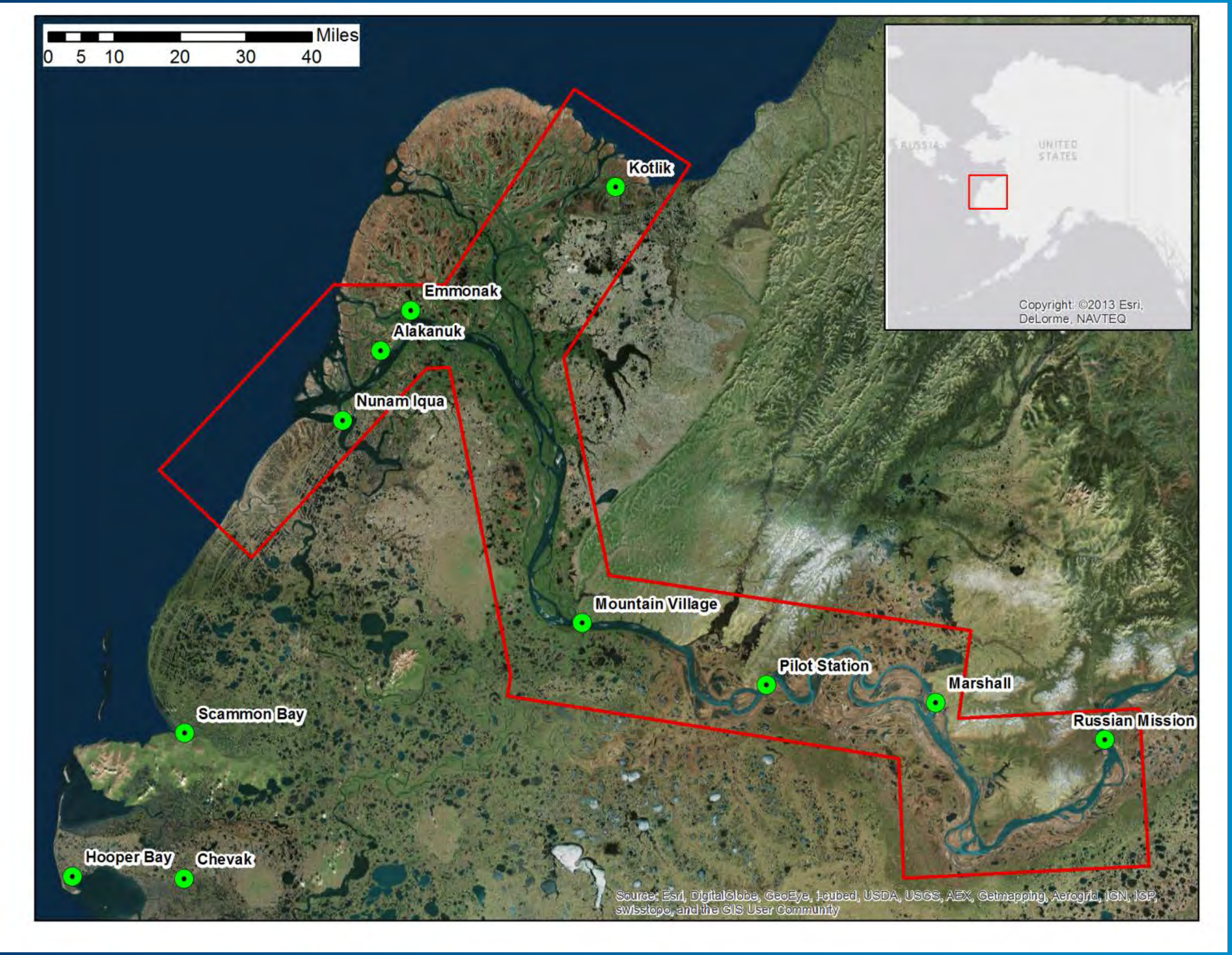
Previously “uncharted”



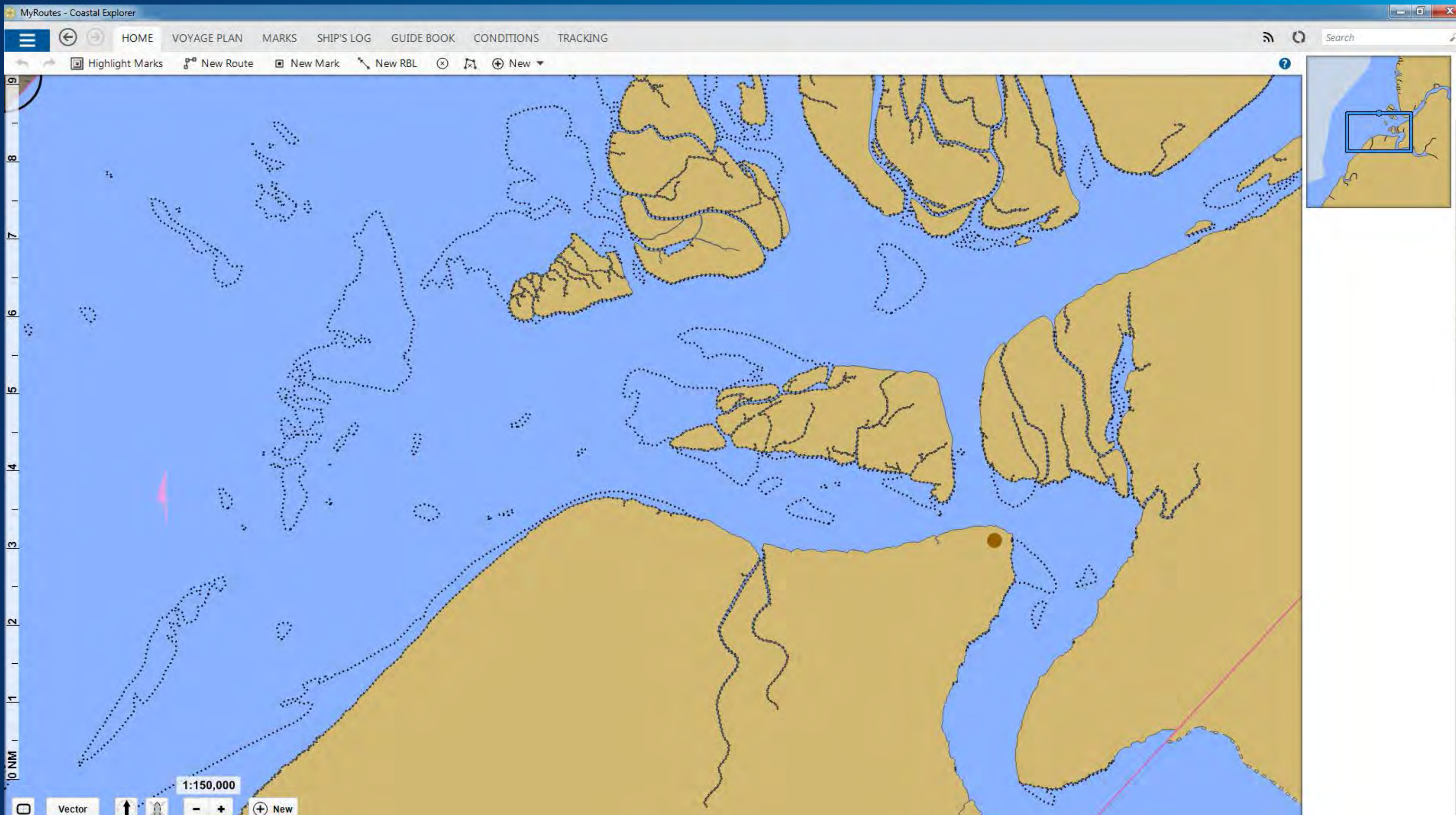
ENC depth areas over RNC (1:300,000)



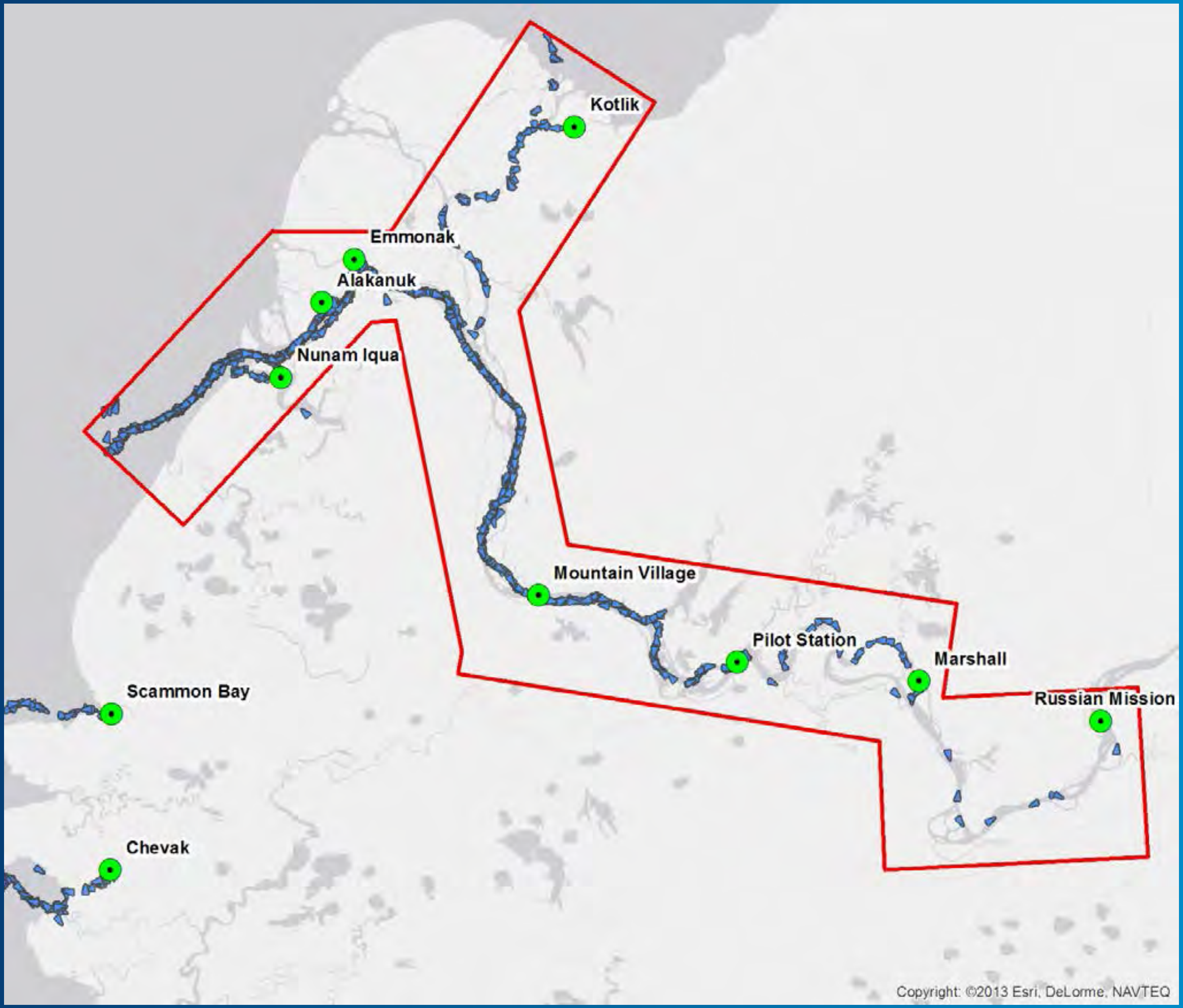
Solution? Satellite-derived bathymetry



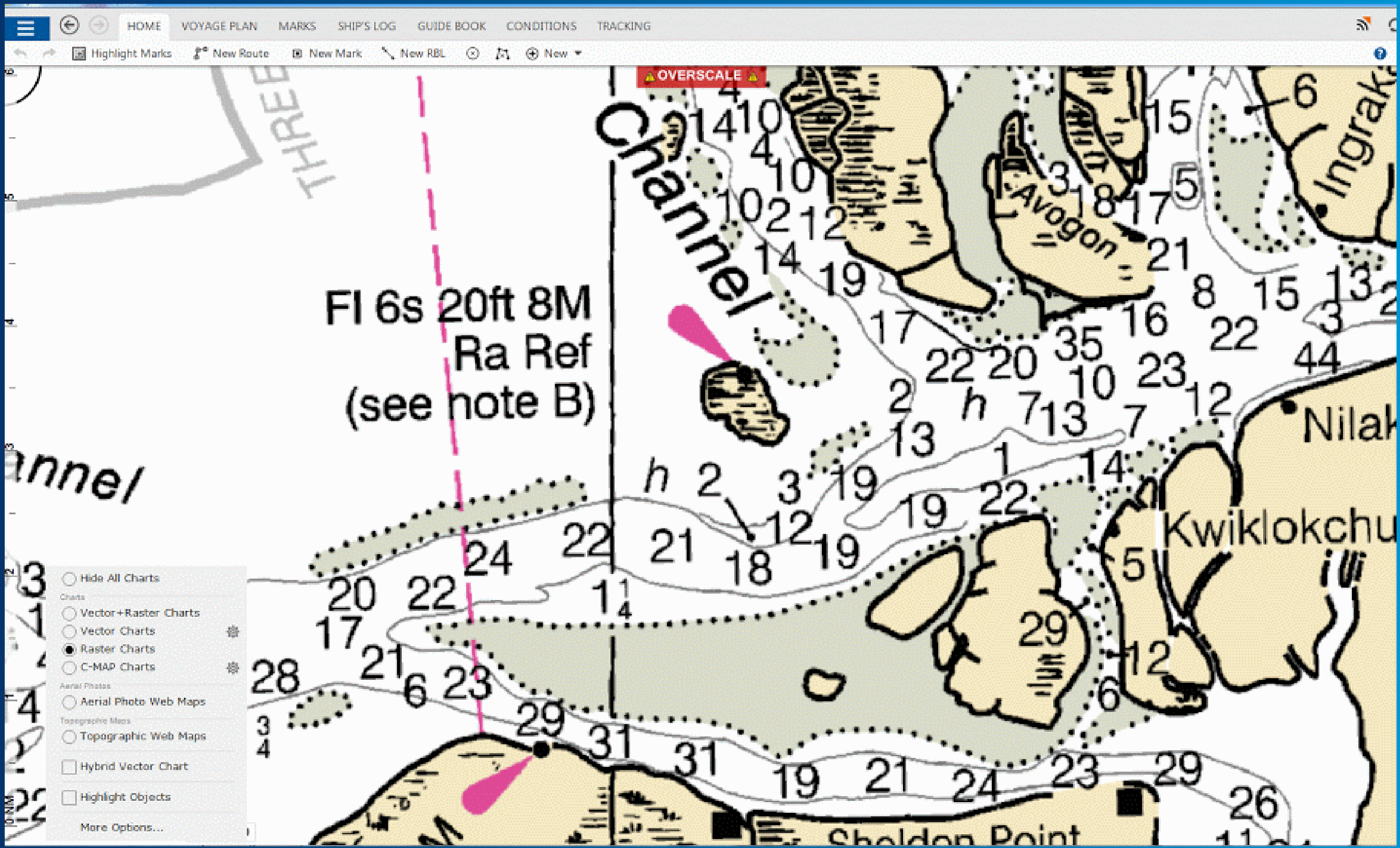
Shoreline and obstruction areas



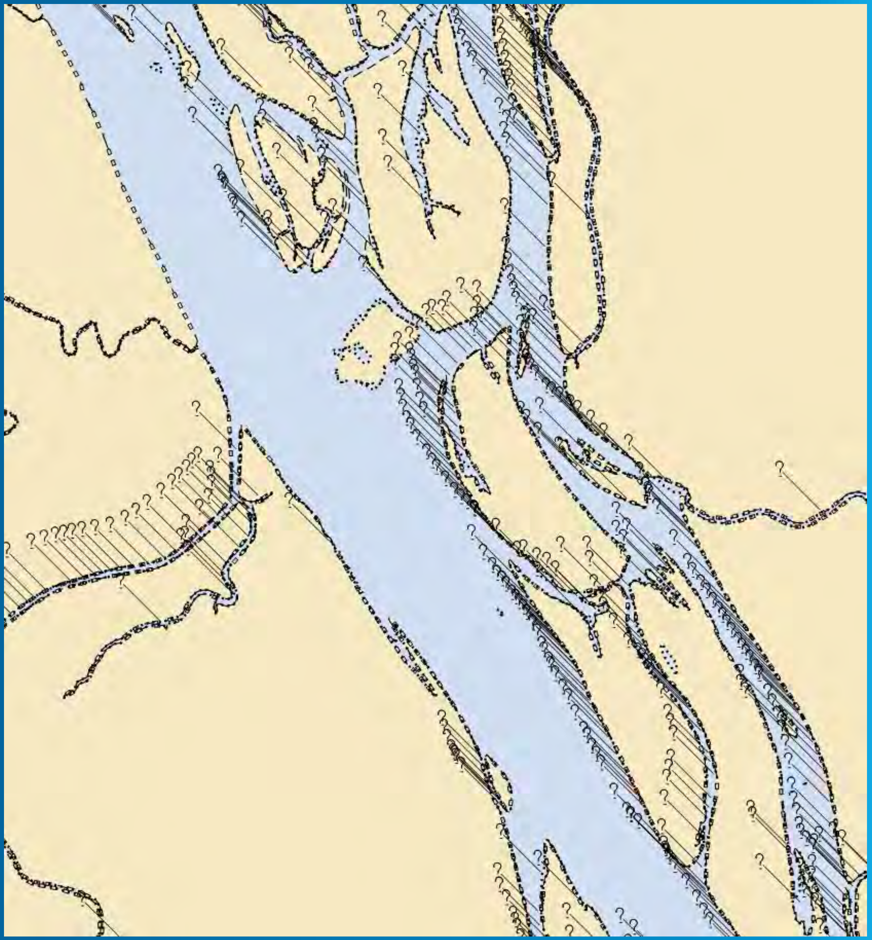
AIS vessel tracks determined the extent



ENC vs raster (RNC)



Display issues with early prototypes



Special notes

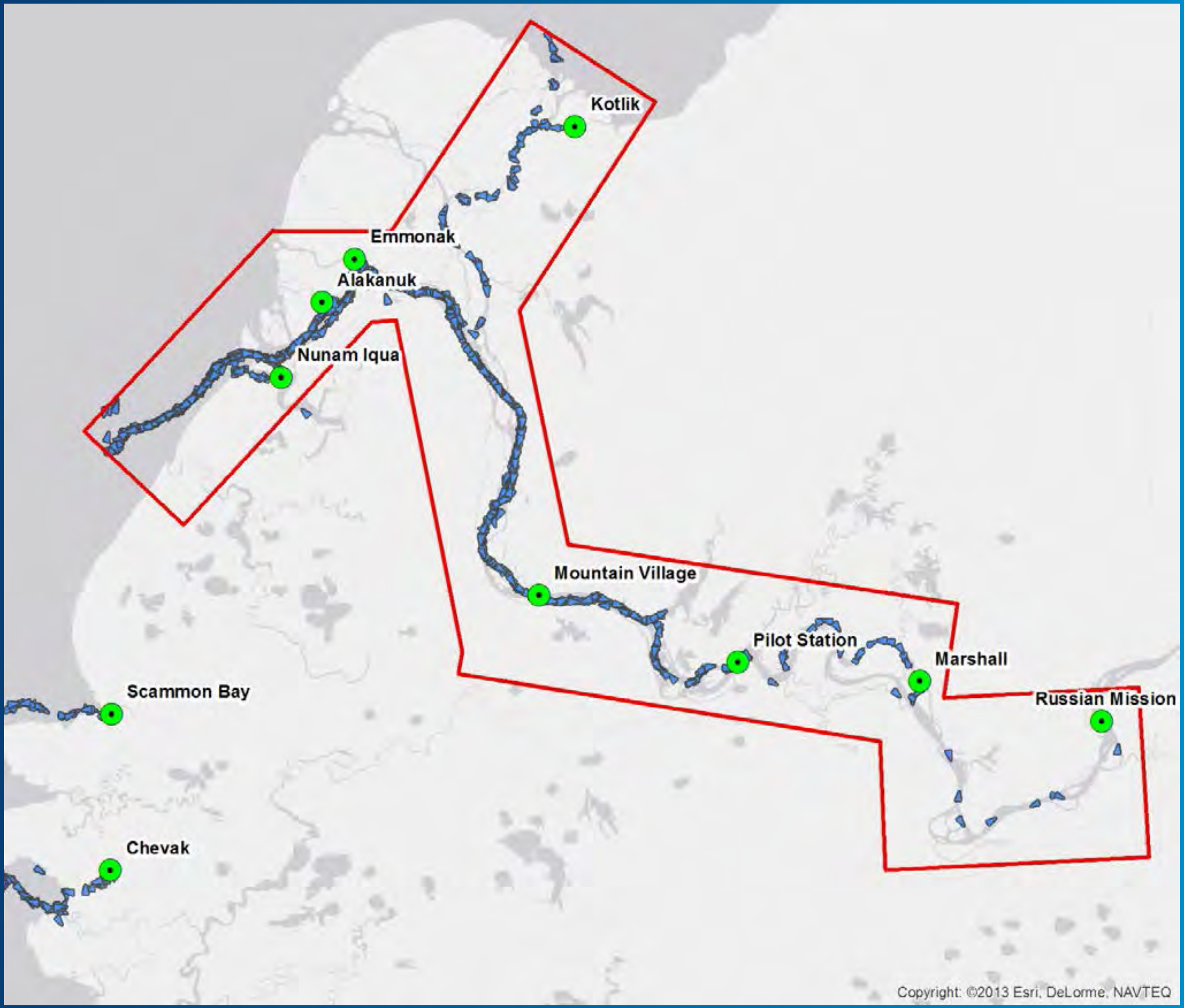
WARNING PROVISIONAL ENC

This ENC was constructed using the best data available. All or much of the shoreline, depths and shoals within this ENC are below customary quality, are not corrected for tides, nor based on a known sounding datum. All or much of the charted detail is highly changeable. Navigators should use this ENC with extreme caution.

SATELLITE DERIVED DEPTHS

Shoreline, depths, and obstruction areas within the area of this ENC are derived from satellite imagery from 2015. Their vertical accuracy is typically ± 2m. Uncharted dangers may exist.

Add a “recommended route”?



Future plans

- Analyze first LANDSAT images after Yukon thaws
  - May/June 2016
- Release updated ENCs
  - June/July 2016
- Refine the process
  - 2017 and beyond
- Build on any successes

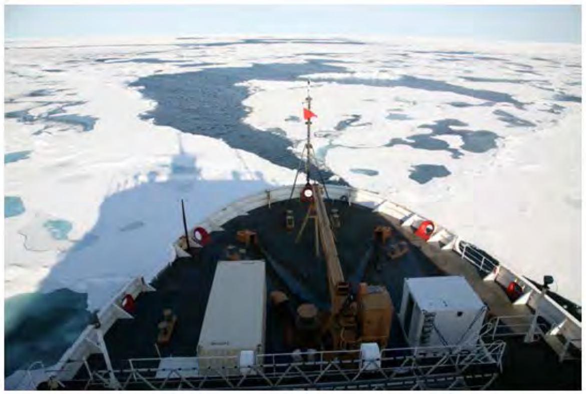
Your thoughts?

- We've received feedback on scale and timing. Other feedback?
- Are there other places where satellite-derived bathymetry can help address navigational needs?
- Other stakeholder issues

Colby Harmon, Marine Chart Division

U.S. ARCTIC NAUTICAL CHARTING PLAN

First published June 2011



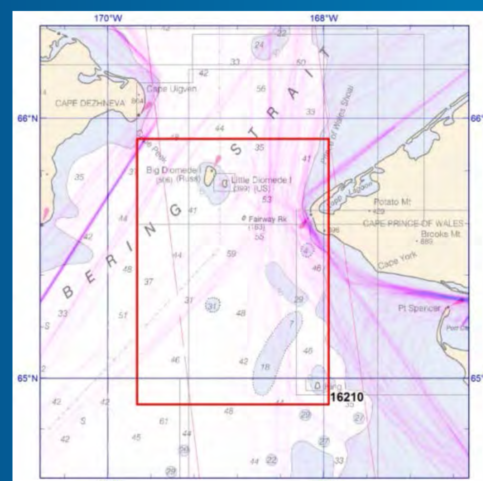
Arctic Nautical Charting Plan

A Plan to Support Sustainable Marine Transportation in Alaska and the Arctic

Office of Coast Survey
Marine Chart Division

June 1, 2011

- Proposed 15 new charts
- For each new chart:
  - Image of footprint
  - Other chart details



Bering Strait: Chart 16210 **1:100,000**

Largest scale chart currently: 16005, 1:700,000

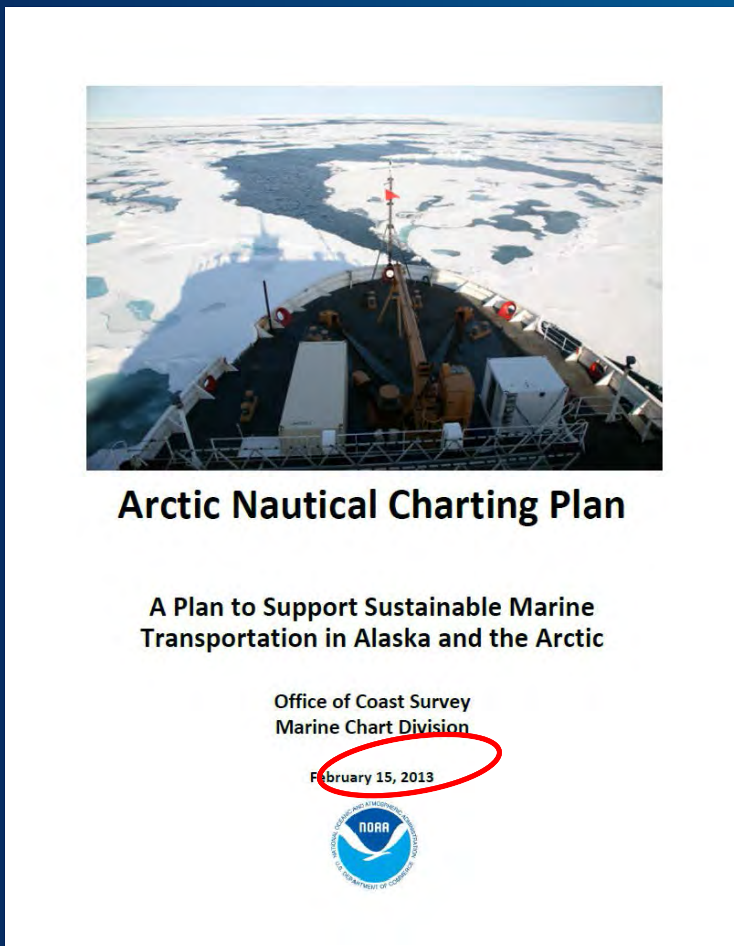
Village of Inalik on Little Diomede Island[22]

The Bering Strait is 44 miles wide between Cape Prince of Wales, Alaska, and Cape Dezhneva, Siberia. It is the gateway from the Bering Sea in the Pacific Ocean to Chukchi Sea in the Arctic Ocean.[21] The Russian island of Big Diomede and the American island of Little Diomede lie just three nautical miles apart. These islands divide the two major passages through the strait, which lie to the east and west of the islands with depths of about 20 to 30 fathoms. Much of the Alaskan vessel traffic clings close to the shore rounding Cape Prince of Wales, as shown by the clustering of AIS returns on the chart graphic below. New chart coverage includes a 1:40,000 scale inset of Little Diomede Island on the Bering Strait North Chart.

Chart Details **as of February 1, 2013**

Chart Number: 16210	National Stock Number: 7642016122022
KAPP Number: 0000	NGA Reference Number: 16BCO16210
Title: Alaska – West Coast Bering Strait	
Scale: 1:100,000	at Latitude: 65° 24' 00.0" N
Horizontal Datum: NAD83	Projection: Mercator
Soundings In: Fathoms and Feet	at: MLLW
Depth Curve Values: 1, 2, 3, 6, 10, 20	Blue Tint Curve(s): 10
Limits	65° 55' 14.0" N
169° 43' 42.0" W	167° 57' 15.0" W
	64° 53' 48.0" N
Total Latitude: 01° 01' 26"	Total Longitude: 01° 46' 27"
Neatline Height: 847.725 mm	Neatline Width: 1206.5 mm

First plan revision: February 2013



Arctic Nautical Charting Plan

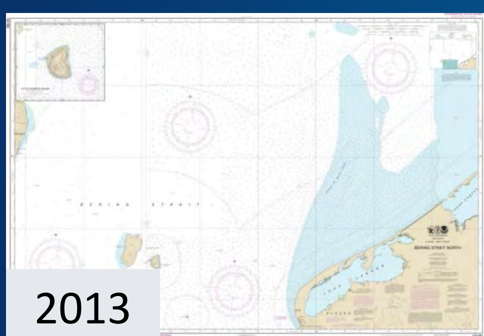
A Plan to Support Sustainable Marine Transportation in Alaska and the Arctic

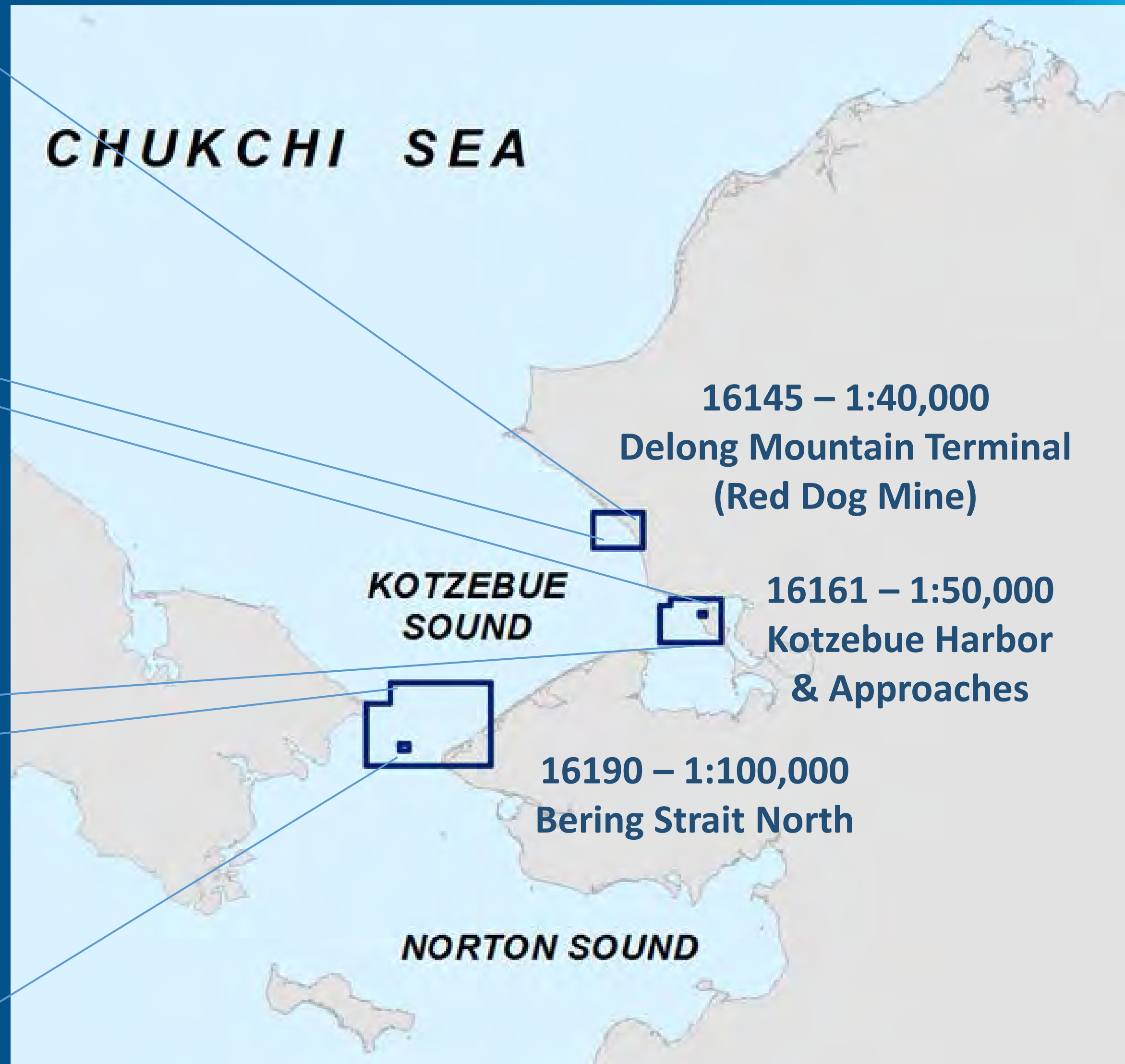
Office of Coast Survey
Marine Chart Division

February 15, 2013

- Kotzebue Harbor & Approaches
  - Scale 1:30K -> 1:50K
  - Extended coverage to SW
  - Added Cape Blossom inset

Three charts published

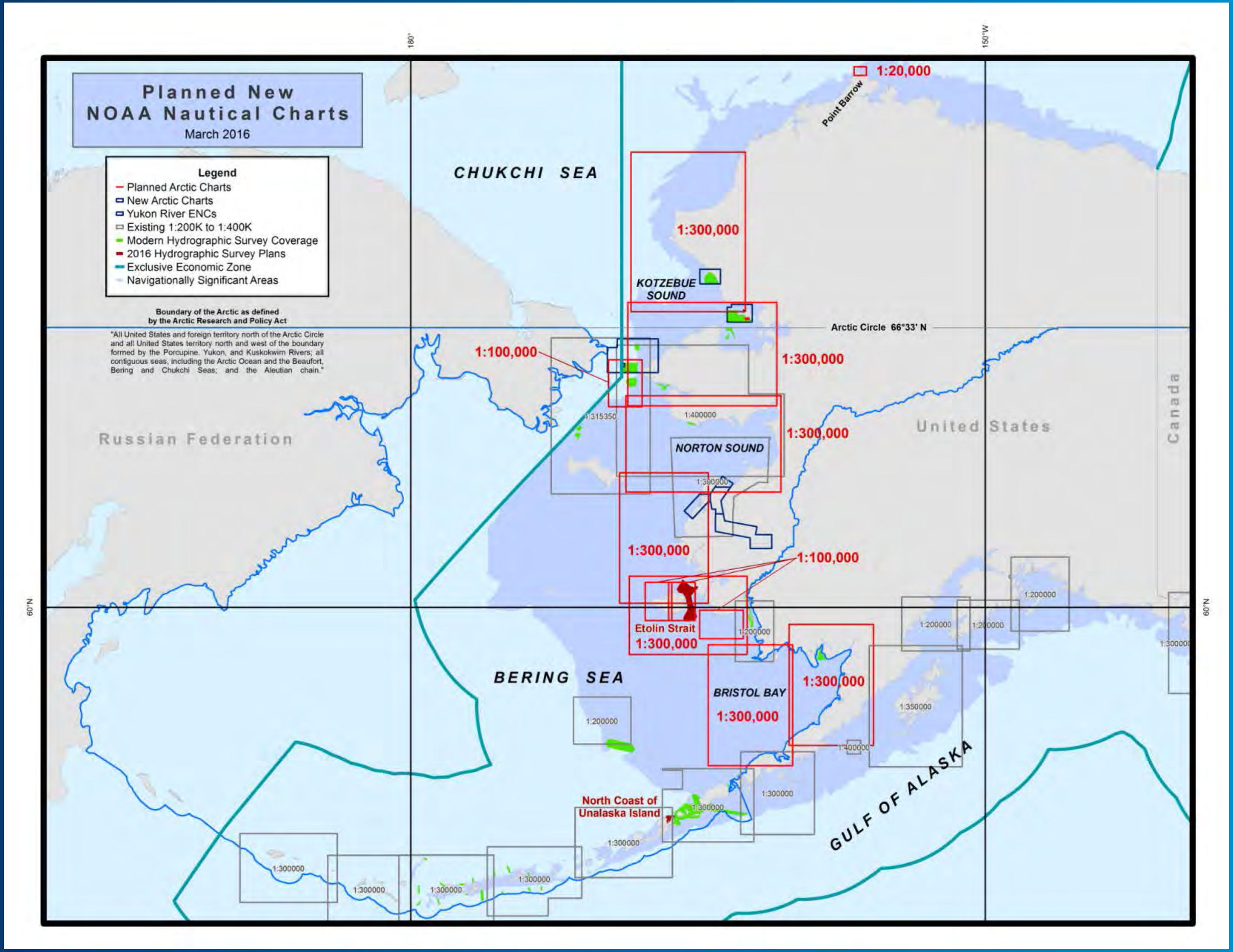




Current plan revision

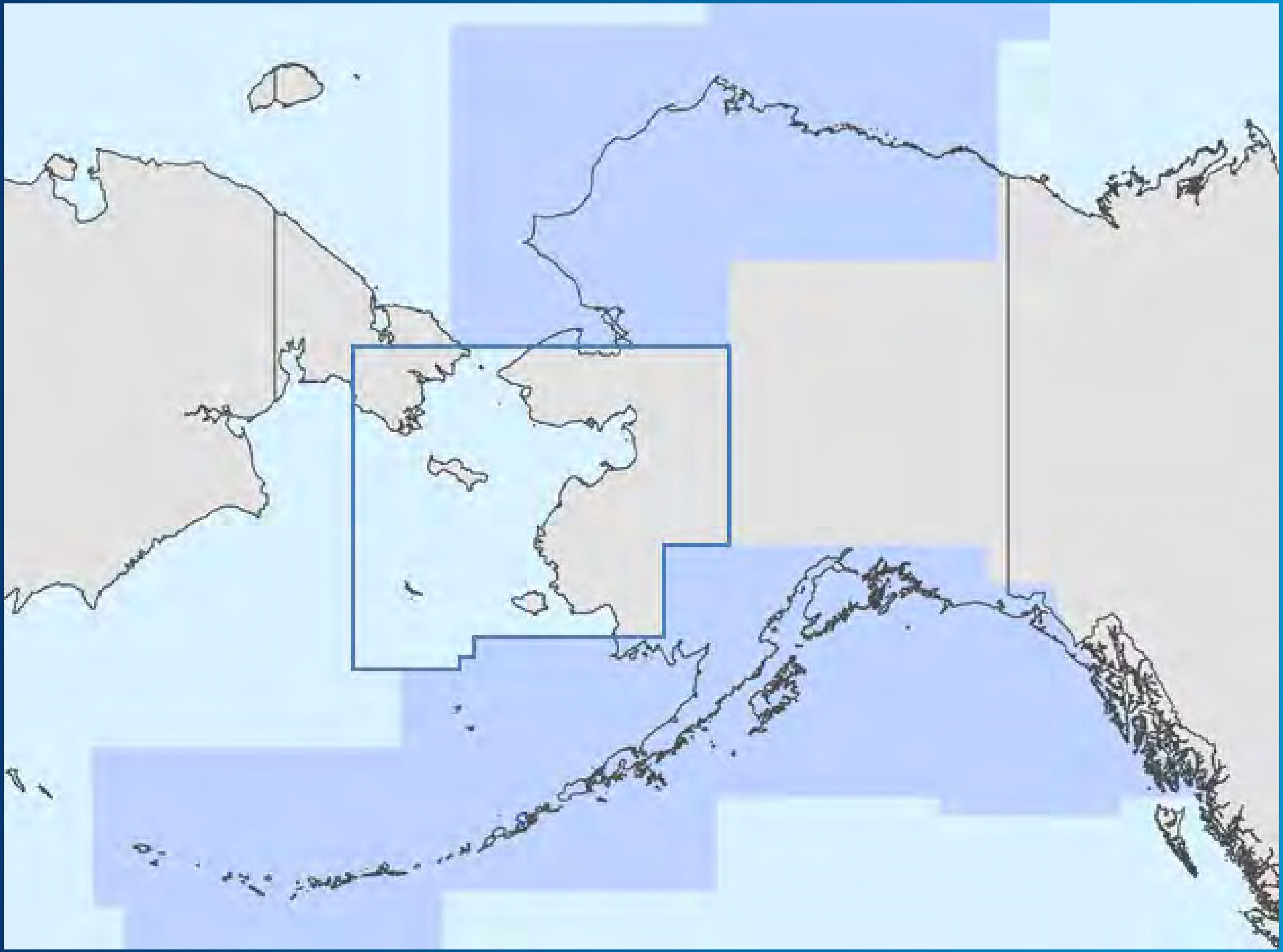
- Draft published June 2015
  - Federal Register request for public comments through Oct 1, 2015
    - 13 comments received
  - Revised coastal (1:300K-400K) chart scheme
  - Moved some charts eastward to close gaps
  - Considering changes in Etolin Strait

Coast Survey will release finalized version of this 3rd revision in the summer of 2016



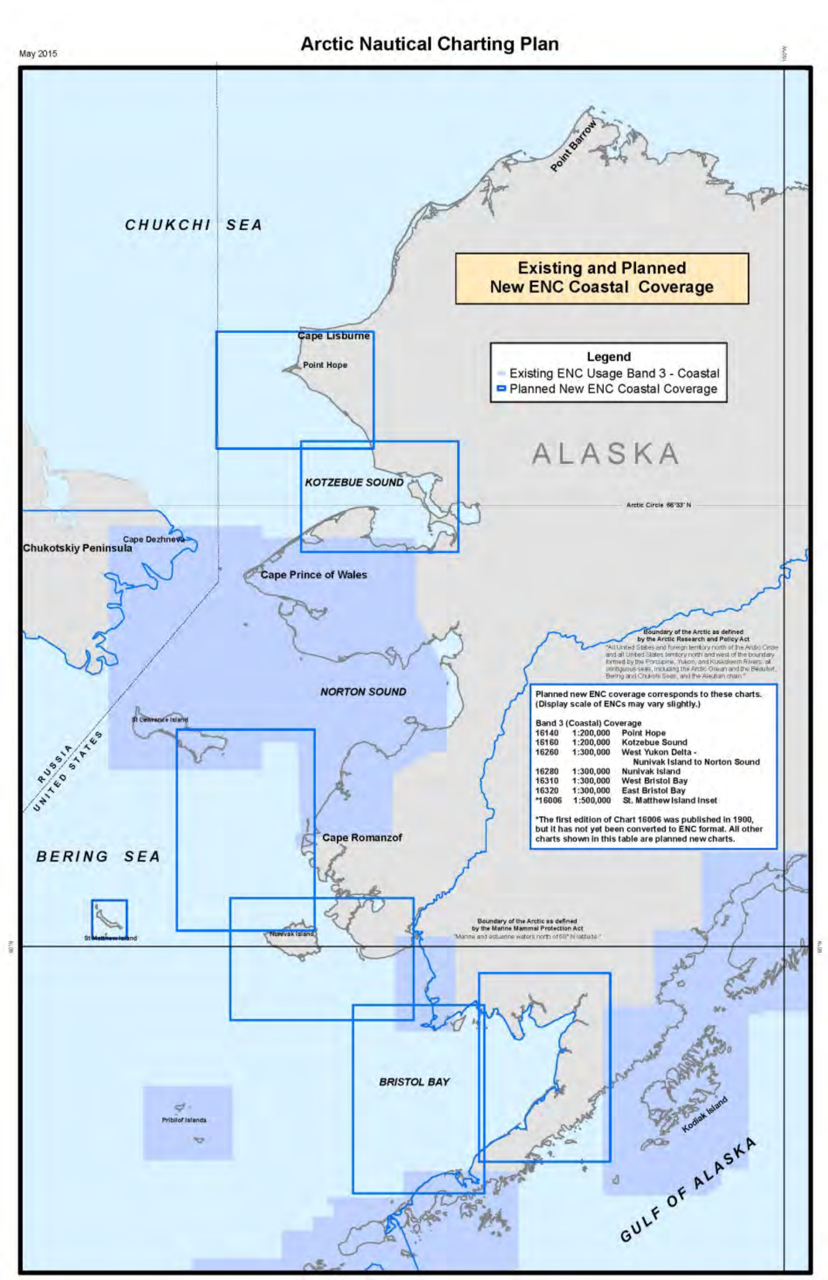
Planned New
NOAA Nautical Charts
March 2016
Legend
Planned Arctic Charts
New Arctic Charts
Yukon River ENCs
Existing 1:200K to 1:400K
Modern Hydrographic Survey Coverage
2016 Hydrographic Survey Plans
Exclusive Economic Zone
Navigationally Significant Areas
Boundary of the Arctic as defined
by the Arctic Research and Policy Act
"All United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain."
CHUKCHI SEA
1:20,000
Point Barrow
1:300,000
KOTZEBUE
SOUND
Arctic Circle 66°33' N
1:100,000
1:300,000
1:315350
1:400000
1:300,000
NORTON SOUND
1:300000
United States
Canada
Russian Federation
1:300,000
1:100,000
Etolin Strait
1:300,000
1:200000
1:200000
1:200000
1:200000
1:300000
BERING SEA
BRISTOL BAY
1:300,000
1:300,000
1:350000
1:200000
1:400000
GULF OF ALASKA
North Coast of
Unalaska Island
1:300000
1:300000
1:300000
1:300000
1:300000
1:300000
1:300000
1:300000

ENC Band 2 (General) 1:350,000 – 1:1,500,000



ENC Band 3 (Coastal)

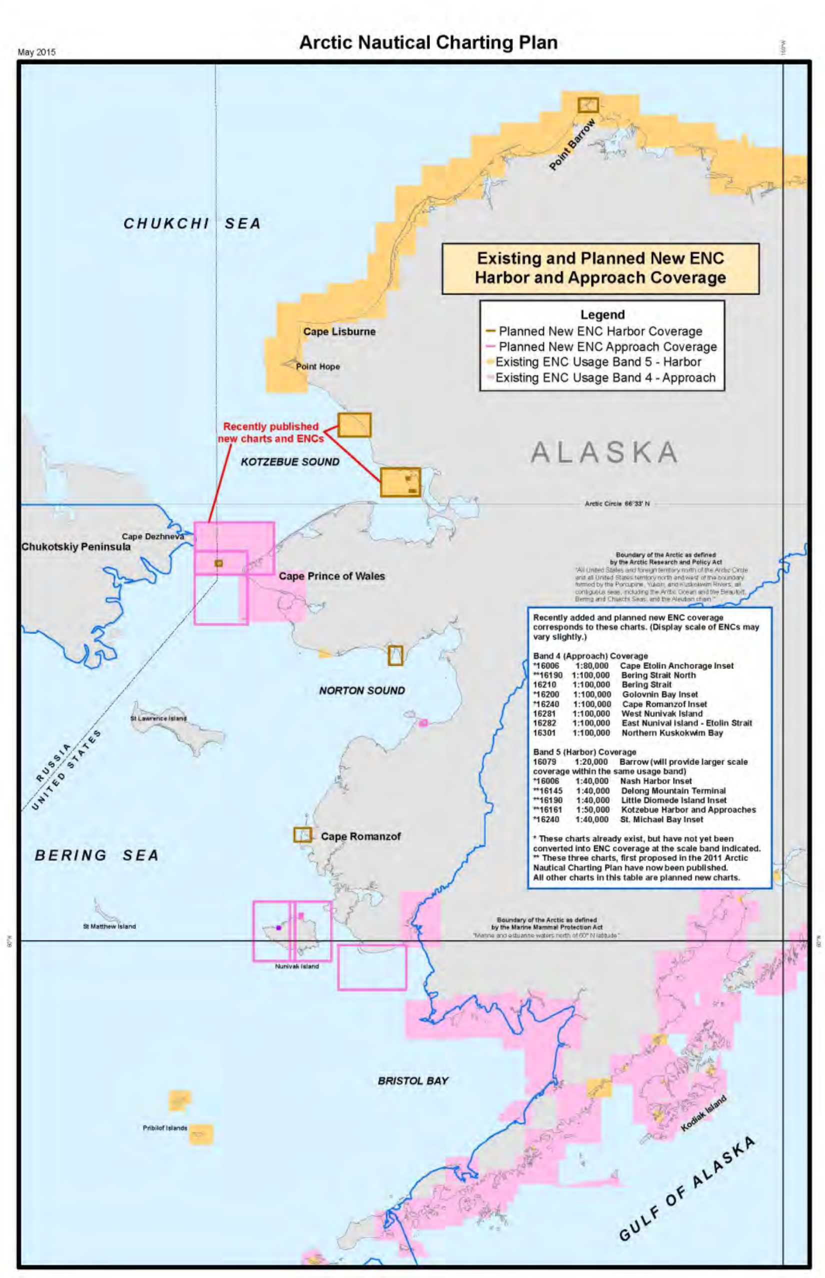
Band 3
1:90,000 – 1:350,000



ENC Band 4 & 5

Band 4 (Approach)
1:22,000 – 1:90,000

Band 5 (Harbor)
1: 4,000 – 22,000



Internet link for the plan

http://www.nauticalcharts.noaa.gov/mcd/docs/Arctic_Nautical_Charting_Plan.pdf

or

An internet search for
"Arctic Nautical Charting Plan"
will usually show the link above as the first result

Your thoughts?

- Will this plan meet emerging needs of navigation in the Arctic?
- Does this represent the proper scales, extents, coverage?
- Other stakeholder issues?

Rachel Medley, chief, Customers Affairs Branch

U.S. ARCTIC VOYAGE PLANNING GUIDE

U.S. ARCTIC VOYAGE PLANNING GUIDE

Home

Important Notice | This Guide | Partners and Authorities | Feedback

Navigation in the Arctic region should be considered dangerous.

This Mariner's Voyage Planning Guide must be kept up to date using the latest applicable notice to Mariners that are available. This Guide does not replace information contained in critical nautical charts and other official nautical publications published by services on the authority of national Governments.

Masters should carefully and in good time plan their passage through Arctic waters, making use of navigational charts of sufficiently large scale and with enough detail to ensure the safety of navigation. The latest edition of nautical charts and publications must be used.

The International Maritime Organization is developing a Polar Code that should be consulted for recommended practices for navigating in polar waters. The Polar Code will be finalized in May and enter into force on January 1, 2017.

Disclaimer: The information provided is intended to consolidate information helpful in planning an Arctic voyage, but should not be relied upon exclusively. All relevant information sources should be consulted and all applicable international, national, and state/local (if any) requirements must be adhered to.

Emergency Information | Geography of US Arctic | Navigation | Regulations & Requirements | Weather & Ice

http://www.nauticalcharts.noaa.gov/avpg

or search for “NOAA AVPG”

Your thoughts?

- Do you use the guide, or do you plan on using it?
- Does the guide's form and content meet your needs?

OPEN DISCUSSION

nauticalcharts.noaa.gov

Blogging at noaanauticalcharts.wordpress.com

Twitter @NOAAcharts

Facebook at NOAA Charts

Join the discussion

Alaska Nautical Charting Workshop

March 22, 2016
8:30 a.m. - 5:00 p.m.

222 West 8th Ave.
Conference Room A/B/C
Anchorage, Alaska 99513

Please bring a photo ID to enter this federal facility.

Join the experts from NOAA's Office of Coast Survey for some deep dives into plans for future hydrographic surveys and nautical charts.

***NOAA cartographers, surveyors, and technology experts want to hear from you*, as they plan for the next generation of navigational products and services to support Alaska's vital maritime interests.**

Register today!

Email timothy.m.smith@noaa.gov or amy.holman@noaa.gov

NOAA Coast Survey

THE NATION'S CHARTMAKER SINCE 1807

nauticalcharts.noaa.gov

8:30 - 9:00 a.m. Coffee
9:00 start presentations and discussions

Coast Survey Overview – Rear Admiral Gerd Glang, director, Office of Coast Survey
Topics: NOAA navigation products and services
Open forum:

- What do Alaskan mariners need from NOAA's navigation services?
- What are the primary products you rely on for navigation?
- Is there a navigational product/service that is not currently meeting your needs? How can we improve our products and services?
- Other stakeholder issues

Hydrographic survey plans – Corey Allen, Hydrographic Survey Division - Operations
Topics: Hydrographic surveys in 2016 and the future
Open forum:

- What additional locations should we consider for additional/updated bathymetric coverage?
- Conversely – are there regions that have adequate coverage, adequacy standards?
- After seeing the "corridor approach" to Alaska and the Arctic (not doing complete end-to-end coverage) – is this a reasonable compromise for attaining bathymetric info?
    - looking for Validation of this approach to coverage
- Or….Is there a specific inshore limit that best suits needs? (i.e., survey to the 8m curve)
- Other stakeholder issues

ENC coverage & Yukon River Chart – Andy Kampia, Marine Chart Division, branch chief for Alaska & Great Lakes
Topics: Current Alaska ENCs; using new technology for charting needs (satellite-derived bathymetry for Yukon River ENC)
Open forum:

- Are people using our ENCs? If not, why not?
- How can we increase confidence in our product?
- What systems are you using to plan/navigate? What charting format?
- Are there other places where satellite-derived bathymetry can help address navigational needs?
- Other stakeholder issues

Arctic Charting Plan – Colby Harmon, Marine Chart Division
Topics: Overview of intended Arctic Charting Plan
Open forum:

- Will this plan meet emerging needs of navigation in the Arctic?
- Does this represent the proper scales, extents, coverage?
- Other stakeholder issues

Arctic Voyage Planning Guide (AVPG) – Rachel Medley
Topics: Overview of Arctic Voyage Planning Guide (AVPG)
Open forum:

- Does the form and content of the AVPG meet your needs?

Charting Workshop List of Attendees

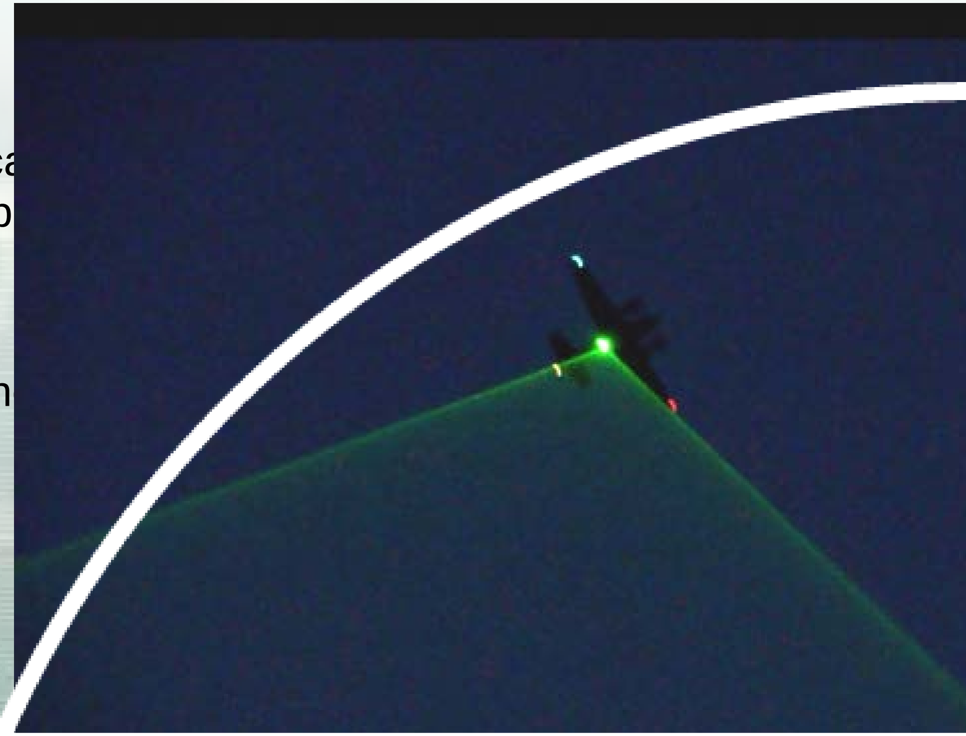
Last	First	Org	Phone	e-mail
Allen	Corey	NOAA	-	corey.allen@noaa.gov
Baker	Joyce	City of Nome	Called in	
Brigham	Lawson	UAF	907 622 7119	lwb48@aol.com
Chung	Eugene	USCG	907 428 4189	eugene.chung@uscg.mil
Garcia	Rven	USCG	907 428 4173	rven.t.garcia@uscg.mil
Graham	Doug	NOAA	301 713 2675	doug.graham@noaa.gov
Haeussle	Peter	USGS	907 786 7447	pheuslr@usgs.gov
Harmon	Colby	NOAA	301 713 2737	colby.harmon@noaa.gov
Hartman	Chris	Ocean Xchange	907 885 9250	chris.hartman@americanaqua.com
Holman	Amy	NOAA	907 271 5334	amy.holman@noaa.gov
Johnson	Anne	AK DNR	907 854 4635	anne.johnson@alaska.gov
Kee	Church	ADAC (Arctic domai	907 786-0798	rakee@uaa.alaska.edu
Khadjinova	Rada	Fugro	907 227 2995	rada@fugro.com
Kinsman	Nic	NOAA	907 271 5116	nicole.kinsman@alaska.gov
Krieger	Kacy	UAA	907 786 7749	kekrieger2@uaa.alaska.edu
Krynytzky	Marta	Fugro	907 854 7808	martak@fugro.com
Lage	Jana	APICC	907 980 9368	jana@apicc.org
McIntyre	Drew	Vitus Marine	907 469 0693	drew.mcintyre@vitusmarine.com
Newman	Tom	TerraSond	907 745 7215	tnewman@terrasond.com
Oliver	David	Benthic GeoScience	907 715 8144	doliver@benthicgeo.com
Pewlowski	Bob	Self	907 301 2464	cptbob@qci.net
Pister	Benjamin	NPS	907 422 0501	benjamin_pister@nps.gov
Ribuffo	Steve	Port of Anchorage	907 343 6201	ribuffos@muni.org
Rosen	Yereth	AND	907 227 9242	yereth@alaskadispatch.com
Smith	Mark	Vitus Marine	907 351 9745	mark.smith@vitusmarine.com
Wright	Brian	USGS	907 786 7479	bwright@usgs.gov
Tencza	Michael	USACE	907 753 2648	michael.g.tencza@usace.army.mil
Vermette	Carolyn	SWAPA	907 953 3484	cmvermette@me.com
Wordwell	Nathan	JOA Surveys, LLC	907 227 6635	nathan@joasurveys.com

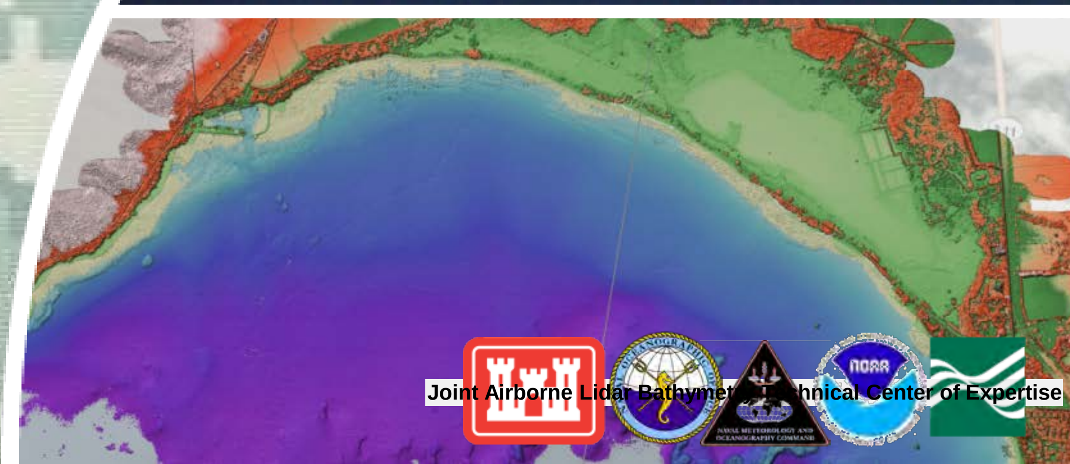
JALBTCX in Alaska

Jennifer M. Wozencraft
Director, Joint Airborne Lidar Bathymetry Technica
Program Manager, USACE National Coastal Map

Chris Macon
Technical Lead, USACE National Coastal Mappin

6 June 2016





US Army Corps of Engineers
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ERDC
Engineer Research and
Development Center

COASTAL & HYDRAULICS LABORATORY

Joint Airborne Lidar Bathymetry Technical Center of Expertise

Annual Technical Workshop, 14-16 June 2016

OPERATIONS

Aircraft

Surveys

Procedures

People

Hardware

Software

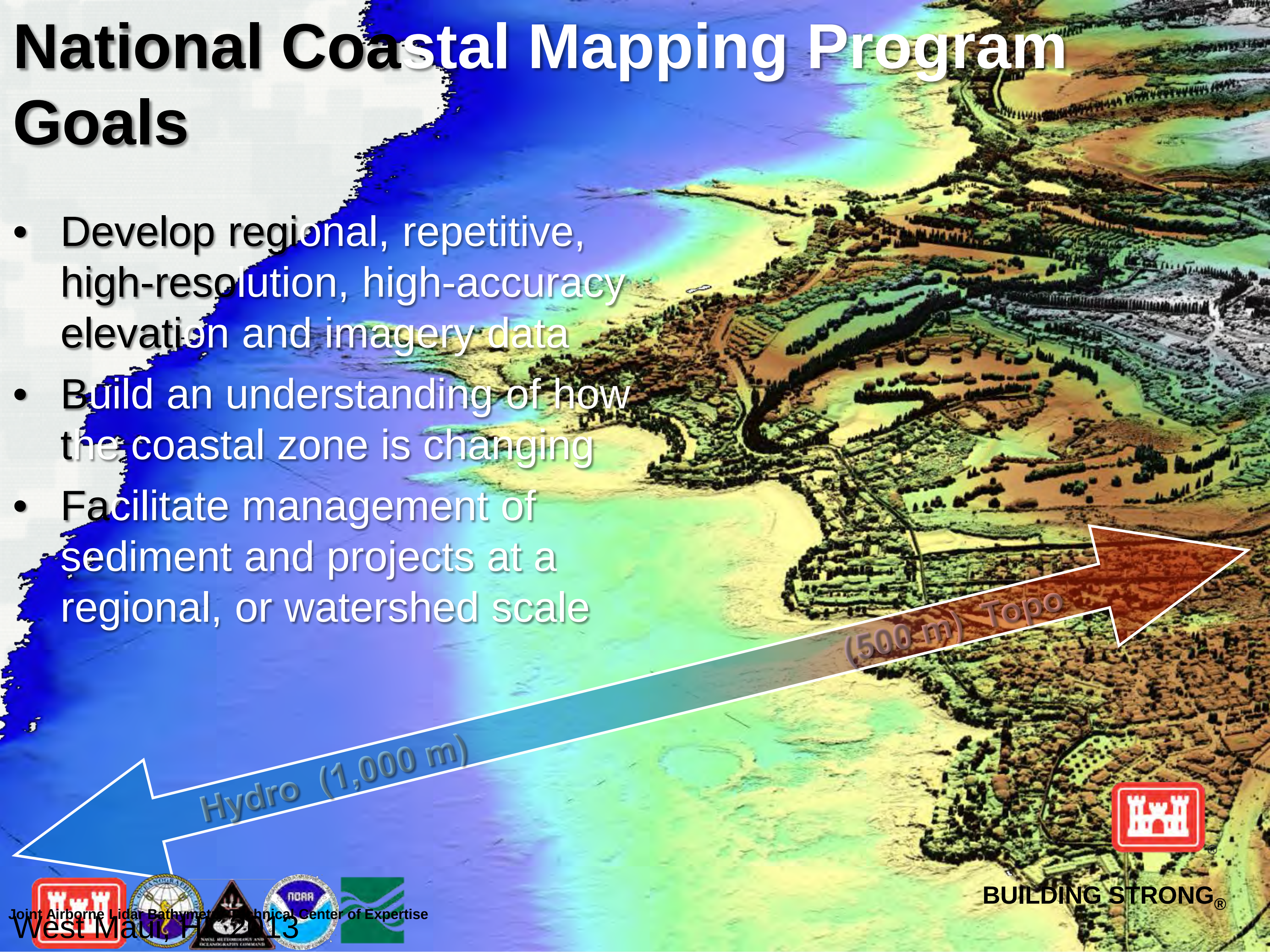
RESEARCH AND DEVELOPMENT

Algorithms

Data exploitation

National Coastal Mapping Program Goals

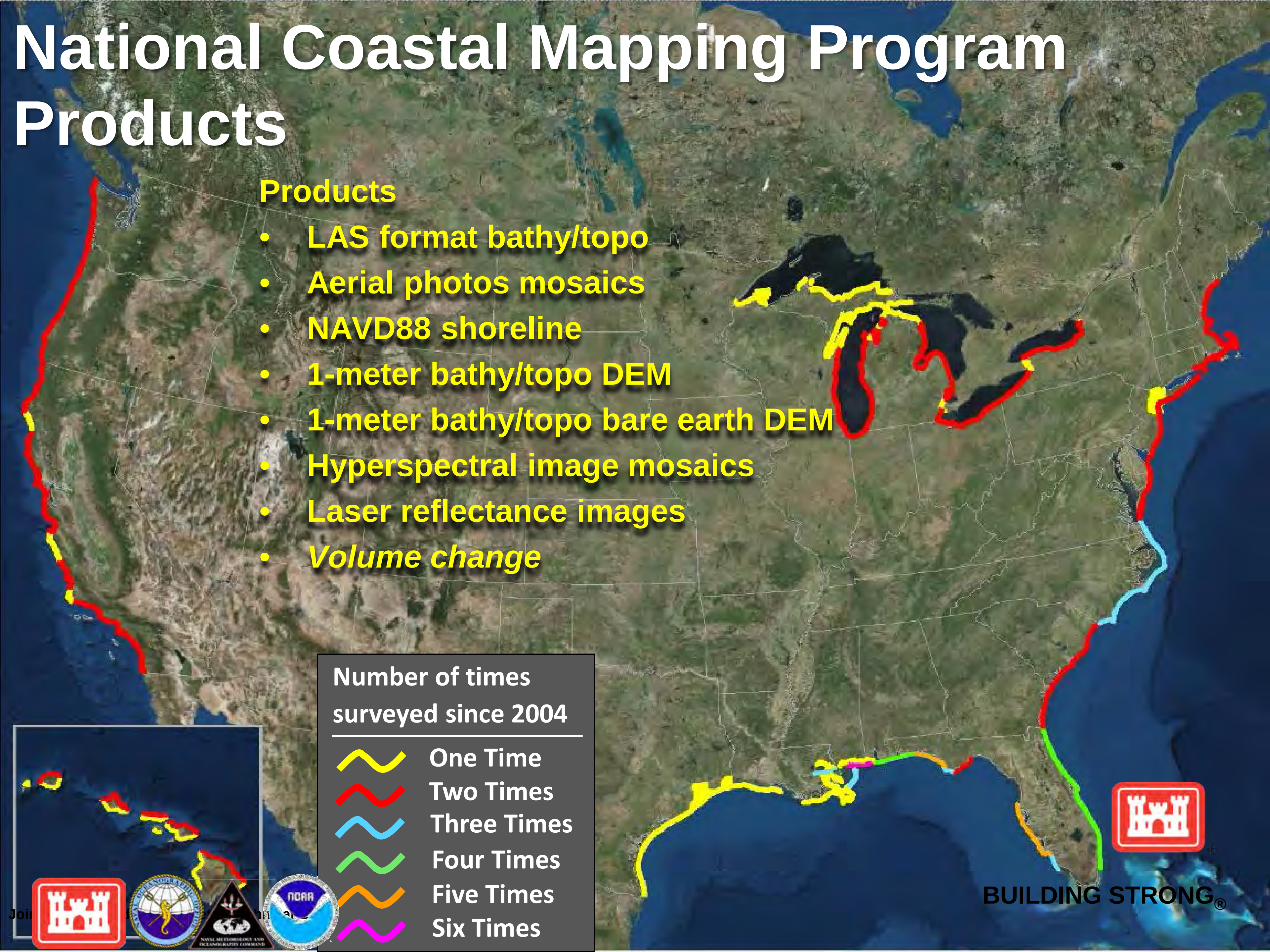
- Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
- Build an understanding of how the coastal zone is changing
- Facilitate management of sediment and projects at a regional, or watershed scale



National Coastal Mapping Program Products

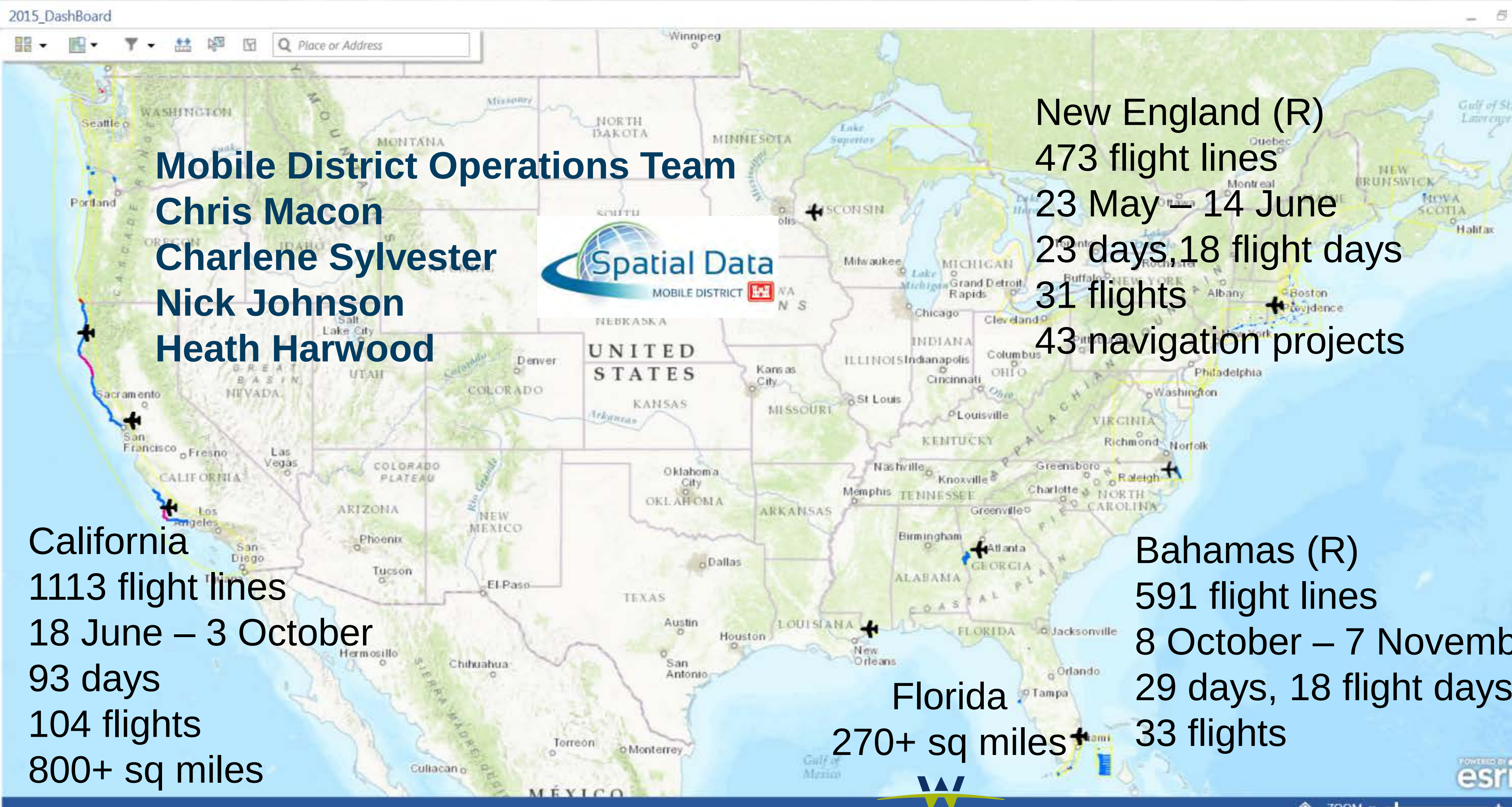
Products

- LAS format bathy/topo
- Aerial photos mosaics
- NAVD88 shoreline
- 1-meter bathy/topo DEM
- 1-meter bathy/topo bare earth DEM
- Hyperspectral image mosaics
- Laser reflectance images
- *Volume change*



2015 JALBTCX Survey Season

2015_DashBoard



Mobile District Operations Team
Chris Macon
Charlene Sylvester
Nick Johnson
Heath Harwood

Spatial Data
MOBILE DISTRICT

New England (R)
473 flight lines
23 May – 14 June
23 days,18 flight days
31 flights
43 navigation projects

California
1113 flight lines
18 June – 3 October
93 days
104 flights
800+ sq miles

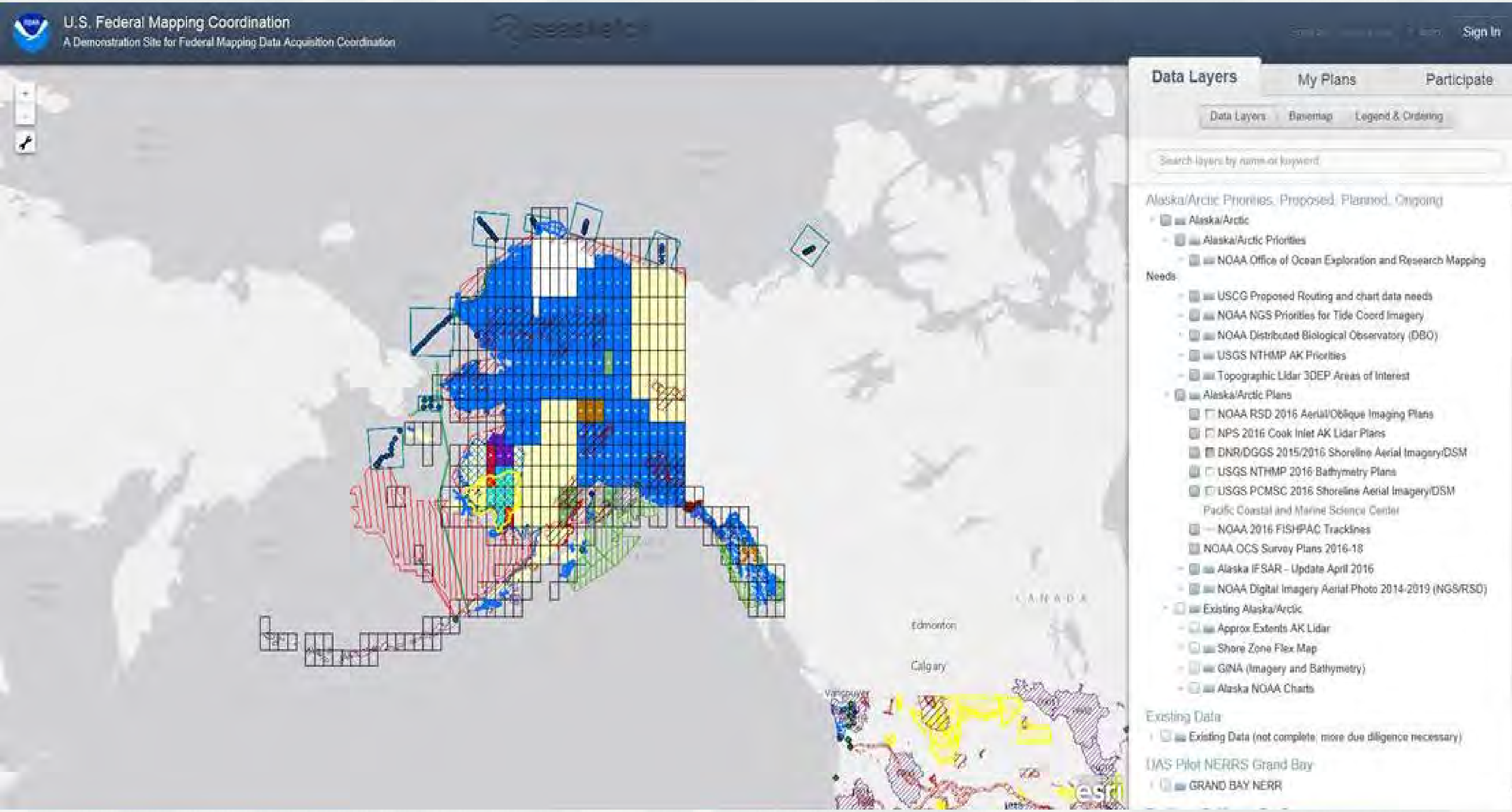
Florida
270+ sq miles

Bahamas (R)
591 flight lines
8 October – 7 Novembe
29 days, 18 flight days
33 flights

WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

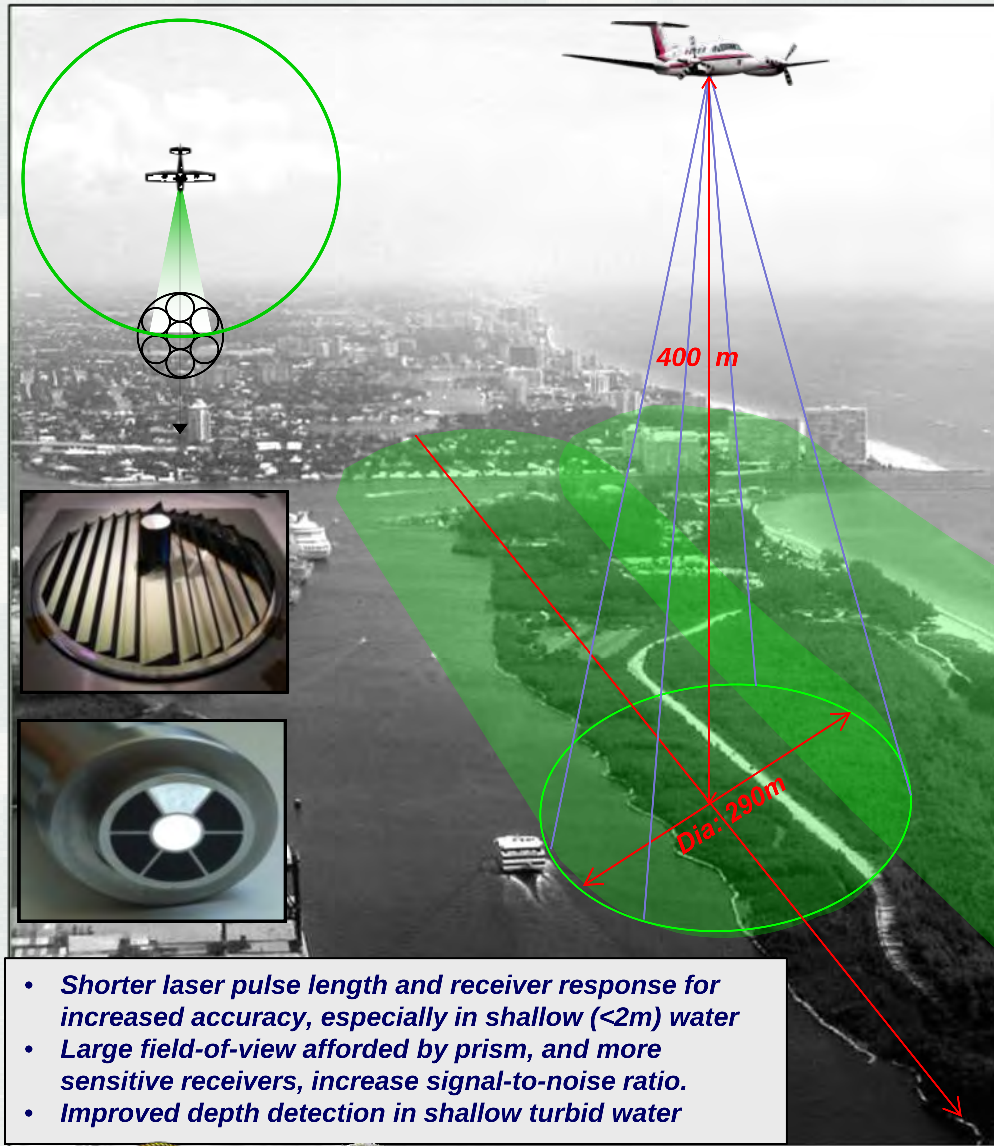
GEOMATICS DATA SOLUTIONS

Future NCMP collections



http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4

CZMIL Coastal Zone Mapping and Imaging Lidar



10,000 Hz Pulse Rate (hydro / topo)

0.4 Hz / 60 MP Digital camera (~5 cm pixel)

CASI-1500 Hyperspectral Imager

- 1500 pixels
- 380 – 1050 nm wavelength
- 288 possible bands

15 cm RMSE bathymetry

7.5 cm RMSE topography

Shot spacing:

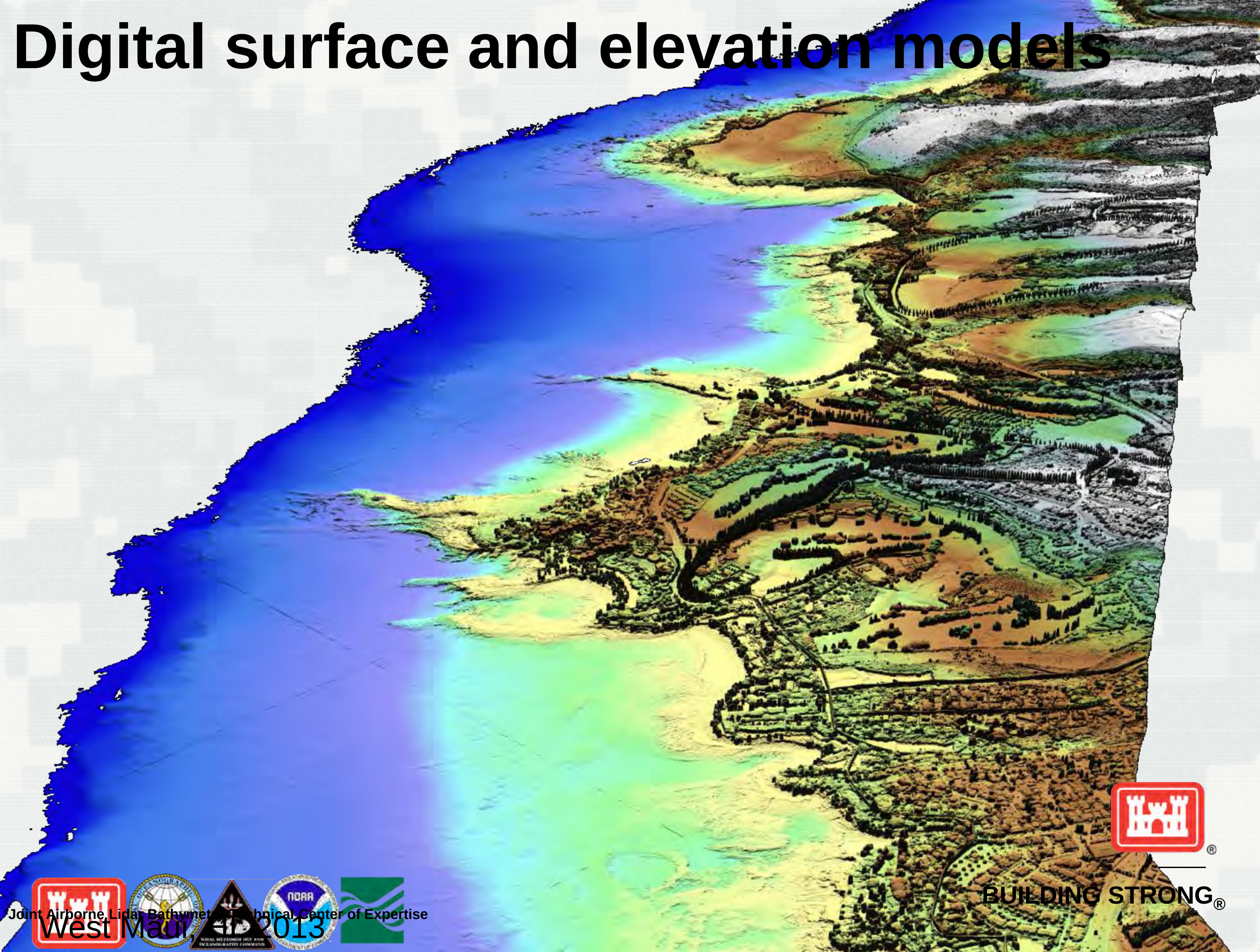
0.7 X 0.7 meter topo / shallow hydro

2.0 X 2.0 meter deep hydro

- Shorter laser pulse length and receiver response for increased accuracy, especially in shallow (<2m) water
- Large field-of-view afforded by prism, and more sensitive receivers, increase signal-to-noise ratio.
- Improved depth detection in shallow turbid water

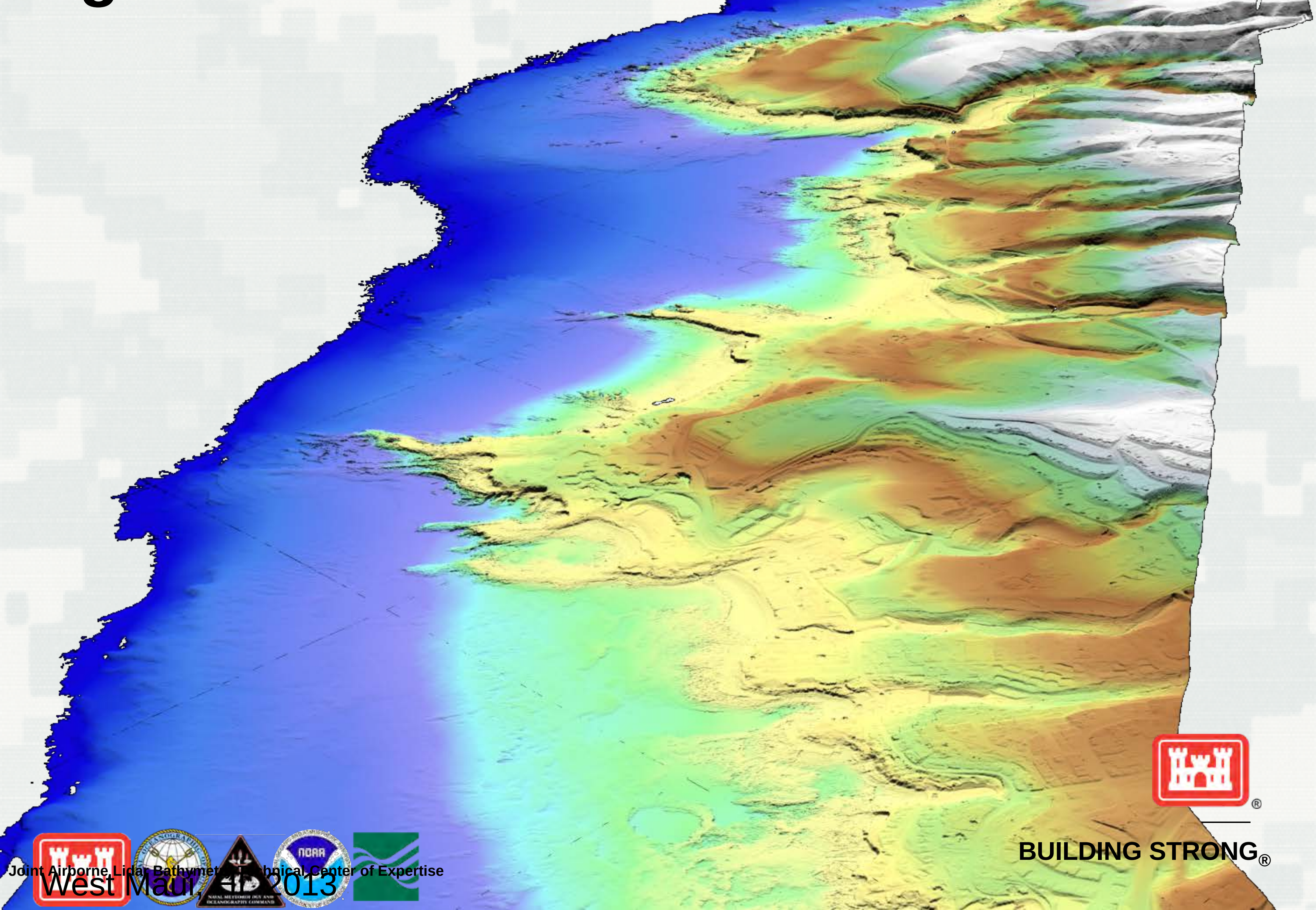
Coastal Zone Mapping and Imaging Lidar

Digital surface and elevation models



West Maui, HI 2013

Digital surface and elevation models



West Maui, HI 2013

Aerial photography/lidar

Siuslaw River Entrance, OR 2014

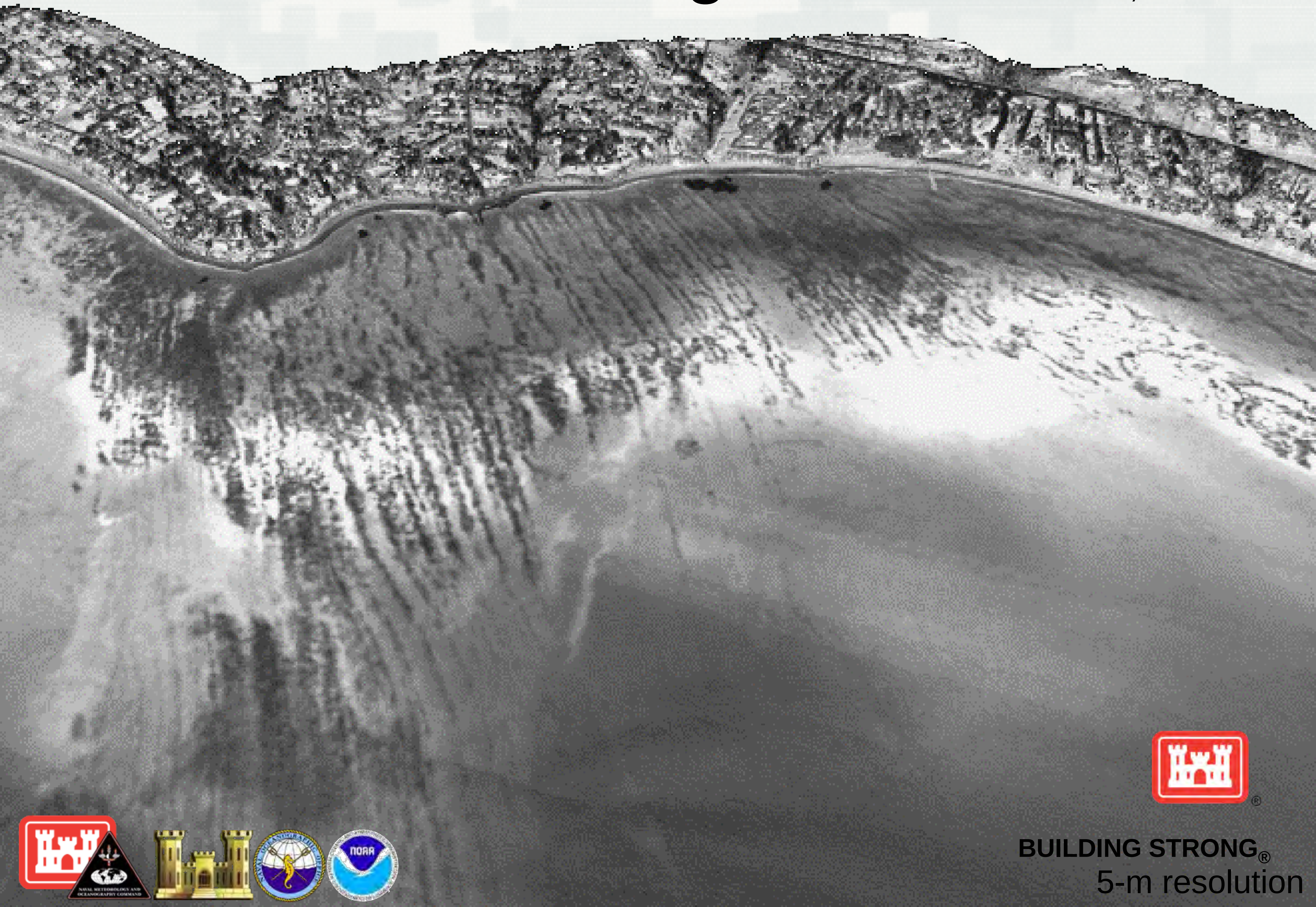
Hyperspectral imagery

1 m pixel resolution, 48 spectral bands
375-1050 nm

Olowalu, Maui, HI
2013

Laser reflectance image

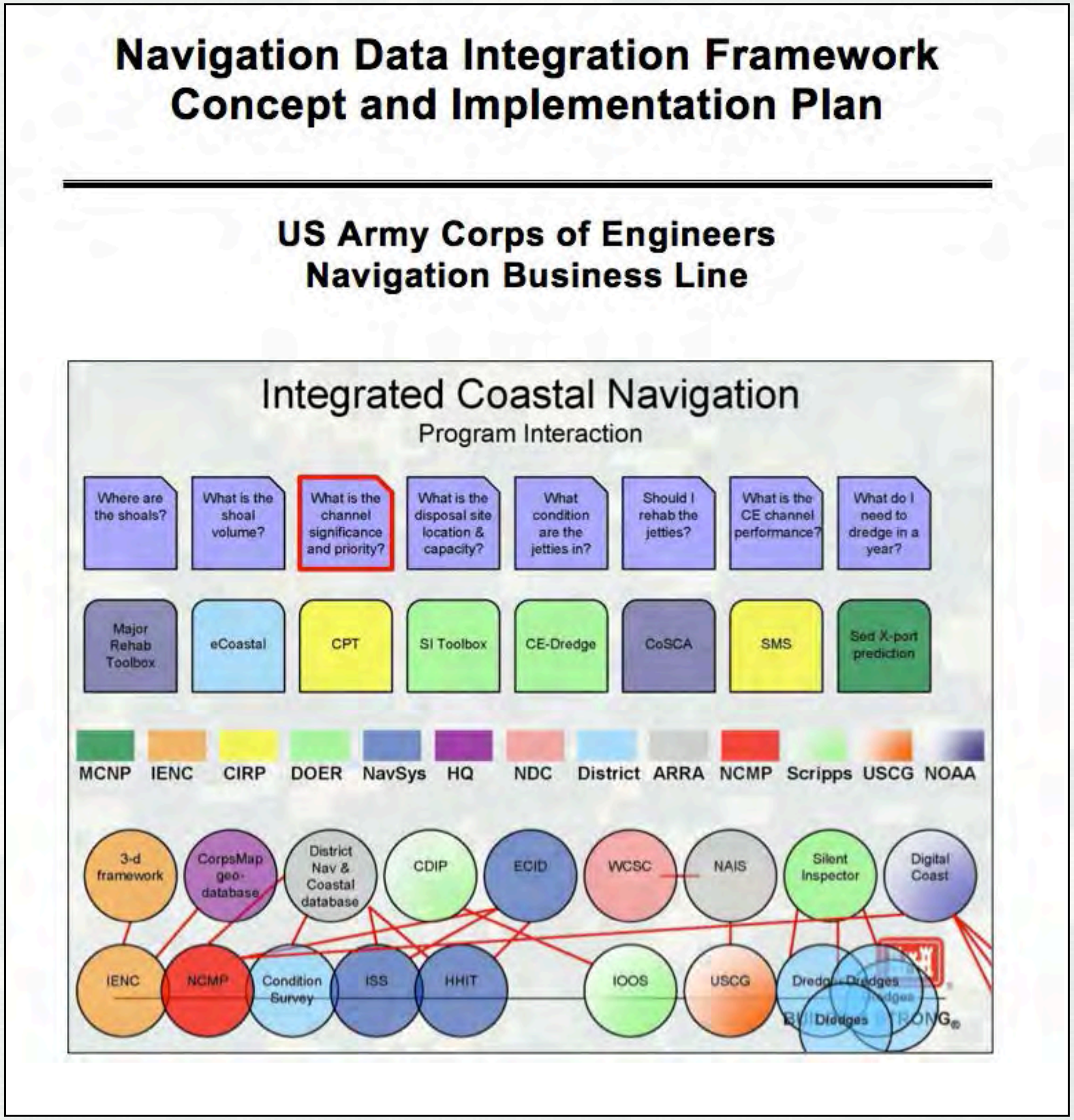
NCMP 2009
Malibu, CA



BUILDING STRONG®

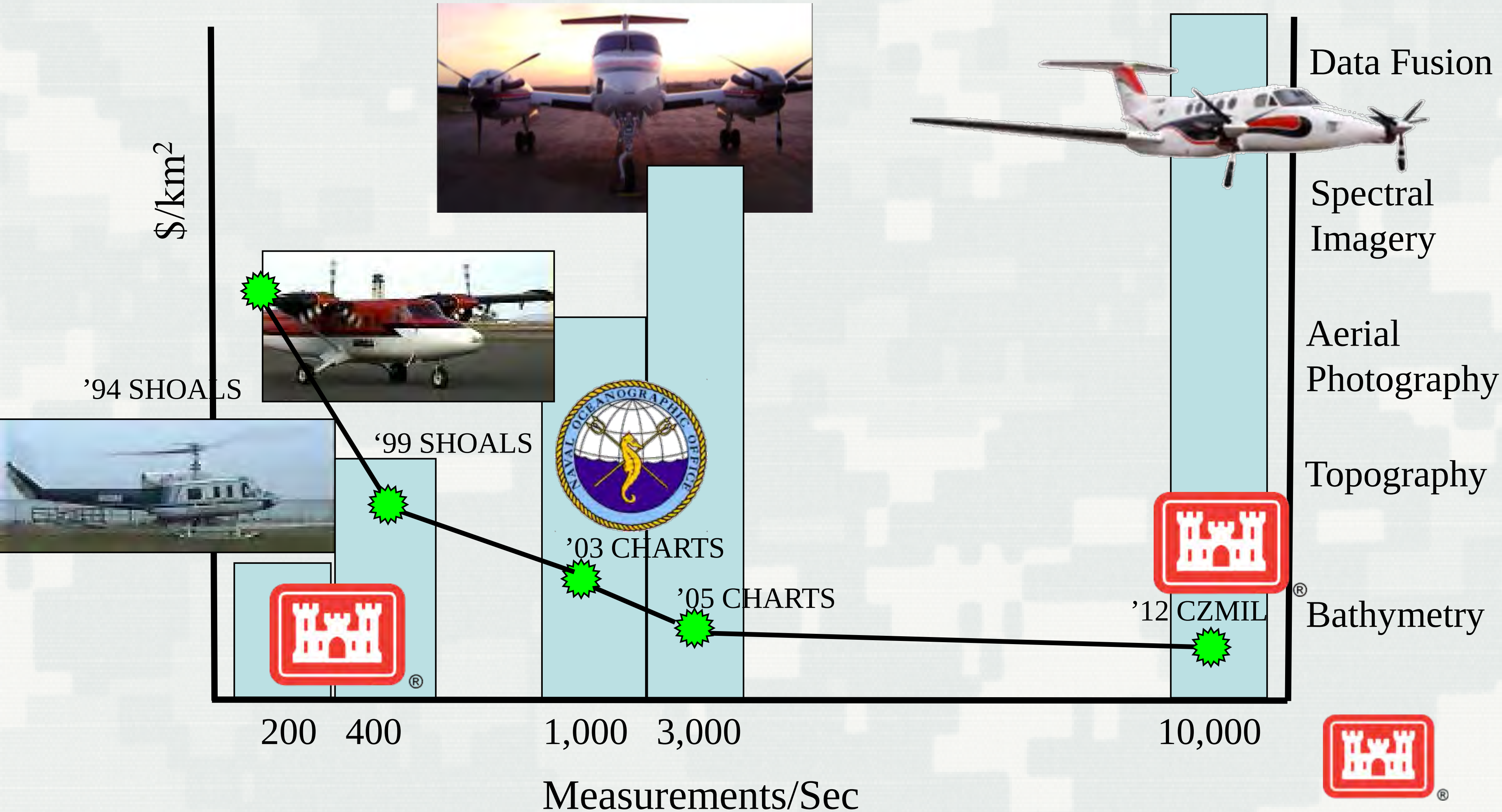
5-m resolution

NCMP Data Access

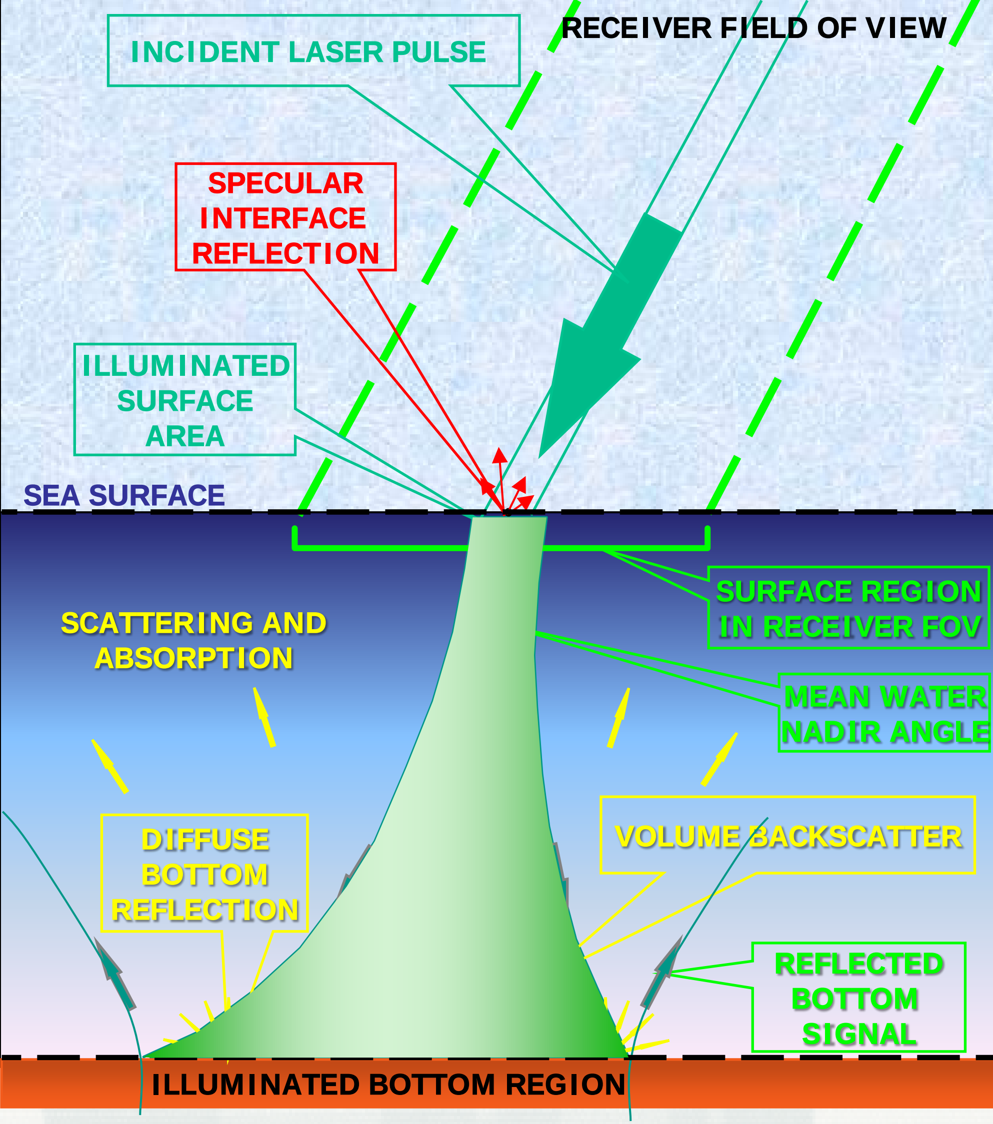


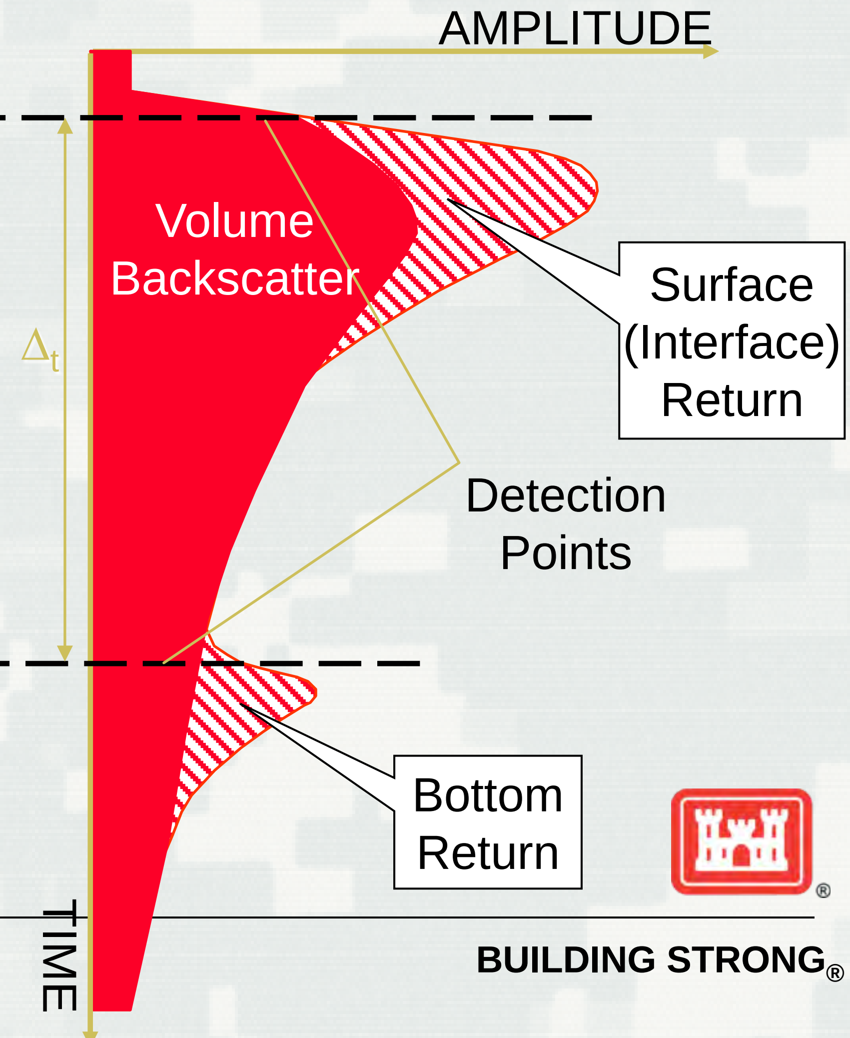
- USACE District Office
- NOAA Digital Coast
- USGS St. Petersburg
- USGS EROS
- USACE GRiD
- By request to jalbtcx@usace.army.mil

JALBTCX sensor development history



Bathymetric lidar principle



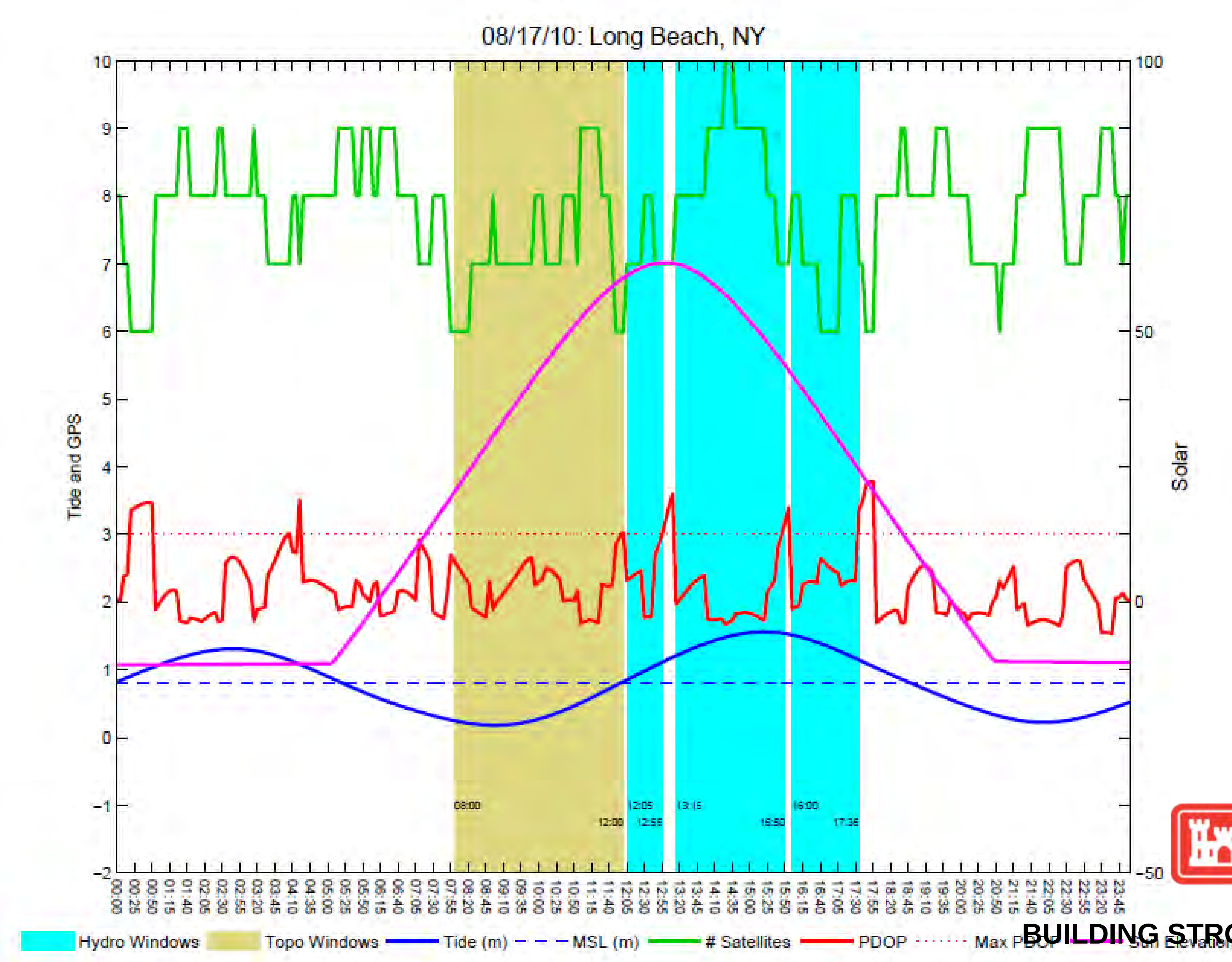


Engineer Research and Development Center

COASTAL & HYDRAULICS LABORATORY

OPERATIONAL CONSIDERATIONS

Daily flight windows



ARECIBO, PUERTO RICO

Facing: **North**

81° | Wind - AROP4 N/A @ 0 k ts | Buoy 41053 5.6ft @ 13sec | Low: 12:28 AM High: 07:40 AM | 82° Wetsuit Guide

SURF FORECAST

	AM	PM
FRIDAY	4-6+ ft	4-5 ft

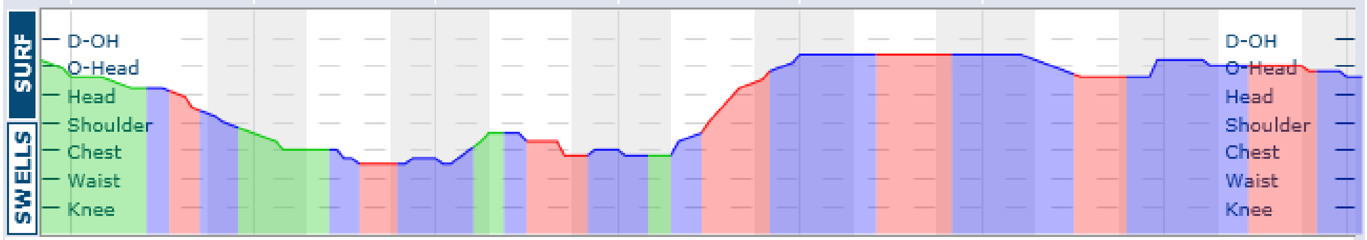
SURF
Chest to head high N ground swell for the morning with occasional slightly overhead high sets. This drops in the afternoon with occasional head high sets.

CONDITIONS
Clean in the morning with SSE winds less than 5mph. Bumpy/semi bumpy conditions for the afternoon with the winds shifting NE 5-10mph.

WIND		SWELL	
6am	SSE 4mph	N	5.6 ft @ 12sec
9am	SE 3mph	N	5.3 ft @ 12sec
12pm	NE 5mph	N	5.1 ft @ 12sec
3pm	NNE 8mph	N	4.8 ft @ 12sec
6pm	NE 5mph	NNE	4.5 ft @ 12sec

	AM	PM
SATURDAY	3-4+ ft	3+ ft
SUNDAY	3-4+ ft	3-4+ ft
MONDAY	2-4 ft	4-7 ft
TUESDAY	6-9 ft	6-9 ft
WEDNESDAY	6-8 ft	

FRI 1-08 | SAT 1-09 | SUN 1-10 | MON 1-11 | TUE 1-12 | WED 1-13

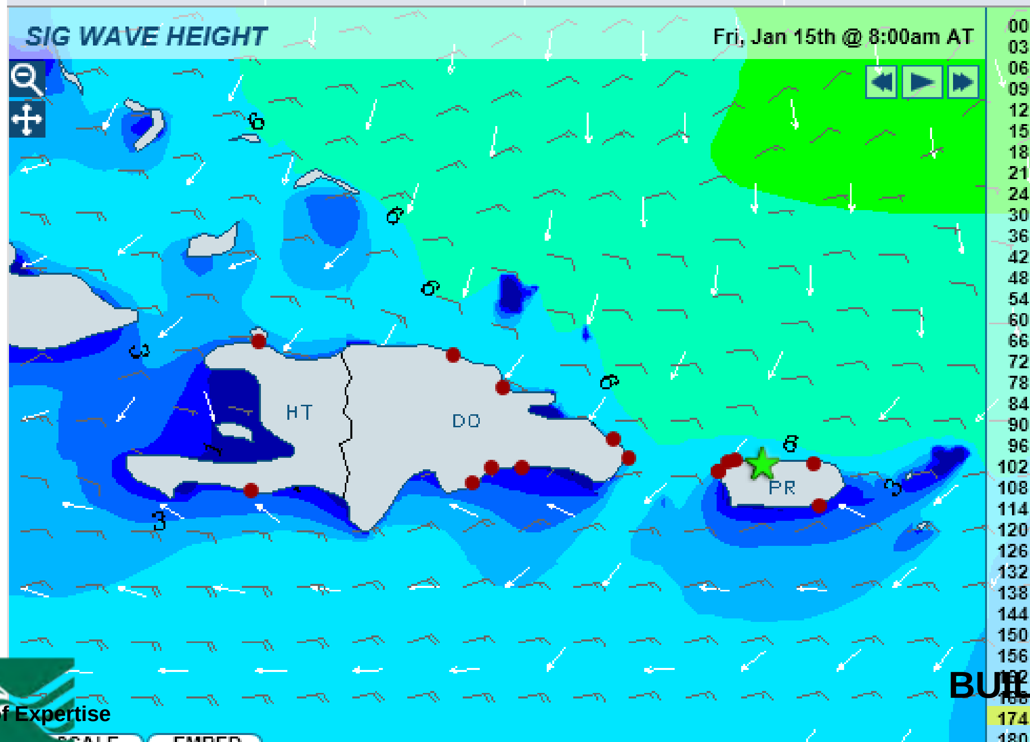


Forecast Updated: Jan 8 6:45 am   Clean   Fair   Choppy   Beach Direction: N

SWELL TABLE | WEATHER FORECAST | TIDE CHART | WIND TABLE

WAVES | WINDS | STATION DATA | OCEAN TEMPS

SIG WAVE HEIGHT   Fri, Jan 15th @ 8:00am AT



Joi... ...r of Expertise

...CALE | EMBED

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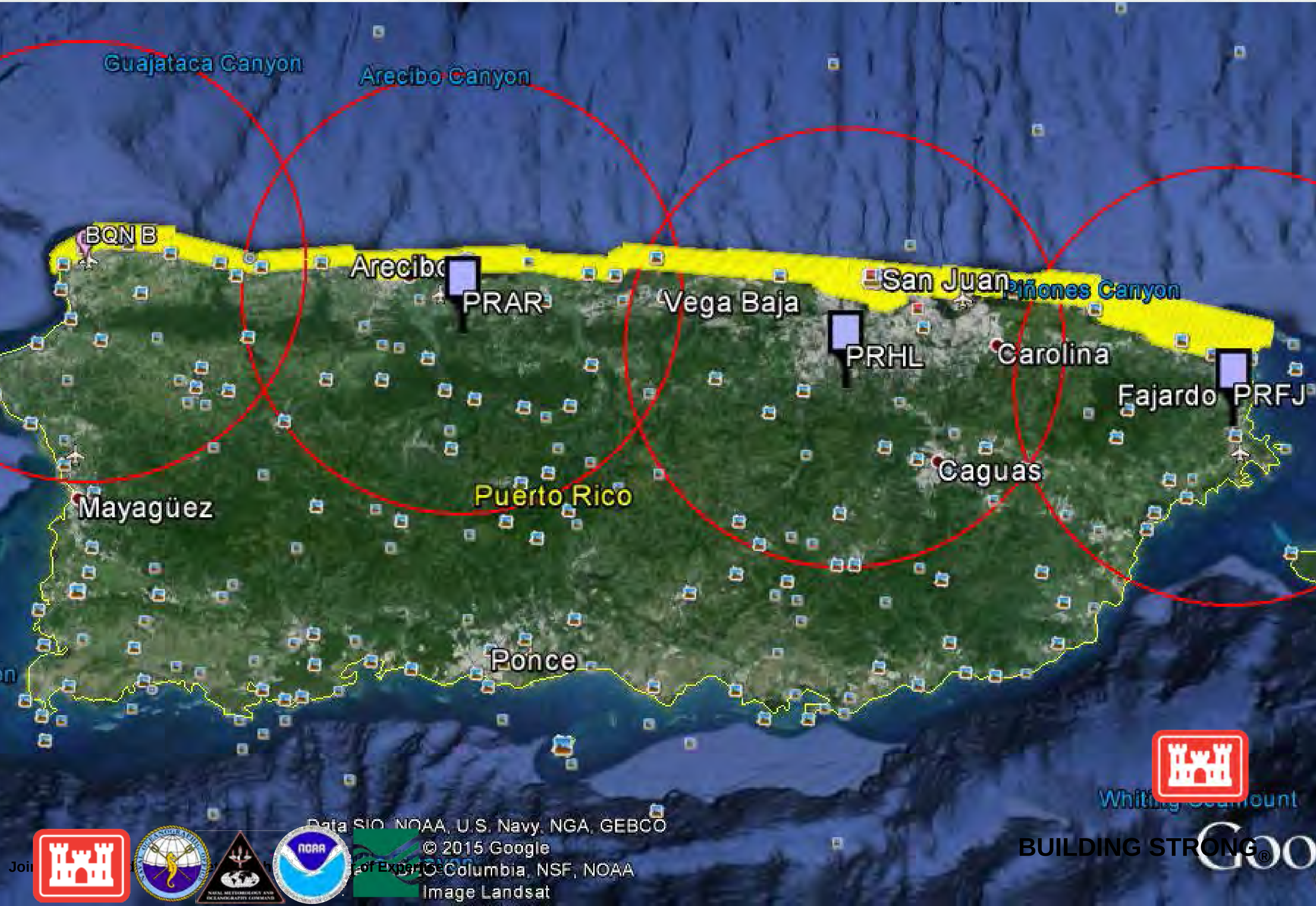
GPS control


Guajataca Canyon
Arecibo Canyon
BQN B
Arecibo
PRAR
Vega Baja
San Juan
Piñones Canyon
PRHL
Carolina
Fajardo
PRFJ
Caguas
Mayagüez
Puerto Rico
Ponce
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2015 Google
Image Landsat

Tide level and solar illumination

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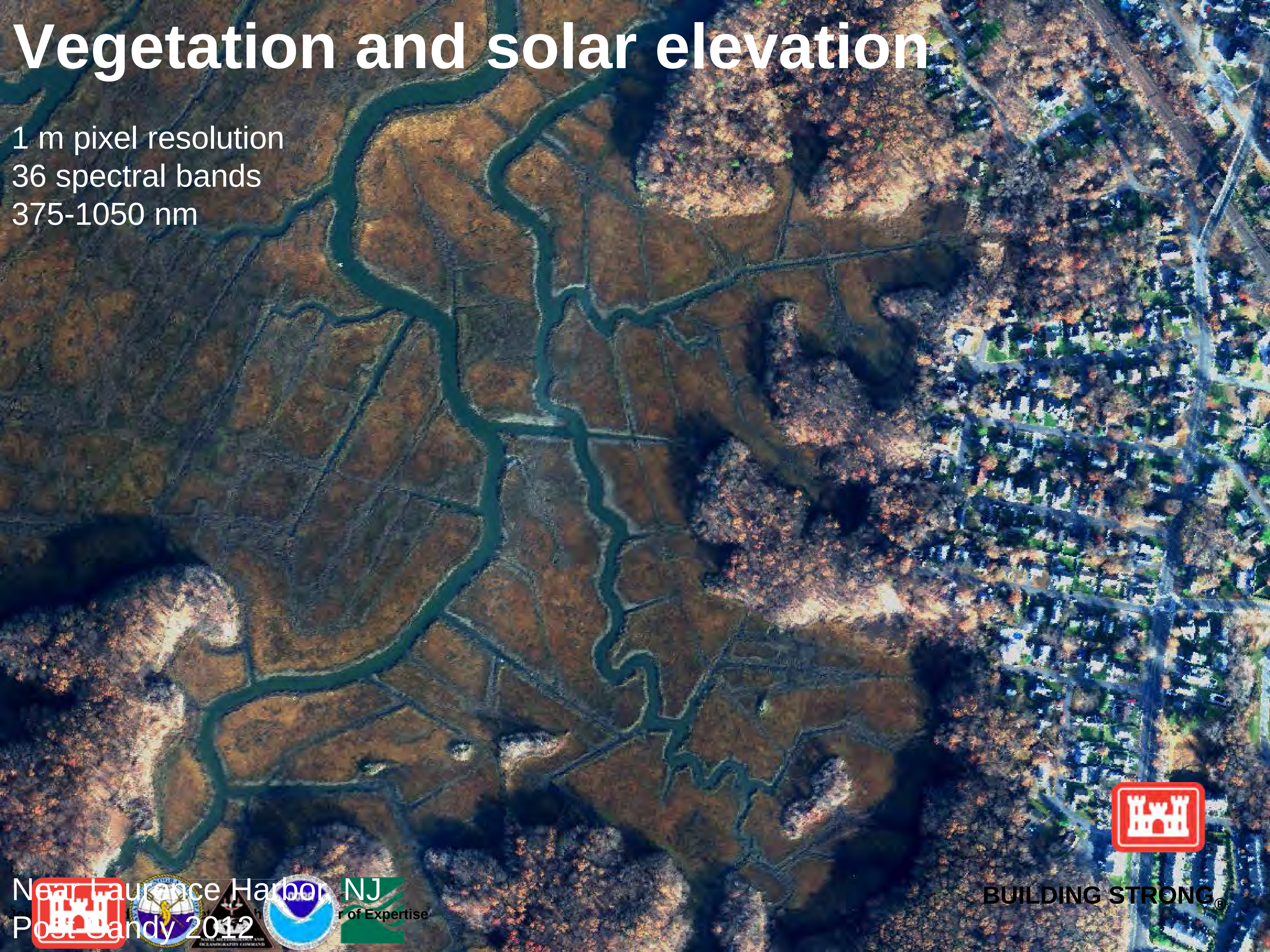
Tide level and solar illumination

1 m pixel resolution
36 spectral bands
375-1050 nm

Seabrook, New Hampshire
2005

Vegetation and solar elevation

1 m pixel resolution
36 spectral bands
375-1050 nm

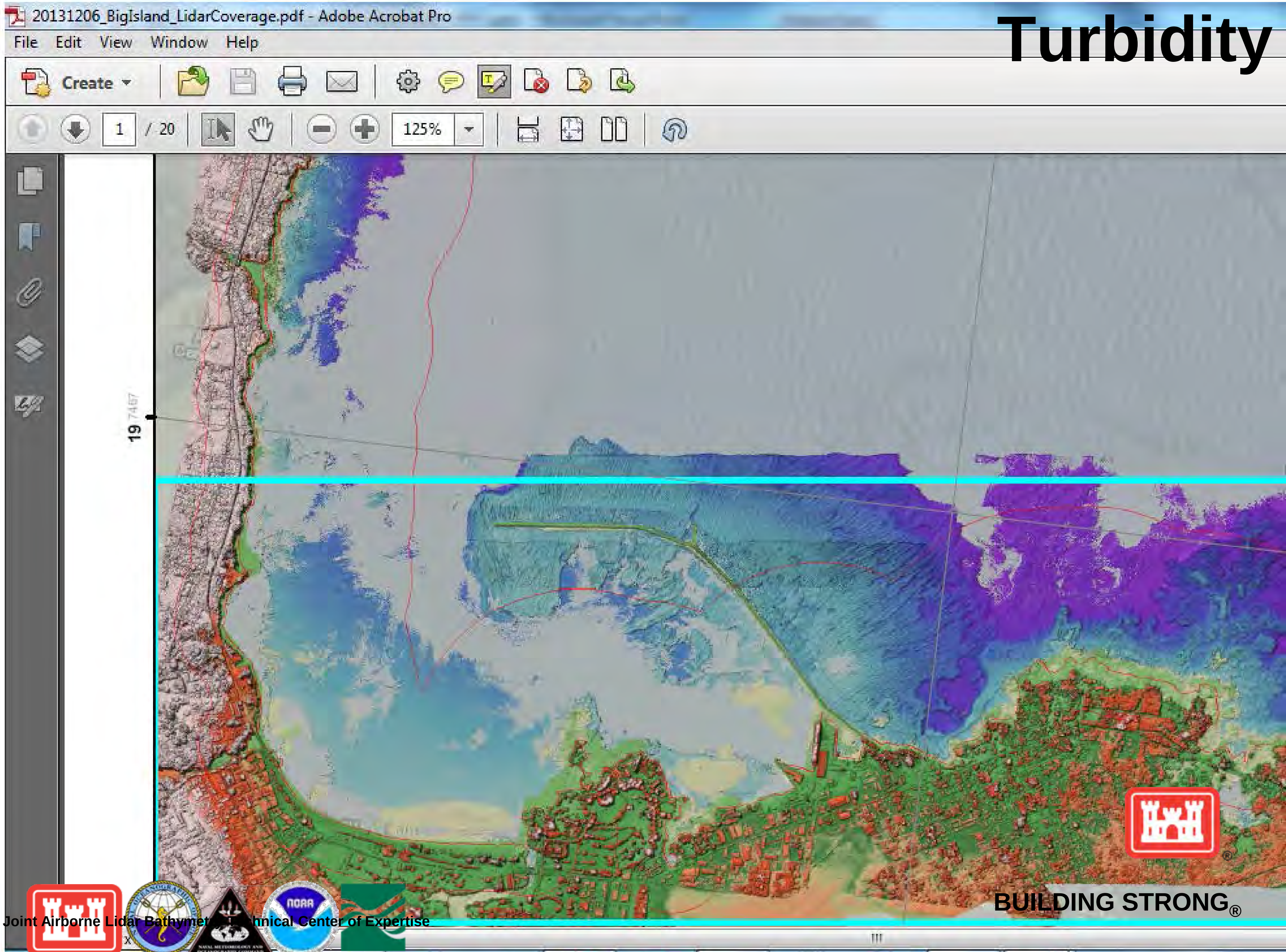


Near Laurance Harbor, NJ
Post Sandy 2012

Environmental Factors

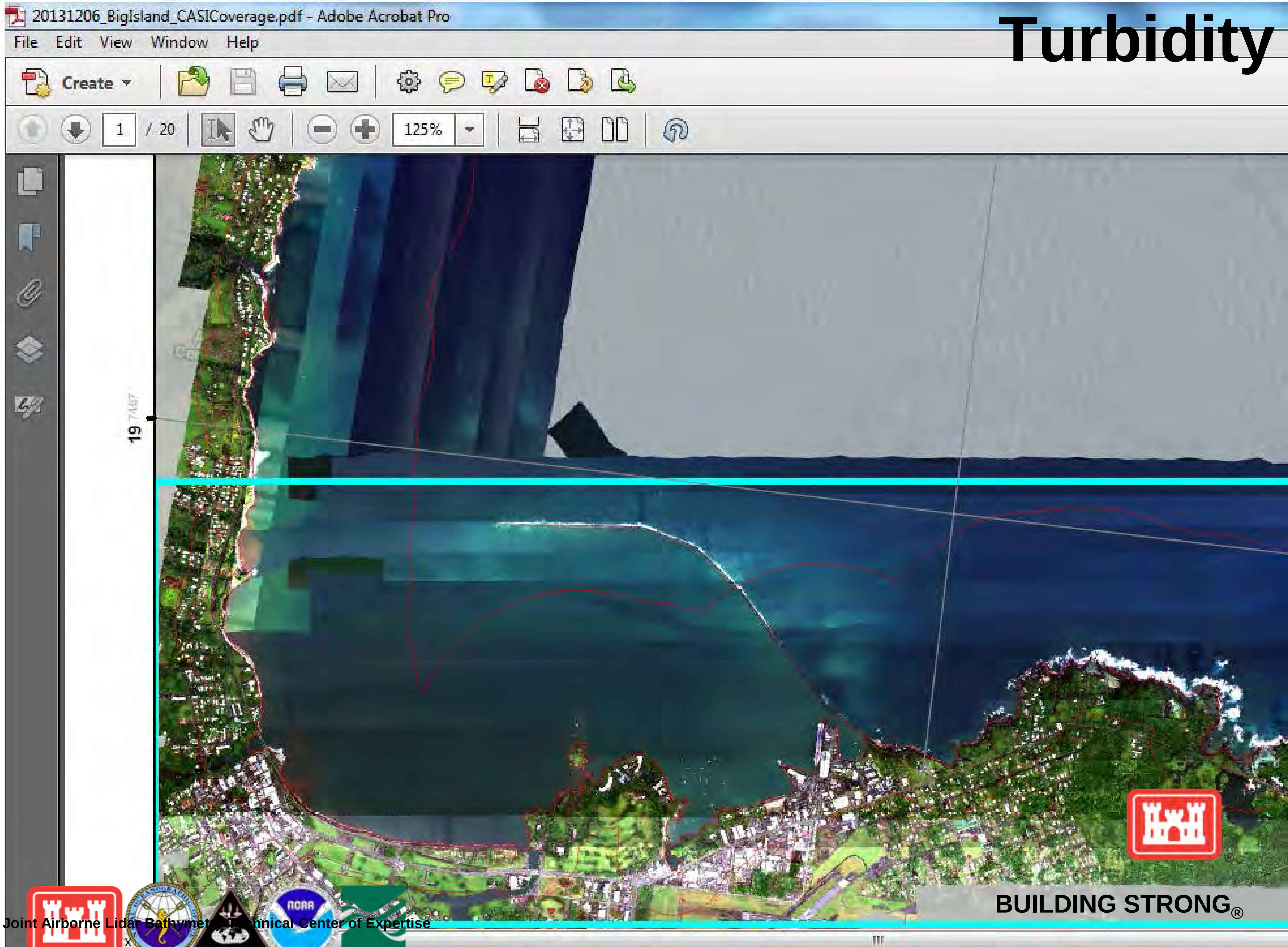
- Weather
- Water Clarity
    - Run Off (Snow Melt, Rain, etc.)
    - Tides
- Bottom Type
- Sub Aquatic Vegetation (SAV)
- Algal Blooms

Turbidity



20131206_BigIsland_LidarCoverage.pdf - Adobe Acrobat Pro
File Edit View Window Help
Create
1
/ 20
125%
19

Turbidity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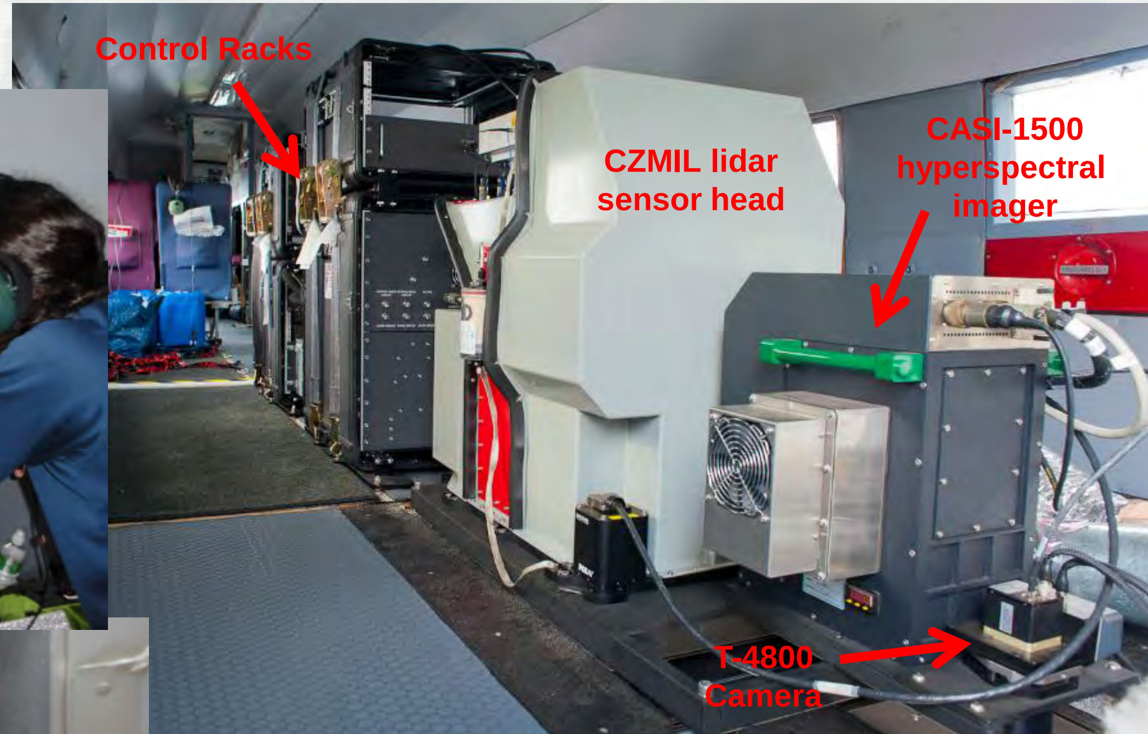
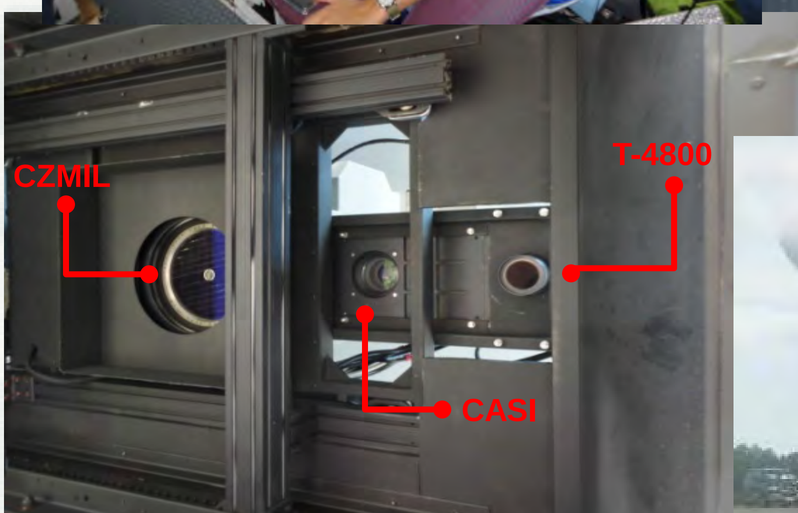
File Edit View Window Help
Create
1 / 20
125%
19

Aircraft – Long Range





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CZMIL SYSTEM ACCURACY

CZMIL Topographic Calibration

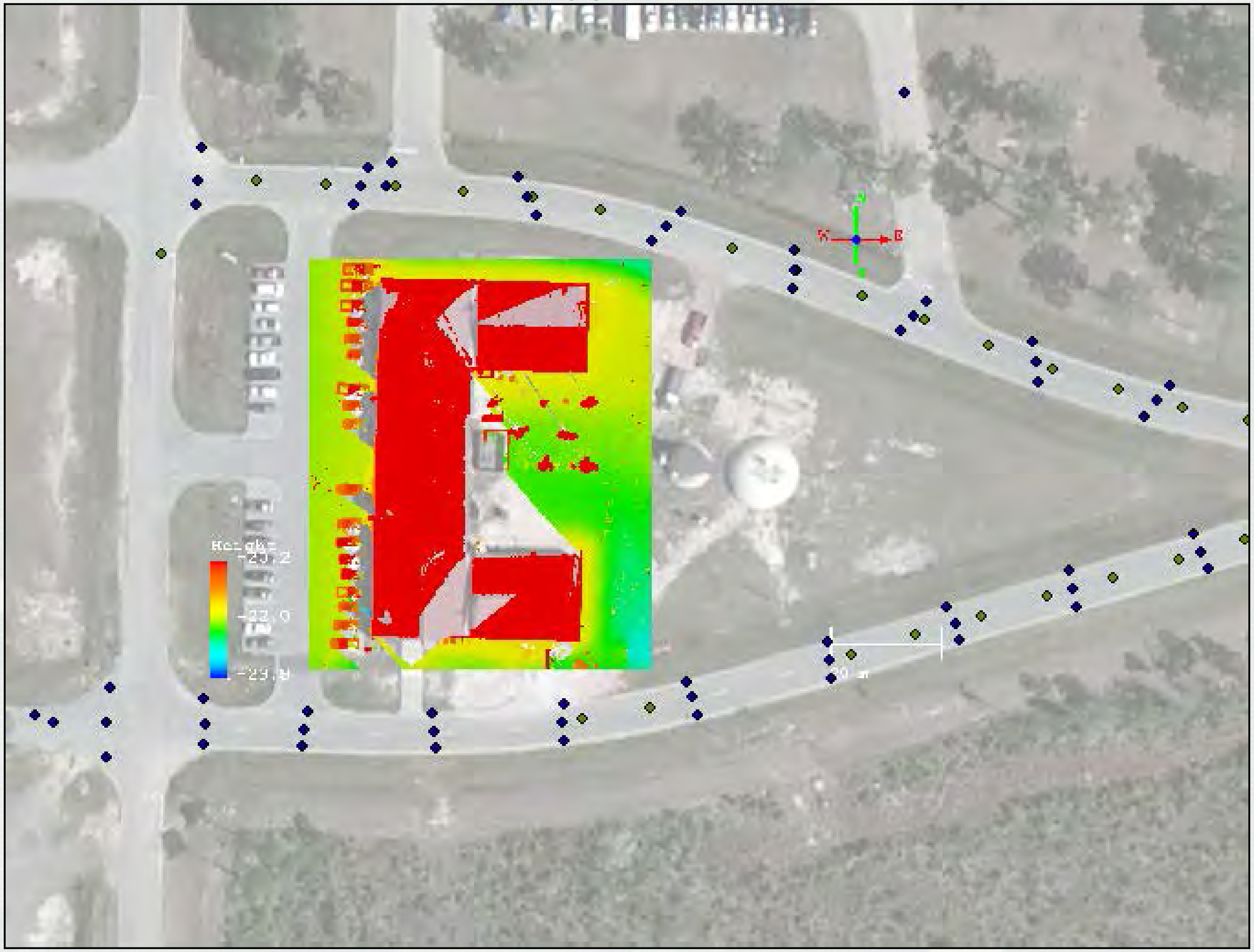
Ground Truth Comparison

LYNX Mobile Mapper and total station

CZMIL Topographic Calibration

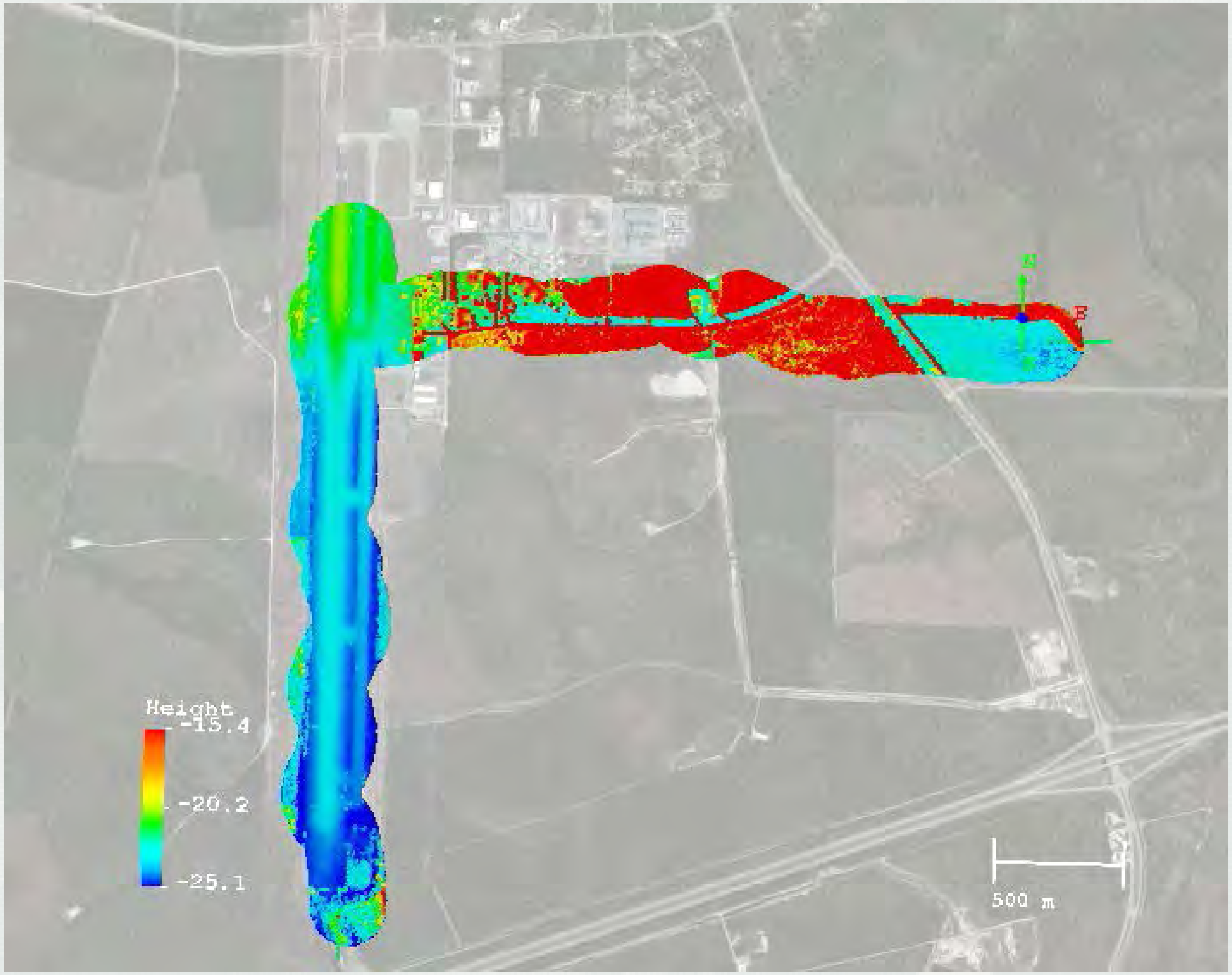
Ground Truth

LYNX Mobile Mapper and total station



CZMIL Topographic Calibration

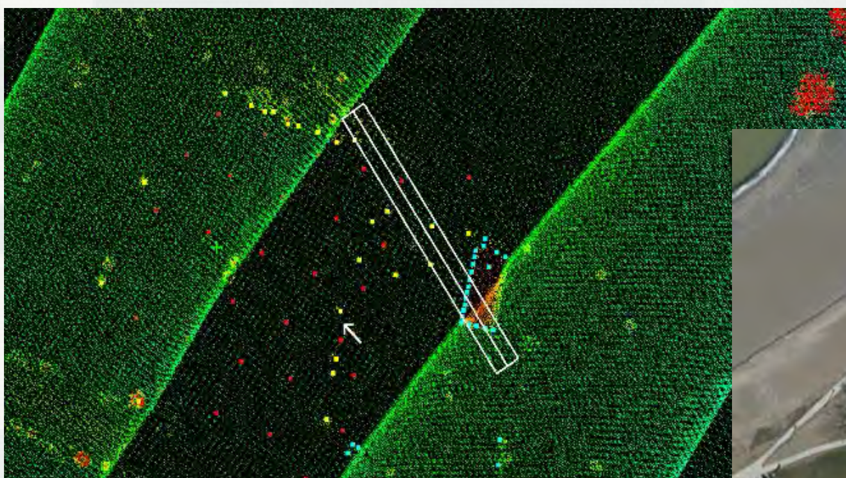
Flights Over Ground Truth Locations

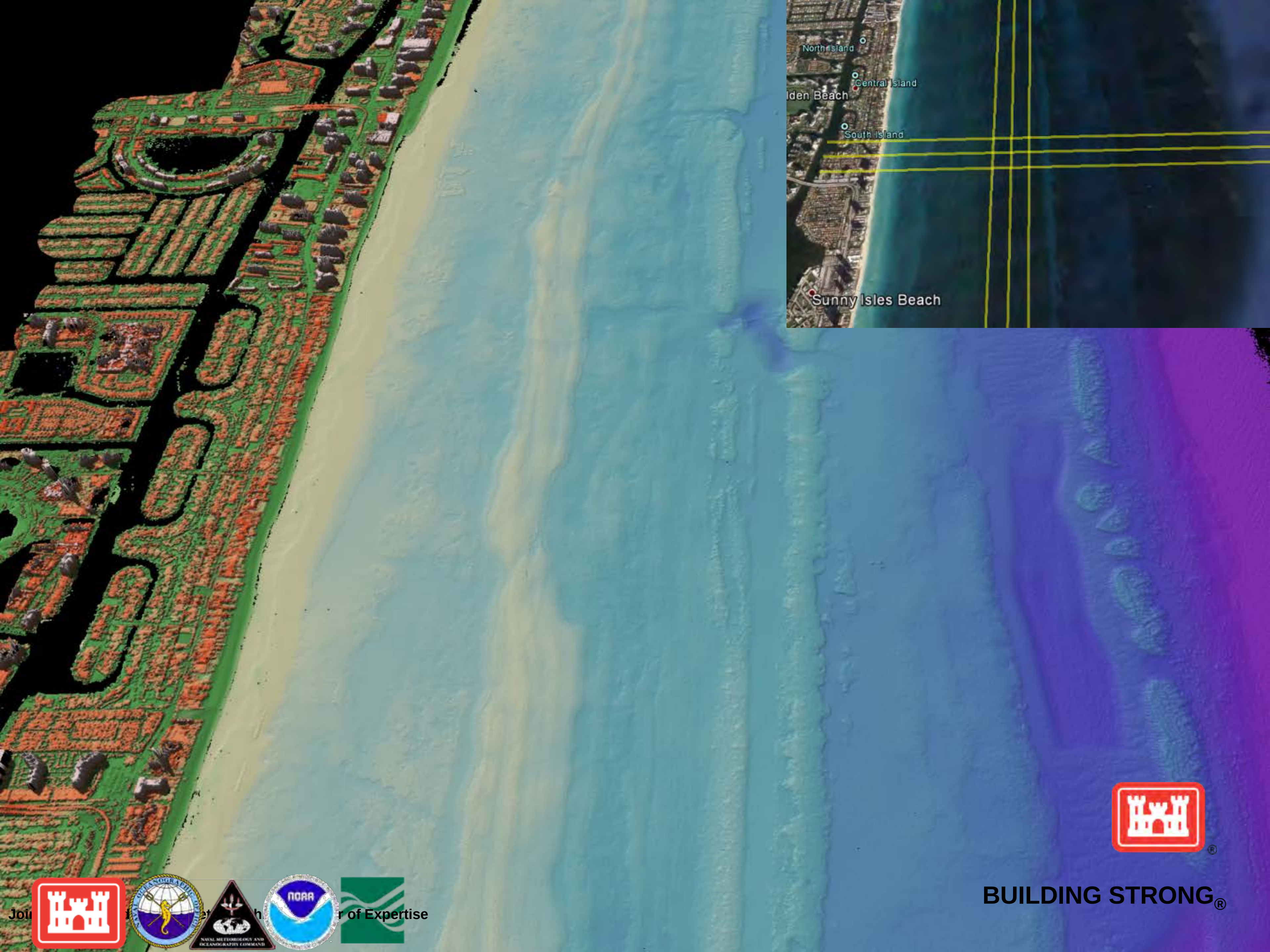


CZMIL Topographic Accuracy Assessment

2012 NCMP Great Lakes

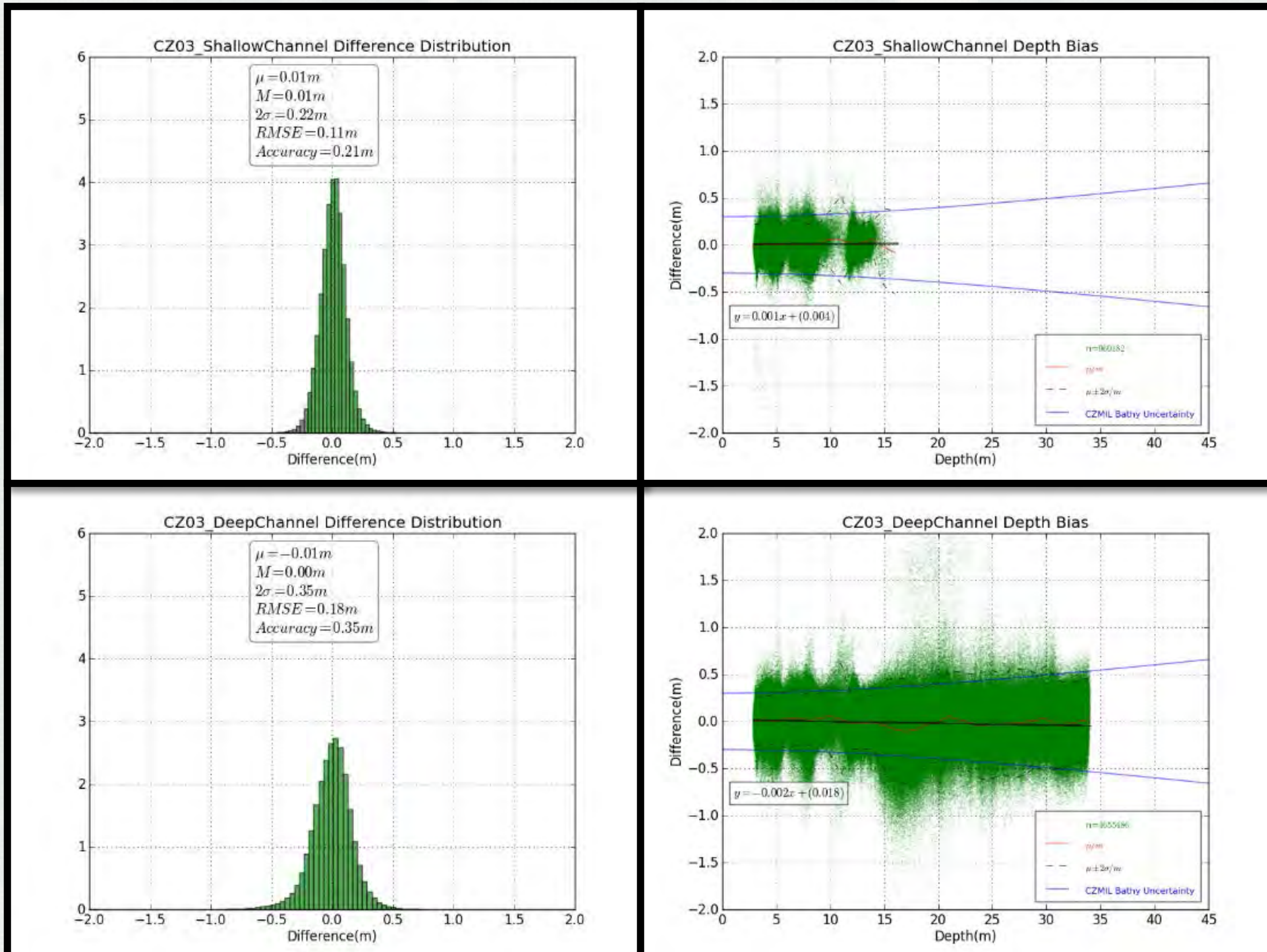
Category	n	Mean	RMSEz	σ
Bare earth	203	-0.008	0.033	0.025
Low grass	157	-0.034	0.050	0.033
Urban	122	-0.023	0.110	0.101
Trees	137	-0.105	0.150	0.087





North Island
Central Island
lden Beach
South Island
Sunny Isles Beach

CZMIL Bathymetric Accuracy Assessment



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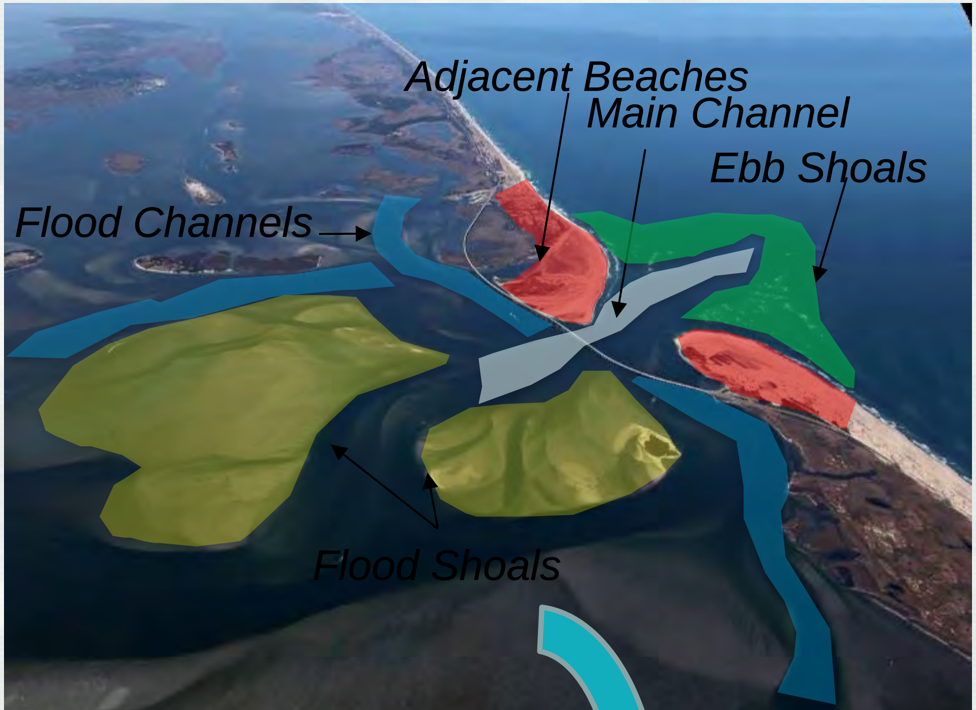
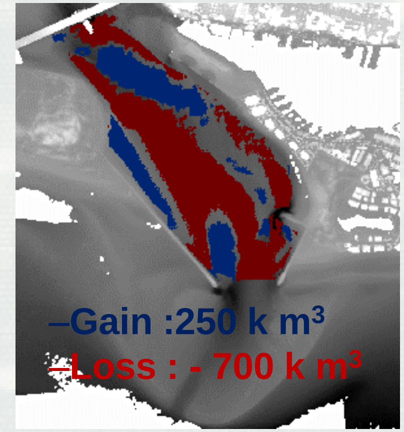
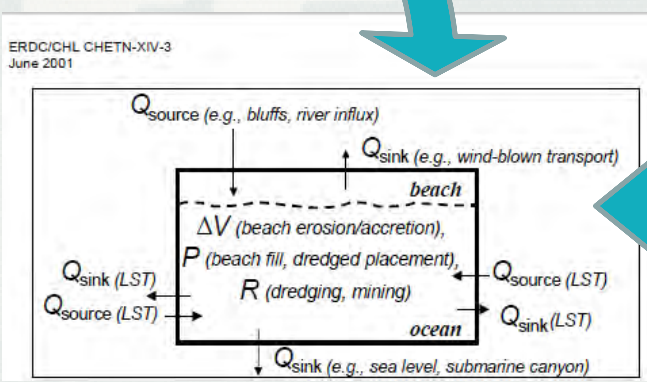
NCMP ADVANCED PRODUCTS AND APPLICATIONS

Sediment Pathways & Budget



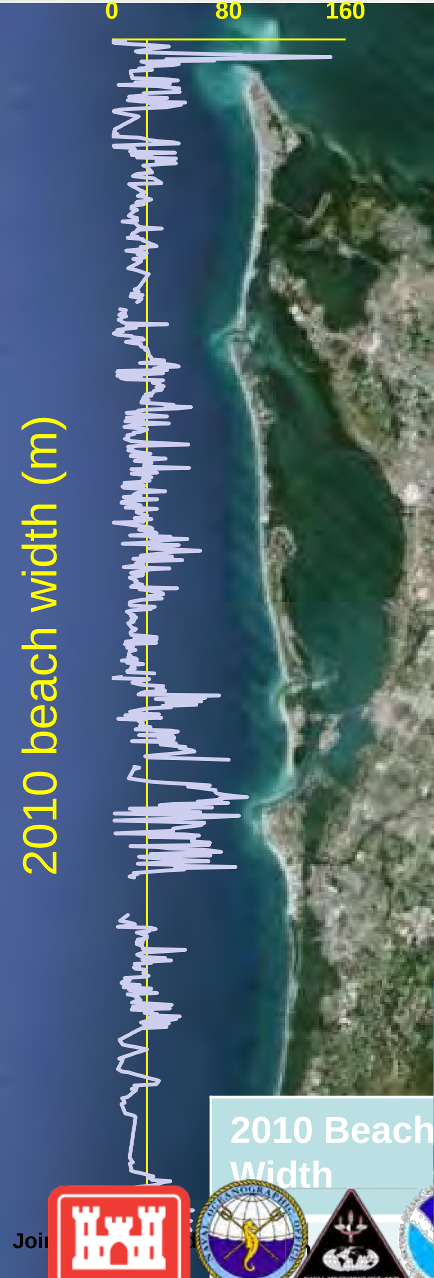
Inlet and ebb shoal





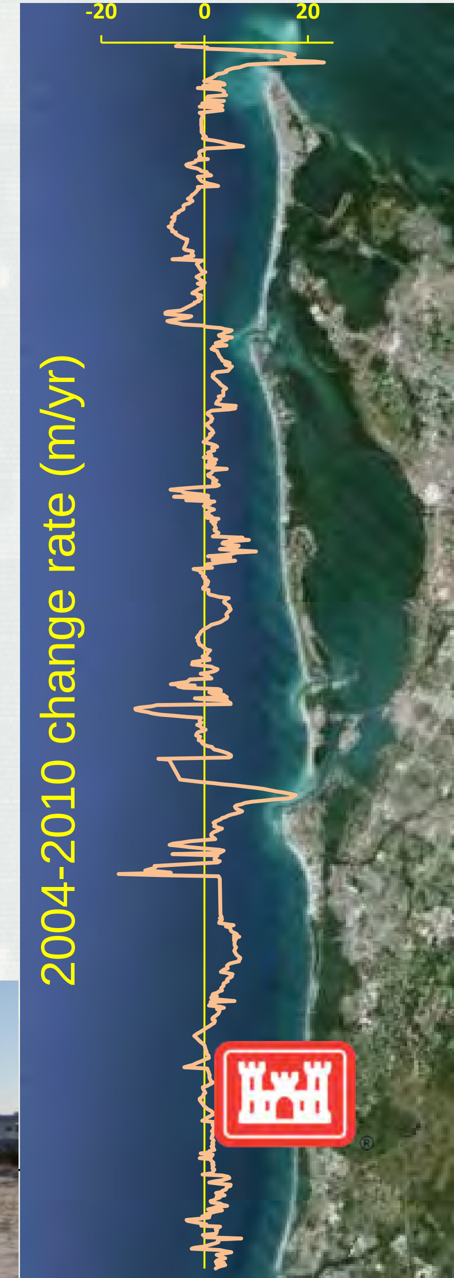
Zero Contour

Zero Contour Change Rate
1.3 m



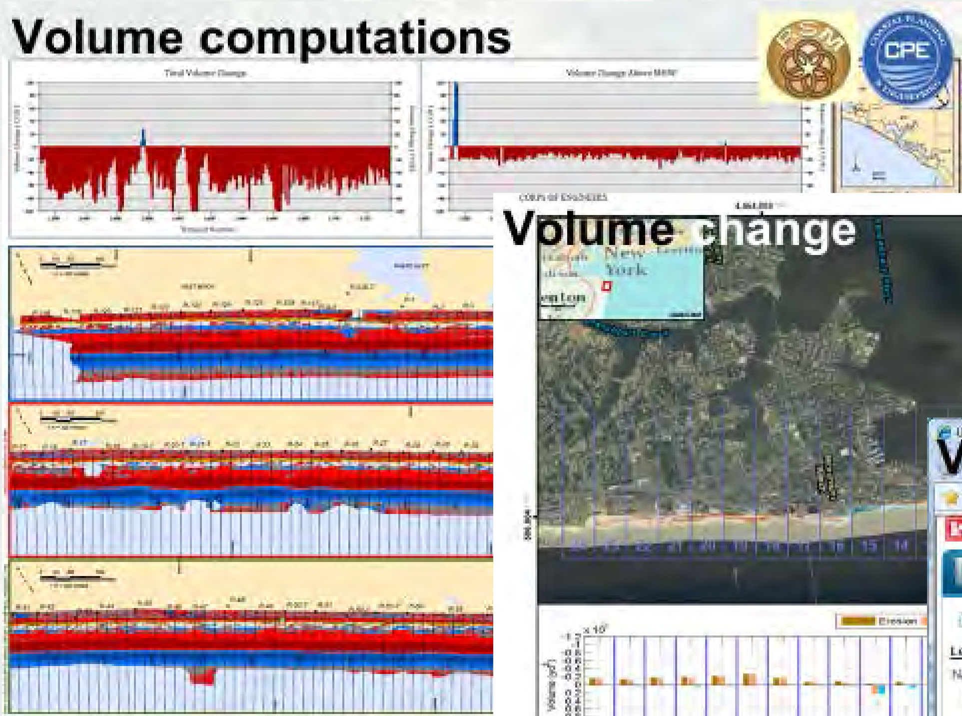
- Beach width provides buffer before the dune as well as recreational benefits
  - Defined as the distance between the zero contour and the dune toe
  - Active portion of the beach
- Contour change rate
  - Used to determine hot spots of erosion and cumulative change can identify extent of inlet influence

1) What shoreline is most meaningful to you?

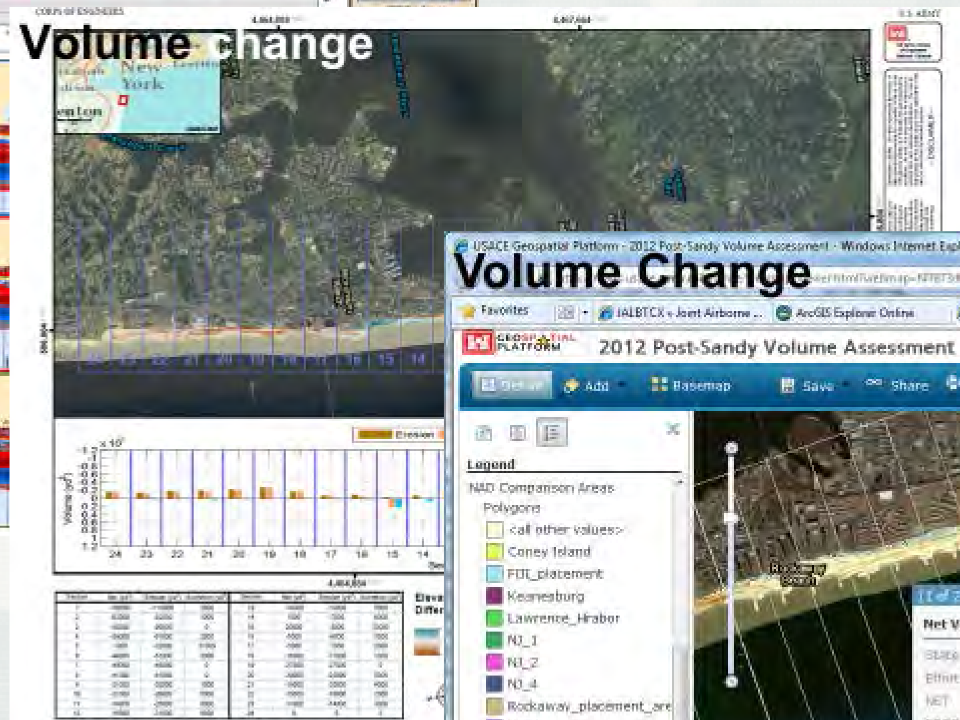


Joi

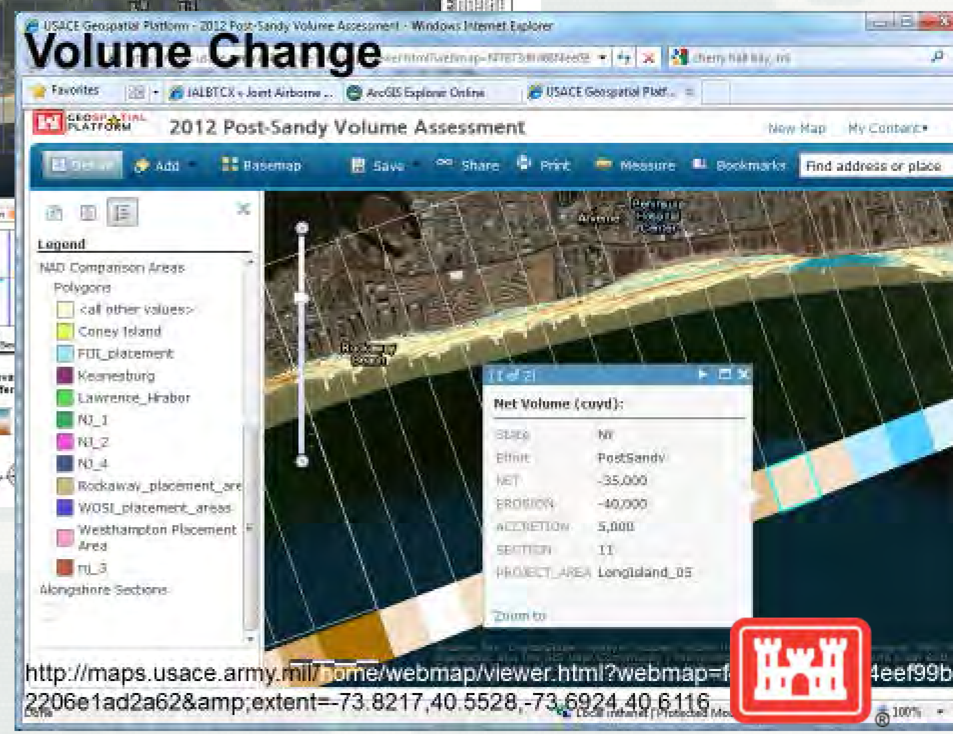
Volumes



2012 pilot project



2012 emergency operations



2013 web services

Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
ME	10/19/2005	6/19/2010	62	633	(0.4)	13.5	0.7	0.6
NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

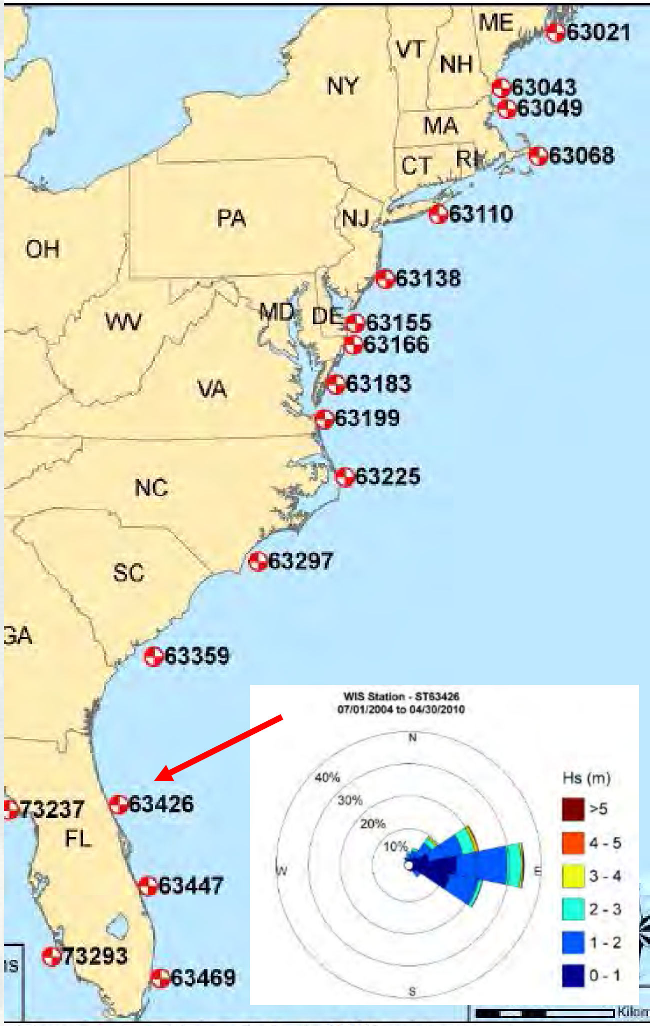


Figure 5. Locations of selected WIS stations.

Volumes

Table 6. Condensed Results by State

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Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

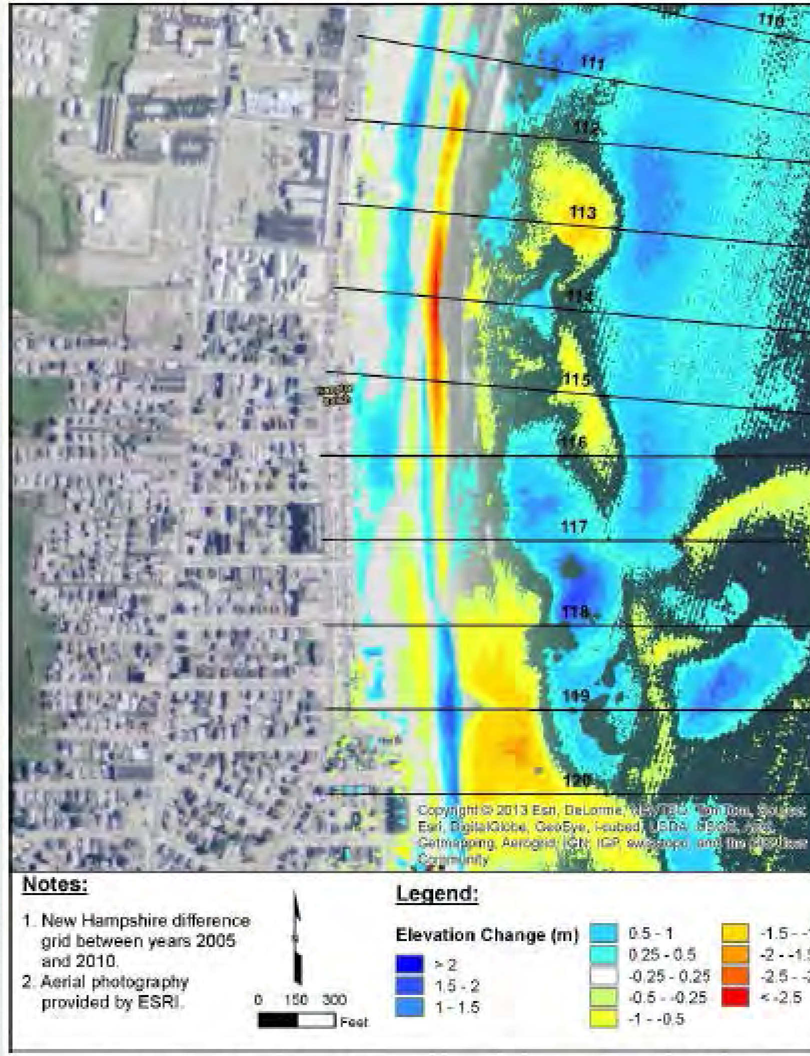
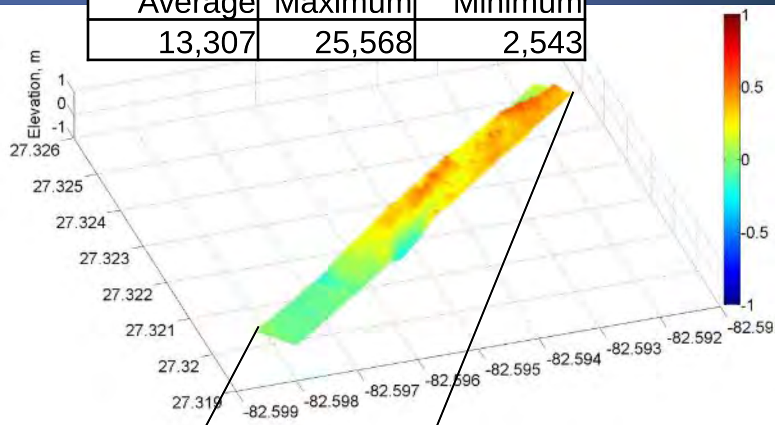
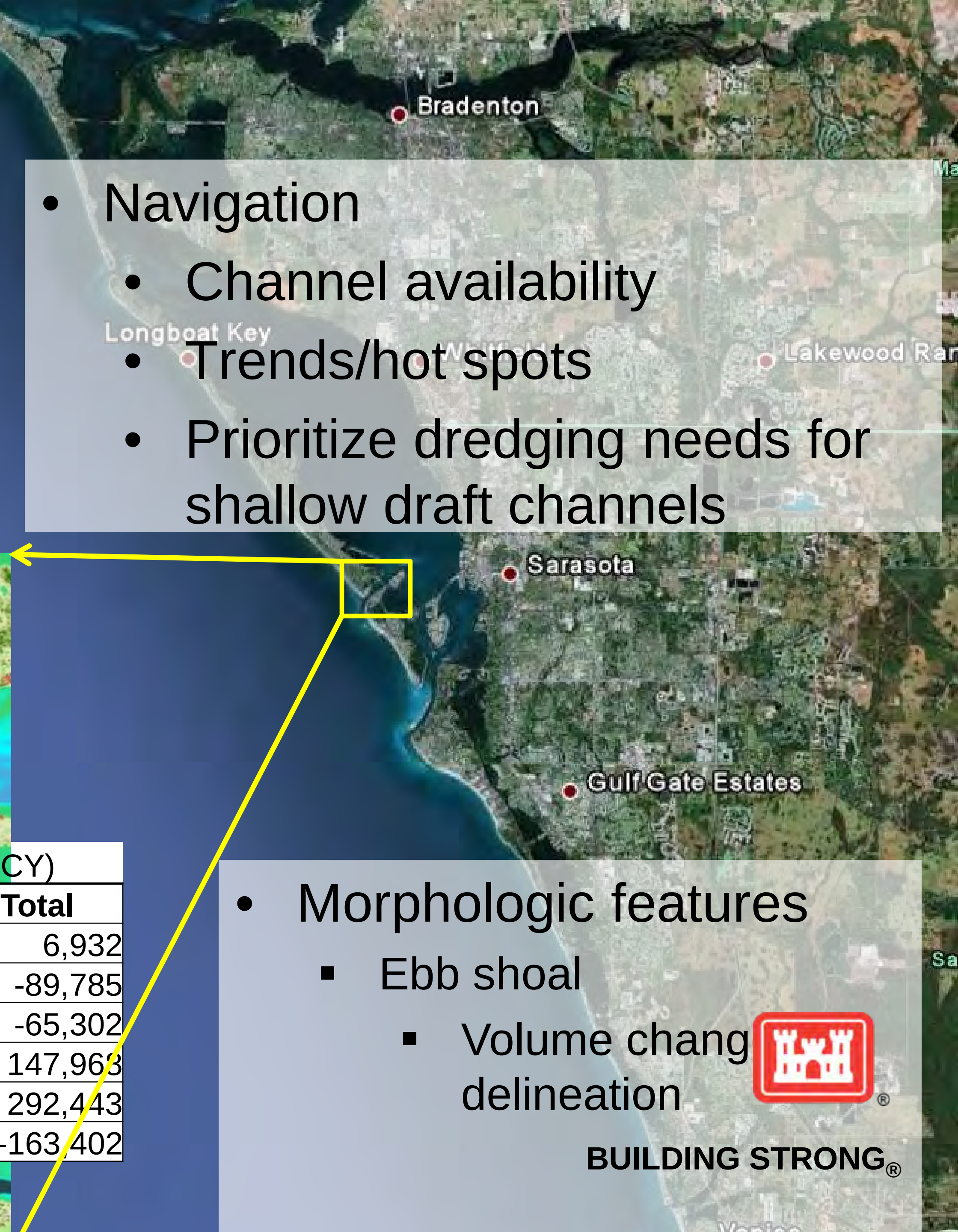


Figure 8. Elevation change near Hampton Beach, NH.

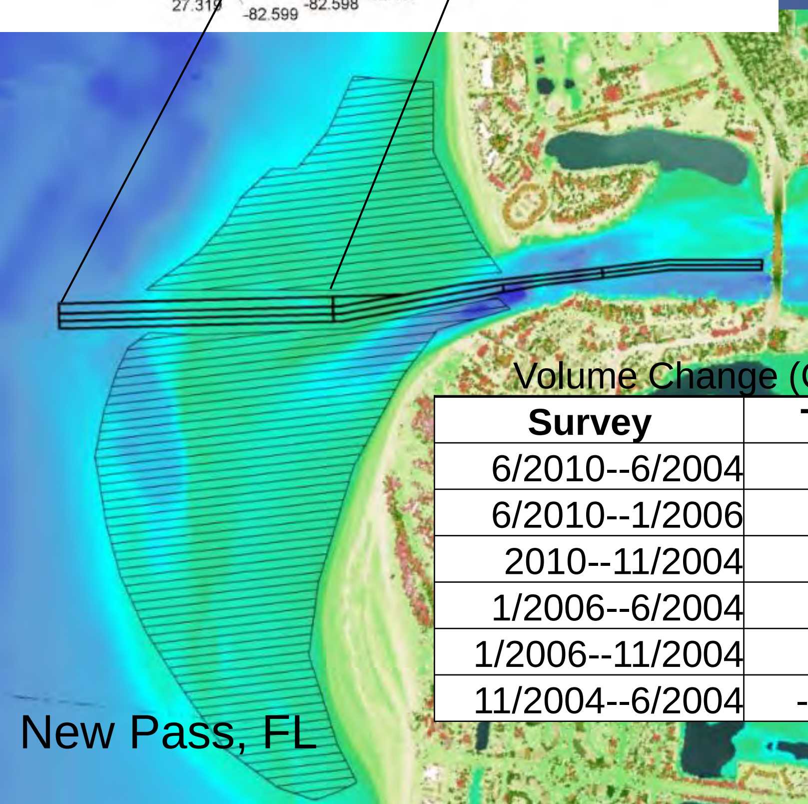
Inlets

Channel Volume CY/yr		
Average	Maximum	Minimum
13,307	25,568	2,543





- Navigation
  - Channel availability
  - Trends/hot spots
  - Prioritize dredging needs for shallow draft channels



Volume Change (CY)

Survey	Total
6/2010--6/2004	6,932
6/2010--1/2006	-89,785
2010--11/2004	-65,302
1/2006--6/2004	147,963
1/2006--11/2004	292,443
11/2004--6/2004	-163,402

New Pass, FL

- Morphologic features
  - Ebb shoal
    - Volume change delineation

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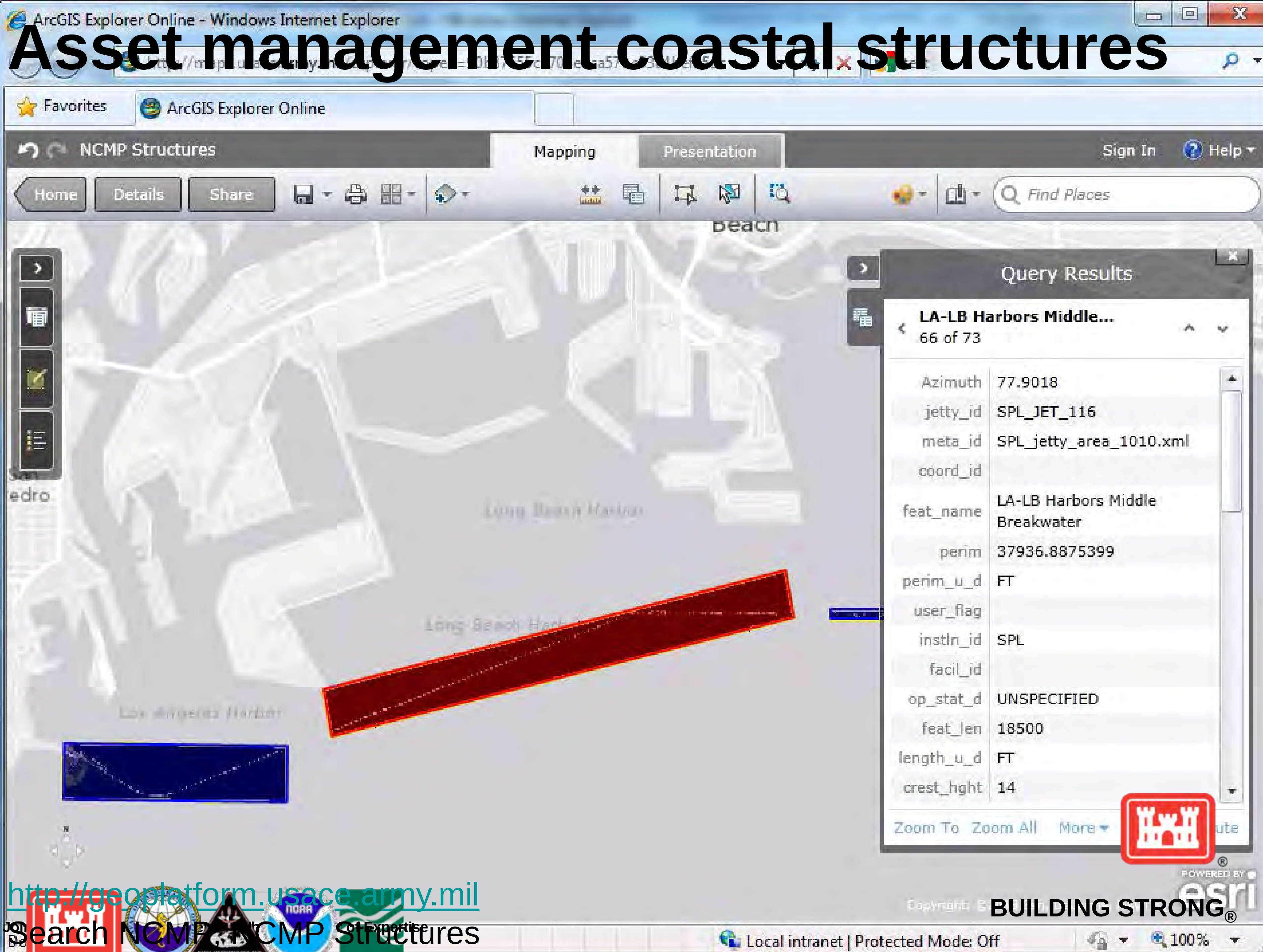
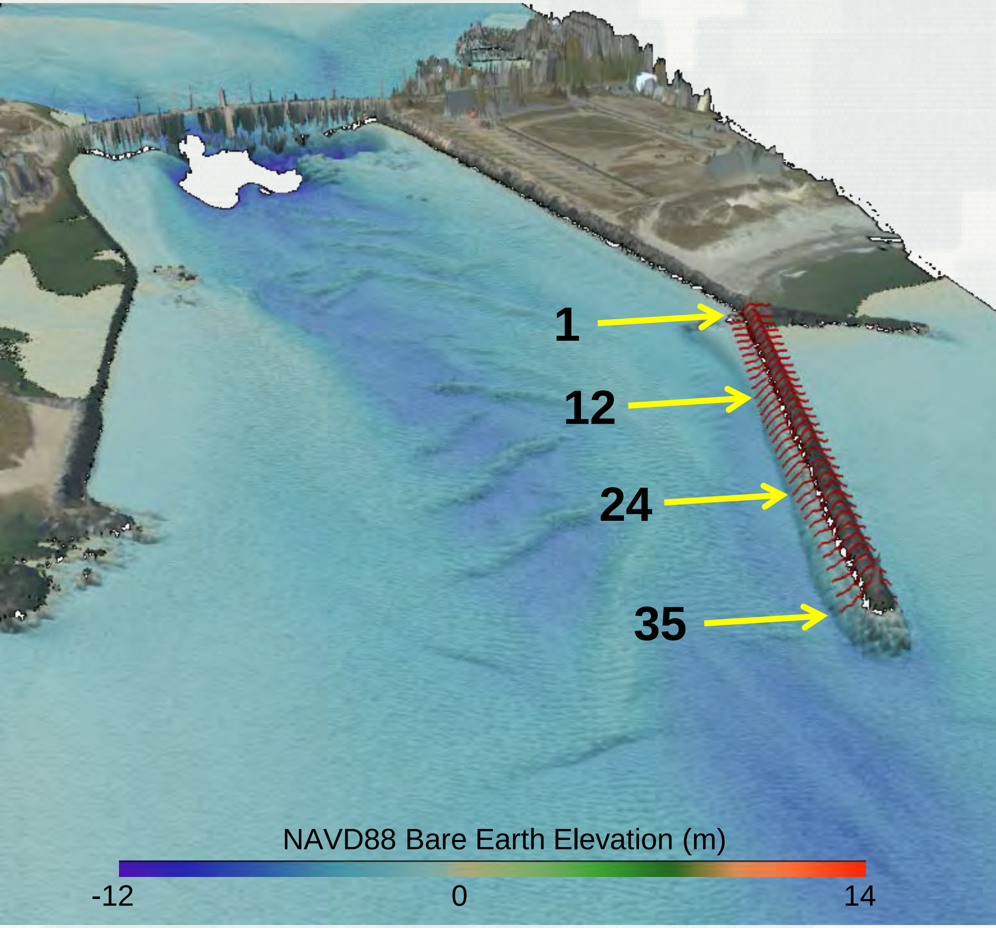
Asset management coastal structures

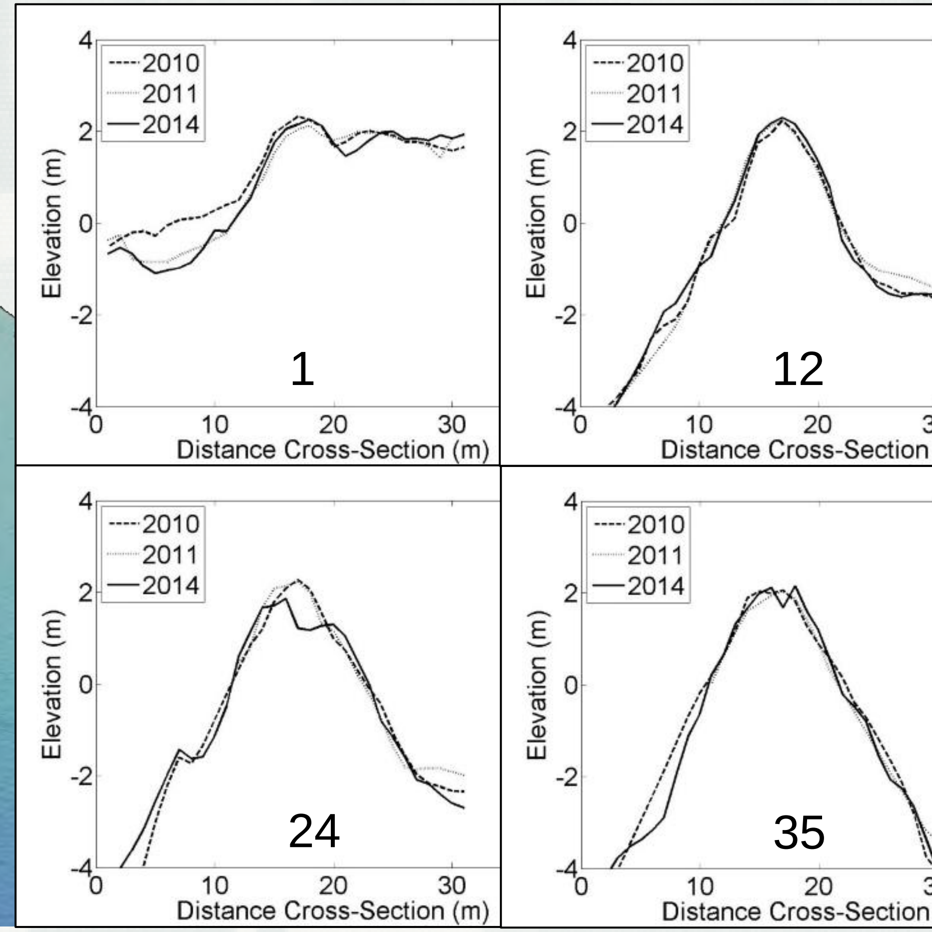


http://geoplatform.usace.army.mil

Search NCMP - NCMP Structures

Asset management coastal structures



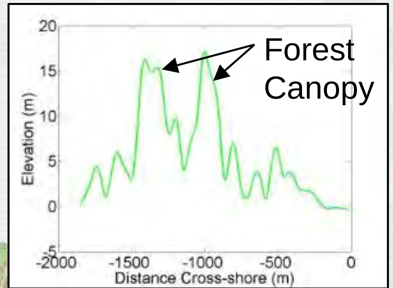


Hampton Harbor, NH, 2014

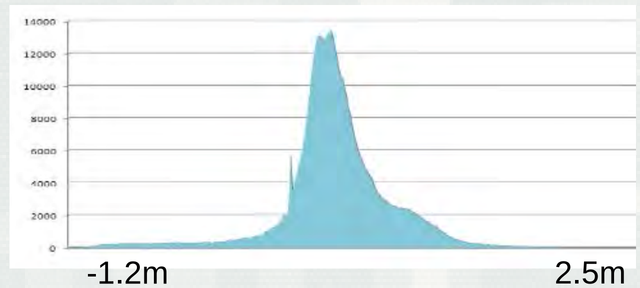
1) What are the meaningful structure parameters? Ex. Side slopes, rock size

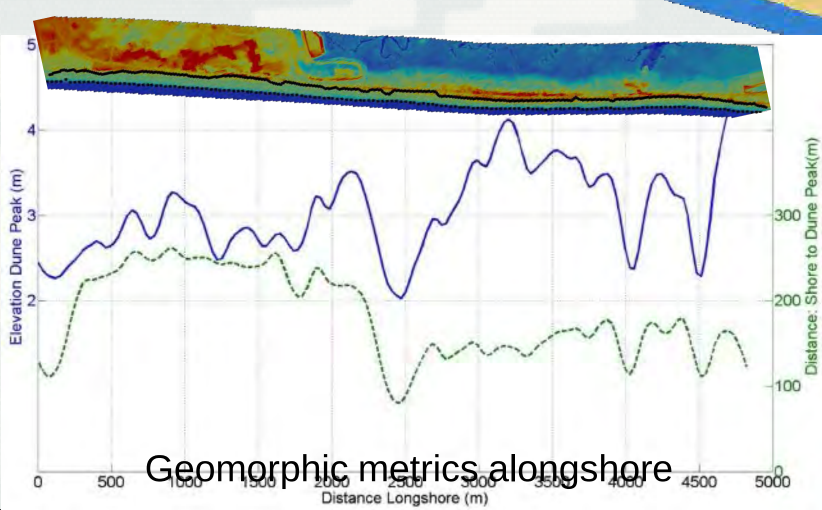
Coastal land cover classification

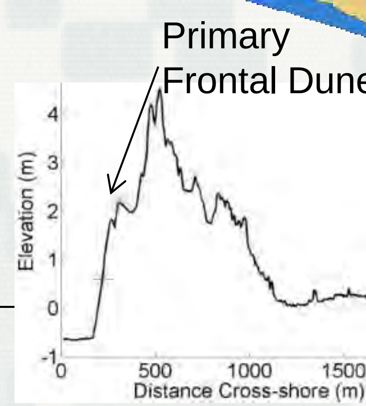
Landcover type	Manning n Value
bare/open	0.04
buildings/structures	0.07
grass/lawn	0.034
marsh	0.04
road/impervious	0.012
sand/beach	0.04
shrub	0.05
trees/forested	0.12
water	0.02



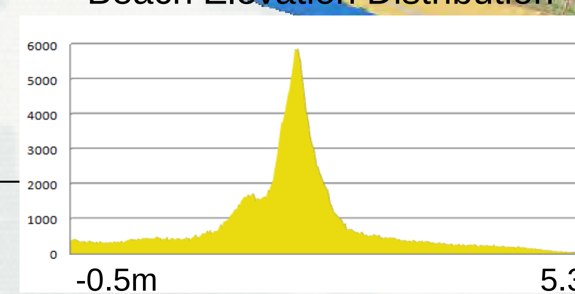
Marsh Elevation Distribution





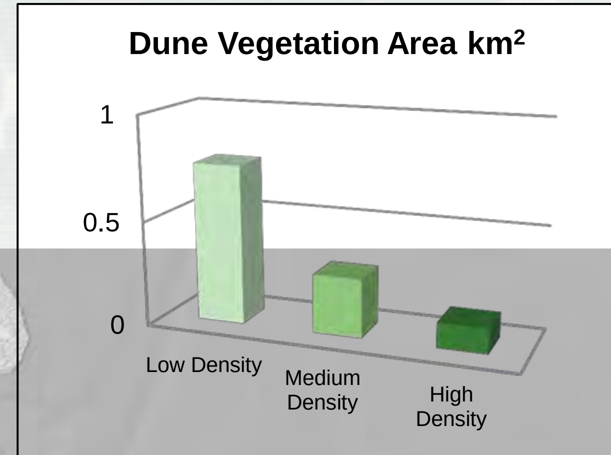


Beach Elevation Distribution

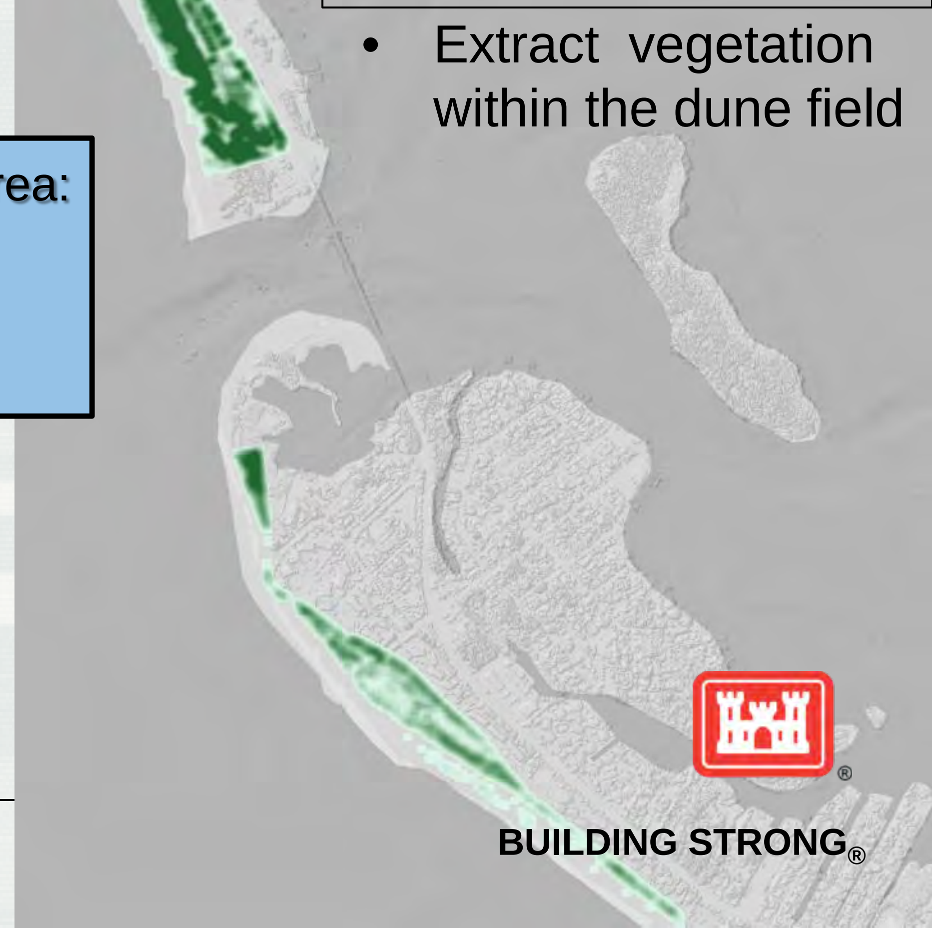


Dune Vegetation Density

- Helps stabilize dunes and reduces erosion by trapping sand
- Provide habitat for critical species, including TE species



- Extract vegetation within the dune field

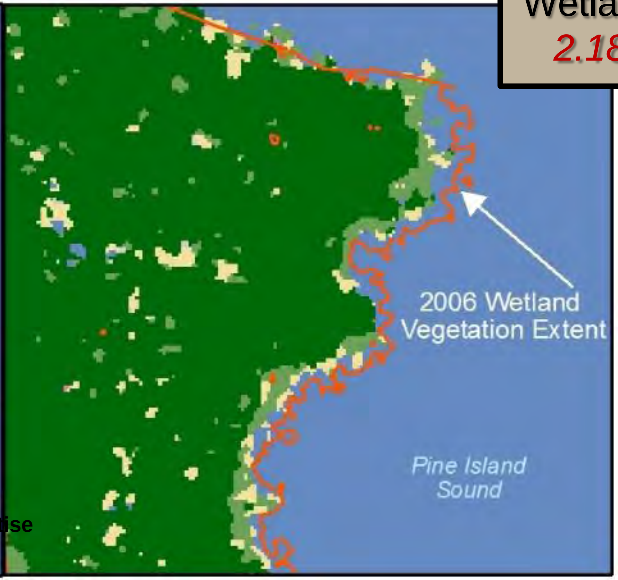


Dune Vegetation Density Area:
Low: *0.75km²*
Medium: *0.28km²*
High: *0.12km²*

Wetland Density

- Protects and mitigates damage to wetlands through regulatory action dictated by the CWA
- Provide a variety of important functions:
  - Food chain production
  - Habitat/Nesting/Spawning
  - Protection from wave action/erosion
  - Storage of flood/storm waters
  - Natural water recharge and filtration

Critical Habitat Summary:
Mangrove and Forested Wetland Area:
2.18km²

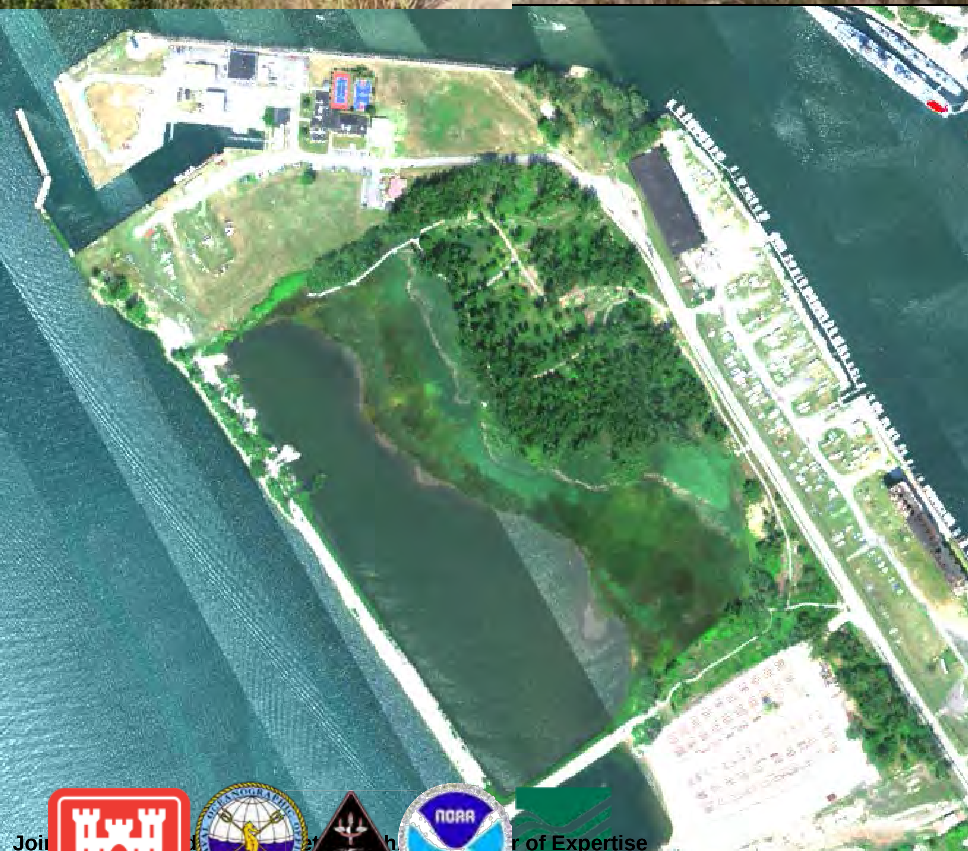


- Extract wetland class from the coastal land cover classification

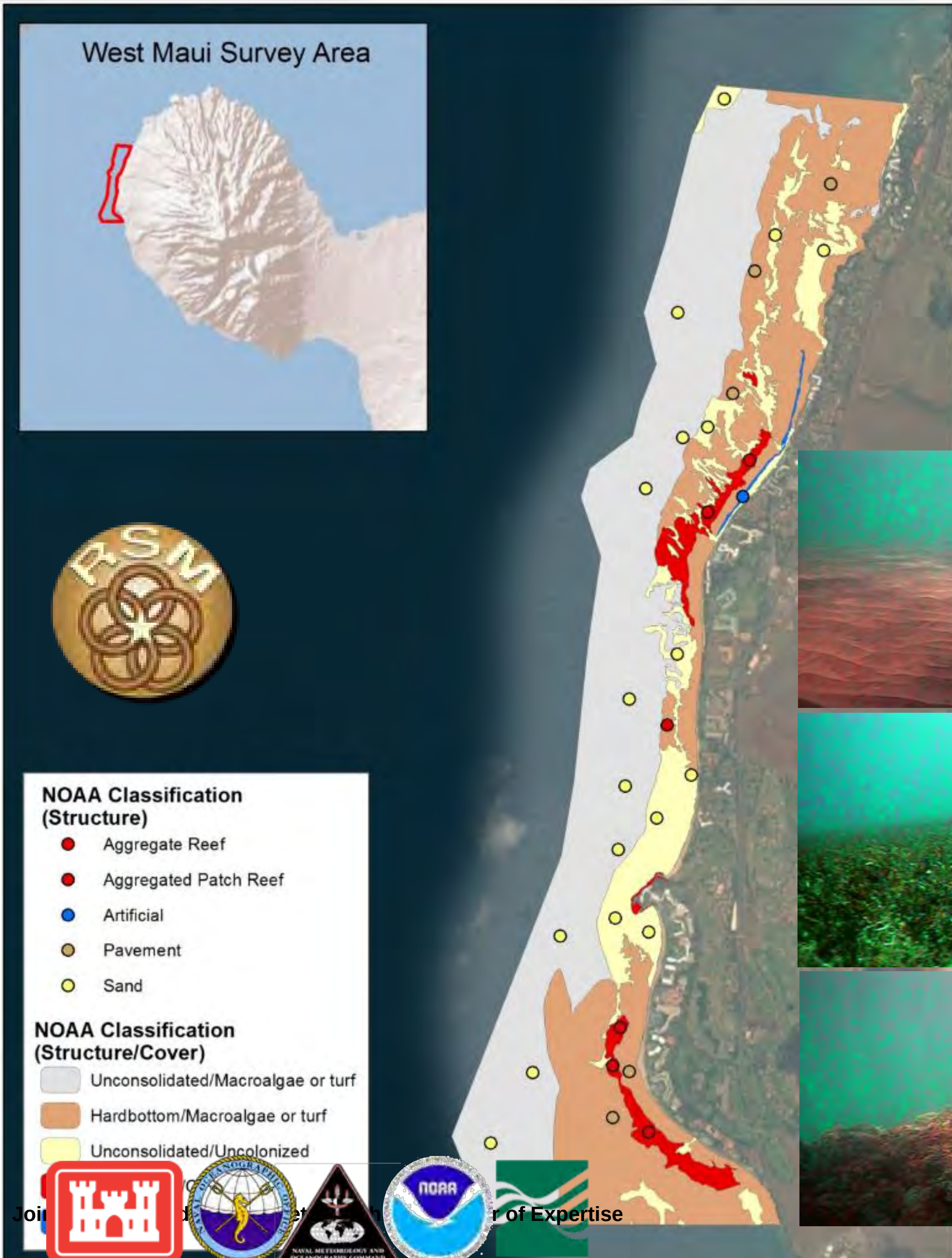
Invasive species detection


Times Beach, Buffalo NY, 2007

Emergent marsh dominated by *phragmites*




Benthic Habitat Mapping – West Maui, HI

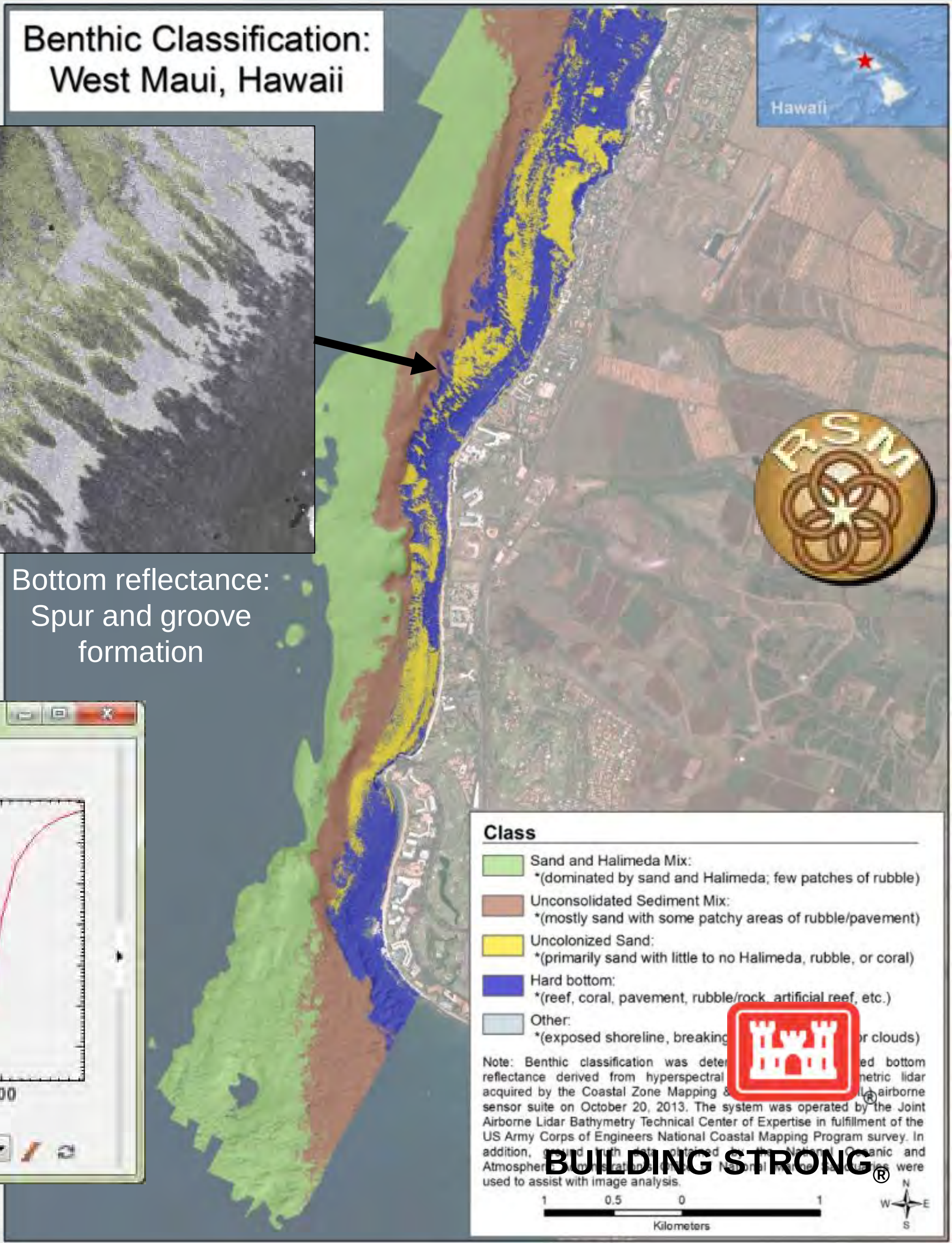


Develop enhanced seafloor data products to assist with identification of hard bottoms (e.g. corals) and sand fields in support of RSM and dredge material management

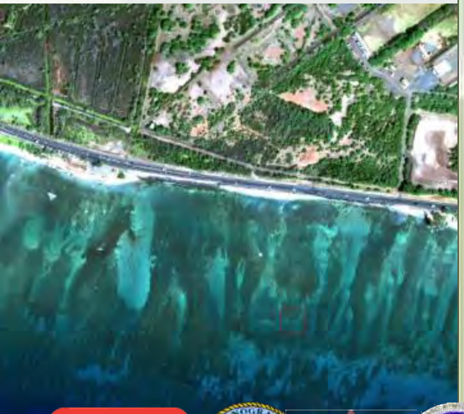
- Explore remote sensing methods using hyperspectral imagery and lidar to identify bottom types
- Coordinate with NOAA's Office of National Marine Sanctuaries for ground truth data (drop camera images and spreadsheet of habitat types)

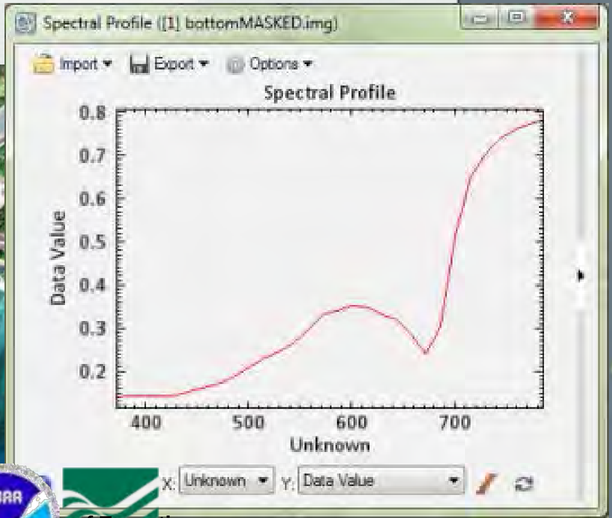
Benthic Habitat Mapping – West Maui, HI

- Estimate bottom reflectance from hyperspectral imagery and depth
- Apply NOAA's ground truth data to create regions of interest in a supervised classification approach to identify major bottom types

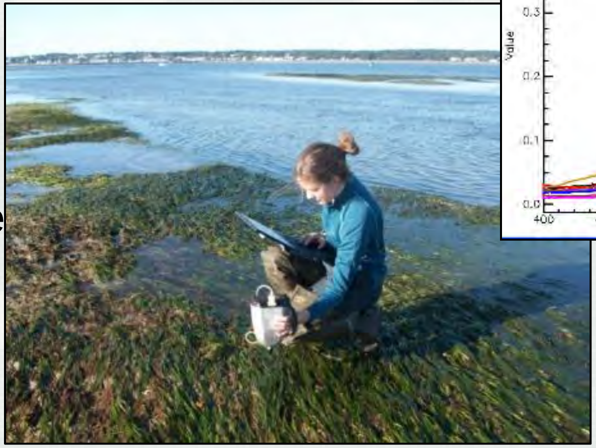


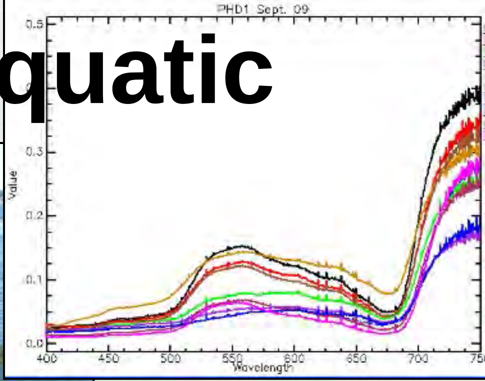
Bottom reflectance: Spur and groove formation





Discrimination of submerged aquatic vegetation species

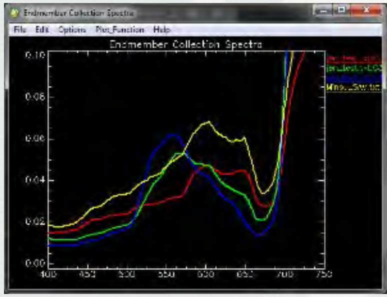




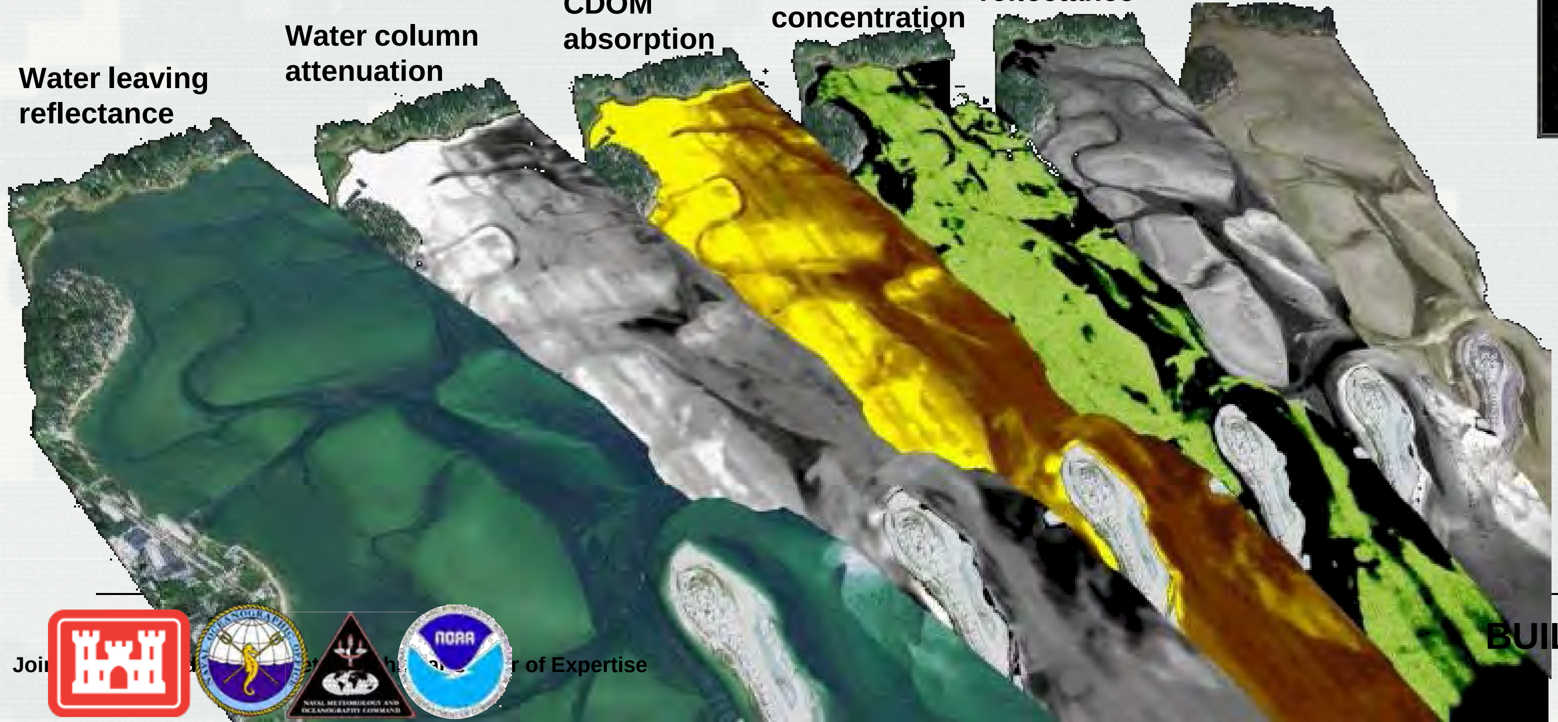
Submersed Eelgrass spectra, Plymouth Harbor, MA

Background: Dredging impacts to SAV vary by species; CWA lists SAV as a Special Aquatic Site
Mapping species is important for:

- Planning dredging operations
- Mitigating ecological damage
- Monitoring SAV



Seagrass



Questions?

1) *What areas are of highest importance?*
2) *What accuracy level can be accepted?*
3) *What is the best time of year?*
   - *Weather*
   - *Water Clarity*
   - *Ice/Snow Cover*
   - *Vegetation State*
   - *Solar Angle and Availability*
4) *Which vertical datum is required?*
   - *Ellipsoid*
   - *Orthometric (12A, scientific model, experimental model)*
   - *Tidal*
   - *NOAA can assist*
5) *Logistics (Lodging, airfields, fuel, etc.)*

Puerto Rico North Shore, January 2016

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