New Projects in the ADAC Portfolio

The future of ADAC Arctic research

By Executive Director Church Kee

In the course of the past several years, ADAC has conducted two Arctic related Incidents of National Significance (Arctic IoNS) workshops in close coordination with the U.S. Coast Guard (USCG) District 17 and an array of planners and select participants. The focus of these workshops is to address specific problems or concerns identified by the USCG District 17 Commander in which new research in science and technology may provide solutions to address shortfalls in capability. The two prior ADAC Arctic IoNS workshops were conducted in June 2016 and October 2017. The June 2016 workshop focused on science and technology needs in case of an emergency response to a disabled cruise ship in Arctic waters. Two research projects, one led by Dr. Nathan Kettle from the University of Alaska Fairbanks and the other by Dr. Carol Janzen from the Alaska Ocean Observatory System, were funded from the resulting Request for Proposals. Both of these projects are now nearing completion.

The subsequent Arctic IoNS 2017 workshop was “Coping with the Unthinkable...an Arctic Maritime Oil Spill,” conducted October 23-25, 2017 at the University of Alaska Anchorage (UAA). Currently, ADAC has received five accepted proposals and is working with each research team to transition these accepted proposals into approved and funded workplans. The review process is on-going and ADAC is expecting to receive additional approved project concepts in the near term. The following are summaries of the new pending projects.

- **Mitigating the Damage to Arctic Copepods from Surface Oil Spills: When to Apply Dispersants.** Led by Bigelow Laboratory for Ocean Sciences in Maine, this project conducts specialized research and analysis via controlled experiments of the impact of chemically dispersed oil on key Arctic organisms, specifically calanoid copepods.

- **Photo-enhanced toxicity of dispersed and burned crude oil to Arctic mussels.** Led by University of Alaska Anchorage College of Arts and Sciences, Alaska Sea Life Center and University of New Orleans, this project seeks to determine whether extreme seasonal changes in sunlight exposure can affect the toxicity of oil, dispersed oil, and burned oil to Arctic mussels and to communicate to spill response personnel which strategy has the least impact.

- **Marine Induced Polarization Methods for the Detection and Mapping of Oil in an Arctic Marine Oil Spill, including investigation of Oil within and under broken ice fields.** Led by Induced Polarization Associates, LLC, this project demonstrates Marine Induced Polarization (IP) to detect and potentially characterize contamination of hydrocarbons in Arctic waters, including partial ice formations and under ice pack.

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Student Spotlight: 
Kelsey Frazier

Arctic Domain Awareness Center (ADAC) Fellow

Kelsey Frazier, a lifelong Alaskan, joined the ADAC Fellows program in spring 2017 as an undergraduate student. With a previous business degree in hand, she is currently pursuing a degree in Mechanical Engineering at the University of Alaska Anchorage. In the course of her ADAC Fellows career, she has been involved with ice-related research, specifically how surface conditions of arctic sea ice are related to subsurface conditions and potential oil spill issues. Starting this fall, Kelsey has also worked on ADAC’s Arctic Ice Condition Index (ICECON) project on a team led by Dr. Tom Ravens from the University of Alaska Anchorage (UAA) and Dr. Andy Mahoney from the University of Alaska Fairbanks (UAF). Kelsey will graduate from the ADAC Fellows Program at the end of the fall 2018 semester after she reaches her two-year eligibility limit. ADAC's Education and Administrative Manager Malla Kukkonen sat down with Kelsey in early November to reflect on her time as an ADAC fellow:

What initially attracted you to the ADAC Fellows program?

My interest in the ADAC fellows program stemmed from the unique research opportunities offered to undergraduate students. Typically, undergraduate students are not involved in research projects because funding is finite. Available research positions go to graduate and doctoral candidates. This practice, though, limits the breadth of ideas and critical questions being investigated. If we only engage the small percentage of students who can afford to pursue a masters or doctoral degree, then the solutions we get to the big problems our world faces will be equally small. I was encouraged to see that ADAC breaks away from this exclusionary practice and is leading the way in establishing a more collaborative research program.

What kind of opportunities has being an ADAC Fellow offered to you in the course of the nearly two years now?

I’ve met some really fantastic people while being a fellow. From leviathans in research to extraordinary men and women in the military, it’s been my pleasure to get to know the remarkable people who work and interface with ADAC. Also, through my research work, I’ve discovered that I like research with a purpose. As scientists, we often are funded to go figure out something new and unique, but the real-life applications of that work gets lost in translation. Here at ADAC, research is directly tied to its utility, and we regularly interact with the men and women who need to use what we discover or build. I get great satisfaction knowing that the work I do makes someone’s job easier, or safer, or both.

What are your most memorable ADAC Fellows moments to date?

My other, equally favorite memory was from this past summer. I am a three-time scholarship recipient with BP and interned with them here in Anchorage in their regional office. Interns produce a body of work and are evaluated based on a final presentation. At the end of my internship, I was allowed to invite the ADAC staff to come to that presentation. Seeing them in the audience cheering me on was quite special. Definitely a memory I won’t soon forget.

Now that you have also been accepted into a graduate degree program at UAA, what kind of career interests do you have?

Fortunately, my time with ADAC has helped me figure out that I like solving questions for which there are no easy answers. Unfortunately, that means I have an uphill battle on this career path. I can’t just go down the street and get a job with a local engineering firm and be satisfied. So, I’ll keep working on research projects and work on my master’s degree and see how things shake out. I’ve submitted a proposal to the NSF to work on AUV technology for remote Arctic fisheries monitoring. That kind of monitoring requires that I do some basic scientific research that hasn’t yet been done, which I find exciting. Hopefully, my work will lead to some great collaborations and I’ll figure out my next career path somewhere in between.
The Arctic is experiencing rapid transformation throughout the entire region, including new climate and weather extremes, increased temperature, loss of sea ice cover in oceanic and coastal regions, and changing permafrost and coastal landscape stability. These changes pose strong challenges in predicting the future of environmental change and in decision-making on many levels—from local concerns to regional and national initiatives. This is particularly an issue for effective response to operational situations in coastal navigation, emergency response, and near- and long-term planning. A key component in addressing these types of challenges is the application of existing knowledge, or where none exists, conducting discovery-based research.

The type of research that ADAC has been supporting is what we term Operationally Focused Research, which is externally funded to support fundamental and applied research targeted to address specific areas of inquiry. By contrast, traditional Basic Research has few boundaries or expectations, and is typically funded by agencies like the National Science Foundation (NSF) or the National Institute of Health (NIH). Basic Research is by far the most common type of research undertaken at universities and similar institutions, and is designed to push the boundaries of what is known. For the Arctic, comparatively little is known, and thus pushing boundaries encompasses most of the environmental issues, locations, operational needs, and emergency situations likely to occur.

Our research network is relatively unique in that funded projects span several different types of Arctic research, including scientific study directed towards increasing fundamental knowledge and understanding, systematic expansion and application of fundamental knowledge to develop useful products, integration of existing systems and components into feasible and operable units, and more. ADAC researchers also work to expedite transitions of the research knowledge products into useful operational applications.

ADAC as a rule does not respond to funding opportunities offered by state and federal agencies. Instead, ADAC works as a project management center similar to a funding agency and supports research through subawards. The projects themselves come from a very rigorous evaluation of proposals submitted to ADAC through our own Request for Proposals based on exploratory work conducted in workshops like the IoNS and MaLTE (Incidents of National Significance, Medium and Long-term Environmental issues). These research projects involve development and application of new technology to improve our understanding of the physical and ecological environment of the Arctic, including remote sensing, unmanned vehicles in air and under water, environmental modeling of coastal erosion, and ice movement, among others. The goal is the development and application of tools that facilitate rapid decision-making by U.S. Coast Guard and functionally related agencies in the U.S. and other Arctic countries.

These are exciting times for Arctic research efforts and for us in the ADAC community. We are working to transfer scientific knowledge and results between our extensive research network and our broad community of end-users. As often happens, we have found that what we discover now serves as the basis for new directions and new projects that will expand our knowledge of the Arctic. We look to an exciting future!
Arctic Vessel Monitoring, Geofencing & Alert Awareness

A watchdog alert system for the Arctic

By Buddy Custard, Project Principal Investigator

Depending on the time of year, on any given day, there are 100 to 400 vessels operating within the U.S. Arctic region as defined by the Arctic Research and Policy Act of 1984, exceeding 10,000 vessel transits annually. Currently, active monitoring of vessels in the Arctic regarding compliance with environmental protection regulations, entering marine protected areas, disrupting protected species rookies and walrus haul-out areas, endangering bird nesting areas, and impeding subsistence marine hunting activities is practically nonexistent. The sheer volume in monitoring the continuous movement of the number of vessels to keep constant situational awareness in this region of national importance is overwhelming.

The challenge of managing this volume of information requires a means to help filter the hundreds of vessel movements during any given hour to detect a potential incident. Building on the recent advent of satellite and terrestrial Automatic Identification System (AIS) technology provides a means to monitor and detect Arctic vessel transits that may present an elevated risk to people, property, and the marine environment.

The project team seeks to advance Arctic Maritime Domain Awareness & Management by developing enhanced protocols and software to AIS technology, and subsequently leading to appropriate action for safe and environmentally sound maritime operations in the Arctic. This project will develop and apply innovative AIS software and procedures to automatically transmit “alerts” of vessel movements of concern to authorized parties. The project will aid Coast Guard decision-makers to rapidly condense, analyze, and prioritize potential threats to efficiently allocate resources through the development of triggered “watch-dog” alarms facilitated by enhanced geofencing technology. This project will provide the capability for alerts to be configured by a wide range of specified criteria and parameters, including vessel type, size, speed, activity, and geographic location.

By providing improved geofencing alerts to the Coast Guard, other agencies and maritime stakeholders (e.g., Alaska Native coastal communities), the project’s overall objective will enhance maritime security and safety, environmental protection, and vessel regulatory compliance in U.S. Arctic waters.

Tentative Calendar

November 2018

• November 8: ADAC quarterly review with project research teams
• November 12-14: U.S. Coast Guard Maritime Risk Symposium, Oak Ridge, TN, ADAC ED attending
• November 12-14: Canada Maritime Arctic Safety and Security Symposium, St. Johns, Newfoundland, Canada, ADAC PI, Dr. Causey attending

December 2018

• December 5-6: ADAC’s Annual meeting, U.S. Coast Guard Headquarters, Washington, D.C.
• December 14: Tentative publication of ADAC co-hosted North American Arctic Futures Security workshop report
• December 18: ADAC Fellows monthly meeting
• December 24-January 1: University of Alaska Anchorage winter break

January 2019

• January 14: Spring semester starts at University of Alaska Anchorage
• January 25: Mid-year review of research projects with ADAC Executive Counselors
• January 28-February 1: Alaska Marine Science Symposium, Anchorage, Alaska.
• January 29: Tentative ADAC Fellows monthly meeting

February 2019

• February 14: ADAC Customers and Partners roundtable via teleconference
• February 26-28: ADAC to host Interagency Arctic Research Policy Committee (IARPC) annual meeting at the University of Alaska Anchorage
• February 22: Tentative ADAC Fellows monthly meeting

March 2019

• March 12-14: ADAC to host the 2019 Arctic Incidents of National Significance workshop at the University of Alaska Anchorage

ADAC’s Mission

The Arctic Domain Awareness Center, led by the University of Alaska, develops and transitions technology solutions, innovative products, and educational programs to improve situational awareness and crisis response capabilities related to emerging maritime challenges posed by the dynamic Arctic environment.

Contact Information

Center News is presented quarterly by the Arctic Domain Awareness Center. Please provide feedback or questions via any of the following contact points:

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