IV. BREAKOUT GROUP DISCUSSION DIGEST

CONTENTS

1. DISTRIBUTED QUESTION LIST

- Map Once, Use Many Times -

2018 IWG-OCM Alaska Coastal Mapping Summit

2018 Alaska Coastal Mapping Summit Breakout Session Questions

- Participants are encouraged to review the topics below prior to the Summit.
- Each breakout group will be assigned a dedicated lead that is responsible for documenting the ideas, perspectives, and discussion of the group.
- The provided questions are just intended to seed dialog, so please do not feel compelled to answer every question; pick a few that capture the interest and expertise of your particular breakout group or pose new questions of your own.

ShoreZone Photo: North of Cape Sabine, Chukchi Sea, North Slope.

Discussion Session I: "Stories that Speak"

The value of coastal geospatial data in Alaska

1. When it comes to coastal mapping in Alaska, where have we been successful and where have we run into barriers? How can we put numbers to these successes and failures?
2. What are examples of how coastal geospatial data (bathymetry, topography, imagery, or other derivative map products) have been or are being used in Alaska?
3. What end products or projects have been created or enhanced as a result of these data? (example: engineered structures, vulnerability mapping, etc.)?
4. Where does a lack of existing geospatial data cost money or cause harm to residents, government, industry, or other users?
5. Are there known examples of projects with timelines that have been significantly slowed for lack of coastal geospatial data?
6. Are there any metrics that could be used to better quantify the benefits of baseline geospatial data in Alaska's coastal areas? (one example could be the cost per day of a grounded barge)
7. What types of strategies might we employ to best communicate the value, opportunities, and/or some of the barriers associated with coastal mapping in Alaska to a national audience?

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Session II: Technologies & Specifications

Opportunities by technology category, test beds, and technology-neutral data specifications

1. What data or data quality specifications are most important to you and why? What specifications could be relaxed and still meet the data requirements of your industry/agency? How much does this vary by location (provide examples)?
2. What types of locations are the top priority for geospatial data with high resolution, absolute an/or relative positional accuracies? Are these priorities the same for topobathy data as they are for imagery? Include specific examples.
3. How important is it to have tide coordinated data?
4. What are desired refresh rates for various types of coastal geospatial data?
5. What environments or coastal conditions are unique to Alaska and what locations would be good candidates for testing new/emerging technologies?
6. Can we, as a group, make a list of representative test locations for Alaska environments?
7. What is needed to make crowd-sourced data more useable in the development of derivative products, and how can we ensure that crowd-sourced data are mutually beneficial?
8. Are there any specific national standards or specifications that pose a barrier to cost-effective geospatial data collection in the Alaska region?

Session III: Coordination & Collaboration

Strategies for working together

1. What are some success stories of past geospatial data collaborations in Alaska? What worked well and what did not?
2. What role should coastal mapping priorities play in guiding Alaska Geospatial Council and Alaska Mapping Executive Committee priorities over the next decade?
3. How can we better connect entities with overlapping/adjacent project locations or objectives?
4. How can we encourage/enable private industry to collect data of opportunity?
5. How can we encourage coordination with non-mapping projects that may be able to contribute value-added support such as ground control or tidal observations?
6. How can we work more effectively with university research/projects to foster products and deliverables that are of direct use to stakeholders or can be incorporated into non-research projects?
7. In what ways can Alaska leverage coastal mapping efforts (past or present) in other geographies (e.g. California Seafloor Mapping Program or Florida Coastal Mapping)?
8. What do you see as important next steps for the development of an Alaska coastal mapping roadmap? What types of content need to be included in a strategy document to outline next steps for transitioning today's dialog into action?

2. STORIES THAT SPEAK HIGHLIGHTS

A. INTRODUCTION BY JACQUELYN OVERBECK

Hello everyone, I'm here to introduce the next topic for discussion, and I'd like to do that by explaining a story that has spoken to me throughout my career, and has given me the feedback I've needed in order to continue doing my job and even feel good about doing that job. Within the DGGS Coastal Hazards Program, one of our primary objectives is to provide coastal residents of the state of Alaska with the tools they need to be prepared for flooding from coastal storms. This last storm season was very active, with 7 storms that DGGS was able to help respond to. Unfortunately, with reductions in sea ice during the storm season, the impacts of these storms are expected to increase. So today, I want to share a story with you that speaks to the need for baseline coastal mapping with very real and impactful results. A story that, although it only represents one community among many, sheds light on the state of weather forecasting and community response to coastal storms. A story that shows what progress in coastal mapping can do for individuals.

DGGS maintains relationships with local individuals throughout the state, but by far the most productive relationship has been with the Chinik Eskimo Community in Golovin, Alaska. Through the years we've worked together in preparing for, responding to, and measuring the impacts of coastal storms on this small western Alaska community. Golovin is located on a low-lying sand spit on the northern end of Norton Sound. They regularly experience coastal flooding, and in 2011 shared photos of flooding at the base of many homes, with people canoeing down the streets to get from place to another. During the 2011 flood, weather forecasters and emergency responders had no idea in advance what the impacts of the storm would be. They just knew it would be big.

Since then, storms have continued to impact Golovin, but coastal mapping has been conducted at the community to connect the forecasted storm water levels onto a local digital elevation model. The community has responded by building a temporary storm berm to protect low lying areas of the spit every time a storm is forecasted. So, when they get a forecast, they also get a map showing the potential elevations at which flooding could reach. The tribe then determines whether the storm berm should be built or not and works with the city and corporation to extract the gravel resources needed to build the berm. Over the last few years, they have even been able to provide feedback on how well the storm was forecasted. Allowing DGGS to catalog the resulting impacts of storms, and use that information to improve future forecasts. Residents of Golovin, working with DGGS have created a full circle communication loop which is so difficult to maintain in western Alaska. But is so important if the coastal mapping that is conducted in the state is truly going to benefit those who need it.

So today, I want to challenge you to think of your own stories that speak. Look at the questions that have been provided for this session to start thinking along these lines. But I can almost guarantee you that most people don't want to hear about vertical datums or the ground sample distance of your digital elevation model. They want to know what that data means in a real-life situation, and as group we have the opportunity to document these stories so that they

can benefit coastal mapping for the state. So, take this time to discuss and like the earlier session, we will report back the highlights of the group discussion.

B. SUCCESSES

Success is defined as productive collaborations, the acquisition of needed data, the access of that data so that it informs locals and all planners understanding of risks, and leads to actions that reduce risk.

- Bathymetric data acquisition in Southeast Alaska has been successful. Factors leading to this include relative accessibility of the areas, tourism as a driver, the nature of the steep and deep bathymetry that leads to more efficient mapping by multibeam, and relatively clearer waters that allow for bathymetric lidar data collection.
- The Statewide Digital Mapping Initiative (SDMI) is also a great example of widespread elevation data acquisition with a variety of funding sources and data collection over a number of years.
- The 3DEP program in general is a great success in Alaska, as we have been getting projects every year. This success can be attributed to the matching funds of the program and quality work of the local program coordinator, Brian Wright.
    - Second half of Prince of Wales Island will be mapped under this program this year.
    - North Slope Borough is seeking a USGS BAA award this year for Lidar mapping
    - Yukon-Kuskokwim area lidar data collection in 2016 was a great example of coordination of multiple partners to fund a large swath collection along the coast. This data collection was funded by a consortium of agencies and matched by the USGS 3DEP program. The complexity and remoteness of the area required adjustments of the standard QL2 requirements for field data to make the project feasible yet still retain the QL2 accuracy.
        - The adjustment of the checkpoint specification from “regular” to “reasonable” spacing enabled checkpoints to be distributed in accessible areas rather than a rigid grid pattern, thus, eliminating the need for massive amounts of helicopter charter time and special access permitting. This change is estimated to have saved the project well over six figures in budget, and also significantly increased the feasibility of project completion in a single season. Furthermore, special access permitting for regular grid spacing would have likely delayed the project a season.
        - These data are being used for multiple applications, including change studies, resource management, planning trails and to assist the potential move of the community of Newtok to its new location to Mertarvik.
        - The lidar data collection was funded by the USFWS National Wildlife Refuges Program, the Western Alaska Landscape Conservation Cooperative, AKDNR - Division of Geological & Geophysical Services, Natural Resource Conservation Service, Federal Emergency Management Agency and the Alaska Ocean Observing System (who sent money to DNR

to help fund the work). The funding from all of the previous partners was matched by the USGS's 3DEP program. NOAA contributed in-kind services and was integral in developing the funding proposal and providing the specifications to USGS.

- Lidar data has already been utilized near Emmonak for a soon to be published shoreline change study
- Lidar data over Hooper Bay was compared to photogrammetric DSMs acquired in 2015 in poster published by the AGU in 2017.
- The Alaska Native Tribal Health Consortium and the Denali Commission were early users of the data to help assist Newtok on its move to Mertarvik.
- This project was conducted through a USGS contract with Woolpert, Inc and Kodiak Mapping with regional partners (FWS, Western AK LCC, NRCS, FEMA, AKDNR) represented through the Western Alaska LCC.
- The data are publicly available through the DGGS Elevation Data Portal and will also be available on the USGS site soon.

- ShoreZone is an example of a successful program given its tie-in to the Cook Inlet Response Tool (CIRT) (http://portal.aoos.org/cirt). It gives access to daylight, low-tide imagery and allows responders to know what to expect in advance of a response and also provides a snapshot of space in time before a spill. The Kulluk incident was an example where ShoreZone data was used to provide a safe location where the drill rig could be towed to wait out the storm. Additionally, the images generated from the project improves awareness of coastal areas as they tour the state – this allows people to gain appreciation for a place they may not otherwise have access to or be aware of.
    - ShoreZone has been effective in passing the cup to chip away at imaging across the state. ShoreZone's goal is to provide a consistent imaging and mapping dataset for the whole state, asking partners to help meet the goal. Program has well-articulated goals and protocols (Cook et al., 2017). Since ShoreZone started an estimated $12M have gone into ShoreZone in Alaska. Annual meetings have been useful in keeping the ball rolling, but a single coverage of state is still not finished yet with central and western Aleutians yet to be completed. ShoreZone would have benefited by having a strategy from the beginning. Having an IDIQ with NOAA National Marine Fisheries Service (NMFS) was useful.
- Locally, a small project success story from the University of Alaska Anchorage (UAA) is the Point Woronzof bluff erosion study in Anchorage. The driver to this small project was actually the neighborhood community council that was concerned about the loss of public park land due to bluff erosion. The community brought the issue up to UAA, which was able to conduct the study using structure from motion.
- An innovative use of crowd sourced data was the Alaska State Department of Natural Resources study of a storm event in 2016. The DNR collected iPhone images taken by members of a coastal village during storm surge run-up. Those images were co-registered with a DEM to get the heights. This information was then compared to existing modeling to improve the database and future models. More information on this study can be found in this report: http://dggs.alaska.gov/pubs/id/29730.

Group discussion digest is a compilation of handwritten or typed notes from all groups with limited opportunity for participant review. Efforts have been made to preserve the intent of each comment, however, it is possible that some facts and context may have been misconstrued in this process.

- For the community of Shaktoolik, having the color-indexed elevation maps was hugely helpful in communicating to local individuals about flood vulnerabilities remaining after constructing a locally led flood berm. The map showed how ATV access points along the beach, were lower elevation, and provide access to flood waters from beach to Front Street. The 100 year storm, however, is still so high that individuals would not be able to see the ocean from their house anymore. Seems like an over design. How do we evaluate model results in AK, when so few models and comparative data exist?
- UAF/Alaska SeaGrant conducted coastal resiliency assessment project in Goodnews Bay. The project mapped the coastline and historical coastal erosion in the area and trained locals on how to measure coastal profiles.
    - It was challenging at first to get community support but with time, effort and engaging the community and elders (and listening to their stories), support and trust was gained to make this project successful.
    - More information on the project can be found below:
        - https://seagrant.uaf.edu/research/projects/summary.php?id=1019
        - http://annualreport.seagrant.uaf.edu/studying-erosion-with-local-students/
        - https://news.uaf.edu/two-year-project-on-coastal-resilience-wraps-up-in-goodnews-bay/
- The North Slope Borough
    - USACE will be doing a study near Barrow in the near future on coastal erosion and coastal hazards

C. EXAMPLES OF UNDER-MAPPED AREA ISSUES

- Compare the oil spill response efforts from Exxon Valdez and the Macondo Prospect Mississippi Canyon Block 252 (MC252), also known as Deepwater Horizon. There are many situational differences between to the two events, an important one to note is coastal data in the region of the oil spill. When Exxon Valdez occurred, there was very limited shoreline data available and that slowed and complicated the oil spill response.
- There is water that has not ever seen large ships before that is now opening up. These areas must be mapped for safety of navigation. One documented report is the USCG Port Access Route Study Report (https://www.regulations.gov/document?D=USCG-2014-0941-0040. Consider quantifying based on the value of the goods on the vessels, cost of salvage. Larger vessels that can carry more fuel equals more risk. What is the monetary value of cargo at risk?
- The United States Coast Guard Absent from Bristol Bay
    - Bristol Bay is one of Alaska's iconic fishing grounds, with millions of salmon harvested every year. However, this area is not patrolled regularly by the United State Coast Guard (USCG) due to a complex mix of challenges including the quality of current hydrographic data and charting information. The USCG is concerned about the

safety of mariners operating in the area, and the congestion caused by a highly competitive seasonal fishery. The current availability of soundings, tides and currents, and charting information increases the risk of operating USCG vessels in Bristol Bay, limiting their capability to establish an enforcement presence and ensure the safety of all vessels operating in the area.

- From the engineering perspective, rural Alaska projects (structural), depend on local hazard mitigation plans to plan/site new/updated infrastructure. For one particular case, the FEMA's Local Hazard Mitigation Plan (LHMP) stated that past erosion was imminent to the current water source. If the infrastructure is rebuilt at its current location, it won't be viable in the next 20-40 years, however, they would have to totally rebuild and site the infrastructure (including groundwater well) to avoid erosion. This decision is, however, based on information provided in the LHMP, which does not map out erosion at the site, or give information on other sites that might be more suitable for that infrastructure.
    - Currently, Alaska Coastal Hazards program is under contract with FEMA to perform coastal erosion mapping for communities along the coast from Wales to Platinum, and combine with existing datasets to show localized rates of erosion at individual communities.
- Old mapping on the North Slope is based on topographic quads from 1950s gets reused & recycled in things like critical habitat mapping. Decisions are being made on data that are no longer valid. This also translates to administrative boundaries which are no longer valid. This creates administrative risk and redundancy in not knowing where MHW line is. Shoreline vectors need to be maintained for permitting as well, however much of this data is nonexistent or out of date. For example, Section 10/404 wetland permitting for USACE dredging is relevant to many coastal areas. Additionally, if you have an emergency, how can you rapidly and reliably define the USCG-EPA jurisdiction line for response activities? Example Alaska Clean Seas procedures.
- As of January 2018, NOAA's Continually Updated Shoreline Product (CUSP) vector in Alaska is at 39.76% with an average age of 11.4 years old.
- The Cape Lisburne airstrip is known to completely flood. JOA surveys was involved in the response to re-establish airport survey control after a flood. The flood event completely covered the airstrip.
- Land area around the Kuskokwim River is extremely flat. During a spring tide water flooded all around tide stations while crews was working/camping out. Crews were establishing temporary tide stations for NOAA charting project of the Kuskokwim River. How much land floods because it is so low lying?
    - The Yukon-Kuskokwim Delta area is extremely flat and subject to flooding during coastal storms and high tides. While completing a NOAA hydrographic survey of the Kuskokwim River, spring tides inundated temporary tide stations while survey crew were working and camping on-site. The inundation made for hazardous work conditions and required specialized equipment and planning for continued operation. See figure below.

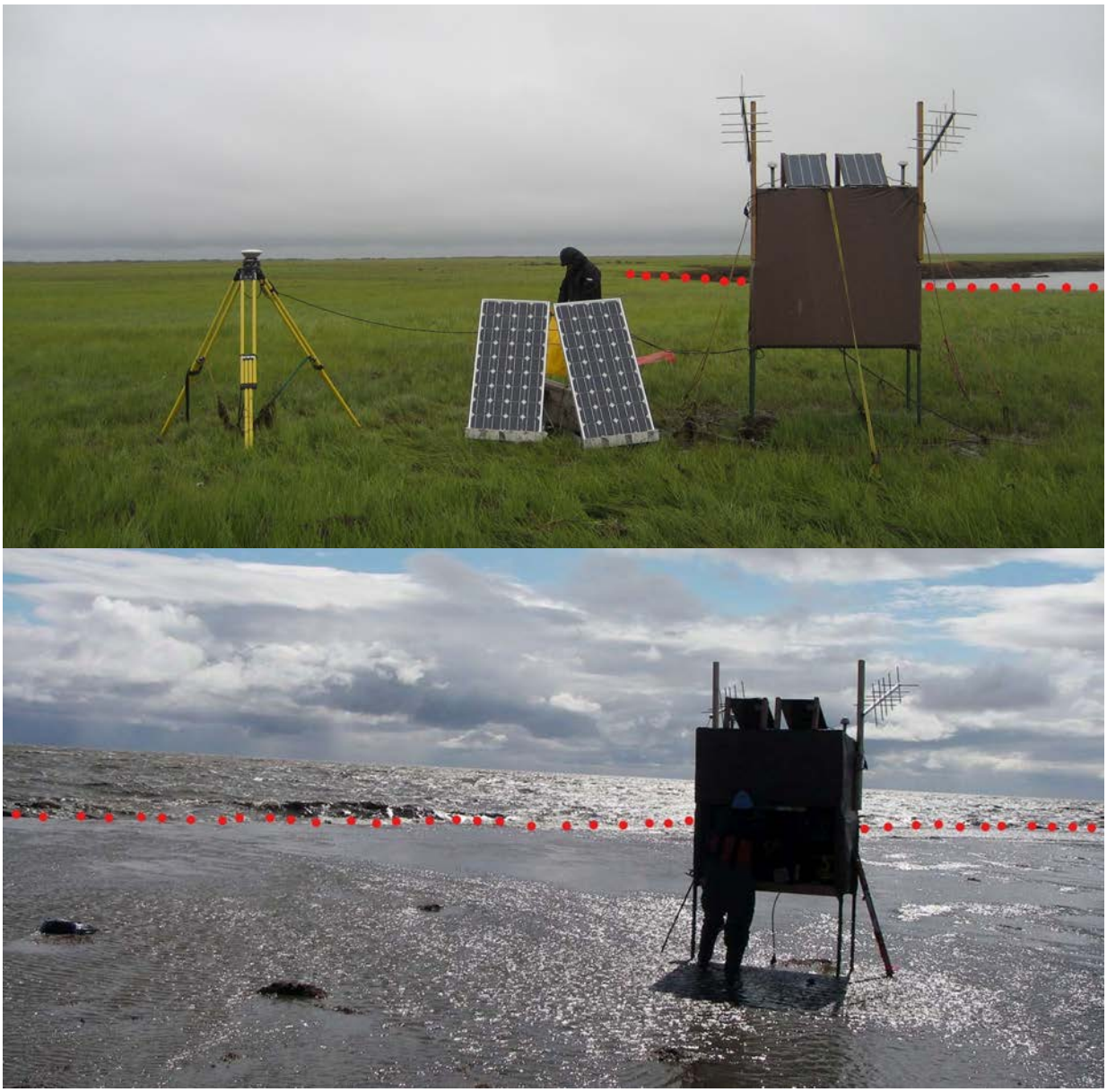

Figure 15: Popokamute tide station shack, photos taken approximately one month apart from different angles. Red dots indicate the bluff edge. Top photo was taken in July of 2011, courtesy of TerraSond Limited. Bottom photo was taken in June of 2011.

- The Alaska Coastal Hazards Program contracted the collection of photogrammetrically derived elevation models in this region, which show relative land elevations. There aren't, however, enough tidal datum conversions in the region to convert modelled water levels onto the land elevations. The Alaska Coastal Hazards Program established a flood monitoring staff at Kwigillingok, Alaska, near Kuskokwim Bay in 2017 and have recorded 2 storms so far by collaborating with the Native Village of Kwigillingok.

- The village of Newtok has a good example the cost of no bathymetry data. A large landing area was built in too shallow area. More money was needed to build second, deeper landing area. Bathymetry was acquired prior to building the second landing area.
- Lack of baseline data, particularly the lack of geotechnical information, prolonged the Shishmaref Relocation Site Feasibility Study. Three relocation sites were being considered. Study link can be found here: https://www.commerce.alaska.gov/web/Portals/4/pub/Shishmaref_Site_Selection_Feasibility_Study_FINAL_022316.pdf
- North Slope villages/communities must take into account eroding coastline, tundra subsidence and other environmental factors into account for developing infrastructure, moving homes and people out of hazardous situations, and for long term community planning. More frequent mapping is needed in these areas.
- What is the cost of moving a village? Often, the two reports below get cited for cost estimates, but there are several issues with using these values.
    - United States Government Accountability Office, Report to Congressional Requesters, Alaska Native Villages, Limited Progress Has Been Made on Relocating Villages Threatened by Flooding and Erosion: June 2009 - https://www.gao.gov/new.items/d09551.pdf
    - U.S. Army Corps of Engineers, Alaska Village Erosion Technical Assistance Program: An Examination of Erosion Issues in the Communities of Bethel, Dillingham, Kaktovik, Kivalina, Newtok, Shishmaref, and Unalakleet (Alaska District: April 2006). - http://66.160.145.48/coms/cli/AVETA_Report.pdf
    - Recognized issues with using values cited in these reports:
        - These estimates are more than 11 years old.
        - An adjustment of these values to the national rate of inflation would not be accurate, as shipping and logistics costs have likely risen higher in remote Alaska than the national average
        - The assumptions made for these calculations are not well known or understood.
        - These reports don't reflect any progress, construction, mitigation projects that has been made since these reports.
- What is the true cost of moving a village? Not just monetarily but also to culture, the individuals, and archeological sites lost to erosion. Communities need data to sustain planning on a 50+ year timeframe.
- Without accurate data, communities may develop infrastructure in areas where life and property are at risk.
    - The community of Unalakleet has experienced coastal erosion and selected to expand their community, by building infrastructure further inland and on higher ground. Entire residential neighborhoods and a housing facility for community elders are under development at "the Hills".

- There is a general lack of erosion vector map near communities, or risk assessment (similar to what the US has on the East Coast)
    - Include sea level rise, fault movement and horizontal & vertical control
- Western Alaska is where the most threatened communities are, but also has the most challenges, including remoteness and lack of vertical datum and control.
- Lack of continuous monitoring can have bad results. For example, earthquake and volcano monitoring in Bristol Bay. If there is no monitoring, there is not planning or warning.
- Is lidar enough for engineering planning? It's not available in most places. Engineers should conduct ground surveys for siting design.
- Slowed projects: Kivalina relocation, Liberty oil and gas hazard assessment and mitigation for coastal communities; baseline permafrost degradation info slows as well.
- Delays or inability to deliver fuel to communities (i.e. at the end of the navigation season)
- Operational costs due to groundings: time losses, vessel damage, insurance rates
- Under Mapped areas
    - General areas noted: everything north of the Aleutians, Bristol Bay, Y-K Delta
    - Between Kuskokwim and Etolin Point there are uncharted shoals, barges go around, way offshore, increases fuel costs to the communities
- One result of these navigational uncertainties is the potential impact on the developing fuel distribution model in Western Alaska. Since about 2012, companies supplying fuel to remote villages and communities in Western Alaska began the practice of lightering fuel from large tankers to barges to reduce barge transits. These lightering operations occur outside of the 3 nautical mile state waters boundary. Bathymetric mapping could help reduce the potential risk of an offshore oil spill and determine areas of higher and lower risk for lightering operations.

D. APPLIED DATA USES

Groups noted the below items as general uses for geospatial data.

- Vessel navigation: shipping/barges, fishing, tourism, local use, law enforcement (USCG)
- Infrastructure planning: docks/ports, barge docking, water treatment plants, sewage lagoons/water treatment areas, landfills
- Hazard mapping/mitigation locations
    - Tundra subsidence/permafrost thaw
    - Flood Hazards
        - Tsunami maps/modeling
        - Flood inundation maps

        - Flood insurance map rates
    - Infrastructure damage
    - Erosion Hazards
        - Shoreline change maps
- Emergency response
    - Oil spills
    - Search and rescue
- Environmental monitoring/habitat
    - Fisheries management
    - Vegetation
    - Erosion assessment
    - Change detection: riverine, storms, seasonal permafrost monitoring. There is also desire to be able to understand the relationship of land to estuaries and nutrient flux modeling to understand ocean acidification.

E. KNOWN BARRIERS

- Alaska has unique conditions: large distance between populated locations, lack of infrastructure, lack of established GPS control points, permafrost, ground temp monitoring, SAR, IR, distributed mapping, distributed communities across large areas of coast.
- Alaska is the only state that is excluded from the IWG-OCM's Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) program due to the size and remoteness of Alaska's coast. This which means limited federal funding for ongoing coastal mapping. There aren't enough people in Alaska to justify sending resources. We must pool resources. JALBTCX could have 2 platforms running, but needs funding to do so.
- Survey markers are eroding or sinking. Some have subsided multiple feet. This, along with the low density of CORS, means that surveyors must occupy benchmarks for much longer periods of time, increasing field costs even more.
- How will GEOID 2022 be updated in Alaska? How will accuracy be assessed? Will it suffer from a lack of observations in northern and western Alaska, like other models?
- No uniform coastal permitting process, every location is different and has a different process.
- State government is people limited. No longer any coastal engineers on staff at DOT&PF. Now projects must go out for contract every time. Will this increase costs since now projects must include the whole site assessment? Value of having data a priori grows.
- ShoreZone is regularly brought up as a useful tool in oil spill response, but the frequency of imagery is not keeping up with changes in the lagoon systems in places like the North

Slope. This area is very dynamic and rapid refresh rates are of high value. Other folks utilize ShoreZone for project planning. Refresh rates can affect efficiency of pre-project planning. Accurate imagery reduces extra costs by making field operations more efficient because conditions onsite are more accurately known.

- Some Native Corporations are utilizing ShoreZone images to evaluate real estate in the coastal zone. While ShoreZone is better than no data, it lacks significant details including actual elevation and erosion rates.
- ShoreZone is used by a lot of agencies, researches, by the public (e.g. kayakers). However, due to the online interface it is not always accessible to communities (hopefully changing via offline application soon).
- Hard to know if the data that is being collected and produced will actually be used by the communities or people that will need it
- Some communities are applying for grants but without baseline data they can't ask specific enough questions or demonstrate quantitative damages and the process of getting money is slowed down.
- For aerial drones, there are several non-technical limitations:
    - takeoff and landing locations are restricted from national parks and wildlife refuges
    - Some offshore Alaskan islands are part of parks and can't fly over them
- Biological permits take a long time to obtain
- On the North Slope and Western Alaska, village/community footprints are small, but separated by large areas of coastline.
- There are a lot of uncoordinated mapping activities and studies occurring near Barrow and on the North Slope by universities and oil/gas companies.
    - University studies often make data available but not always accessible or in an easy to digest fashion for community planners.
    - It is not required for data to be turned over to the state or borough. Datasets that the state has received from oil and gas companies have been few and far between.

F. STRATEGIES FOR SUCCESS

- Shoreline data is useful for response activities like oil spill cleanup- but the data need to be in a form where it is accessible and usable.
- We need to leverage Federal project funds in Alaska, where appropriate. Often, those in charge of nationwide funds are not familiar with Alaskan needs, so funds go to more familiar projects.
- Need to have a person on the ground in Alaska that reports to Office of Coastal Management on issues in the state. Office of Coastal Management is very unfamiliar with what is going on, and needs someone with a pulse on what is happening.

- Where else in the lower 48 does erosion play a key role… everywhere. Even small events, such as nor'easters travelling offshore can cause erosion of the outer banks beaches. Local city and community governments are constantly managing sand to avoid erosion and loss of tourism dollars.
- Look at Digital Coast (https://coast.noaa.gov/digitalcoast/) —stories from the field—this is how they show impact stories to funders (congress).
- Where do you get your geospatial data for engineering projects in the coastal zone? The first place to look is the AGC website. They are using all layers, and it is unfortunate when some layers aren't available, then they must collect those layers themselves.
- Disaster declarations happen almost every year from the coast of Alaska. It would make sense if the state invested in pre-storm surveys, so that when the state puts forward a disaster declaration, it has a better chance of bringing federal disaster relief dollars to the table. Local collaborators are interested in using UAS systems for post-storm documentation. Train citizen scientists, we don't need as accurate mapping for disaster situations.
- Interview community members, examples, viral video, convey struggles, impacts, hazards; put personal picture out to huge audience; most people don't realize. Also show value of culture and subsistence lifestyle
- Iditarod has brought awareness along coast. We need to leverage this more.
- Lobby mainstream media
- Focus discussions around environmental issues and impacts on people
- Make a GIS story map of these examples in "Stories that Speak" and or NY Times article
    - include images in a story map that show before and after difference in areas undergoing high rates of change to emphasize the importance of data refresh (with examples)
- Ukpeaġvik Iñupiat Corporation (UIC) has a website for distributing mapping and study information: http://barrowmapped.org/
- Michael Brady, a student from Rutgers University worked on developing web maps for the North Slope Borough community planner use and for building community involvement and understanding for coastal erosion data.
- Goal for 2018, is for the North Slope Borough to have a website for distributing GIS mapping and study information.
- Include/highlight stories of companies sharing data as examples, promote companies that share secondary data as a way of leading by example.
- Continue to break down silos of information by hosting summits like this.
- Get community involved before mapping takes place. Community consultations are often an afterthought which can affect how the data was used

- Include data access to rural communities: final data presentations, community involvement before a project takes place, line item in budget for community engagement

G. OPPORTUNITIES FOR SUCCESS

- Leverage what the parks are doing…. Partnership on the non-park sides of Park boundaries. If there is a project happening in a NP – check for partners!
    - Glacier Bay, Kenai Fjords – National Park Issues rules on how close they can get (set back distances). Passenger vessels for ecotourism. Glaciers are receding and we don't know what the seafloor is like in those areas.
- Nunivak Island southern side is wilderness. Would think we need some mapping there, USFWS land managers would have interest there too. Charting would support navigation and thereby protect wilderness land from incidents.
- Look for ways to work with ongoing research observation programs like National Science Foundation's National Ecological Observatory Network.
- Seek opportunities in coordination with Outer Continental Shelf 10-02 Area leasing as Alaska National Wildlife Refuge opening for petroleum exploration, increased shipping, ecotourism, and advances in horizontal and vertical equipment accuracy.
    - The industry has interests, but they are privately held. Are there things that could be done to work better together? Perhaps some way to start early in coordination process, like right at the start of a new lease?
    - Good project examples are cable routes: Quintillion, GCI mapping efforts for marine cable
- How can we extract more meaningful data out of ShoreZone imaging and mapping?
    - Add Structure from Motion (SfM), enhance by adding beacons, add metadata including info on cameras and equipment, lens angles, offsets, how it was mounted, flight log, for SfM 4K video minimum
    - What about ground control points?
    - Consider other derivative products
    - Refresh areas imaged and mapped farther in the past for repeat collection. Imaging technologies continue to improve and having those sections of coastline to the latest standards would ensure consistence in the overall dataset.

A. SPECIFICATIONS

- Specifications should be linked to data use and purpose, perhaps need a matrix of data applications. Ask ourselves, what is the impact of getting it wrong?
    - for permafrost change is more important to have higher vertical detail than horizontal detail
    - Fault line detection, subsidence, erosion
    - Property boundary determinations are directly linked to tidal fluctuations and how far those go upriver.
    - Infrastructure areas
    - Navigation
- For an area as large as Alaska we can relax standards to study larger area. General picture provides more bang for your buck
- Validation of data is extremely important. Specifications for lidar are based on hard surfaces. More focused on validating layer
- Communities going out bid on mapping projects often copy/paste specification from boiler plates that they don't understand and that may not be needed
    - Problem alleviated by going through NOAA or USGS contractor
- Tighter, well thought-out specifications are appreciated by contractors
    - With an understanding that the questions that need answering in some areas could be answered by something different
- Some contractors may not be familiar with what and why certain data standards are needed. Need to be able to communicate with private companies to update and make standards realistic, on a project-by-project basis. Having flexibility is a must.
- Being flexible on a project by project basis can be good but don't necessarily want to relax specifications to the point where to data isn't useful
- There are drawbacks to having specifications written that are tied to a specific technology. For instance, in some cases lidar and fodar (a type of SfM) could provide similar results at vastly different budgets. However, because projects are often written to an ASPRS specification, it is not possible to propose with the less expensive option (point density for ground control was provided as an example; as well as hydro-flattening). A technology neutral specification is something the group considered important.
- Nationally-derived standards are not always applicable to Alaska. We don't fit for a lot of reasons and we need the ability to work with those who are developing these national standards, as well as educate the enforcers of standards about unintended

consequences of the mandates. The group specifically discussed the ASPRS requirements for ground control as being inappropriate for many projects in Alaska.

- Many topographic or bathymetric surveys are geared toward the 'gold standards' of surveys rather than what is really needed
- Across Platform/Technology Shared Specification
    - Pixel size
    - Ground sample distance
    - Detection vs recognition
    - Accuracy specs
    - Vertical accuracy specs
    - Metadata
        - ISO metadata everything is optional so we're only getting name, phone, and org. Could save a lot of time and effort if metadata was robust. The problem is getting worse with drones and other ability to acquire large amounts of data. Example: DOT elevation data doesn't have any information. How can we foster and encourage good metadata practices so that less geospatial data goes to waste?
- Across Platform/Technology Specification Differences
    - Conditions on when you can collect
    - QL1 vs QL2 imagery/lidar are different
    - Satellite? Control of some sort?
    - NOAA: Formula vs. Depth
    - LIDAR - current USGS and other specifications are well written and give good guideline. It is not necessary to relax any standards <u>except</u> on a case-by case basis (like the YK Delta example)
    - Satellite imagery specifications work well although challenges exist in some areas
- Specification to relax
    - ASPRS standards for data collection are considered a suggestion, even to federal contracting agencies. Every project will need flexibility in data standards, and have similar issues in Hawaii, where regular ground control would require collecting on the side of volcanoes (not possible), private lands (not accessible), and other deltas such as Louisiana (spongy and difficult to access). So, changes are regularly made to alter ASPRS GCP standards.
    - For topo-bathymetric data, the 20% of LLW specification should be relaxed in favor of utilizing a weather window.

        - Topo-bathy - tide coordination with MLLW can be prohibitive with weather and low clouds
        - Some require slack currents
    - Keeping in mind the differences, control points shouldn't be relaxed but checkpoints could be
    - Land cover checkpoints for USGS need bare earth hard surfaces and land cover checkpoints. This will often require helicopter access.
        - Land cover checkpoints inhibit collection
            - "Reasonable" vs "regular"
            - Land cover checkpoints - add cost
            - Bare earth checkpoints - add cost
        - What to do about squishy surfaces? (tundra)
    - Technology advances have reduced the cost of meeting spec, except USGS number of checkpoints
    - 10% cloud cover not always feasible, 25-30% might be feasible
    - For Lidar, most specifications read 'no snow' and during leaf off. In Alaska, this window is typically in the spring, and is very short. Timing must be perfect to get it after the snow melts and before the trees leaves bud. (especially in spring between no snow and leaf budding)
    - Sun angle 30 or 20 degrees
    - Sometimes for SFM some shadows work better than full sun, as long as you can see in the shadows
    - Tide coordination in SE AK gets expensive due to low clouds & fog for aircraft
    - Slack currents are experienced differently for small boat vs large vessel due to draft
- Bathymetry
    - The USCG in many areas measures tides and storm surges in sub feet to measure under keel clearances to be barges into areas
        - The Port of Long Beach, CA even uses wave and swell to calculate how keep depth changes with vessel motion
    - Nome is a difficult port for larger vessels to get into
    - In Alaska, low draft barges are dependent on tides and time of year to get in
- Positioning
    - Aircraft specifications have been loosened
        - As technology advances that reduce the cost of accuracy

        - We may be able to meet specs without checkpoints
    - For Ships, Post Processing Kinematic (PPK) is good for about 20 miles
- People want the same things you can get in the lower 48 states, but Alaska doesn't have that kind of data. Since Alaskan data is different in resolution, quality, type and coverage, we can't use the same tools that are used in the rest of the states. When tools need to be redesigned or re-coded to Alaskan data it adds a large cost.
    - Example: People want sea level rise viewers for Alaska. People build them using IFSAR data and the results are not accurate, and folks must have a number of disclaimers explaining.
    - Example: Storm surge tools. Ken Woods (with the State of Alaska) is expending lots of time creating something from first principles something that exists in lower 48, but can't use it since we don't have the quality of data.
    - Example: AK's Shoreline profile tool must be built
    - Cost estimate from Surging Seas effort to change their tool to work in Alaska
    - What is the cost of difference for creating a new tool verses collecting better data?
    - Does it even make sense to apply these tools to Alaskan data?

B. TYPES OF ELEVATION DATA NEEDED

- For LIDAR, engineers typically ask for one foot contours. Other customers ask for recommendations on what needs to be done. Data companies then shows them the options based on desired data application. This process typically requires consultation. Takes more time, but makes an informed decision.
- USGS base specification document shows the difference in data levels.
- Quantum Spatial also has a power point that shows 2 vs 6 vs X point data.
- Alaska's strategic mapping plan should have something that matches typical uses to lidar standards with qualifiers on landscape types (vegetation cover). Landscape ecology plays a big part of it. It is hard to have a one size fits all.
- Some clients ask for QL1 (point density of 8 pixels per square meter) or better and ½ foot pixels. This maybe over kill for many projects. Typically, QL2 (point density of 2 pixels per square meter and the same accuracy as QL1) can be less expensive to acquire, as line spacing is wider and planes can fly higher.
- Floodplain Managers' conference showcased a decision-making tool that would take several parameters into consideration to determine what type of data was needed to achieve improved floodplain models. See below image, taken from Appendix E2: FEMA Report 100049589_FEMA_ASFPM_Inputs_Final2, Appendix E2, which is available in the appendices.
    - This type of tool/explanation would be great to have for lidar in AK.

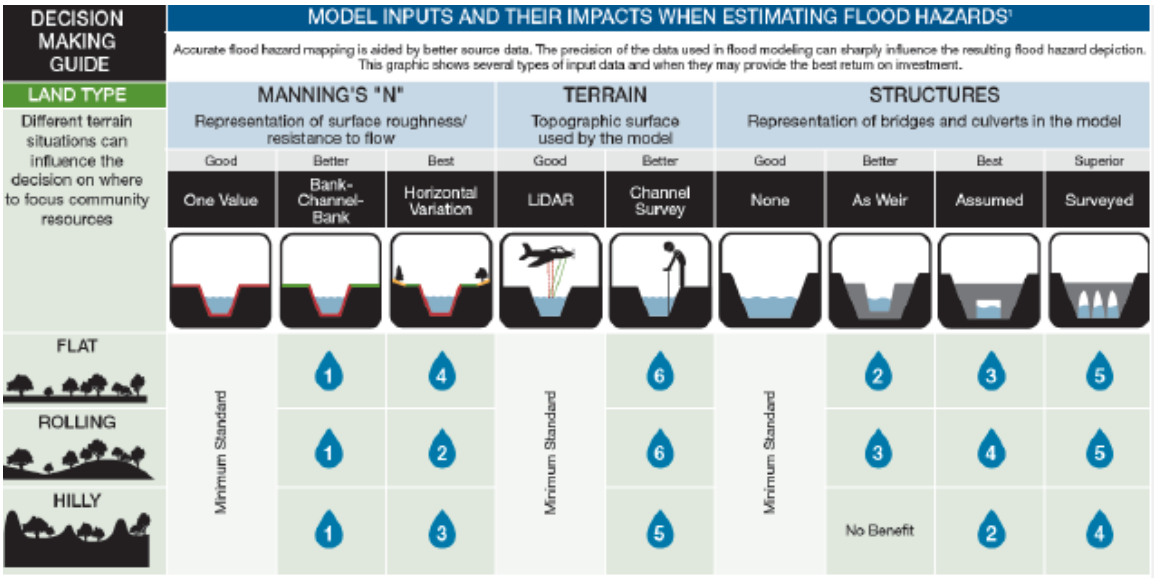

Figure 16: Image taken from FEMA Report 100049589_FEMA_ASFPM_Inputs_Final2, Appendix E2.

C. DATA FORMATS AND STANDARDS

- ESRI's .LASD format is not good for Alaska data distribution. Need just .LAS files. We need to tell customers to keep the .LAS files even though they are larger than the ESRI proprietary compressed format for point cloud.
- The parallel problem on geospatial side is hiring a licensed surveyor who pulls all that data through ESRI and someone later must reconstruct what occurred (if possible). Sloppy data transport is rampant in the state. It takes a week to reconstruct. This is not a unique problem to Alaska, but it speaks to the importance to the state's geoportal. We don't put enough stress on this.
- All large projects in the last two years are being delivered to the ellipsoid. NAVD88 is not a reliable vertical datum in Alaska unless you know how it was determined. New time-dependent NSRS will help with some of these issues, but only if people exercise good metadata habits.
- Academic datasets can be of great quality, but without metadata that can make them next to useless. People collect the data and the state must figure out how to fix it. Example: NEON data is combining geoid model with the wrong reference frame. Project areas have spots of lidar every year. Annual recollects, but they are not in a real reference frame. Having places (like a statewide geoportal) where data lives or where it must pass through is a benefit.
- Having someone with authority say it must be delivered with these minimum and some form of "metadata police". What options do we have to address this? Can AGC address this? If AGC had UL stamp of approval would that carry any weight/be of value. Is there any role that AELS could potentially play in this?
- There are AELS standards, but they are optional/not required.

Group discussion digest is a compilation of handwritten or typed notes from all groups with limited opportunity for participant review. Efforts have been made to preserve the intent of each comment, however, it is possible that some facts and context may have been misconstrued in this process.

- Standards do exist, but are sometimes ignored or some people/projects are not educated on them.
- Alaska climate change round table discussed data integration issue of this nature that could be a template – NWS demos data and determines what is/is not usable in broader products. This does have some drawbacks – limits incorporation of nimble, new, and emerging technologies.

D. WATER LEVELS AND TIDE COORDINATED DATA

- Generally, low tide is better for LIDAR or topo bathy because you get the most data
- High priority for ShoreZone
- NOAA needs to tide coordinate.
- Erosion precision modeling of bluffs is dependent on tidal heights and surges
- Tide coordinated data is very important—necessary.
- Always ask: "How important is that?" when a tide level is specified or else you may never acquire your data
- Don't need really clean water levels to get tidal datums. Example: Astra station, processing the data showed the Astra data RMS was 6mm. The cost savings for this station was huge, an order of magnitude in costs compared to NWLON. The Astra data is spiky, but when properly processed, it is good. Easier access to datums and tidal datum transformation tools improves coastal data quality. Biased water level does become an issue in places with only very short-term water level stations.
- State should take lead in developing its own water level monitoring if NOAA don't/won't meet Alaska mapping needs.
    - Are there methods other than the tide coordinated standard to achieving water level monitoring
    - Getting tidal information can be a barrier. There are places where there is only one hour of data you can collect to make the data requirements.

E. EMERGING TECHNOLOGIES

- NOAA is beginning to experiment with finding appropriate uses of satellite derived bathymetry. In 2015 NOAA created provisional Electronic Navigational Charts (ENC)s using satellite data. The turbid Yukon River and Yukon Delta are the locations of this new type of chart. This area is known for its changing shoals and coastline. The charts include shoreline and approximate shoals derived from satellites and NOAA is aiming to update them annually. This approach provides the mariner and barges that frequent this area more up to date information than previously available at a fraction of the cost of a ship based traditional sonar-based hydrographic survey. More information on this project can be found at https://landsat.gsfc.nasa.gov/satellite-images-are-source-for-first-of-its-kind-charts-of-alaskas-yukon-river/ and http://ccom.unh.edu/publications/yukon-river-

prototype-electronic-charts-using-satellite-derived-bathymetry. NOAA is continuing to experiment with satellite derived bathymetry in other areas, including planning ship based sonar surveys to test and validate the results of satellite data.

- It would be useful to have a comparison of new technologies with accepted technologies and to make available to contracting entities (and end-users) the pros and cons of each.
- It would also be useful to have quality rankings for different approaches to the same technology type (e.g., SFM or SDB). How do different methodologies measure up to others?
- It would be good to have a website dedicated to research on new technologies so published papers, articles, presentations, etc. can be co-located to the benefit of everyone (the USARC has something like this).
- Single-photon and Geiger-mode are two newer lidar systems that perform photon counting, but neither of them have full acceptance yet by USGS for the 3DEP. Both single-photon lidar and Geiger-mode lidar can fly higher and create higher point densities than conventional linear-mode lidar. While single-photon and Geiger-mode lidar consistently deliver higher point density, their vertical accuracy has not yet performed comparable to linear-mode lidar.
    - Alaska could be a potential test bed for these systems, if there was funding.
    - Some contractors agree to fly this type of data because it can shorten acquisition time.
    - Both single-photon and Geiger-mode systems are more expensive to operate per hour than conventional linear-mode lidar.
    - All lidar systems are limited by clouds, fog, haze and smoke. Thus, project cost savings in flight time could potentially be offset by extra costs in weather down time.
    - Already some projects in Alaska get flown at lower altitudes than planned due to lower cloud ceilings. It can be more cost efficient to fly at lower altitudes and acquire more data than necessary rather than wait for ideal weather and cloud conditions. Potential projects may need to be individually evaluated on a case by case basis for the most cost-efficient technology and seasonal timing.
- Differential INSAR
    - Space born SAR that is building a timeline
    - Using the wave information of radar to measure change
    - Challenge to use in areas without fixed structures
    - Could be useful to test in the Arctic
- Perhaps not enough existing satellite data in the Arctic to test, but could be looked into.
- ShoreZone testing out high resolution still photo SfM imagery collection in Glacier Bay National Park in July 2018

- Since 2001, the informal ShoreZone partnership has administered a successful program to collect coastal imagery along the Alaskan coast. Utilizing the video and still photos, ShoreZone has been able to classify the biological and physical attributes of the shoreline including biobands, coastal class, oil residence, wave exposure, shoreline modification, and coastal vulnerability including stability (erosion/accretion), flooding sensitivity, and thaw sensitivity. However, existing ShoreZone products fall short of the type of geospatial map products that many users require, including updated Mean High Water shoreline vectors. Photos and videos are geospatially referenced to airborne locations and are not orthorectified to ground, although all attributes are attached to the best available digital shoreline. New use of SfM techniques in combination with ShoreZone imaging and mapping protocols creates the potential for more quantitative map products.
- SfM is great because it's fast, cheap and easy but need to make sure it is being done properly.
- How can we get more standardized quality control of point clouds from SfM projects?
    - We have to have something to measure against
    - Even lidar is controlled by discrete points
    - Standardize quality & data accuracy so everyone can use the same
    - Include a quality map to make the data to earn more user trust
    - How can we communicate the data quality/accuracy in the metadata when downloading from the internet?
- Drones
    - Underwater & unmanned vehicles & aerial
        - Find control to go to every time
        - Train people in communities
    - Drones are great for focused sites to get high resolution data
    - Can be used anywhere you can get imagery
    - partnerships/education
    - Research, monitoring
    - Programs in place
    - New lidar technologies are smaller, can carry it for longer than 30 minutes. Are getting much better. Can use with unmanned systems. FAA has given opportunity to get RPIC to everyone. Point lay data took 7 min to collect.
    - UAV downsides: battery life and dependence of battery life on non-freezing temperatures

- Sometimes a plane is faster & quicker than a UAV
- Pacific Marine Environmental Lab
  - Has UAS deployed from ships in Dutch Harbor
  - Maybe able to engage in partnerships

F. TEST LOCATIONS

- Getting technology that works well in Alaska will work anywhere else
- Test locations should be easily accessible
- We want community and collaborator buy-in and support for test locations
- Test locations should also be challenging for the new technologies and be beneficial to large groups of people
- Satellite Data/Remote Sensing
  - Cook Inlet good spot due to access and lots of existing data
  - Whittier: close, Prince William Sound is clean for satellites
  - Kuskokwim - USCG maps regularly to put in buoys, I think with single beam
  - Kodiak and Yakutat good areas for remote sensing technology testing
- Types of areas:
  - Turbid areas where the satellite bathymetry won't work
  - River deltas
  - Different slope areas: Flat areas, steep slopes
  - forested areas
  - Areas influenced by Sea ice, there are specific data needs to collect the sea ice edge
  - Areas with permafrost for radar testing
  - populated areas
  - areas that have been mapped already
    - Existing corridors / populated areas / Areas that already get mapped regularly for data comparison to reduce access cost
      - Electricity infrastructure & road transportation vehicles, roads
      - Does the haul road (to Deadhorse) get flown with UAVs?
      - DOT monitored areas

- Using same technologies and accuracies that we would in lower 48 with GLONASS satellites
- How much infrastructure requires real-time monitoring?
    - Marine based: tailing ponds behind dams, dredging projects in Seward and Port of Anchorage
    - Land based: landfills & mines, hydro facility monitoring (high resolution scan of dams), utilities, bridges, wildfire areas that are monitored timber health & dryness

- Locations:
    - YK Delta a good test place for Bering/Arctic and has lots of existing data and relatively good access
    - The Arctic because it is so unique due to the high rate of change and that change is accelerating
    - The Aleutians are unique in their remoteness and challenges working in that area
- See if there any interest from USACE - CRREL, maybe there is something that could be of interest in Alaska or outside of Alaska.
    - Cold regions research and engineering lab
    - Scan now and then on Greenland to measure a glacier

G. COMMUNITY NEEDS/PRIORITY LOCATIONS

- Use threat assessments, immediate vs long term
- Take advantage of any additional funding partners
- Top priority for geospatial (high res) data would be the villages in the remote areas
- Get SAR every few years and then LIDAR specific areas for more detail
- Alaska's big challenge is our dynamic coastline.
- Community needs, threat assessment, immediate need, should play a big role.
    - The "Hydro Health" model is a risk based, weighted formula for refresh & maps. It is starting to be utilized by NOAA and weights refresh rates for bathymetric data needs in different areas according to the environment, human residence, type of use and economic value. The Hydro Health model is still under development and is expected to be publicly available before the end of 2018. https://nauticalcharts.noaa.gov/publications/national-hydrographic-survey-priorities.html
    - Could we build a similar model or formula that includes Alaska's offshore and onshore coastal zone?

- The group had a variety of thoughts on how to prioritize mapping. These included: areas with sea ice, permafrost, lack of roads; areas that are the flattest; areas where communities reside; areas where communities do not reside. We recognize the mixed messages in those last two items. However, a good point was brought up—some areas are never mapped because they are not close to a community. But there are areas that are moving up to 1 km a year (Yakutat/Glacier Bay). The danger of not mapping these locations is that you don't know what you don't know. There may be fault lines that haven't been mapped, for instance. To summarize, it was recognized that starting with coastal communities and expanding outward is the best approach, gaps could be filled by agencies as funding and study priorities align.
- Rock and gravel needs:
    - Communities desperately need gravel and rock resources in coastal areas, what technologies can help? For surficial mapping, would need combo of imagery and ground truthing. Some technologies may be available to automate the identification of gravel in particular from UAS collected imagery. Using multispectral processing to ID surface gravels. Kivalina's gravel resources were identified 10 miles inland, needed gravel to create a road to the resources, then get the resources to community. Is Alaska interested in using/identifying offshore gravel resources for dredging? We could do bathymetry plus contracting to measure seafloor depth and sand/gravel content. Can we use sand to make concrete or just use gravel? Can also use lidar return signal to identify gravel/rock—maybe a by-product or additional data product as a result of coastal mapping.
    - We must change our designs of revetments because of the cost of gravel/rock materials. FEMA won't pay for full design, look for less expensive rock.

H. REFRESH RATES

- Dependent on use/application
- How dynamic the area is depending on geomorphology?
- Permafrost and ground temperature monitoring sampling will need different refresh rates than areas without permafrost.
- It takes 1-2 survey to know what is rate of change in different areas
- Some areas are stable; some areas are moving. It would be good to make an attributed coastline that demonstrates rates of change and then use that as a tool to plan refresh rates. The group also acknowledged that it is hard to argue for refresh rates if some places haven't ever been mapped.
- Must closely space surveys better for the lower resolution technologies
- Fixed refresh rate not necessarily a good idea but should be determined for each area and the type of data
- High refresh rate for areas with villages and more intense coastal use or where change is occurring at a higher rate

- Form an acquisition stand point, costs can be scaled down if there is a program with a known acquisition or refresh rate
    - Can also allow the process to be refined with consistency of data collection schedules.
- Get high quality lidar data as baseline and then use satellite data to determine change every year after
- Temporal aspect, where change is happening fastest need to survey multiple time to quantify
- Create a weighted formula to drive re-survey periods

I. ELEMENTS OF THE COASTAL MAPPING STRATEGY

- More opportunities for national contracts
- Be open to emerging technologies. Look at outcomes or standards without being rigid to how it must be collected. Water levels and GPSC strategies have the same issue.
- Areas of needed training & training opportunities focused on coastal data collection/use for the Alaska geospatial community, a plan to chip away at gaps and refresh data where needed, investment in emerging technologies.
- The aspiration to collect the coastline at a continuous vector with recommended refresh rate. This would get CUSP filled up and keep it fresh.
- This project must be strong throughout. One piece can kill a project.
- The plan/strategy must speak to policy folks
- A mandate to give the data to the state would be ideal.

4. COORDINATION & COLLABORATION HIGHLIGHTS

A. COORDINATION

- The scale of data that is needed in Alaska is not going to happen. We need to pare down needs to identify priorities. What areas would provide the most impact. What areas need higher cost products. What areas can we test pilot projects. Use AGC coastal working group to do this and bring priorities to AGC—they have a coastal mapping priority, but no progress to-date.
- 3DEP is a successful program:
    - Economy of scale
    - 30-35% match makes it successful
    - USGS liaison connects people or pings directly
- There is an organized structure for 3DEP, but users can't get other end products from this program. Can we use the same structure with NOAA OCM? Yes.
- Projects need seed funding to go around to other agencies with, to ask for funds, and use BAA business structure.
- How do you put it out there that you have funds?
    - reach out to USGS (Brian Wright), Sea Alaska, Forest Service
- Scientists overseas value in simplified purchasing - government kickstarters, eliminate interagency coordination
- GSA - for small quantities, price per square KM possible, etc.
- Make it so if it's under a certain amount of money, then a government agency can kick in some money for SMALL projects
    - Simplify contracting/procurement process
    - Might work better with non-profits than government spending
    - GPSC - contracting a little more flexible, need memorandum of understanding
    - GSA - buy small quantities off the shelf data at a certain spec per scale per mile
        - Exchange funds in a relatively easy way
- Most projects need some set of characters with deep pockets - some guidance for contacts
- Is there a database showing all research efforts on the coast? LCC's funded this type of work, immediately outdated, but might be beneficial if someone could take this on continuously.
- Need a dashboard of coastal mapping activities along with a newsletter that keeps people up-to-date.

Group discussion digest is a compilation of handwritten or typed notes from all groups with limited opportunity for participant review. Efforts have been made to preserve the intent of each comment, however, it is possible that some facts and context may have been misconstrued in this process.

- ShoreZone has had many partners through the years, but always 5 key federal agency partners, through IDIQ, allowing them to share funds. Coastal and Ocean Resources (CORI), the company that holds the NOAA IDIQ, can be flexible and work outside the fiscal year.
- For particular collection assets, like lidar plane for example. Once they get to the state ½ the battle is done, ½ the cost has been paid. How do we optimize those efforts?
- Field planning for private industry is happening in Feb-march, that is the best time to get in contact about opportunistic collects, but it could happen later in the year.
- Agencies or local jurisdiction can include the establishment of ground controls
- EPA IGAP Program (Indian General Assistance Program), build into work plan, required communication with communities and EPA coordinators https://www.epa.gov/tribal/region-10-tribal-environmental-gap-funding
- There may be a decision support role of Arctic observing network programs including the US AON (http://www.arctic.noaa.gov/Arctic-News/ArtMID/5556/ArticleID/386/United-States-Arctic-Observing-Network) and the NSF Arctic Observing Network (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503222). There could be opportunities for collaboration and capacity building to access AON observing capacity for decision support products related to Alaska coastal mapping. How involved are the Alaska coastal mapping entities in the Arctic Observing Summits? What are some benefits and barriers/costs with such collaboration and how could barriers be overcome?
- University projects
    - Coordinate while project is being planned
    - Need policy people to explain how work is useful and how you can help in a direct way
    - Take time to go to meeting to find out what project are going on
    - We need the people writing RFPs to go out and do work, or at least understand how to do it.
    - Come contacts don't allow private funds
    - When feds get data, the data will be made public.
    - Have some sort of royalty system for data
    - Efforts for Universities to be more responsive to stakeholders and non-research projects
    - Linkage between non-research needs and needs to increase life-safety, etc.
    - Effectively engaging academia to enhance research product usability for users is a benefit. Workshops designed to get usability feedback from stakeholders on beta coastal map products are a good approach. Are other agencies doing workshops with traditional and non-traditional product users to expand data access, usability, and multiple uses? How much effort goes into effective stakeholder interaction

design to enhance usability including non-traditional product users? What are the agency incentives?

B. COMMUNICATIONS

- Statewide communications/announcements
- Need to communicate before RFP is written
- SeaSketch - feds & some state folks use it, locals don't use it
    - If SeaSketch could extract and feed to google earth
    - Could SeaSketch pushed through to google earth? Something similar to GINA best data layer or USGS earthquake data, that gets automatically pushed to your computer
    - SeaSketch has ArcGIS layer
    - Is ERMA in SeaSketch?
    - What about a name change for SeaSketch? It's not just about water areas.
    - How often do projects get added? IT varies among users.
    - Ability to select Geolocation area of interest and get push notifications
    - SeaSketch Organization - There is not a good place to put 'wish list' data acquisition areas. Only place for areas that already have some money committed to them.
    - Many of us haven't used SeaSketch since last meeting.
    - Private industry not interested in advertising work to everyone, but would be interested in sending information to an individual that could keep the pulse on coastal mapping projects and make the collaborative connections for them.
- Everyone has their own website is challenging, no info until project is done
- Make a network game-plan
    - Email Link or distribution list?
    - Email forum/chain, similar to the harbormaster's email list
    - Know where people are, talk to the right person at the right agencies
- How can we set up equipment sharing in remote locations/areas/field locations?
- University/Academic
    - Communication in project planning
    - Set up in advance
    - Student helpers

- People in industry/government gave more stories to universities than people in university

- Advertise at AAUG, ASPLS meetings

C. WORKING WITH THE PRIVATE SECTOR

- When private industry makes data public, then they can't' resell data to someone else.
  - Can private sector lease data for a certain study or amount of time?
  - Certain data have a shelf life of usability
- How can we address the issue of industry data not being made public?
  - Industry's stock answer is no. Having a form or common document to show the lawyers specifically what is being asked for – so the answer becomes yes.
  - Have possible downscaling
  - Data does not have to become public, or there could be terms or limitations on when it could become public.
  - Get together a working group of industry lawyers to help.
  - Build a geospatial data sharing form
  - There could be tax incentives for sharing data.
- Encourage data of opportunity with private sector
  - Data for free vs. pay
  - Company contribution
  - In kind matching
  - Mutual agreements
  - Issues: culture is to be proprietary, competition plays into it
  - Should be incentives for private industry to share data
  - Recognize entity from which data is derived
  - Coordinate with private sector
  - Get folks to talk to us, personnel & networking
  - Presentation to ASCE, ASPLS or other professional organizations?
  - Get a website
  - People are wary of "consultant mafia" who come in and go out
    - No community engagement

        - Need to foster a better relationship
            - Tribal office, city
            - Inventory equipment onsite
            - Construction material inventory
        - Build this into the project budget and put in a line item for outreach
    - Private sector looks at adjacent land ownership when planning projects
        - Hard to find the right person
        - Hard to get them to pay for it if they could get it for free
        - Easier to get in kind matching, like control points or something
- How to make data public? Everything from Dewberry is produced for the public. Other smaller projects, not necessarily. Can private industry inform clients that having the data go public could be in their best interest? Is there a cost with making data public? Who can pay that?
- Private industry would be interested in collecting data opportunistically and providing on spec. There would need to be a regional coordinator, however, rather than just SeaSketch.

D. CROWDSOURCING DATA

- How can community-based or crowd-sourced data be better used? Need a reference system. Start from the same point. Lidar is useless if it has no reference/metadata.
- Standard for resolution needed
- Need to ensure good metadata (when, what, camera/equipment type)
- Consistent platform to upload it to
    - Distribute design for collecting data
    - Should be some sort of data check before distributed
- Hydro model
    - Olex - company out of Norway
        - Standardize equipment install
        - Service to share data
    - Coastal explorer -> coast survey was looking into it, so was Vitus Marine?
    - Need to time tag data to tidally correct
    - Need tidal data & tidal datums
- Photo-identifiable point to check every time for quality control

- Can we make it similar to geocache hunters for control points?
- Have well-trained volunteers for crowd sourced data is very important
    - There was support for involving Alaska native partners who are trained and paid and operating under a set structure. The example of the Bering Watch environmental observers was provided as a potential model. Another example of a "skipper science" program was provided, where training is provided in high school.
    - Need to educate communities on the values of data to get people to participate
- Is crowdsourcing appropriate for remote Alaska?
    - Citizen science projects directed by knowledgeable collectors would likely be more useful for small communities in Alaska
- Need a way to benchmark the quality of data
- Need to provide oversight for quality control
- Include something so that the data supplier won't be held responsible

E. POTENTIAL LEVERAGING OF COASTAL MAPPING ACTIVITIES OF OTHER STATES

- Lessons learned, what worked, what didn't
    - Lessoned learned from other states can lead to specifications that make it difficult to afford in Alaska, but we can learn from without making the same specifications for Alaska
    - AK can't afford to meet those specs
        - Don't have tax base or number of vendors
        - AK is different from other states
    - Drivers for different parts of AK are different
- Data Architecture
- Methodology
- Funding Sources
- How to tell your story, how to leverage
    - An example of good leveraging from another state is the USO landslide in Oso, Washington (https://www.usgs.gov/news/revisiting-oso-landslide). They were able to show lidar data in 3D before and after the USO landslide and leverage this story for funding.
- In Oregon, there are local science meetings, they result in good communications but are a lot of work to put on.

- Alaska's coastal communities are based on water transportation liquid or frozen. Does it have any bearing that Alaska doesn't have a coastal zone program?
    - The important thing for a coastal zone mapping-type support is a delivery pipeline in place for geospatial products, even if there is no coastal zone program. If we can demonstrate we have a pipeline in place to serve managers, that should be good enough. Must have the ability to deliver products and services.
- Florida has a steering committee for coastal mapping, but they know they need a strategist to make things happen. There are benefits to working with the Florida steering committee to see if there are ways to talk about coastal mapping in a way to sway national decisions. Alaskan case studies do catch attention. We also have AMEC, while Florida has lots of people and post hurricane supplemental.

F. NEXT STEPS/ROAD MAP STRATEGY DOCUMENT

- Partnerships for more money results in more data
    - Acquiring federal funds
    - Look for local resources
    - Native Corporations - USGC has good tribal coordination
- Establish a vision
- Get buy-in on vision from governor's office. Align with research needs of Alaska Climate Action Strategy to ensure Gov. buy-in.
- Identify needs, resources, stakeholders
- Strategy should include populated coastline first, then fill in the gaps
- Model to follow- Alaska DEM white paper. NRCS – NEA study. Now all kinds of congressional support. (QL1 CONUS update every 3 years → $21 million in savings?) Start with cost-benefit analysis and work with stakeholders. Document highest return on investment, they will advocate for it. One thing all success stories have in common is a strong Cost-Benefit analysis.
- The challenge with coastal mapping is cost might exceed the benefits in Alaska for a single standard. Need to think of where we need topo-bathy. Goal of something with a sound cost-benefit return might need to be less than 100% and take a tiered approach.
- It is easier to articulate the shoreline (separate from deeper water). Hopeful the 3D nation study will give AK ammunition. Map out where you want to be by when and set an implementation plan/schedule. JABLTEX schedule being mapped out for years enables planning and collaboration with other agencies to augment.
- We have discontinuous population along the coast – very different to lower 48 continuous population along the coast. Shallow bathymetry is a huge barrier. Topo-bathymetry may be more doable over a set of years if we focus on strategies that provides returns at the community level.

- The original cost share for SMDI was 2/3 fed 1/3 state based on percent of land ownership. What the percent for state/federal ownerships are for the shoreline.
- Show authorities what they are missing.
    - Example: An individual said he needed a topographic map within 48 hours to show the zoning officials for a business he wanted to start. The map was made and the zoning officials loved it so much they asked for it is other places.
- It is not sure there is a mechanism in the state to create a continuous shoreline with SOA budget because the need is not enough to justify the effort. There have been reorganizations in the state due to budget. We are not sure how that impacts mapping initiative activities. Lots of the data collection funded by the State right now is directly project linked.
    - A continuous coastline would be useful for administrative boundaries. We should ask tidelands survey group at DNR for cost/benefit of having this feature? The National Park Service and Native Corporations might be interested too.
- What about aquaculture?
    - It's a bit different in Alaska because no support for fish farming. There is more focus on kelp, oysters, etc. Coastal marine spatial planning does have a need for understanding where this type of aquaculture might occur & to avoid permitting in places that might interfere with vessel traffic.
- Does the issue of baselines (for 3 miles limit) come up? Examples uplift in SE and erosion on the North Slope. Also – what do we use as the administrative lines? Where is HWL, and is there a "story that speaks" re: cost of bringing in State Department over an international boundary dispute/international affair? Freedom of Navigation information is a dollar value because it is useful to mariners and keeps other nations accountable in US waters.

G. 3D NATION SURVEY

- Get word out about survey
    - State agencies and government agencies
    - How to get private sector involved
    - Native corporations
- No one says they need coastal datums or mapping, but they ask for the information/products they get for that? When we are in national competitions, we look like Alaska is in the stone age. Would like to see better end-to-end linkages associated with geospatial data requests at the coast.
- There are some worries about the 3D nation study. We need their stories and they won't see themselves as the ones to respond (they will see technical folks as the target). Need Alaskans to help us get that.

    - Note: State 3D Nation Champion, Anne Johnson, plans to have small group meeting inclusive of leadership, management, technical and contracting staff within each state agency to help mitigate.

- We don't have a state level management program to respond so we will have very technical and very stakeholder oriented answers. Not sure what that will mean. This is a huge challenge. Coastal managers speak differently from local stakeholders and Geospatial community. How do we best get 3D nation input from the local level?
- What are the options to get information about 3D nation? What about tapping people at AFN or AFE? Perhaps there is value in having a 3D Nation Study Workshop there. We would need geospatial translators to put conversation into an appropriate national survey response
- There was a reasonable number of people talking about doing something at AFN vis-à-vis education on the 3D nation survey.
- Would there maybe be some way to crowdsource some subset of the 3D Nation Survey content on a platform like Facebook or Twitter?