ALASKA COASTAL MAPPING STRATEGY

Implementation Plan 2020-2030

ALASKA MAPPING
Executive Committee

JUNE 2022

About the Alaska Mapping Executive Committee

The Alaska Mapping Executive Committee (AMEC) coordinates the modernization of critical geospatial data and mapping products for Alaska. Executives from fifteen Federal agencies and Departments and the State of Alaska meet semiannually to discuss and prioritize statewide mapping objectives. Since its inception in 2012, AMEC partner agencies at the Federal and State level have contributed more than $60M toward the completion of a statewide Interferometric Synthetic Aperture Radar (IfSAR) dataset, a completely refreshed statewide imagery mosaic, and more than 11,000 updated topographic maps. AMEC currently promotes acquisition of several digital map layers including Shoreline Mapping, Imagery, Terrestrial Hydrography, Elevation, and Airborne Gravity. In 2018, the National Oceanic and Atmospheric Administration (NOAA) became a co-chair of this committee with the U.S. Geological Survey, and the AMEC charter was revised to include a focus on coastal mapping, including the creation of a Coastal Mapping Subcommittee in coordination with the existing AMEC Technical Subcommittee. AMEC's Coastal Subcommittee is co-chaired by the State of Alaska. All AMEC member agencies are encouraged to attend and participate in the Coastal Subcommittee. AMEC's Coastal Subcommittee supports the coordinated development and execution of coastal mapping plans to meet stakeholder requirements.

AMEC Executive Membership

National Oceanic and Atmospheric Administration Co-Chair

- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Ocean Energy Management
- Department of Defense
- Department of the Interior
- Environmental Protection Agency
- Federal Aviation Administration
- Federal Emergency Management Agency
- National Geospatial Intelligence Agency

U.S. Geological Survey Co-Chair

- National Park Service
- National Reconnaissance Office
- Natural Resources Conservation Service
- Office of Management and Budget
- State of Alaska
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Senate

COVER PHOTO: Nunam Iqua, Alaska
Credit to ShoreZone (https://shorezone.org/)

Table of Contents

Acronyms and Abbreviations

ACMP – Alaska Coastal Mapping Protocol

ACMS – Alaska Coastal Mapping Strategy

AGC – Alaska Geospatial Council

AGO – Alaska Geospatial Office

AMEC – Alaska Mapping Executive Committee

AOOS – Alaska Ocean Observing System

CMECS – Coastal and Marine Ecological Classification Standard

CoNED – Coastal National Elevation Database

CORS – Continuously Operating Reference Stations

CS – Coastal Subcommittee

DGEOID – Dynamic Geoid

EEZ – Exclusive Economic Zone

FGDC – Federal Geographic Data Committee

GDA – Geospatial Data Act

GeMS – Geoid Monitoring Service

GIS – Geographic Information System

GNSS – Global Navigation Satellite System

GRAV-D – Gravity for the Redefinition of the American Vertical Datum

ICESat-2 – Ice, Cloud and land Elevation Satellite

IfSAR – Interferometric Synthetic Aperture Radar

IP – Implementation Plan

ISO – International Organization for Standardization

IWG-OCM – Interagency Working Group on Ocean and Coastal Mapping

JALBTCX – Joint Airborne Lidar Bathymetry Technical Center of Expertise

LCC – Landscape Conservation Cooperative

MHW – Mean High Water

MLLW – Mean Lower Low Water

NASA – National Aeronautics and Space Administration

NCEI – National Centers for Environmental Information

NGA – National Geospatial-Intelligence Agency

NGO – Non-Governmental Organization

NOAA – National Oceanic and Atmospheric Administration

NOMEC – National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone

NSF – National Science Foundation

NSRS – National Spatial Reference System

NWLON – National Water Level Observing Network

SDB – Satellite Derived Bathymetry

SOA – State of Alaska

S&T – Science and Technology

TWG – Technical Working Group

USACE – U.S. Army Corps of Engineers

USFWS – U.S. Fish and Wildlife Service

USGS – U.S. Geological Survey

USIEI – U.S. Interagency Elevation Inventory

VDatum – Vertical Datums Transformation

Executive Summary

The Alaska Mapping Executive Committee (AMEC), a consortium of State and Federal agencies with the shared goal of improving the quality of Alaska's mapping, is undertaking an effort to accurately map Alaska's 66,000 miles of coastline. To this end, AMEC has developed the Alaska Coastal Mapping Strategy (ACMS), which sets goals to complete this effort within ten years.

This Implementation Plan (IP) lays out a series of actionable steps that Alaska and its partners can take to implement the ACMS. The steps, if resourced as laid out, will achieve the four goals of the ACMS within the next ten years:

1. Build on Existing Mapping Partnerships to Meet Alaska's Coastal Mapping Needs
2. Expand Coastal Data Collection to Deliver the Priority Geospatial Products Stakeholders Require
3. Leverage Innovation in Mapping Technology Development
4. Conduct Strategic Communications to Promote Widespread Stakeholder Engagement

This IP lays out a road map for achieving the following ACMS priorities:

- Elevation data collected above and below the water surface, specifically topography and nearshore bathymetry
- Orthorectified aerial imagery
- The linear demarcation of the shoreline at different datums (e.g. Mean High Water, Mean Lower Low Water)
- The supporting positional control required for specified accuracies

The focus of this IP is on the coastal and nearshore areas that can be mapped with airborne and satellite remote sensing technology, roughly two miles landward from the coast to the seaward extinction depth of these optical technologies.

For each of the four ACMS goals outlined above, this IP lays out a series of objectives. Each objective has a defined measure of success, along with clear and achievable milestones for each lead and support agency or entity, performance indicators, and target dates for completion.

The ACMS does not significantly address vessel-based surveying in nearshore waters deeper than remote sensing depths, which is the goal of another effort, the National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone (NOMEC), which addresses ocean mapping[1]. This ACMS IP does emphasize coordination between ACMS and NOMEC to ensure complete and seamless coastal zone mapping coverage. Implementation of ACMS and NOMEC together will require coordination on acquisitions and research, particularly into uncrewed and force-multiplying technologies to enable safer and more efficient collections in Alaska's often challenging nearshore environment.

This plan lays the groundwork for meeting the ambitious mapping goals outlined in the ACMS. Significant interagency communication, cross-sector coordination, and technology improvements are necessary to ensure the success of this effort. AMEC plans to review and update this IP every three years, incorporating lessons learned from accomplishments and challenges over time. With sufficient funding among AMEC partners to resource the plan over the next ten years, we can achieve the ACMS vision of an Alaska in 2030 that possesses seamless and accurate coastal mapping data to support the State of Alaska, Alaska Native Organizations, local and national economies, national security, and the environment.

[1] Both the NOMEC Strategy and its Implementation Plan are available at https://iocm.noaa.gov/about/strategic-plans.html
Note: Federal funding commitments are subject to the availability of fiscal appropriations.

Introduction

Alaska has the longest coastline in the Nation; spanning the Pacific and Arctic Oceans; the Gulf of Alaska; and the Bering, Chukchi, and Beaufort Seas. The State's 66,000 miles of shoreline and coastal ecosystems are geologically complex and diverse, including glacial fjords, 52 active volcanoes, a delta that is 12 times larger than the Mississippi Delta, inlets, bays, parks, and refuges. These coasts have a long history as places of subsistence, Indigenous culture, and economic and recreational activities. Alaska's coasts are also known for their challenging weather and ocean conditions. Informed decisions in the coastal zone depend heavily on accurate and up-to-date coastal mapping data.

Despite their importance, accurate and up-to-date maps of Alaska's coast and nearshore areas do not exist for much of the State. The supporting geospatial data and positioning framework are also deficient. Tidally referenced elevation and imagery are critical to ongoing activities along Alaska's entire coast, yet there are only five continuously recording water level stations north of the Aleutian chain. Gaps in Alaska's water level station network and spatial reference system restrict the development of an accurate and reliable vertical datum transformation tool (e.g. VDatum), which is necessary to efficiently acquire and merge topographic and bathymetric datasets. Unlike most states, Alaska does not have adequate or integrated topographic and bathymetric elevation data coverage at its coasts. These data are the foundation for administrative boundary determinations for natural and cultural resource stewardship, resource and lands management, sustainable fisheries management, energy and mineral resource development, safe maritime operations, natural hazards assessments, emergency response, understanding of earth system dynamics, scientific research, and other applications.

A 2019 inventory of existing coastal mapping data revealed that 86 percent of the Alaska data are inadequate to support critical coastal zone applications. Alaska's lack of mapping data is particularly challenging considering the longstanding threats of tsunami and earthquake, extreme weather and storm surge, changes in sea ice, and coastal erosion. Environmental and economic decisions must be made every day without the benefit of data-enhanced situational awareness.

Implementation Planning

To remedy these deficiencies, the Alaska Mapping Executive Committee (AMEC), a consortium of Federal and State agencies with shared mapping goals, developed an Alaska Coastal Mapping Strategy (ACMS) titled *"Mapping the Coast of Alaska: A 10-Year Strategy in Support of the United States Economy, Security, and Environment."*[2] Released in June 2020, the ACMS set achievable but challenging goals to guide near-term action, including acquiring priority coastal mapping datasets over the next five years, and completion of the remainder of acquisition at least once by 2030. This Implementation Plan details the actionable steps to achieve the four ACMS goals below:

1. Build on existing mapping partnerships to meet Alaska's coastal mapping needs.
2. Expand coastal data collection to deliver the priority geospatial products stakeholders require.
3. Leverage innovation in mapping technology development.
4. Conduct strategic communications to promote widespread stakeholder engagement.

By strengthening existing partnerships and policies, Alaska will be able to implement this comprehensive, collaborative mapping strategy for its shoreline and nearshore waters.

Planning Assumptions

Except where specifically noted, this Implementation Plan (IP) assumes that partner resources to execute the plan are stable. The IP serves to guide coordination and collaboration as the partners strive to achieve its milestones and performance indicators in part, if not in whole. This plan is also "scalable," such that additional resources can be efficiently expended if/when they become available.

[2] ACMS available at https://iocm.noaa.gov/about/documents/strategic-plans/alaska-mapping-strategy-june2020.pdf

Definitions

As defined within the ACMS and for the purposes of this IP, coastal mapping priorities are defined as:

- Elevation data collected above and below the water surface, specifically topography and nearshore bathymetry
- Orthorectified aerial imagery
- The linear demarcation of the shoreline at different datums (e.g. Mean High Water, Mean Lower Low Water)
- The supporting positional control required for specified accuracies

The focus of this IP is on the coastal and nearshore areas that can be mapped with airborne and satellite remote sensing technology, roughly two miles landward from the coast to the seaward extinction depth of these optical technologies. The IP does not currently address vessel-based surveying in nearshore waters deeper than remote sensing depths, but overlap between the two is required for a comprehensive coastal dataset. The ACMS is buttressed by its corollary, the National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone (NOMEC), which addresses ocean mapping, to ensure complete and seamless coastal zone mapping coverage[3]. Implementation of ACMS and NOMEC together will require coordination on acquisitions and research, particularly into uncrewed and force-multiplying technologies to enable safer and more efficient collections in Alaska's often challenging nearshore environment.

Goals and Actions

ACMS GOAL 1. Build on Existing Mapping Partnerships to Meet Alaska's Coastal Mapping Needs

This goal builds on prior partnerships across Federal and State agencies, regional, local, and Alaska Native Organizations, academia, and the private sector.

Objective 1.1. Establish a Team for Alaska Coastal Mapping Implementation

Collaboration is critical to making geospatial data collection a priority and to successfully implementing this Strategy. Working with many different State and Federal agencies over a ten-year period, AMEC utilized this model for coordinated mapping with the IfSAR terrestrial mapping program. With the completion of the ACMS, AMEC stood up a Coastal Subcommittee (CS) to draft and execute the IP in conjunction with AMEC partners, the State-led Alaska Geospatial Council (AGC), the Federal Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM), and external stakeholders. The Alaska Geospatial Council provides stakeholder coordination of geospatial initiatives in Alaska. AGC is directed by the State of Alaska Geospatial Information Officer (GIO) and supported by the Alaska Geospatial Office (AGO). AGC membership is open to the public.

Measure of Success: AMEC and its CS execute the ACMS IP with observable improvements in coastal and nearshore mapping coordination across agencies and external partners.

[3] NOMEC available at https://iocm.noaa.gov/about/documents/strategic-plans/20200611-FINAL-STRATEGY-NOMEC-Sec.-2.pdf

Cook Inlet
Colin Tyler Photography

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.1.1	Create a Coastal Subcommittee (CS)	AMEC	Technical Subcommittee (TSC)	CS created; co-chairs identified, meetings held on regular basis, AMEC reporting procedures established	2020 (completed)
1.1.2	Convene Alaska Coastal Mapping Summit for stakeholder input on ACMS and IP	CS	AGC	Summit held (annual event)	Dec 2020 (completed), annually
				Stakeholder input integrated into draft IP	Dec 2020 (completed)
				Summary notes and follow-up actions released	Jan 2021 (completed), annually
1.1.3	Develop the ACMS IP in conjunction with stakeholder input/insights	CS	AMEC, TSC	Draft plan submitted to AMEC for review	Dec 2020 (completed)
				Draft plan published for public comment	Jan 2022 (completed)
				Final plan cleared by AMEC for publication	June 2022 (completed)
1.1.4	Lead execution of ACMS IP to meet stakeholder requirements	CS	AMEC, TSC	Periodic outreach/engagement opportunities held for stakeholder feedback loop	June 2023, ongoing
				Milestone activities implemented with progress made/reported on performance indicators	July 2022, ongoing

Kodiak Island
Photo courtesy of Dewberry

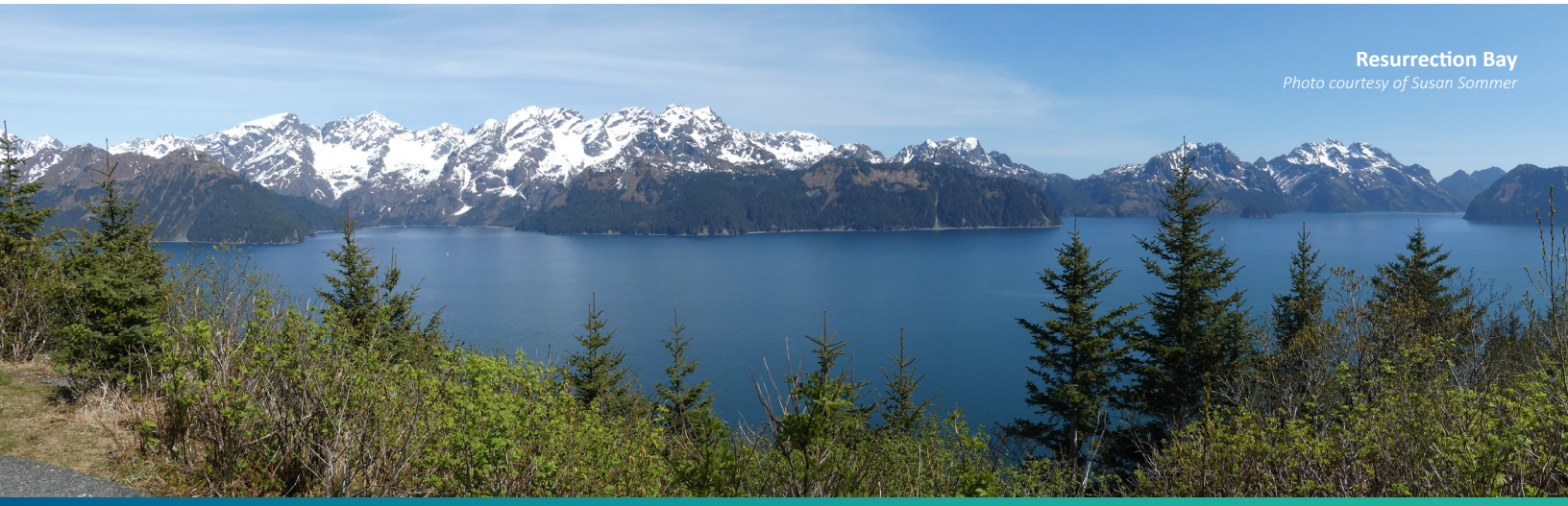
Objective 1.2. Refine Stakeholder Mapping Priorities, Costs, and Data Standards

A 2019 assessment of existing coastal data quality, coverage and gaps, and a State of Alaska (SOA) stakeholder coastal mapping prioritization survey helped to inform the ACMS. The assessment found that currently available statewide elevation and orthoimagery data do not meet all AMEC agency coastal requirements. The prioritization survey reinforced that specific coastal areas need very high-resolution data with rigorous vertical control to support the accurate measurement of dynamic changes, determine the position of the shoreline vector for administrative boundary demarcation updates (e.g. Mean High Water), show vulnerabilities to flooding, and for engineering design. While statewide datasets have seen a vast improvement over the last ten years, at the coast, a resolution of one meter or finer is required to produce products with acceptable uncertainties in this highly dynamic environment. Tidal coordination is also critical to accurately determine the shoreline and effectively use the data.

Participants in the survey included Federal, State and local agency liaisons, Native Corporations and Associations, non-profit and professional organizations, and academia. The input from the data assessment and survey are the foundation upon which to build mapping requirements, as they represent the direct needs of the coastal communities and industries that will benefit from the acquisition of new coastal mapping data.

A number of different agencies and organizations maintain quality standards for coastal data, including recommendations for refresh cycles. In general, the International Hydrographic Organization standards are the most widely used reference for bathymetry, the 3D Elevation Program base lidar specifications for topographic lidar, and the American Society for Photogrammetry and Remote Sensing standards for orthoimagery and photogrammetrically-derived digital surface models. Refining base specifications and standards for acquisition and resulting geospatial data products is key to integrated mapping of Alaska's coasts. Coalescing around an Alaska Coastal Mapping Protocol (ACMP) of specifications referencing these established standards for priority data types will benefit consistency and coordination, informing the Alaska coastal mapping community of preferred quality levels and standards. Finally, maintaining accurate cost estimates to meet these requirements will enable AMEC to plan and share information on anticipated acquisition coverage and annual budget shortfalls.

Measure of Success: Published priorities reflecting existing data gaps, stakeholder requirements, accurate cost estimates, and clear data standards result in efficient and responsive Alaska coastal mapping acquisition planning.



Resurrection Bay
Photo courtesy of Susan Sommer

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.2.1	Publish/maintain inventory of existing coastal data quality, coverage, and gaps	CS	AGC, AGO	2019 data/gaps inventory published as geospatial service(s) and updated annually to inform acquisition planning	July 2022 (completed), annually
				2019 Data Quality Assessment published as report and geospatial service(s); updated biannually to inform acquisition planning	July 2022 (completed), biannually
1.2.2	Publish/maintain Coastal Mapping Priorities: Synthesize results of 2019 spatial prioritization with IWG-OCM and stakeholder priorities into map layers to be validated/ updated biannually to inform acquisition planning	CS	AGC, AGO, AMEC agencies, IWG-OCM, External stakeholders	Draft priorities synthesis vetted with stakeholders at an Alaska coastal mapping event	Dec 2022 (completed)
				Final priorities synthesis published as report and geospatial service layer for use in acquisition planning and on U.S. Federal Mapping Coordination site, SOA Geoportal, AGC website, GIS-based analyses, etc.	March 2023 (completed)
				Priority requirements and map layers updated with agency and partner input, using the ACMS as stakeholder engagement opportunity to vet/validate	Jan 2022 (completed), biannually
1.2.3	Validate coastal mapping data costs periodically with acquisition leads and private sector providers to ensure efficiency and transparency in overall acquisition strategy	CS	External stakeholders	Acquisition cost estimates by data type and metric (e.g. per linear mile, per square mile, other) assembled and maintained to inform IP ballpark coverage estimates and annual shortfalls, planning decisions, congressional queries, etc.	Nov 2021, ongoing
1.2.4	Develop an ACMP around topography/ bathymetry and orthoimagery for consistency in acquisition that synergizes with the Standard Ocean Mapping Protocol	CS, AGC	IWG-OCM, External stakeholders	Audit conducted of established specifications for coastal data by type to inform base specifications	Nov 2021
				ACMP base specifications drafted for data standards and quality levels (e.g., horizontal and vertical accuracy, refresh rates, etc.)	Dec 2022
				Draft ACMP validated through stakeholder engagement	Jan 2023
				ACMP finalized with schedule for periodic update	March 2023

Objective 1.3. Cost-Effectively Resource the Alaska Coastal Mapping Implementation Plan

As with AMEC's IfSAR strategy, setting clear goals and combining resources from Federal agencies, State and local entities, and academia, will allow for leveraging and efficiency gains in coastal mapping data acquisition. For example, Federal geospatial contract vehicles with high funding ceilings, such as the NOAA Shoreline Mapping, Hydrographic Services and Coastal Geospatial Services Contracts, and the USGS Geospatial Product and Services Contracts are available for use in coordinated mapping campaigns. In addition, the U.S. Army Corps of Engineers (USACE) will also contribute to this Strategy. The Alaska Geospatial Office may also provide coordination for funding opportunities and utilizing state contract vehicles. The role of the private sector is important as well; private sector participation underpinned the success of IfSAR by managing data acquisitions and collection as well as performing data merges and quality assurance.

Measure of Success: No barriers exist to funding transfers between and among Alaska coastal mapping partners; collaborators can quickly and easily transfer funds to the agency(ies) managing the acquisition of Alaska coastal mapping data using a known set of transfer options.

Photos courtesy of NOAA Fisheries

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.3.1	Inventory and publicize existing AMEC agency resources and capacities for coastal mapping data acquisition collaboration	CS	AGC, AMEC agencies, IWG-OCM, External stakeholders	Existing acquisition assets catalogued (e.g. funding lines, planes, ships, uncrewed systems, satellites)	Nov 2022
				Existing contract vehicles inventoried and evaluated for sufficiency in ACMS implementation (e.g. data types, standards, capacities for growth)	Nov 2022
				Existing memoranda of agreements between/among Federal/State agencies and other partners inventoried and assessed for gaps/improvement opportunities	Nov 2022
1.3.2	Improve contract vehicles and agreements process to facilitate ACMP resourcing	CS	AGO, AMEC agencies, IWG-OCM, External stakeholders	Identified contract vehicles clearly communicate steps for different types of partners to utilize (Federal, State, local, academia, Non-Governmental Organization [NGO])	Dec 2022
				Contracts and task orders pre-negotiated for large areas to provide alternative work area flexibility when weather/other impacts derail operations	Dec 2022
				Agreement templates pre-cleared by Federal/State general counsels for rapid clearance to sign	Dec 2022
				Streamlined agreements signed and in place ahead of time to expedite cross-partner use of contract vehicles and in-house acquisition assets	June 2022
1.3.3	Explore options to procure "spec data" as defined in the Alaska Coastal Mapping Protocol (1.2.4) from contractors	CS		Options for using existing or modified contracts to procure "spec data" known and publicized	June 2022
1.3.4	Develop and share flowchart to illustrate avenues of entry for Federal/State/NGOs/Landscape Conservation Cooperatives (LCCs) and other groups to contribute funding and receive Alaska coastal mapping data	CS	SOA	Flowchart shared via AGC website and other outreach opportunities	Jan 2023
1.3.5	Conduct periodic requirements meetings to discuss available resources/priorities/assets/ specs and "buy up" options for most efficient approaches to acquisition	CS, AGC	IWG-OCM, External stakeholders as appropriate	Quarterly planning calls held to coordinate, make transfers, negotiate, award	Quarterly

Objective 1.4. Integration with Complementary AMEC Mapping Priorities

Currently, AMEC tracks five themes: coastal shoreline vector, imagery, terrestrial hydrography, coastal topography/bathymetry, and airborne gravity. There are additional themes of interest to AMEC members that frequently overlap with coastal mapping priorities; these include wetlands, marine mammal and shorebird location and counts, geophysical, targeted lidar, and vegetation. Coastal mapping not only crosses physical boundaries between land and water; it crosses agency and jurisdictional boundaries as well.

Coordination with thematic data leads across all of these statewide interagency efforts will be integral to the success of coastal mapping to ensure agencies are efficiently using resources rather than duplicating data collection efforts. The CS will summarize coordination mechanisms and general contacts for each AMEC thematic interest. This approach includes coordination with interagency working groups, Federal agencies, the State of Alaska, and other stakeholders.

Measure of Success: Complementary AMEC mapping priorities are factored into acquisition plans, including strategic timing of data collection or processing, combined requirements in coastal and nearshore areas, and leveraged resources and capabilities.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
1.4.1	Develop and maintain a matrix of existing AMEC mapping themes with mechanisms for coordination of coastal mapping projects	USFWS		Matrix completed; periodic updates made to keep matrix current	Oct 2020 (completed), annually
1.4.2	Maintain contact information for specific liaisons and AMEC mapping themes as a resource for coordination of coastal mapping projects	CS		Contact list created and maintained	March 2021 (completed), annually
1.4.3	Follow mechanisms for coordination guidance for new coastal mapping projects based on data type with AMEC mapping themes	CS		Use the contact list to communicate regarding new mapping projects	As needed through 2030

ACMS GOAL 2. Expand Coastal Data Collection to Deliver the Priority Geospatial Products Stakeholders Require

Mapping the Alaska coast is challenging. However, utilizing targeted and coordinated data collections will reduce overall costs and improve the cost-to-benefit ratio of expanded mapping activities. Data acquisition also depends heavily on improvements to the underlying positioning framework, which is a prerequisite to seamlessly integrate data on the coast.

Objective 2.1. Execute a Flexible Alaska Coastal Mapping Campaign

The IP will follow the IfSAR framework of clearly delineating priority areas into manageable acquisition targets of appropriate scope, scale, timing, and cost. This is a key step to coordinated acquisition. The IP will factor in existing data coverage and quality to achieve complete mapping coverage of Alaska coasts with topobathymetric lidar and orthoimagery before 2030. In locations where topobathymetric lidar is unsuitable, other technologies, including shallow water sonar, Satellite-Derived Bathymetry (SDB), and uncrewed systems may be needed to achieve this goal. Flexibility to move among stakeholder priority areas is essential, as both Alaska's fluctuating weather conditions and measures to safeguard Indigenous food security will dictate where mapping efforts can be most effective. National data standards and best practices will be used, as required by the Geospatial Data Act (GDA) of 2018. Periodic analysis of acquired data should also be considered as these datasets have shorter lifespans due to the continually changing nature of shoreline and coastal areas.

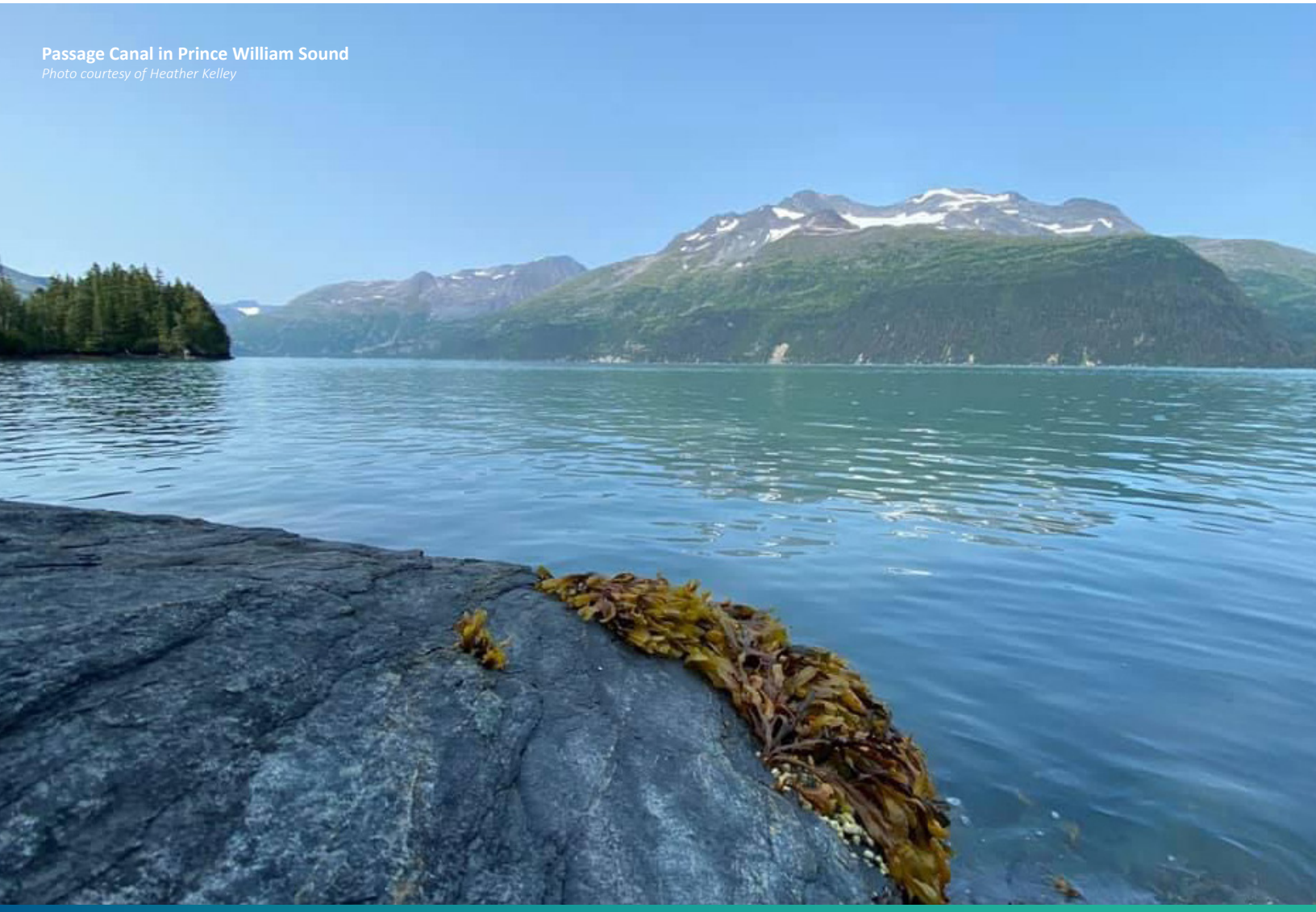
Measure of success: Acquisition of comprehensive coastal mapping data follows a trackable yet flexible approach to map manageable segments of Alaska's coastline.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.1.1	Determine manageable coastal mapping segments for the State and prioritize using Goal 1 outcomes and upon completion of 1.2.2	CS	AMEC agencies, AGC, external stakeholders	State divided into manageable segments of sensible acquisitions/ specs intersected with priorities	Dec 2021 (completed)
2.1.2	Build a ten-year coastal mapping campaign for Alaska based on priorities, capabilities/capacities, and asset/sensor availability (with 2.1.1, Goal 1 inputs)	CS	AMEC agencies, External stakeholders	Documented coastal mapping campaign of Alaska using a prioritized, scalable approach, revisited annually	Jan 2023, annually
				Plan published as a living document for public comment, continuous feedback incorporated	Feb 2022
2.1.3	Develop, share and execute FY22 Operations plan based on 2.1.1 and current program resources, adjusting on fly for real world impacts (e.g. weather, equipment, resources)	CS	AMEC agencies, External stakeholders	Mapping acquisitions shared for public input, executed against annual plan, with adjustments and lessons learned incorporated into next year planning	2022 field season (completed)
2.1.4	Develop and execute FY23-30 Operations plans, building from 2.1.1. and prior year experience	CS	AMEC agencies, External stakeholders	Annual mapping acquisitions shared publicly and executed against plan, with feedback loop to improve outyear efforts	2023-2030

Objective 2.2. Upgrade Alaska National Spatial Reference System (NSRS) Components to Support Mapping Data Acquisition

In Alaska, integrating nearshore bathymetric and topographic data at the coast can only be completed with enhancements to the NSRS. These enhancements include collection of airborne gravity data to update and monitor the Alaska/Arctic geoid for centimeter level positioning accuracy; establishing Alaska Foundation Continuously Operating Reference System (CORS); filling the 32 identified Alaska gaps (21 of which are located in the Arctic) in the National Water Level Observing Network (NWLON); co-locating existing water level stations with continuous Global Navigation Satellite System (GNSS) stations; acquiring geodetic ties (GNSS Observations on tidal benchmarks) on current and historical water level stations; and building VDatum models to seamlessly link topographic and bathymetric datasets together. VDatum enables users to convert data from different horizontal and vertical references to a common system, making it possible to accurately integrate diverse datasets. In places where traditional tide gauges cannot be easily installed and maintained—like Arctic Alaska—temporary gauging can help verify the accuracy of VDatum in offshore areas.

Measure of Success: New investment to fill Alaska Foundation CORS and water level gaps, co-locate NWLON stations with cGNSS capabilities, and install temporary tide gauging to enable VDatum model coverage for seamless data integration across Alaska.



Passage Canal in Prince William Sound
Photo courtesy of Heather Kelley

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.2.1	Produce geoid models for Alaska to improve vertical data positioning accuracies	NOAA	NGA	Remaining areas of Alaska Gravity for the Redefinition of the American Vertical Datum (GRAV-D) project completed over Aleutians for 100% Alaska coverage	Oct 2022
				Absolute Gravity Network and Geoid Monitoring Service (GeMS) established to support dynamic geoid (DGEOID) model	Oct 2025
				GRAV-D data fully incorporated into gravimetric geoid model (GEOID2022)	Oct 2025
2.2.2	Establish Foundation CORS in Alaska for active NSRS control and International Terrestrial Reference Frame alignment	NOAA	NASA, NSF, NGA	Five NOAA Foundation CORS established	Oct 2023
2.2.3	Conduct cost assessment to establish improved geodetic control and relative sea level trends at Alaska water level stations	NOAA	SOA, AOOS	Cost assessment to add GNSS to 27 existing Alaska NWLON sites and 31 new NWLON stations to fill Alaska gaps	Oct 2022
				Improved geodetic control at water level stations in Sand Point, Sitka, Seward, and Unalaska (Global Sea Level Observing System stations)	Oct 2025
2.2.4	Establish comprehensive Alaska VDatum coverage to enable regional transformations and support real-time mapping data acquisition and processing	NOAA	SOA, AOOS	Short term tidal observations acquired	Oct 2027
				GNSS observations taken on tidal benchmarks	Oct 2027
				Models of transformation grids developed and published for use	Oct 2028
2.2.5	Establish preliminary real-time water level network to support mapping activities in communities where there are NWLON gaps	AOOS	NOAA, SOA	Alaska Water Level Watch alternative water level sensors installed at key sites to supplement NWLON	One per year at current funding levels

Objective 2.3. Produce and Disseminate Key Datasets and Products from Alaska Coastal Mapping Data

The acquisition of new and accurate coastal mapping data will inspire a generation of improved and derivative datasets. Products that would benefit from new topographic and bathymetric data include administrative and jurisdictional boundary lines, NOAA's tsunami models, and the USGS Coastal National Elevation Database (CoNED) models for Alaska. These digital elevation products support inundation forecasts and sediment transport models. Accurate coastal mapping data will also help to improve Alaska terrestrial hydrography efforts and wetlands inventory in coastal low relief areas, among many other uses. Best efforts will be made to coordinate for mapping and characterization, which together can inform habitat classification using national standards such as the Federal Geographic Data Committee (FGDC)-approved and IWG-OCM-supported Coastal and Marine Ecological Classification Standard (CMECS).

The State of Alaska, NOAA, and AMEC partners are committed to ensuring that data are readily available to the public, in conjunction with the Geospatial Data Act's advocacy for quality metadata following ISO 19115 standards. The Alaska Geospatial Office actively maintains the State's Open Data Geoportal, Elevation, and Imagery portals for viewing and downloading historic and modern geospatial data. NOAA serves as a central repository for topographic and orthoimagery coastal mapping data at the Digital Coast and bathymetry at the National Centers for Environmental Information (NCEI). USGS and NOAA also manage elevation data reporting at the United States Interagency Elevation Inventory.

Measure of success: Key coastal datasets and models are updated, interoperable, and made available to the public via State/Federal data delivery portals and frameworks.

Homer small boat harbor
Photo courtesy of Joe Kujawski

	Milestone	Lead	Support	Performance Indicator	Year/Goal
2.3.1	Inventory, promote, and utilize centralized data portals and repositories for Alaska coastal mapping data management, access, synthesis, visualization, and archive	CS, AGO	Federal agencies, SOA	AGC website updated with inventory of data portals and repositories for data access	Nov 2021 (completed)
				Mapping data acquired with public funds archived at national (e.g., National Centers for Environmental Information (NCEI), Digital Coast and other Federally-funded repositories) and SOA (e.g., SOA Geoportal) repositories and made publicly accessible	Aug 2021 (completed)
2.3.2	Evaluate agency mapping data holdings to ensure adherence to open data delivery commitments (formats, metadata, archive, accessibility) to enhance interoperability	CS agencies, AGC	IWG-OCM	Agency data holdings assessed using FGDC-like Lifecycle Maturity Assessment tool; percent increase in interoperable data availability on national delivery systems	Dec 2021
2.3.3	For existing and new mapping data, ensure data formats and products meet FGDC/ International Organization for Standardization (ISO) metadata and GDA requirements for archive	All CS agencies collecting data, AGC	IWG-OCM, FGDC	FGDC/ISO-compliant data, compiled into accessible and readily usable databases and products	As data is acquired
2.3.4	Develop, produce, disseminate, and routinely evaluate use/usability of authoritative information products derived from OCM data (e.g. shoreline vector, accurate administrative boundaries, digital elevation models, CMECS-classified benthic habitat change maps)	CS agencies, AGC		Inventory of authoritative datasets produced and shared via SOA Geoportal	June 2022

Autonomous Surface Vessel (ASV) collecting bathymetric data
Photo courtesy of TerraSond

ACMS GOAL 3. Leverage Innovation in Mapping Technology Development

New and emerging science and technology advancements are key to making Alaska coastal mapping more efficient and effective. Remote sensing technologies, from aircraft and satellite-based systems to uncrewed platforms, will continue to improve, thereby reducing time and cost to acquire data in challenging coastal and nearshore areas. Leveraging partner expertise in marine technology development, including private industry, academia, and NGOs, will be key. AMEC partners will coordinate efforts to identify technology requirements and to promote and advance new solutions to support Alaska coastal mapping. This goal aligns with NOMEC Goal 4, "Develop and Mature New and Emerging Science and Technologies to Map, Explore, and Characterize the United States EEZ." The Coastal Subcommittee will engage in NOMEC developments on Goal 4, including proposals for testing and developing technologies in Alaskan environments.

Objective 3.1. Upgrade Alaska Climatology Tool for Smart Application of Satellite and Airborne Lidar Bathymetry

Satellite-derived bathymetry (SDB) and bathymetric lidar rely on reflected light and laser penetration of the water column. Acquisition of these datasets is therefore more successful during times of high water clarity. NOAA's climatology tool uses satellite image records to identify patterns in time and space that enable more successful SDB and bathymetric lidar acquisitions. Using satellites to coordinate the timing of nearshore bathymetric data may result in more frequent and effective acquisitions, thus decreasing cost and improving quality.

Measure of success: Quality and timing of Alaska lidar and satellite nearshore data acquisitions are improved by an enhanced NOAA water clarity climatology tool for planning.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.1.1	Improve acquisition planning with satellite imagery-enhanced survey timing tools	NOAA	NASA, USACE, USGS, SOA	Water clarity climatology tool upgraded with real-time capability	Oct 2021 (completed), annually

Objective 3.2. Monitor and Test New Technologies for Acquisition Efficiencies

Across the globe, mapping efforts are benefitting from rapid technological advancements in sensor technology, platforms, processing, and inferencing. Satellites such as WorldView-3 and ICESat-2 have demonstrated their potential in this arena. However, they need to be incorporated into routine operations in locations where they are most effective. Uncrewed systems are also of interest as force multipliers, particularly at sea to augment data collection, increase safety, and reduce human and equipment risk in Alaska's remote or extreme environments. The JALBTCX research and development partnership among USACE, NOAA, USGS, and the U.S. Navy is an important contributor to this objective. Alaska is a natural testbed for new technologies, particularly in unique and tough environments with the benefit of local community on-the-ground knowledge.

Successful implementation will include open and transparent mechanisms to solicit, assess, and pilot (via demonstration projects and trials) relevant innovations, including those from the private sector.

Measure of success: AMEC agencies efficiently and effectively execute development, testing, and adoption of new and innovative technologies by scaling up existing capacity to map Alaska's coastal and nearshore waters.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
3.2.1	Compile and maintain list of existing and emerging science and technology requirements and testing opportunities from the Alaska mapping community (operations, research, industry) through published materials and relevant meetings/ workshops (e.g. Alaska Survey and Mapping Conference, Alaska Coastal Mapping Summit)	CS, AGC	IWG-OCM, Industry, Academia	Synthesis completed to help identify emerging technologies for test and use in Alaska coastal mapping	July 2022, ongoing
				Engagement on Science &Technology topics occurring at Alaska-focused science and mapping meetings, workshops, etc.	July 2022, ongoing
3.2.2	Identify technology demonstration pilot projects to test and evaluate new methods/platforms and related costs/efficiencies for suitability in meeting Alaska mapping requirements	CS agencies, SOA	IWG-OCM, External stakeholders	Pilot projects executed to test technology feasibility for Alaska coastal mapping	July 2022, annually

ACMS GOAL 4. Conduct Strategic Communication to Promote Widespread Stakeholder Engagement

Communication between Federal and State agencies, boroughs, Alaska Native Organizations (to include Alaska Native Associations, Alaska Native Corporations, Alaska Native Consortia, and Alaska Native Co-Management Organizations), and other key stakeholders was critical in the development of the ACMS. This communication will be equally critical for its successful implementation. Sustained engagement is necessary to confirm that coastal mapping efforts meet user needs and to incorporate new requirements, and to consider how communities can contribute to measurements that impact their infrastructure and early assessment for future mapping needs. Special consideration will be given to Alaska Native Organizations in order to minimize potential conflicts with food security practices and cultural activities. For example, mapping, exploration, and characterization activities will avoid time frames of whale migration, bird nesting and other important subsistence time periods.

Objective 4.1. Strengthen Stakeholder Communications to Grow Participation in the Alaska Coastal Mapping Campaign

Multiple forums and governance structures exist for communicating with stakeholders and the public. AMEC CS partners and the AGC will provide technical guidance to parties interested in their own coastal mapping data acquisitions, conduct outreach to update State priorities as data are collected, and actively seek new partnerships for potential data acquisitions. Promoting this Strategy, its implementation, and subsequent data acquisitions will require participation from all partners.

Measure of Success: Stakeholders easily find ACMS status updates and opportunities for participation from in-person interactions and on AMEC agency and AGC websites.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
4.1.1	Leverage agency and AGC websites to inform stakeholders on current status and acquisition accomplishments	CS, AGC	IWG-OCM	AGC and websites such as fedmap.seasketch.org utilized to share status updates and opportunities for engagement	June 2021 (completed), ongoing
4.1.2	Provide updates to AMEC at biannual meetings	CS	AGO	AMEC executives informed on ACMS progress	April 2021 (completed), ongoing
4.1.3	Host annual Alaska Coastal Mapping Summits	CS	AGC, AOOS	Summits held as a forum to exchange information on mapping plans, technology, successes, lessons learned	Dec 2021 (completed), annually
4.1.4	Seek opportunities to increase awareness within the State of ACMS activities through conferences, workshops and meetings	CS agencies, AGC	AGO	Increased participation in conference sessions, panels, workshops, and meetings on topics related to ACMS to raise awareness and support data visibility, discovery, and access	Jan 2021 (completed), ongoing

Objective 4.2. Use Online Tools and Technologies to Communicate Plans and Performance

Transparency in the execution of this Strategy will be essential in building trust and ensuring coordination across the broader Alaska mapping community and sustaining support with the public. Providing clear and frequent information, in a consistent manner, about the mapping effort will promote transparency and bi-lateral dialogue with the stakeholder community.

Measure of Success: Stakeholders have the information they need to know what coastal mapping data are available/pending, as well as how to provide new mapping requirements for inclusion in acquisition planning.

	Milestone	Lead	Support	Performance Indicator	Year/Goal
4.2.1	Host online interactive maps of spatial prioritization results and assessments of existing data	AGC, AGO	CS	Maps hosted on SOA Geoportal and AGC website, updated routinely	June 2021 (completed), ongoing
4.2.2	Use base specifications as performance measures to track and report	CS, AGC		Metrics and performance indicators defined/detailed for tracking purposes	Dec 2021 (completed)
4.2.3	Host online performance measurement and progress tracking against priorities and plans as additional datasets are collected	AGC, AGO	CS	Metrics hosted on AGC website, updated routinely	Oct 2021 (completed), ongoing

North Slope Oil Pipeline
Photo courtesy of NOAA

Conclusion

IP Updates: AMEC will review and update the IP every three years, incorporating lessons learned from accomplishments and challenges over time. AMEC will also update the IP as new capabilities and technologies arise, partnerships develop, and progress on Alaska coastal mapping is made.

Synergies: This IP requires close coordination with the NOMEC Strategy in the areas of overlap between Alaska's coastal shoreline/nearshore and offshore waters. Specifically, shallow water bathymetry beyond the extinction depth of optical sensors is a high priority for Alaska and acquisition of this dataset is scheduled to be captured in the NOMEC Strategy. Goal 4 of the NOMEC Strategy and Goal 3 of ACMS both address the need to leverage innovation and support new and emerging technologies. Support for these initiatives will have a significant impact on the ability to effectively map Alaskan coastal waters. AMEC will participate in and encourage the implementation of NOMEC Goal 4 activities (Develop and Mature New and Emerging Science and Technologies to Map, Explore, and Characterize the U.S. EEZ) in Alaskan waters.

Looking Forward: This plan lays the groundwork for Alaska coastal mapping partners to resource and meet the ambitious mapping goals outlined in the ACMS. Significant interagency communication, cross-sector coordination, technology improvements, and progress tracking are necessary to support data acquisition and product development. With sufficient funding among AMEC partners over the next ten years, we can achieve the ACMS vision of an Alaska in 2030 that possesses seamless coastal mapping data to support the State of Alaska, Alaska Native Organizations, local and national economies, national security, and the environment.

Coastal area near Saint Michael, Alaska
Photo courtesy of NOAA