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ARCTIC DOMAIN AWARENESS CENTER
A DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE

ADAC
An Overall Current Summary

22 March 2017

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ADAC is hosted by the University of Alaska, *with work conducted at UA campuses in Anchorage and Fairbanks…and conducts research across a growing network of academic and industry partners.*

Vision: *The DHS Center of Excellence, providing networked and mission-focused support to the USCG Operator in the High North.* ***The vision includes efforts to transition ADAC into a National Center.***

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

Strategy: *ADAC's strategy is to advance knowledge in relevant science and technology through conducting research and development in close collaboration with mission agencies' end users.*

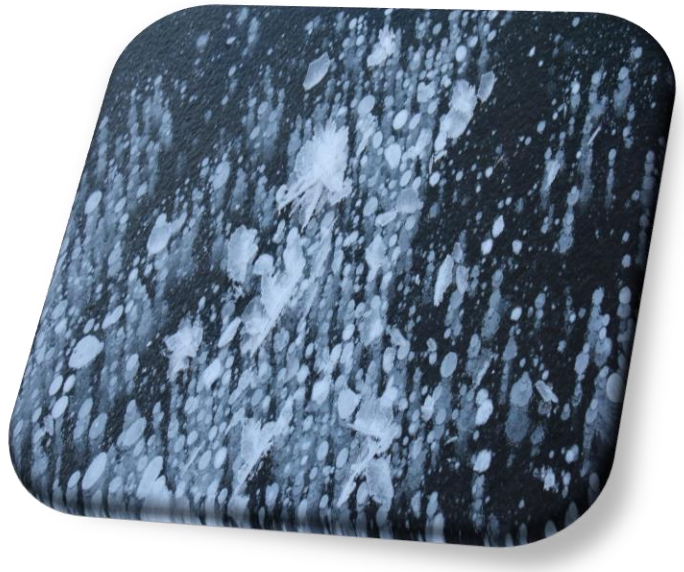
The Center also develops future leaders for the DHS enterprise through structured education programs.

ADAC's principal customer: *USCG…in support of Arctic Search and Rescue, Humanitarian Assistance, Disaster Response and Security missions.*

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

Arctic Domain Awareness Center Program Overview

- ***Funded via DHS Cooperative Grant:*** DHS awarded UAA approx. $2.5M annually over a 5 year period in July 2014.
- ***Projects can presently be funded*** via Existing Cooperative Grant, Basic Ordering Agreement (BOA) or DHS Supplemental.
- ***One of two DHS Centers of Maritime Research:*** Maritime Security Center (MSC) at Stevens Institute is ADAC's sister research center.
- ***Conducts Arctic oriented*** Science and Technology, Research, and most importantly, supports Student development.
- ***Principally focused*** on the USCG Arctic Operator.



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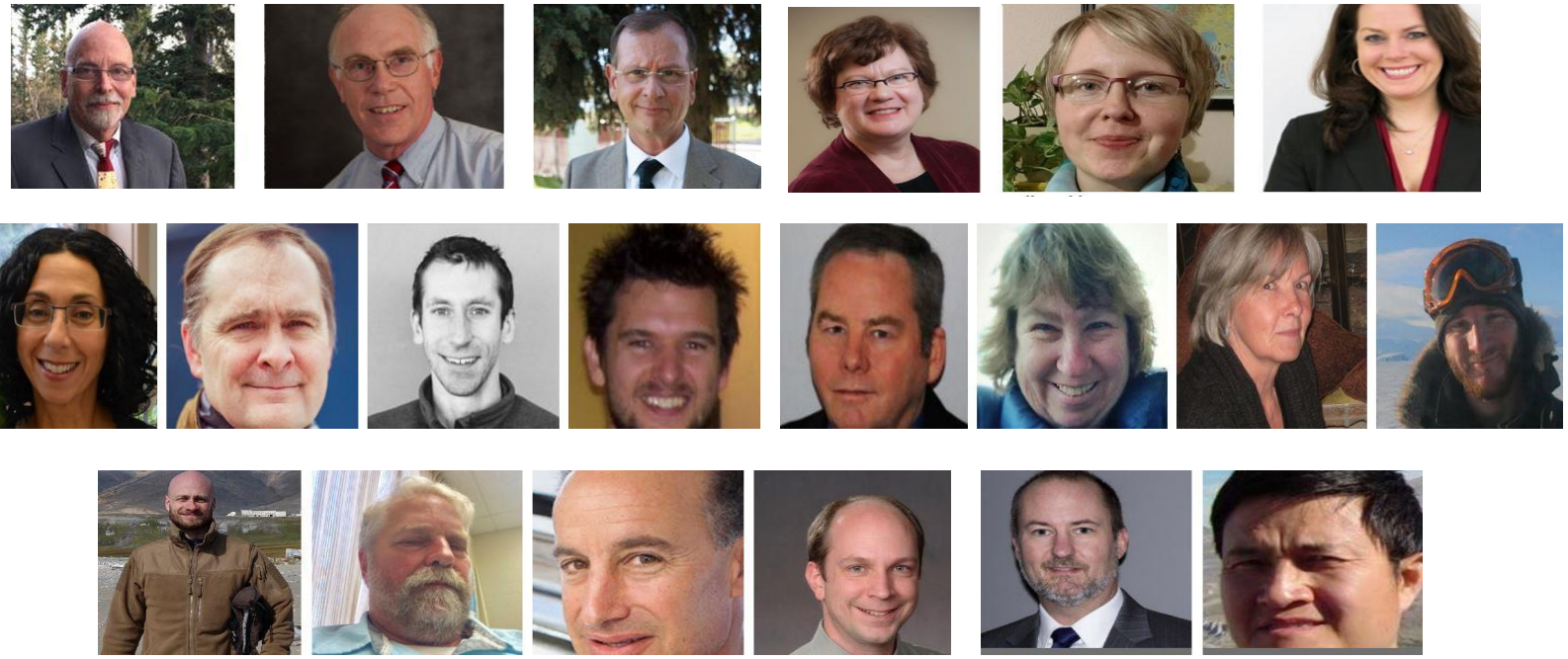
ADAC…Industrial Strength Arctic Research

- *ADAC:* ***A growing network…driven by the Arctic Operator.***
- *Academics Partnered with Industry****…pressing for results every day.***
- *Iterating with the customer****…in order to be relevant.***
- *Eyes on the future****…near, mid and long term.***



In Summary: Arctic Domain Awareness Center

ADAC: A networked team advancing S&T + R&D to ***meet Arctic operator needs:***

- ***Supporting*** POTUS, DHS and USCG Arctic Strategy and IARPC's 5 Year plan.
- ***Establishing*** a growing collaboration with Canadian government and academia.
- ***Partnering*** across the U.S. federal family.
- ***Developing*** new research through a comprehensive approach.
- ***Leveraging*** new initiatives such as "Eyes North."
- ***Creating*** education and professional Arctic mariner courseware.
- ***Conducting*** science and technology research and development as aligned to DHS Funding Opportunity Announcement.
  - Oriented to DHS "Enable the Decision Maker" Goals.
- ***Building*** the next Generation through ADAC Fellows Program.
- ***Envisioning*** a future as a U.S. National Center of Arctic R&D.

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ADAC Organizational Construct

ADAC Federal Coordinating Committee

HOMELAND SECURITY UNIVERSITY PROGRAMS
TODAY'S RESEARCH & EDUCATION, TOMORROW'S SECURITY

DHS S&T
OUP PM

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President

UAA

Chancellor
& Provost

ADAC Executive Counselors (External Advisors Board)

ADAC Leadership Team

ADAC Research Network

ADAC Research Projects

ADAC Leadership Team Composition:

- **Principal Investigator.**
- **Research Director.**
- **Executive Director.**
- **Finance Director.**
- **Project Manager.**
- **Education and Workforce Development Director.**
- **Administration and Communications Officer.**

ADAC's Developing Leadership Ideas for Year 4

- Center Technology Transition Officer from Industry.
- NOAA Science Advisor.
- Adjustments to assignment of Education, Administration and Communications (in particular, report writing tasks).

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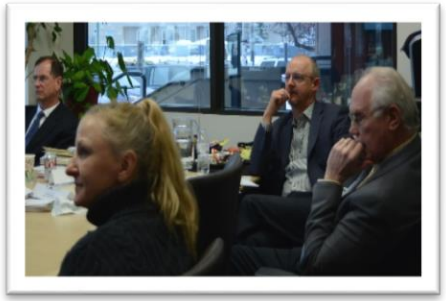
ADAC Leadership Team

ADAC's Current Leadership

- Douglas Causey, PhD, Principal Investigator, University of Alaska, Anchorage (UAA).
- Larry Hinzman, PhD, Research Director, University of Alaska Fairbanks (UAF).
- Randy Kee, Maj Gen (Ret) USAF, Executive Director (UAA).
- Heather Paulsen, MBA, Finance Director (UAA).
- LuAnn Piccard, MSE PMP, Project Management Director (UAA).
- Education Manager (TBA).
- Malla Kukkonen, Administration and Communications Officer (UAA).

ADAC's Executive Counselors

- Tom Barrett, VADM (Ret), USCG, Former Vice Commandant, and D-17 Commander, Current President, Alyeska Corporation.
- Paul Hubbard, PhD, Canada Department of National Defense.
- John Farrell, PhD, Executive Director, U.S Arctic Research Commission.
- Ruth Lane, Commander, U.S. Navy, Director, National Ice Center.
- Mike Faust, Vice President of Exploration, Conoco Phillips (Ret).



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"So, What is Domain Awareness?"

ADAC: is a Center of Maritime Research…focused to advance domain awareness…Pan-Arctic

One illustration…of it like a basic algebra equation of environmental factors: In simplest terms:

a + b + c +…, etc. = "Approximate" Domain Awareness

Note…each environmental factor variable is changing, at an increasingly dynamic rate …all across the High North!

Three Distinct Perspectives:

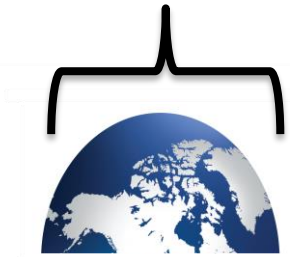
"3d Column"

Surface to High Altitude

Sea-bed to surface

"Specific region"… (such as the Bering Straits)

"Theater wide"



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Partnerships…the core of ADAC's "Research Network"

Program Year 3 ADAC Research Network:

From Academics :

- Maine Maritime Academy.
- University of Idaho.
- University of Washington.
- Woods Hole Oceanographic Institute.
- US Coast Guard Academy and their Center for Arctic Study and Policy.
- Texas A&M University.
- University of New Mexico. *
- University of Texas El Paso. *

From Industry:

- Axiom Data Science.
- Alaska Marine Exchange.
- Dubay Business Services.
- NOVA DINE-Kestrel. **
- ASRC Federal Solutions. **

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

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ADAC's Non-DHS & USCG Partnering and Collaborating Organizations

- NOAA & National Weather Service.
- Canadian DND and Canadian Academic Researchers.
- DoD Alaska Command and Alaska NORAD Region.
- Alaska Ocean Observation System.
- NASA-OSD Arctic Collaborative Environment.
- State of Alaska Department of Military and Veterans Affairs.
- DHS Centers of Excellence at Rutgers University, Stevens Institute and University of Houston.
- National Ice Center.
- National Maritime Intelligence Integration (NMIO).
- Office of Naval Research.
- Federal Bureau of Investigation.
- National Science Foundation.

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ADAC Current Projects: The following outlines ADAC underway research:

- Community-Based Observer Networks for Situational Awareness (CBON-SA).
- High resolution Modeling of Arctic Sea Ice and Currents.
- Arctic Oil Spill Modeling.
- Real-Time Storm Surge, Coastal Flooding, & Coastal Erosion Forecasting for Arctic Alaska.
  - **Inactive…awaiting Project Champion Designation.**
- Identifying, Tracking and Communicated Sea-Ice Hazards in an Integrated Framework.
- Development of Propeller Driven Long Range Autonomous Underwater Vehicle (LRAUV).
- Arctic Education: Implementing the Arctic Strategy in Training.
- MSI & Integrated Arctic Education (& Workforce Development).
- Career Development Grant (DHS S&T COE Supplemental).
- Arctic-Related Incidents of National Significance Workshops (DHS S&T COE Supplemental).
- Projects underway, but not approved to continue in ADAC Program Year 4 due to Letter's Review disqualification (project descriptions listed in Backup Slides).
  - **Arctic Information Fusion Capability (AIFC).**
  - **Low Cost Wireless Remote Sensors for Arctic Monitoring and Lifecycle Assessment.**

AIFC Strategic approach in ADAC Program Year 3
…Fusion Central and Fusion Forward…disaggregated in Program Year 4

SAR/HADR: Weather, Sea State, Ice, Debris, Erosion, AIS, Currents, Subsistence Activities

MONITORING

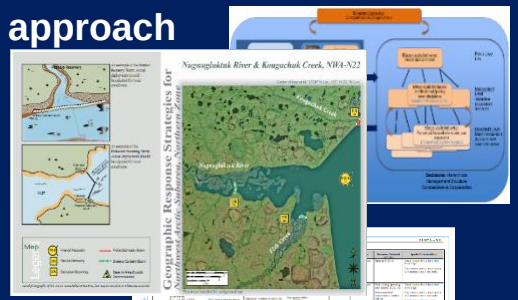
Protection | Response

Changing Arctic Ecosystems | COMMUNITY MAPS

AIFC: A suite approach

Data Interoperability Decision Support for Operators:

- Use case/scenarios
- Fine scale actions
- User defined
- Array of data…from authoritative sources
- Macro and Micro Fusion
- Internet and Austere comms
- Building from ERMA
- Artificial Intelligence (in later stages)



Micro-scale Human Behaviors | Macro-scale SAR/HADR operations

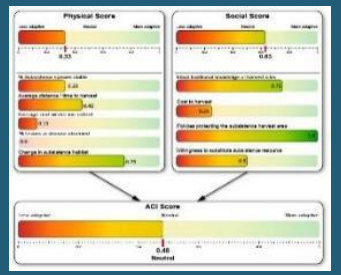
Infrastructure | Risks/Opportunities

Reduce risk to people and resources

Improve forecasting and anticipation

Outputs Over Time Define Indicators for Use in Decision Support

Biophysical, and Infrastructure Capability Indicators Weighted



Sociocultural and Economic Indicators Weighted

Arctic Information Fusion Capability

1) "Fusion Central"…scenario specific, operator driven multi-source data and modeled information for agile decision support
2) "Fusion Forward"…enable user defined operational decision views and criteria, which connects "on-scene" to "command"…critical in austere communications environments.

AIFC: A new approach to information fusion in austere environments. AIFC seeks to create a suite of capabilities, that includes greatly advancing NOAA's Arctic Environmental Response Management Application (Arctic ERMA). Some attributes:

- A Network of inputs through partnerships and access from the tactical edge;
- Connects CBONs via Multi-media field reports, easily accessible;
- Simple and open standards data & system exchange;
- Via FIST) Works anywhere …Cellular/WiFi/SATCOM);
- Tasking from HQ to the field;
- Science focused on enhanced situational awareness and incident response in the Arctic.

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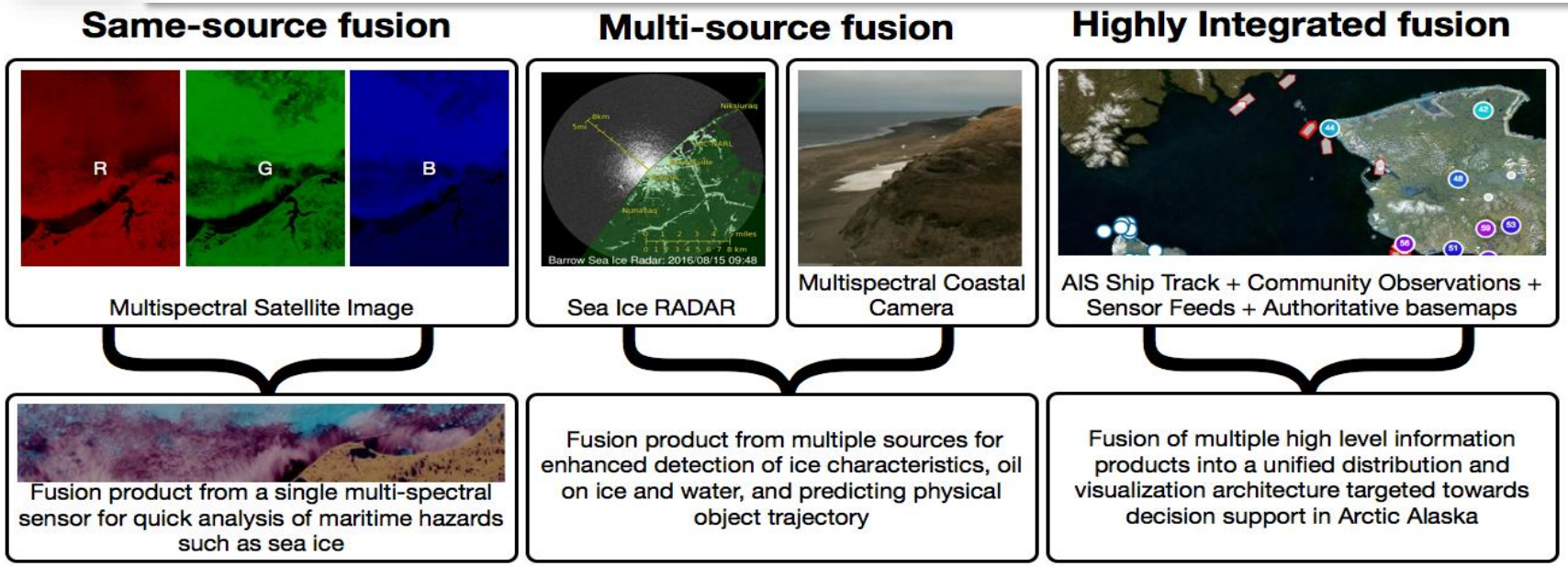
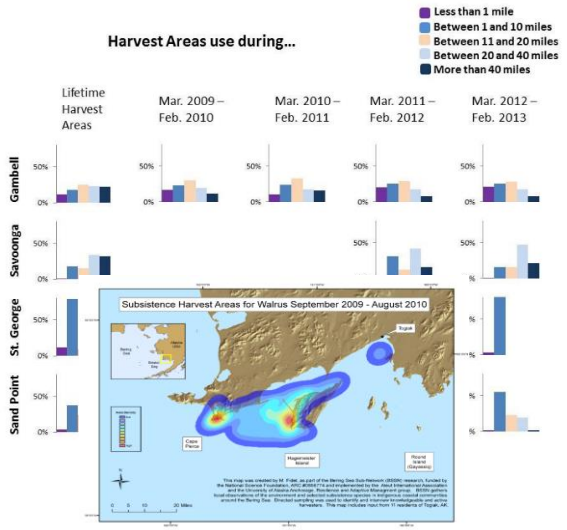
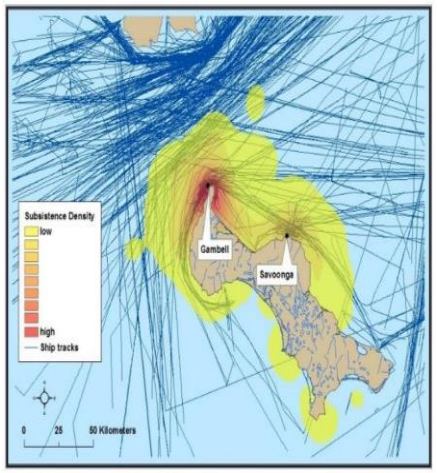
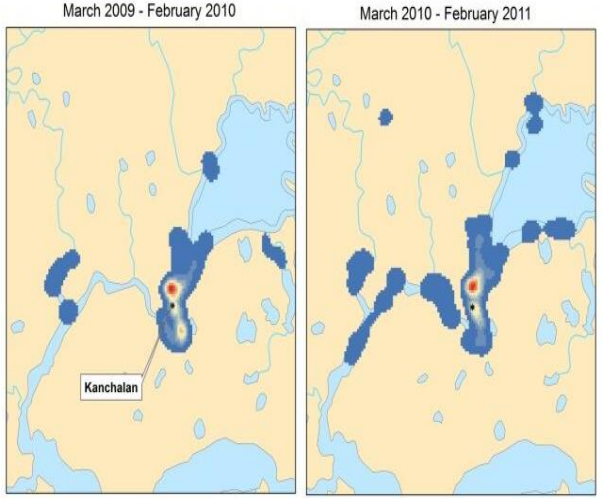
AIFC Strategic approach… Seeking interconnectedness and determining the art of Environmental factors Fusion









- ***Developing a Fusion Engine…***a core need to develop for USCG in support of Arctic Strategy Implementation
- Focused on Physical Environment.
- Accounting for the security dimension

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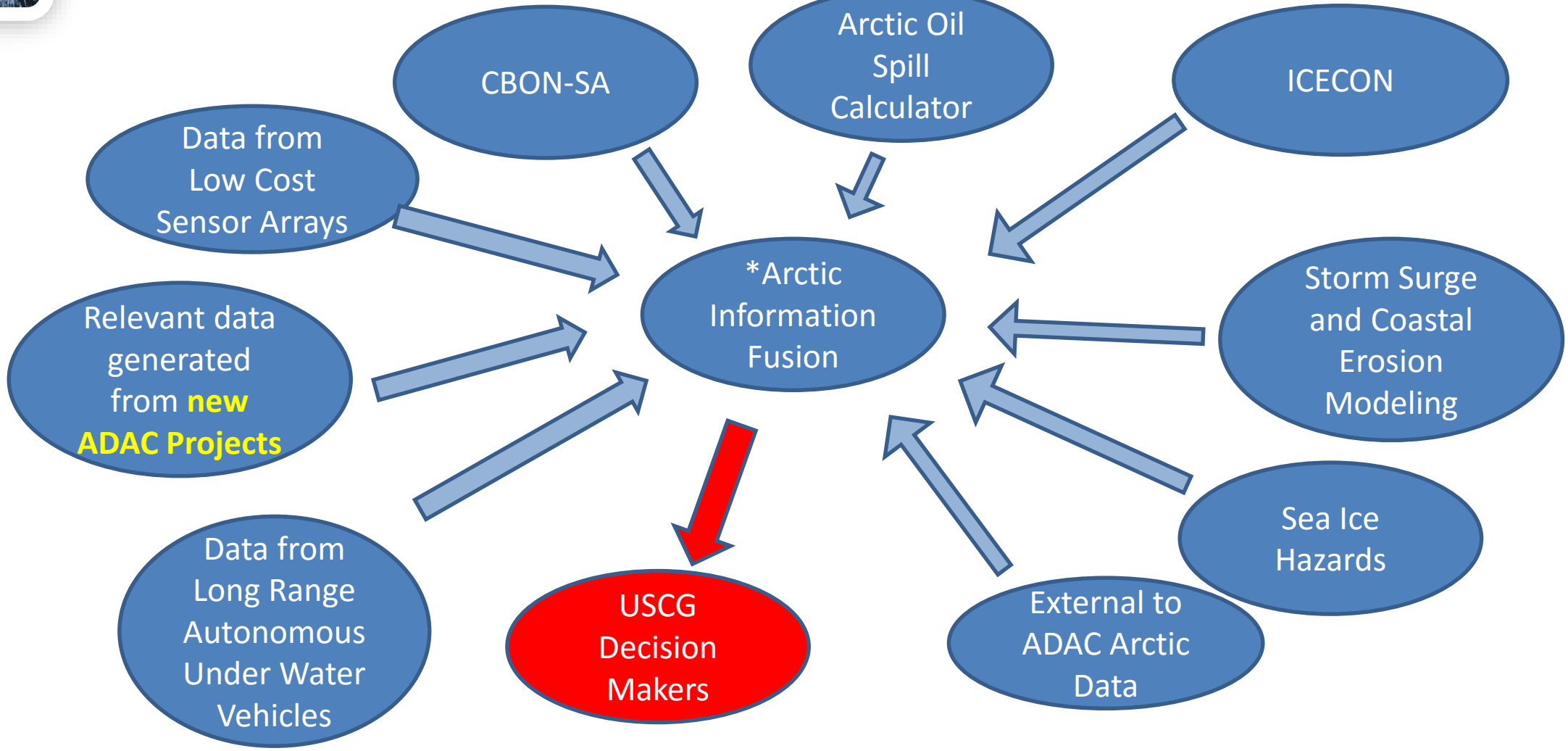
ADAC Current Project Inter-relation Concept



*Note ADAC seeking a disaggregated approach in follow-on efforts to support USCG mission needs in Arctic Info Fusion

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Student involvement: ADAC Fellows Program









"Students supporting Operator driven research"

- *CDG Scholars*
- *Project Research Interns*
- *Academy Cadets*
- *MSI Internships*
- *ADAC Workshops*
- *USCG Exercise Support*
- *Summer Internships*
- *Professional development*

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ADAC's Leadership Core Task…Generating and Developing New Research

As ADAC prepares onward plans for future research: the center is developing a strategy for research development. Included:

- ***Review of DHS FOA:*** brainstorming on the FOA across ADAC's research network…which includes all of ADAC's Partners and Collaborators.
- ***Soliciting USCG Operator network:*** periodically querying USCG for idea generation.
    - Through HQ Staff, USCG commander and center engagement.
    - Through ADAC's Bi-Monthly Customer's and Partner's Roundtables.
- ***Workshop driven research*** such as Arctic Incidents of National Significance (IoNS) and Medium & Long-Term Environment (MaLTE) workshops…as CANUS forums.
- ***Call for White Papers:*** Establishing an annual call for White Papers leveraging DHS, USCG, DHS S&T CoE Network, Universities, and Industry.

A new ADAC Initiative tentatively planned for Mar 2017

Arctic Domain Awareness Center's *Strategy for Research Development*

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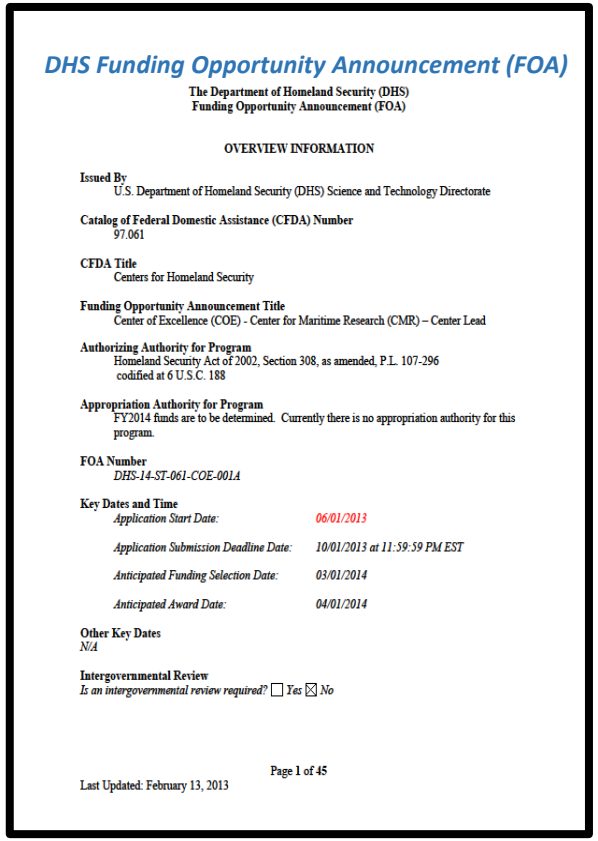
ADAC Project Concepts for new research

Aligned with DHS Funding Opportunity Announcement Themes and Associated Specific Research Questions. ***These are:***

- ***Theme 1:*** *Maritime Risk, Threat Analysis and Resilience.*
- ***Theme 2:*** *Maritime Domain Awareness Research.*
- ***Theme 3:*** *Maritime Technology Research.*
- ***Theme 4:*** *Integration of Science and Engineering with Maritime Security Governance and Policy Research.*
- ***Theme 5:*** *End to End.*
- ***Theme 6:*** *Integrated Education.*



DHS Funding Opportunity Announcement (FOA)

The Department of Homeland Security (DHS)
Funding Opportunity Announcement (FOA)

OVERVIEW INFORMATION

Issued By
U.S. Department of Homeland Security (DHS) Science and Technology Directorate

Catalog of Federal Domestic Assistance (CFDA) Number
97.061

CFDA Title
Centers for Homeland Security

Funding Opportunity Announcement Title
Center of Excellence (COE) - Center for Maritime Research (CMR) – Center Lead

Authorizing Authority for Program
Homeland Security Act of 2002, Section 308, as amended, P.L. 107-296 codified at 6 U.S.C. 188

Appropriation Authority for Program
FY2014 funds are to be determined. Currently there is no appropriation authority for this program.

FOA Number
DHS-14-ST-061-COE-001A

Key Dates and Time

Application Start Date:	*06/01/2013*
Application Submission Deadline Date:	*10/01/2013 at 11:59:59 PM EST*
Anticipated Funding Selection Date:	*03/01/2014*
Anticipated Award Date:	*04/01/2014*

Other Key Dates
N/A

Intergovernmental Review
Is an intergovernmental review required? ☐ *Yes* ☒ *No*

Page 1 of 45
Last Updated: February 13, 2013

While developing ADAC's Research Strategy, the Center created 33 New Project Concepts From Jan to Mar 2017

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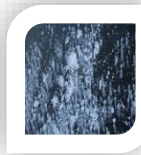

ADAC's New Projects via Arctic IoNS

- ***ADAC's Request for Proposal stemming from Arctic IoNS proposal was conducted Fall 2016.***
- ***Approximately $800K research…***is soon to be awarded to the best/most applicable of 10 qualified responses
  - RFP responses to 20 USCG Research Questions related to disabled cruise ship in Arctic Waters.
  - Projects intended to be 2 years in length.
  - *Following evaluations, selected projects will develop research workplans*
  - *ADAC remains hopeful that research will commence approximately in late Spring 2017.*
- ***More to follow…***as proposal evaluations are concluded.

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ADAC New Project Concepts: Page 1

No.	Project Title	White Paper
1	Enhancing Arctic Coastal Domain Awareness with the New Earthscope Seismic Network in northern Alaska and Western Canada.	Yes: 7 Mar 17
2	Sensor design, selection, and deployment on Arctic-based UAS platforms.	Yes: 7 Mar 17
3	Shore-Fast Ice formation and detachment decision modeling for USCG Arctic near-shore operations and in vicinity of Arctic Ports.	Yes: 7 Mar 17
4	Large and Fine-scale Real-time Monitoring of the Coastal Arctic Environment.	Yes: 7 Mar 17
5	Discerning Dark Targets in the Bering, Chukchi and Beaufort Seas in support of USCG Law Enforcement mission.	Yes: 7 Mar 17
6	Developing a rapid response team for characterizing 3D environmental-infrastructural change following Arctic IoNS.	Yes: 7 Mar 17
7	Virtual Reality for Situational Awareness for Vessels in Ice (V-SAVI).	Yes: 7 Mar 17
8	On-Demand Bathymetry in support of U.S. Coast Guard Arctic-region crisis response.	Yes: 7 Mar 17

ADAC New Project Concepts: Page 2

No.	Project Title	White Paper
9	Feasibility Study to assess how Enhanced Port Facilities in the Barrow Area could enhance USCG Operations.	Yes: 7 Mar 17
10	Small, scalable and sustainable power generation in support of operation at remote austere locations.	Yes: 7 Mar 17
11	High Resolution Coastal Ocean and Sea Ice Modeling for Oil Spill Response, Deepwater Port Planning, and Search and Rescue.	Yes: 15 Mar 17
12	GPS Reflectrometry for Water Level Observations.	Yes: 7 Mar 17
13	Integrated Negotiation of Critical Infrastructure Threats and Engineering for Resilience (INCITER).	Yes: 7 Mar 17
14	Rapid Assessment of Disease Threats in the Arctic Region (RADAR).	Yes: 11 Mar 17
15	Rapid Deployable High Frequency Radar for Mapping Surface Currents for Remote Settings.	Yes: 9 Mar 17
16	Persistent Human Observation Capability for Offshore Surveillance (PHOCOS).	Yes: 9 Mar 17

ADAC New Project Concepts: Page 3

No.	Project Title	White Paper
17	Laboratory Experiments to Validate Arctic Oil Spill Modelling and Forecast.	Yes: 9 Mar 17
18	Sea ice and ocean seasonality for Arctic Maritime Domain Awareness.	Yes: 9 Mar 17
19	Ocean Microbuoys for Rapid and Sustained Maritime Domain Awareness Arctic Ports.	Yes: 10 Mar 17
20	Minimizing earthquake and tsunami risk at U.S. Coast Guard facilities serving the Arctic.	Yes: 10 Mar 17
21	Enhancing Arctic Mobile Communications using Troposcatter Communications with Adaptive Antennas in Northern Alaska and Western Canada.	Yes: 10 Mar 17
22	Exploring Enhancements to Arctic Communications and Domain Awareness using the ASF CubeSat Antenna Farm Experiment (CAFE).	Yes: 10 Mar 17
23	Exploring Enhancements to Arctic Communications using HAARP.	Yes: 10 Mar 17
24	Detecting and sourcing natural gas in the marine environment.	Yes: 10 Mar 17
25	Remotely Deployed, Real-Time Ice Freeze-up Detection Buoy for National Weather Service Ice and Weather Forecasting and Research	Yes: 7 Mar 2017

ADAC New Project Concepts: Page 4

No.	Project Title	White Paper
26	Comprehensive Analysis of Needed Life Saving Appliances needed for Arctic Major Response Rescue.	*No: 10 Mar 17
27	Affordable Autonomous Integrated Systems Coastal and Riverine Surface Vessel.	*No: 10 Mar 17
28	Research and Develop a Sea-Ice Capable long-distance signal relay for LRAUV.	*No: 10 Mar 17
29	Prototype UAS/RPA Field-test research for USCG Crisis Response Research.	*No: 10 Mar 17
30	A networked catalog of assets and social capital for Arctic disaster preparedness and response.	*No: 10 Mar 17
31	Comprehensive feasibility assessment of Security and Crisis Response needs for USCG operating from Arctic Strategic Port.	*No: 10 Mar 17
32	Arctic Training in Education: Arctic Emergency Response Scenario-based training.	*No: 10 Mar 17
33	A series of DHS/USCG validated projects in a disaggregated AIFC.	*No: 10 Mar 17

***Note:** **Associated White Paper in development, but not sufficiently ready to be presented**

Ready for Questions

Backups follow

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ADAC Current Key Engagement Forums

Weekly Teleconferences with DHS S&T OUP PM and All Hands Calls for the ADAC Research Network:

- S&T OUP PM provided detailed outline of ADAC plans, workplan execution, developing efforts and engagement across Arctic-minded enterprise.
- ADAC leadership and Research Network active issue discussion and project status reporting.

Bi-monthly Customer and Partner's Roundtable Teleconferences…for Program Year 3:

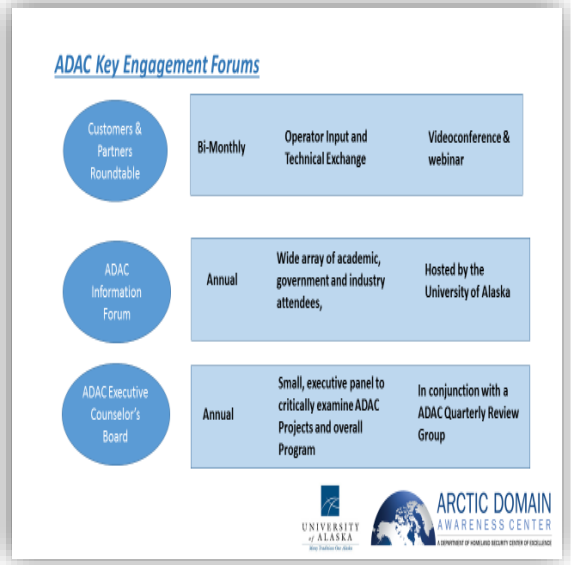
- 3 x Open Roundtables held so far in Year 3.
- 1 x Specific USCG Project Champion Roundtable.
- Adapting after each event following feedback.

Communications Outreach:

- Robust leadership engagement across the Arctic-minded enterprise: CANUS, Federal, State, Local, & Industry.
- Active use of Facebook, Twitter, and Web.

Annual Meeting in Washington D.C:

- ADAC Leadership, Researchers and Fellows present to DHS, USCG and Federal U.S. Agencies.



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ADAC Current Key Management Processes

ADAC Quarterly Program Reviews:

- Conducted as Project Performance Review, including Fiscal Management progress. 2 x Review so far in Year 3.
- Winter Review used to assess semi-annual Programmatic Change Recommendations to DHS S&T Program Manager.
- Note: Winter Review attended by ADAC External Executive Counselors.

Research Development Strategy:

- New Comprehensive Approach to develop Research Proposals.

Near and Long Range CANUS Arctic Workshops to support Research Development:

- Arctic Incident of National Significance (Arctic IoNS).
- Arctic Medium and Long Term Environment (Arctic MaLTE).

Safety and Information Protection Plans:

- Active program management by Leadership & Researchers.

Education Outreach, Workforce Development and MSI:

- ADAC Fellows Program with active student participation in research, workshop development and summer internship.

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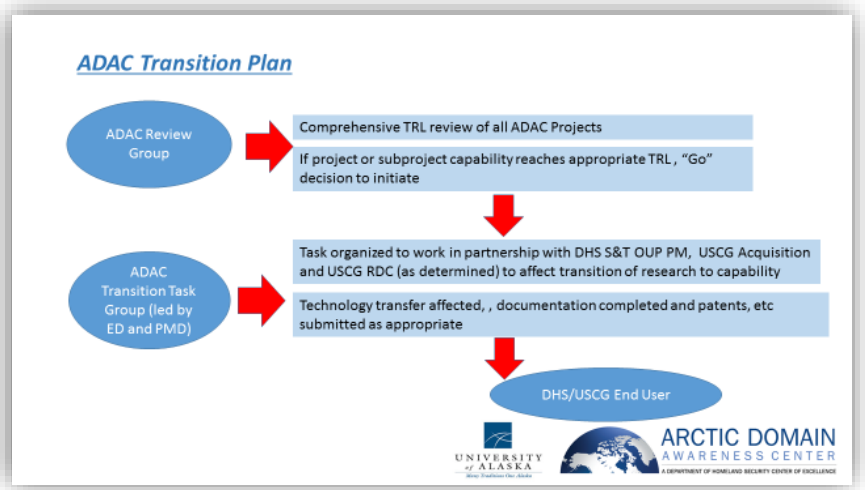
ADAC Project Performance Management and Transition Process

Project Performance Management:

- Conducted during ADAC Quarterly Reviews.
- Actual vs planned accomplishments for Schedule, Milestones and Metrics.
- Fiscal accountability review.
- Simple measurement criteria:
  - ***Ahead, On Target, Behind?***
- Programmatic Adjustment: Consolidated and provided to Program Manager for consideration.
- ***Note:*** Have delayed Year 3 until post FCC to avoid complicating FCC and PM review decisions.

Research to Technology Transition Process:

- Maturing process, leveraging now in support of transition of Arctic Training in Education Courseware.
- Seeking to improve by adding a Center Technology Transition Officer from Industry.



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A DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE

Project Title: Community-Based Observer Networks for Situational Awareness (CBON-SA)

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2c, Information & Intelligence Integration within Maritime Operations. **Specific research question: 2c. 1. question iii.**

Project Objectives:

- Utilize distributed human observers as sensors to systematically observe and document Arctic environmental changes relevant to resource security.
- Utilize human observers to detect and place in context a range of critical variables pertinent to maritime security.
- Develop reliable data streams, in real time, that are compatible with other monitoring data streams.

Potential Impact:

- Provision of local fine-scale data and situational awareness for maritime security.
- Observations feed a portal into NOAA's Arctic ERMA.

Key Accomplishments:

- Established initially capable operational CBON for Bering Sea at 4 current locations
- Developed and tested protocols in villages of Gambell, Unalaska, Kotzebue, Barrow (and formally Wales).
- Successful preliminary test of Field Information Support Tool (FIST) by local observer with USCG Exercise.
- Program was highlighted at White House Arctic Science Ministerial in DC Sep 2016.

Funding:

- Expended to Date by End of Year 2 ……$153,774.80

Key Milestones/Deliverable Schedule:

- Project Start……..Jan 15 √
- Developed and documented data intakes ……May 15 √
- Tested cell-to-satellite phone data relay ..…….....Jun 15 √
- Completed observer training and protocols……Jun 15 √
- Replicated protocols in new communities.……..May16 √
- Expanded network to three communities…….....…Jun16 √
- Operational CBON-SA in place…….Jun 16 √
- Test CBON-SA with field operator tool (FIST)…….....Aug 16√
- Project end date……Jun 19

Performance Metrics:

- Successful image and data relays, integration of observing data with FIST tool, detection of anomalous events.

Project Champions:

- **HQ USCG CG-255.**

Stakeholders/advocates:

- HQ USCG (in particular, CG-5PW); USCG RDC; USCG Pac Area & USCG D-17.
- NOAA and NWS; White House Office of Science and Technology Policy; National Science Foundation.

Points of Contact:

- Lil Alessa, Univ. of Idaho, Project Principal Investigator.
- Andy Kliskey, Univ. of Idaho, Project Co-investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: High resolution Modeling of Arctic Sea Ice and Currents

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2b, Coastal and Marine Modeling and Analysis; Topic 2d, Arctic Analysis. **Specific research question: 2d. 3. question iii**.

Project Objectives:

- To support USCG Arctic operators and planners, develop a High-resolution Ice-Ocean Modeling and Assimilation System (HIOMAS) to realistically forecast Arctic sea ice thickness, concentration, and motion, and ocean currents.

Potential Impact:

- Help the Coast Guard to conduct search and rescue missions more safely and reliably; enhance the Coast Guard's ability to prepare for and respond to oil spills.
- Support Arctic stakeholders in planning; modeling currently feeds NOAA's Arctic ERMA.

Key Accomplishments:

- Developed HIOMAS based on the well-established Pan-Arctic Ice-Ocean Modeling and Assimilation System (PIOMAS) with high resolution (6 km).
- Conducted model calibration and validation using observations of sea ice thickness, concentration, and motion; carried out HIOMAS hindcast and forecast.
- Configured HIOMAS with even higher resolution (2-4 km); currently testing the 4 km resolution HIOMAS.

Funding:

- Expended to Date by End of Year 2 ……$104,148.00

Key Milestones/Deliverable Schedule:

- Project Start…….…. Jan 15 √
- Developed and validated 6-km HIOMAS…....Jun 16 √
- Develop and validate 4-km HIOMAS…….Dec 16
- Conduct hindcast/forecast assessments…….. Jun 17
- Project end date…….....Jun 19

Performance Metrics:

- Mean model error in ice concentration: < 30%, achieved.
- Mean model error in ice thickness: < 0.4 m, achieved.
- Mean model error in ice drift: < 0.02 m/s, achieved.

Project Champion:

- **HQ USCG CG-751.**

Stakeholders/advocates:

- HQ USCG (in particular, CG-255); USCG RDC; USCG Pac Area and USCG D-17.
- NOAA and NWS.

Point of Contact:

- Jinlun Zhang, Univ of Washington, Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Arctic Oil Spill Modeling (AOSM)

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2a Coastal and Marine Critical Infrastructure development; Topic 2b, Coastal and Marine Modeling and Analysis.

Specific research question: Topic 2b. question 3.

Project Objectives:

- In order to support USCG deliberate and crisis planning, assist NOAA Office of Response and Restoration with the development of an Arctic-capable GNOME oil spill model.
- Develop and transfer algorithms for determining the movement and spreading of oil released (a) near the surface, accounting for the presence of sea ice and (b) under ice, accounting for under-ice roughness.

Potential Impact:

- The research contributes to the development of an Arctic-capable oil spill model referred to as GNOME-2.
- Project also feeds Arctic Information Fusion Capability.

Key Accomplishments:

- Guidance to NOAA on how to account for ice in oil spreading algorithms. The guidance was incorporated into GNOME-2.
- Demonstrated that HIOMAS Ocean / Sea Ice model output can be used to drive GNOME oil spill model.
- Successful adaptation of TAMU plume model (for well blowouts) to the Arctic Ocean with ice cover.
- Identified an approach for estimating the movement and spreading of oil released under ice, accounting for the variations roughness of the under side of the sea ice.

Funding:

- Expended to Date by End of Year 2 ……$96,130.65

Key Milestones/Deliverable Schedule:

- Project Start……..….Jan 15√
- Review of 23 Arctic oil spill studies ……..……..Jun 15√
- Completed “Diagnostic Save Files”……..…….Jun 16√
- Successful runs of GNOME model using high resolution & conventional Diagnostic Save Files……..Jun 16√
- Algorithms for oil spreading in icy seas…….....Jun 17
- Project end date……..……...Jun 19

Performance Metrics:

- Number of studies reviewed (target of 10 to 30) – 23 reviewed. √
- Resolution of GNOME model (target 2 km) – 6 km resolution GNOME model achieved (note, project tied to High Resolution Sea Ice and Currents project). √

Project Champions:

- **HQ USCG CG-MER.**

Stakeholders/advocates:

- HQ USCG (in particular, CG-255); USCG RDC; USCG Pac Area; USCG D-9 and D-17.
- NOAA Office of Response and Restoration (ORR).

Points of Contact:

- Tom Ravens, UAA, Project Principal Investigator.
- Scott Socolofsky, TAMU, Project Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Real-Time Storm Surge, Coastal Flooding, & Coastal Erosion Forecasting for Arctic Alaska

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2b, Coastal and Marine Modeling and Analysis. **Specific research question: Topic 2b. questions 1 & 3.**

Project remains in suspended status…awaiting HQ USCG Project Champion

Project Objectives:

- Work in collaboration with the US Coast Guard and NOAA to provide high resolution surge, wave, and erosion forecasts for vulnerable coastal communities.
- Calibrate and validate the models with available data, including observations of ice and geomorphic change.

Potential Impact:

- The research has the potential to transform the Arctic coastal zone from an area with little or no real-time or forecasted coastal data to one with data that is comparable in quality to Continental U.S.
- An added benefit of the high resolution coastal data is that it will potentially improve oil spill modeling and search and rescue operations by providing high resolution velocity data.

Key Milestones/Deliverable Schedule:

- Project Start……...Jan 15√
- Code for real-time surge forecasting……...Jun 15√
- Forecasting of surge in YK Delta……..Jun 15√
- Forecasting of surge in Norton Sound……Jun 16√
- Validation of YK Delta surge model……..Jun 16√
- Coding for real-time surge and wave forecasts……...Jun 16√
- Develop forecasts of storm surge, coastal flooding, nearshore waves, and coastal erosion……..Jun 17
- Project end date……..Jun 19

Performance Metrics:

- Accuracy of surge/flooding forecasts (target error 0.25 to 0.5 m), target achieved. √
- Number of months the surge model was “operational” (target: 0 to 12 months). Model operational: 12 months. √

Key Accomplishments:

- Successful development of a high resolution coastal surge/flooding and wave forecasting model for the Yukon Kuskokwim (YK) Delta and for Norton Sound.
- Successful validation of the surge forecasting model based on near-shore water level data in the YK Delta.
- Validation of surge/flooding calculations with satellite observations of inundation extent.
- Expansion of original scope to include links with UAF’s Ice Radar observations and Univ. of Texas El Paso (UTEP) observations of geomorphic change in Barrow Alaska.

Funding:

- Expended to Date by End of Year 2 ……$202,814.06

Project Champions:

- **Awaiting Project Champion designation.**

Stakeholders/advocates:

- HQ USCG; USCG RDC; USCG Pac Area & USCG D-17.
- FEMA Region 10; NOAA and NWS.

Points of Contact:

- Tom Ravens, UAA, Project Principal Investigator.
- Craig Tweedie, UTEP, Project Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Identifying, Tracking and Communicated Sea-Ice Hazards in an Integrated Framework

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2d, Arctic Analysis; Topic 5c, Arctic E2E. **Specific research question: Topic 2d. question 1.**

Project Objectives:

- Develop framework for identifying, tracking and communicating sea ice-related hazards utilizing existing Arctic observing assets
- Enhance the capability of surface-based radar for monitoring sea ice hazards, particularly in coastal settings.
- Communicate imagery, velocity data and sea-ice related hazards to USCG and other operator centers and provide acquired information to ADAC's AIFC.

Potential Impact:

- Improved ability to leverage Arctic observing assets for sea ice hazard mitigation
- Development of transferable technology to enhance Arctic MDA capabilities of surface-based radar assets.

Key Milestones/Deliverable Schedule:

- Project Start……..Jan 15√
- Development of near-real time ice velocity data product from Barrow coastal radar…… May 15√
- Conceptual framework for Arctic MDA testbed……..Dec 15√
- Application of ice tracking technique to other radar platforms and assessment of MDA value…….....…..Mar 17
- Planning document for TTX within Arctic MDA testbed…Jun 17
- Project end……..……Jun 19

Performance Metrics:

- Radar ice velocity product: TRL 6: achieved √
- Radar ice divergence product: TRL 5 achieved (Target 6)
- Framework document for Arctic MDA testbed: TRL 2:achieved √
- Overlap with AIFC model grid: in progress.

Key Accomplishments:

- Implementation of software to provide near-real time data on sea ice velocity and convergence from Barrow coastal ice radar (June 2016).
- Dissemination of radar imagery and velocity data to Barrow search and rescue team during landfast ice detachment event (29 April 2014).
- Demonstration of ship-based application of radar ice tracking methods on board *USGC Healy* (July 2015)
- Publication of whitepaper outlining Barrow Arctic MDA testbed concept and relevant observing system resources (March 2016).

Funding:

- Expended to Date by End of Year 2…….$127,922.78

Project Champions:

- **HQ USCG CG-751.**

Stakeholders/advocates:

- HQ USCG (particularly CG-255); USCG RDC; USCG Pac Area & USCG D-17.
- NOAA and NWS; State of Alaska's Alaska North Slope Borough.

Points of Contact:

- Andrew Mahoney, UAF, Principal Investigator.
- Hajo Eicken, UAF, Co-Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Development of Propeller Driven Long Range Autonomous Underwater Vehicle (LRAUV)

FOA/NOFO Research Question(s): Topic 2d, Arctic Analysis; Topic 3b, Maritime Robotics; Topic 3c Environmental Technologies. **Specific research question: Topic 3b. questions 4 and 7.**

Project Objectives:

- Build a prototype AUV with long-range based capability to characterize oil & environmental hazards under ice.
- Develop software simulation for operators to plan mission scenarios with available environmental data models.
- Identify and implement an oil detection sensor package.

Potential Impact:

- Provide 'last seat on the helicopter' LRAUV with off-the-shelf capability for baseline surveys and oil detection.
- Give first responders data quickly in order to limit damages.

Key Accomplishments:

- Sensor package identified and integrated into a REMUS AUV for open water testing and Nov 2016 Demo.
- Software simulation for mission planning and operator training.
- LRAUV Tethys fabrication underway.

Funding:

- Expended to Date by End of Year 2 ……$183,441.94

Key Milestones/Deliverable Schedule:

- Project Start……Jan 15 √
- Sensor identified……Jun 15 √
- Software Simulation……Jun16 √
- Sensors integrated on REMUS for Demo……Oct 16 √
- Complete prototype LRAUV ……Jun 18
- Arctic water tests……late 18/early 19
- Project end……Jun 19

Performance Metrics:

- Simulator fidelity: built and tested, enhancements ongoing with modeling data √
- Oil limit of detection< 80 ppb crude oil and oil sensitivity 3 ppb crude oil (verified by WET Labs SeaOWL) COTS, easy to use. √

Project Champion:

- **HQ USCG CG-MER.**

Stakeholders/advocates:

- HQ USCG (in particular, CG-255); USCG District 9 and 17.
- NOAA-NWS; BSEE; US Department of the Interior.

Points of Contact:

- Amy Kukulya, WHOI, PI
- Jim Bellingham, WHOI, PI

**See PowerPoint Notes for Project Abstract*

Project Title: Arctic Education: Implementing the Arctic Strategy in Training

FOA/NOFO Research Question: 6a, New curricula, courses, and certificate programs.

Project Objectives:

- Develop Basic and Advanced Ice Navigation classes.
- Obtain certification for both courses from USCG as meeting requirements for ice navigation under the new International Maritime Organization (IMO) Polar Code.
- Teach basic ice navigation class in a classroom setting.

Potential Impact:

- Provides required ice navigation training under the new Polar Code to USCG and other Arctic oriented U.S. mariners.

Key Accomplishments:

- Basic Ice Navigation Course completed and submitted to USCG for approval for certification.
- Basic Ice Navigation class approved for certification.
- A total of 22 students completed the classroom version of the Basic Ice Navigation course in Spring 2016. Another 22 are underway in Spring 2017 course.
- Participation and presentations at various events and conferences promoting ice navigation and Polar Code compliance.

Funding:

- Expended to Date by End of Year 2 …….$177,372.67

Key Milestones/Deliverable Schedule:

- Project Start…… ……..……..…….Jan 15√
- Finished Basic Ice Navigation class…… ……..……..…….Dec 15√
- First Ice Navigation class taught……...…….Jan 16√
- Basic Ice Navigation class certified by USCG……...Jul 16√
- Advanced Ice Navigation class completed……..…..…Jun 17
- Project End……...……..…….Jun 17

Performance Metrics:

- Basic Ice Navigation class completed & certified – complete. √
- Advanced class completed and certified – pending funding
- Basic ice navigation class taught is a classroom setting and completed by 22 students – complete. √

Project Champion:

- **HQ USCG CG-751.**

Stakeholders/advocates:

- HQ USCG (in particular, CG-1); USCG RDC, USCG D-17.
- U.S. Maritime Academies.
- Professional Arctic Mariners.

Points of Contact:

- Sue Hazlett, MMA, Project PI.
- Captain Ralph Pundt, MMA Technical Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: MSI & Integrated Arctic Education (& Workforce Development)

FOA/NOFO Research Question(s). Topic 6c, Arrangements for programs and linkages with Minority Serving Institutions; Topic 6g, Programs to identify COE students for DHS internship opportunities.

Project Objectives:

- Objective 1: Attract the highest caliber undergraduate and graduate students to ADAC projects within the ADAC Research Network (ARN).
- Objective 2: Nurture and train these students for careers in DHS—related applied fields of science and technology.
- Objective 3: Provide students opportunities for direct involvement in DHS operations and embedded research among our DHS collaborators and stakeholders.
- Objective 4: Provide education, mentorship and internships to students that leads to timely completion of degrees and fulfilling careers in DHS Enterprise.

Potential Impact:

- Impact 1: Contribute to growth of highly skilled workforce for Homeland Security agencies.
- Impact 2: Contribute to the capability of US Coast Guard operator to provide disaster relief, search& rescue, & humanitarian aid in the Arctic.

Key Accomplishments:

- Master's in Arctic Engineering degree program at UAA and online course available to the public.
- Hosted MSI summer intern from FL institute in UAA ADAC project.
- In year 2, ADAC built a plan to recruit disadvantaged students into summer internships that commence summer 2017.
- Creation of ADAC Fellows Program, including CDG, MSI and project research interns
  - MSI and Workforce Development funding for Year 3 approved beginning Nov, 2016.
  - Scope of originally proposed education plan not sufficiently funded or implemented prior to new Center management in Year. 2

Funding:

- Expended to Date by End of Year 2……..…$33,454.52

Key Milestones/Deliverable Schedule:

- Project Start……Sep 14 √
- Key Milestone 1(student recruitment and selection)……Nov 16
- Key Milestone 2 (place minority summer interns)……May 17
- Key Milestone 3 (execute Fellows mentoring).....….Nov 16
- Project End……..……..…Jun 19

Performance Metrics:

- Recruit, assign mentors and student research work in individual ADAC projects for MSI and WFD (year 3 plan)
- Provide bi-monthly ADAC Fellows coaching and mentoring sessions
- Assess performance of minority students in summer research programs
- MSI students who compete and earn CDG scholarships following internship

Project Champion:

- **N/A.**

Stakeholders/advocates:

- DHS, and DHS components.
- State of Alaska; University of Alaska Anchorage, Fairbanks and ADAC Research Network.

Points of Contact:

- **Federal Agency Customer:** DHS S&T OUP Education Outreach and Workforce Development POCs.
- Clarice Conley, UAA, Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Career Development Grant (DHS S&T COE Supplemental)

FOA/NOFO Research Question(s): Topic 6g, Programs to identify COE students for DHS internship opportunities.

Project Objectives:

- Objective 1: Attract the highest caliber undergraduate and graduate students to our science and engineering programs at UAA.
- Objective 2: Nurture and train these students for careers in DHS—related applied fields of science and technology.
- Objective 3: Provide students opportunities for direct involvement in DHS operations and embedded research among our DHS collaborators and stakeholders.
- Objective 4: Provide education and mentorship to students that leads to timely completion of degrees and fulfilling careers in DHS Enterprise.

Potential Impact:

- Impact 1: Contribute to growth of highly skilled workforce for Homeland Security agencies
- Impact 2: Contribute to the capability of US Coast Guard operator and in support of USCG missions in the Arctic.

Key Accomplishments:

- Awarded five full-time fellowships.
- ADAC students completed comprehensive Arctic IONS Literature Review.
- Two scholars participated in MSC Summer Intern Seminar and one completed summer internship with industry at engineering firm.
- 100% student retention rate.
  - Funding arrived in Sep 15, too late to award fellowships for Fall semester 15. Fellowships were awarded in Spring semester 16.

Funding:

- Expended to Date by End of Year 2 ……$77,693.92

Key Milestones/Deliverable Schedule:

- Project Start……..…Feb 16 √
- Key Milestone 1 (student recruitment/selection) ……... Feb 16 √
- Key Milestone 2 (sponsor summer internships)…….....Jun 16 √
- Key Milestone 3 (student degree completion) ……Jun 17
- Project End…….……..….Jun 18

Performance Metrics:

- Type of Major: 5 STEM—2 Masters, 3 Undergraduate.
- 13 DHS focus areas; 17 faculty involved.
- 100% student retention rate.

Project Champions:

- **N/A.**

Stakeholders/advocates:

- DHS, and DHS components.
- State of Alaska; University of Alaska Anchorage, Fairbanks and ADAC Research Network.

Points of Contact:

- **Federal Agency Customer:** DHS S&T OUP Education Outreach and Workforce Development POCs.
- Clarice Conley, UAA, Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Arctic-Related Incidents of National Significance Workshops (DHS S&T COE Supplemental)

FOA/NOFO Research Question(s): Topic 3f, Maritime Incidents of National Significance (IoNS) Response and Recovery. **Specific research question: Theme Area 3 Question 7.**

Project Objectives:

- Objective 1: Working in partnership with USCG and other Arctic operators to construct a workshop with select researchers in order to identify research and technology gaps and define research questions.
- Objective 2: Following the conclusion of the workshop and completion of the associated Rapporteurs report, work with DHS to accomplish merit competitions conducted by issuing requests for proposals (RFPs).
- Objective 3: In support of USCG Arctic Strategy, seek inclusion of Canadian government and academic participation.

Potential Impact:

- Impact 1: Contribute additional S&T R&D in response to workshop conclusions of research concerns derived by USCG and associated Arctic operators. Onward research intended to provide capability to support USCG operator to provide disaster relief, search and rescue, and humanitarian aid in the Arctic.

Key Accomplishments:

- Convening a bi-national planning team
- Conducted comprehensive literature review of USCG and other Arctic operator derived research concerns.
- Assembled bi-national research team to present current state of associated research.
- Conducted a successful Arctic IoNS workshop, hosted in Anchorage Alaska on 21-22 Jun 16.
- Completed post workshop report and associated research proposal.

Funding:

- Expended to Date by End of Year 2……$94,359.00

Key Milestones/Deliverable Schedule:

- Project Start……Mar 16 √
- Work closely with DHS, USCG and Canadian counterparts to develop workshop scenario.....Mar-May16 √
- Conduct research to identify SMEs, determine prior research to address the likely challenges posed by the scenario and challenges most relevant to USCG……Mar-Jun 16 √
- Accomplish workshop……1-22 Jun 16 √
- Develop and issue post event report and RFP……Sep 16 √
- Review and award proposals and develop Workplans……Mar 17
- Project End……Jun 19

Performance Metrics:

- Successful completion of workshop, report, RFP and establishing research.

Project Champions:

- **HQ USCG CG-MER.**

Stakeholders/advocates:

- HQ USCG (CPE, CG 5PW); USCG RDC; USCG Pac Area and USCG D-17. NOAA/NWS; State of Alaska; Canada Department of National Defense; Canada Coast Guard.

Points of Contact:

- **Federal Agency Customer. DHS S&T OUP ADAC Program Manager**.
- Randy Kee, UAA, Principal Investigator.

**See PowerPoint Notes for Project Abstract*

Project Title: Arctic Information Fusion Capability (AIFC)

FOA/NOFO Research Question(s): Topic 1a, Maritime Risk & Threat Analysis; Topic 2b, Coastal and Marine Modeling and Analysis; Topic 2c, Information and Intelligence Integration within Maritime Operations, Topic 2d, Arctic Analysis; Topic 3f, Maritime IoNS; Topic 5c, Arctic E2E. Specific research questions: 2d. 3. i & iii.

Project Objectives:

- Integrate and fuse information from an array of authoritative data sources in support of USCG operators in the Arctic.
- Enhance domain awareness by communicating both from and to community-based observers in the field achieving "Fusion Central and Fusion Forward."
- Provide decision support through data visualization, connecting to and from the field despite austere comms; and in later stage, apply artificial/machine intelligence.
- Through NOAA partnering, utilize and advance Arctic ERMA, as the base platform, a tool already used by USCG.

Potential Impact: Next generation agile decision support.

Key Accomplishments:

- Use case scenarios developed with USCG D17 with agreement on initial focus on marine environmental response.
- Catalog of over 1800 data feeds in support of use cases established.
- Coordination with NOAA on delivery of fusion products through ERMA.
- Field Information Support Tool portal established as conduit between CBONS and AIFC.
- Data fusion testbed / prototype established with oil spill simulation and high-resolution storm surge model.

Funding:

- Expended to Date by End of Year 2 ……..$229,312.72

Key Milestones/Deliverable Schedule:

- Project restart…… Mar 16 √
- Identify elements of domain awareness…… Oct 16 √
- Integrate community based observer through Field Information Support Tool (FIST) demonstration.....Aug 16 √
- 2D map of geospatial data, feeds……..Mar 17
- Completion of demonstration scenario……..May 17
- Near-real-time and intelligent support……May 17
- Project End……..Jun 19

Performance Metrics:

- AIFC products in Arctic ERMA. Some products ingested
- Model data available via Arctic ERMA. Status: completed √ for some products, others in testbed stage.
- AIFC fusion demo. Status: in development.

Project Champions:

- **DHS S&T IMDE.**
- **HQ USCG CG-255.**

Stakeholders/advocates:

- HQ USCG; USCG RDC; USCG Pac Area & USCG D-17.
- NOAA / NWS; NASA-ACE.

Points of Contact:

- Federal Agency POC: NOAA/ORR.
- Kenrick Mock, UAA, Principal Investigator.
- John DeLaurentis, ASRC Federal Mission Solutions, Project Manager.

**See PowerPoint Notes for Project Abstract*

ARCTIC DOMAIN AWARENESS CENTER
A DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE