

Arctic Domain Awareness Center (ADAC)
A U.S. Department of Homeland Security
Center of Excellence

Request for Proposal (RFP)

Seeking solutions to advance maritime spatial understanding, resilience, and awareness to achieve safety and security in the maritime domain

A. Introduction and summary

The Arctic Domain Awareness Center is a U.S. Department of Homeland Security (DHS), Center for Maritime Research (CMR), led by the University of Alaska Anchorage. ADAC seeks to develop and transition 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. The ADAC research network comprises of academic and industry teams focused in delivering solutions to problems faced by the United States Coast Guard (USCG) and other DHS mission operators across the Arctic maritime region.

ADAC announces a competitive search to address research challenges associated with the maritime domain. Specifically, this RFP responds to DHS and USCG maritime awareness and information fusion-related research questions provided by DHS S&T OUP. In particular, this RFP seeks proposals *“to advance maritime spatial understanding, resilience, and awareness to achieve safety and security in the maritime domain.”*

On behalf of DHS S&T OUP and USCG, and in accordance with the terms and conditions of the DHS-ADAC Cooperative Agreement, this RFP is released to a wide audience and solicits proposals that will focus only on the research questions described within this document.

Additionally, applicants should understand and articulate the various missions conducted by the USCG generally utilizing the “Surveillance, Detection, Classification, Identification (“SDCI”) as the key aspect of Maritime Domain Awareness and the enabler to actual mission prosecution. An extract of SDCI accompanies this document as an annex, and also is found at ADAC’s website at: <http://adac.uaa.alaska.edu/>

As a DHS S&T OUP CMR, ADAC conducts unclassified science and technology research. Accordingly, ADAC requests only unclassified responses to this RFP. ADAC principally seeks

proposals that can transition from research to provide solutions and needed capability for USCG and other DHS Arctic maritime operators. Applicants should plan project duration at approximately 18-months, with a start date no earlier than January 15, 2018.

B. DHS and USCG provided Proposal Research Areas of Interest

This RFP aligns to the research areas of interest described in the following paragraphs. Consistent with the DHS S&T OUP-ADAC Cooperative Agreement, ADAC views these research areas of interests as research tasks and seeks proposals that take a task driven approach.

USCG faces a number of maritime safety and security challenges in the Arctic. The USCG Arctic Strategy and Arctic Strategy Implementation Plans identify areas of concern and overall approaches to address the challenges.

DHS and USCG understanding of the Arctic maritime remains imperfect with important safety and security knowledge gaps remaining. Investigations conducted by ADAC and other Arctic researchers have contributed to increased understanding of the domain and are contributing to reduce many gaps and shortfalls. Much more work is needed, however, to increase awareness and to improve maritime safety and security in the Arctic.

Accordingly, DHS and USCG are interested in scientific research and development that will contribute to maritime spatial understanding, resilience, and awareness to achieve increased safety and security in the Arctic maritime domain.¹ Technology should contribute to improving command, control, communications, computers, intelligence, surveillance, & reconnaissance (C4ISR) capabilities and enhance information collection for maximum use. Technologies should improve effectiveness and efficiency of sensors communication capabilities, and other platforms as noted below.

Technology research and development is an underpinning that cuts across many areas of Arctic maritime security. DHS and USCG are interested in fundamental and applied research in maritime technology including but not limited to the following topics:

- Maritime Domain Awareness (MDA)²: Development of MDA technology and global MDA partnerships will require research into new and more efficient capabilities. to improve cooperation and cost effective integration with existing USCG methods and systems, respectively.

¹ The maritime domain is defined as *all areas and things of, on, under, relating to, adjacent to, or bordering on a sea, ocean, or other navigable waterway, including all maritime-related activities, infrastructure, people, cargo, and vessels and other conveyances*. Reference: National Security Presidential Directive-41/Homeland Security Presidential Directive-13 (NSPD-41/HSPD-13) (Maritime Security Policy, December 21, 2004)

² Maritime Domain Awareness is the effective understanding of anything associated with the global Maritime Domain that could impact the security, safety, economy, or environment of the United States. Reference: National Security Presidential Directive-41/Homeland Security Presidential Directive-13 (NSPD-41/HSPD-13) (Maritime Security Policy, December 21, 2004).

- Maritime Robotics: Robotics includes autonomous technologies operated above, on, and below the water's surface that can be deployed in congested port environments, remote offshore locations, and in the harshest of ocean environments (e.g., unmanned aircraft systems (UAS), remotely operated vehicles (ROV), autonomous underwater vehicles (AUV), and unmanned surface vehicles (USV).

Specific questions ADAC invites applicants to respond in preparing a RFP. Teams responding to this RFP need to develop projects advancing MDA or Maritime Robotics in order to deliver solutions to one or more of the below 11 research questions.

1. What new technologies can be developed and applied to effectively improve surveillance, detection, classification, and identification of vessels, suspicious materials, and persons in the maritime domain both on and below the water surface?
2. What new technologies, including technologies combined with new non-technological inspection methods and tools, can effectively improve a user's ability to screen, detect, and mitigate threats?
3. What new technologies and information management system improvements can maximize MDA by leveraging maritime intelligence capabilities and the diverse expertise of domestic and international intelligence and law enforcement communities?
4. What is the most efficient or proficient way for operators and decision makers (at the command center and up to headquarters level) alike to visualize and employ various data sets provided from diverse sensors? How can human assets significantly contribute to the overall operational picture? How best can human assets validate sensor input?
5. What vulnerability assessments are necessary to integrate multiple sensors or databases with common information systems and follow-on end user dissemination? How can critical information decision be shared between Federal, state, local, industry, and private partners, both in the field and at operational & strategic levels, and what is needed to facilitate information retrieval? Researchers should take into consideration challenges such as data availability, data accessibility, data latency, unverified data, and lack of understanding of how to use MDA data. Additional related questions include:
 - a. What are the requirements to integrate sensor or data feeds, particularly from unmanned platforms, into the command center? Analysis should

include the feasibility of integrating information into existing command center display tools such as National Oceanic and Atmospheric Administration's (NOAA's) Arctic ERMA³ or a web-based geospatial tool.

- b. While Arctic Environmental Response Management Application (ERMA) may be an adequate display system for sharing data with non-government partners, what are the limitations and how can they be overcome? Can a web-based geospatial tool be used to minimize any redundancy? What are the options for a User Defined Operational System that would allow all partners to access data and also be able to display this data on display systems of their own choosing? Analysis of options or alternatives shall include Arctic ERMA or similar web-based geospatial tool.

When addressing these questions, researchers should consider the following issues:

- the best way for an operator to visualize and interact with specific sets of data or specific models and simulations;
 - the architecture needed to integrate multiple, existing information systems;
 - the ontologies and metadata needed to facilitate information retrieval;
 - how machine intelligence can be utilized to support human decision making and demonstrated within Surveillance, Detection, Classification, Identification (SDCI) and Tasking, Collection, Processing, Exploitation, Dissemination (TCPED)⁴ processes.
 - the architecture needed to support remote data feeds and remote end users.
6. What new robotics technologies (man-in-the-loop, autonomous) can be deployed to enhance operations that are hazardous to humans, or require/ demand long-term repetitive actions, and/or reduce personnel costs without degrading mission performance?
 7. What new low cost unmanned capabilities can be developed to enhance homeland security mission capabilities in providing persistent surveillance of ports, coastal approaches, maritime sanctuaries, protection of sunken military vessels and wrecks, fisheries, and smuggling activities? To what extent can manned and unmanned platforms communicate using machine learning technology to enable the relay of fused, rather than raw, data to surface or air assets in areas of limited or no communications connection capability in a timely fashion? Conversely, how can operational commanders communicate fused information to on scene field units with limited capability?

³ See <http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/arctic-erma.html>

⁴ The TCPED process operationalizes intelligence to support operations at all levels. An effective TCPED process helps operations and intelligence planners synchronize ISR resource application to address validated needs, collects data and information to best address those needs, and refines data and information into formats and products which decision-makers can quickly and easily understand, access and act upon.

8. To what degree can Big Data Analytics, Artificial Intelligence, and Machine Learning, combine with multi-sensor, fused data products? What are the associated impacts on timeliness, effectiveness, and confidence or accuracy in decision-making? Researchers should consider the following approaches to addressing these questions:
 - a. Development and demonstration of automated, data-fused analytics and processes to improve decision-making;
 - b. Development and demonstration of processes and algorithms that incorporate big data analytics and machine learning, combined with use of Automatic Identification System (AIS) data, which provides real-time and reliable notification of at-sea vessel rendezvous;
 - c. Researching to what degree multi-sensor data fusion can supplement AIS data that provides reliable, accurate vessel tracking and overcomes AIS security and verification limitations.
9. What new technology can significantly reduce operational costs of critical maritime system safeguards (Aids to Navigation (ATON), screening devices, distress notification, and mariner identity technologies)?
10. What new technologies can be developed to support the response phase of a maritime Incident of National Significance (IoNS) – including a catastrophic maritime accident involving hazardous material or mass rescue operation, transportation security incident, and mass migration?
11. What new technologies can be developed to enhance the recovery of the Maritime Transportation System for effective resumption of commerce?

C. Award Information

1. Funding Availability

ADAC anticipates approximately four projects in varying funding amounts may be awarded under this solicitation. After evaluation, DHS S&T OUP, HQ USCG and ADAC reserve the right to determine the number of projects funded. The exact amount of awarded funds to projects will be determined during the negotiations between the proposal applicants, ADAC and/or DHS S&T OUP representatives at time of awarding. Publication of this notice does not obligate ADAC to award any specific project or to obligate funds. Following award selection under this RFP, ADAC has no obligation to provide additional funding in connection with the award.

Notwithstanding written assurances from the University of Alaska Anchorage (UAA), there is no obligation on the part of DHS or ADAC to cover pre-award costs unless approved by UAA, Office of Sponsored Programs (OSP) as part of the terms when executing a proposal award.

ADAC anticipates two types of research project classes: large and small projects. The approximate target value for a large project is \$500,000 and for a small project is \$250,000. For this RFP, ADAC is defining a large project as one that addresses several research questions in an integrated manner. Conversely, a small project is one that addresses one to two research questions. ADAC provides applicants these definitions to assist respondents in gaging the level of complexity in creating their proposal. Final determination on project selection will depend on proposal merit in addressing research questions and customer relevancy. ADAC encourages applicants to carefully observe and diligently comply with each requirement of this RFP in submitting a response.

2. Project/Award Period

Awards made under this RFP may have a maximum period of 18 months; awards may be shorter in duration. ADAC will not accept proposals requesting funding for a longer performance period than 18 months.

3. Type of Funding Instrument

Under this RFP, ADAC will fund projects via a Federal Demonstration Partnership (FDP) subaward agreement. ADAC is required to flow down all DHS S&T, OUP Cooperative Agreement Terms and Conditions with all subawardees.

4. Allowable Costs

Funds awarded cannot necessarily pay for all costs that the recipient might incur in the course of carrying out the project. ADAC determines allowable costs by reference to the Uniform Administrative Requirements, Cost Principles, and Audit Requirements at 2CFR200 and the DHS Standard Terms and Conditions for Centers of Excellence. Generally, allowable costs include salaries and supplies as long as these are “necessary and reasonable.” ADAC funds travel only when considered essential to project completion; travel to present findings at conferences for professional development are not allowable. Additionally, DHS typically does not fund equipment cost requests; if applicant needs equipment, please provide appropriate justification and bids.

5. Student involvement

An important goal of the ADAC is to foster the next generation of scientist and engineers devoted to the discovery, development and improvement of technologies and applications for Arctic MDA, response, and resilience. ADAC supports both

undergraduate and graduate students' direct involvement in ADAC led research projects through the ADAC Fellows program and encourages projects that include student participation. Project budgets may include support for undergraduate/graduate student research, including students seeking advanced graduate degrees. Postdoctoral research support (as student fellows) will not be available at this time. Any student involvement in an awarded project is subject to the agreement of the individual student to commit to the DHS terms and conditions of the student support.

D. Eligibility Applicants

Awards can be made to accredited academic institutions of higher education, non-profit (U.S. non-profit, non-governmental organization must provide a copy of their Section 501(c)(3) or status determination letter received from the Internal Revenue Service), and industry institutions. Partnered proposals between academic, non-profit, and industry are acceptable. ADAC advises international applicants to consider joint proposals with a U.S.-based entity, conforming to this paragraph.

E. Proposal Format and Evaluation Criteria

DHS S&T OUP provides research funds for the project(s) that score the highest overall against the evaluation criteria.

While the intent of this RFP is to resource awards through terms and conditions associated with a cooperative agreement in place with the Department of Homeland Security, it may be determined that an award could be issued through a task-order contract.

Given the complexity of challenges posed by the research questions above, ADAC encourages prefers proposals that incorporate multi-disciplinary expertise in methodological approaches.

ADAC invites applicants to submit a proposal organized to address the following:

Title Page (one-page limit) must contain the following:

1. Project Title;
2. Project Duration (with a start date no earlier than January 15, 2018);
3. Applicant name;
4. Applicant address and phone number of the Principal Investigator or Contact for Institution/organization;
5. The theme(s) for which this proposals addresses.

Technical Narrative (11 point Calibri font, 10-page limit, including figures):

1. Introduction;
2. Research Question(s) being addressed;
3. Goal and Objectives;
4. Research Methodology;
5. Tasks;
6. Milestones;
7. Deliverables (Outputs);
8. Performance Metrics;
9. Stakeholder Engagement;
10. Transition Approach;
11. Impact/Benefit (Outcomes);
12. Programmatic Risks and Mitigation Plans;
13. References (References do not count towards the page limit).

Compliance Assurances (2-page limit):

1. Data Needs– if the applicant is not generating their own data, please outline the data you will acquire in this project and how you will obtain it (e.g., publicly available, available for purchase, federal data). If you are relying on federal data sources, please explain in detail how you plan to gain access to these, as their release is not a condition of the award.
2. Human Subjects Research (IRB) or Animal Welfare Research (IACUC)—if applicable.
3. ITAR/Export Controls– if applicable.

Cost Information (no page limit):

1. Detailed Budget showing itemized direct costs as well as indirect costs;
2. Budget Narrative/Justification.

Biographical Sketch for the PI (2-page limit)

F. Submission Instructions

1. Proposals must be submitted in a single PDF (electronic format) to ADAC at the following email address: uaa.adac@alaska.edu;

2. If application via electronic submission to email is not feasible, delivery via postal mail or commercial mail to:
Arctic Domain Awareness Center
University of Alaska Anchorage
3211 Providence Drive
BOC Suite 120
Anchorage, AK 99508
3. Deadline for receipt of the application (and validated by email response) is 5 PM Alaska Daylight Time, October 31, 2017. ADAC will respectfully reject applications received after the deadline without further consideration.
4. **Please note that ADAC may request additional reference information or supporting documentation (in any format) following submission.**
5. **Please review the DHS and USCG provided Proposal Research Areas of Interest as listed in section “B” of this document and the “SDCI” extract in the adjoining Annex (or on-line at ADAC website) as previously described.**

G. Review/ Selection Process

Reviewers from the academic and/or research community and DHS will evaluate the proposals.

Proposals receive Merit-based evaluation criteria to determine the award(s) based on scientific quality and relevance to DHS and USCG mission.

Scientific Quality Review

Reviewers will be asked to rate how the proposal addresses the following criteria, posed as questions. Reviewers will rate applications using numerical ratings of 1 to 5 (poor to excellent) and apply the percentage-weighting factor as indicated for an overall rating.

1. Originality and/or Innovativeness (25%)

- Is it original, e.g., does the proposed effort challenge and seek to shift current research or paradigms by utilizing novel theoretical concepts, inter-disciplinary approaches or methodologies?
- Is it innovative, e.g., is the proposal a novel refinement, improvement, or new application of theoretical concepts, inter-disciplinary approaches or methodologies proposed?
- Does this research have the potential to generate influential publications in the

scientific community or lead to new discoveries or areas of investigation?

2. Proposed Approach/Methodology (25%)

- Does the proposal establish research goals that are clear and based on sound theory?
- Does the proposal establish research methods clearly and appropriate for testing the hypotheses?
- Are the data generation or collection approaches appropriate for the research methods?
- Is the approach or methodology technically sound, incorporating interdisciplinary expertise when appropriate, including a demonstrated understanding of the critical technology or engineering challenges required for achieving the project goals?

3. Influence and Cooperative Linkages (25%)

- Does the application show partnerships or cooperative initiatives with other institutions or organizations?
- Does the application demonstrate a viable plan for developing substantial and continuing linkages with the Homeland Security Enterprise?

4. Qualifications of Personnel and Suitability of Facilities (15%)

- Does the investigative team have the breadth of qualifications - credentials and experience - to conduct and complete the proposed research?
- Does the investigative team have prior experience in similar efforts?
- Does the investigative team clearly demonstrate an ability to deliver products that meet the proposed technical performance within their proposed budget and schedule?
- Are the facilities suitable for the proposed research?

5. Costs (10%)

- Is the proposed research (and/or education) costs appropriate and reasonable?

Relevancy Review

Reviewers will be asked to rate how the proposal addresses the following criteria, posed as questions. Reviewers will rate applications using numerical ratings of 1 to 5 (poor to excellent) and apply the percentage-weighting factor as indicated for an overall rating.

1. Mission Relevance (75%)

- Does the proposed project address one or more of the research questions as

described within the RFP (as described in Section B).

- Does the proposed project reflect understanding and application of USCG's "Surveillance, Detection, Classification, Identification ("SDCI") methodology as the key aspect of Maritime Domain Awareness and the enabler to actual mission prosecution?
- Does the proposed project complement (and not duplicate) – existing research and development programs sponsored by DHS, USCG or others?
- Does the proposal sufficiently describe the potential research deliverables and users of the research?
- Does the proposal have a clear pathway to transition from research to acquisition according to DHS and/or USCG mission needs?

2. Communicating/Transitioning Results (25%)

- Does the applicant have a record of accomplishment of effectively communicating or successfully transitioning research results to appropriate stakeholders, specifically?
- Will the research team be able to deploy a technology and/or solution(s) transition the project effectively to the user community through either acquisition to USCG or other DHS maritime mission users, commercialization of the technology, open source distribution, or through other means?
- Does the proposal demonstrate the implementation of an appropriate knowledge transfer process (i.e., models from case studies to other areas, patents, etc.) from academic to government end-users and other DHS customers?

H. Award Process

1. ADAC will notify Awardees following DHS S&T OUP and USCG final determination.
2. Subject to the availability of funds, review of proposals will occur during the months following the proposal due date given in this announcement and is expected to be completed no later than December 15, 2017. Awardees should expect project funding following work plan approval. Awarded researchers should not be expect to begin prior work plan approval (approximately January 15, 2018). Please note that selection by ADAC to submit a work plan to DHS does not obligate ADAC or DHS to funding. The proposal packet under this RFP is merely phase 1 of the process for awarding funds.
3. In no event will ADAC or DHS be responsible for proposal preparation costs. Publication of this announcement does not obligate ADAC or DHS to award any specific project or to obligate any available funds. Recipients are subject to all U.S. federal laws, agency policies, regulations and procedures.

I. Points of Contact

Should any applicant have questions or concerns regarding this request for proposal, please email the ADAC Executive team at uaa.adac@alaska.edu. ADAC will not respond to RFP questions after October 31, 2017.

ADAC RFP Annex, corresponding to “Seeking solutions to advance maritime spatial understanding, resilience, and awareness to achieve safety and security in the maritime domain.”

As previously described, responders to this call for proposals should understand Missions conducted by the United States Coast Guard generally utilize the “Surveillance, Detection, Classification, Identification (“SDCI”) as the key aspect of Maritime Domain Awareness and the enabler to actual mission prosecution. ADAC provides the below extract from USCG describing the SDCI process to assist RFP applicants.

Extract:

“Missions conducted by the United States Coast Guard will generally utilize the SDCI process task sequence.”

3.1.2.1 Surveillance

Surveillance is the employment of sensors (active or passive) to scan an area and detect targets. Various platforms will patrol using surveillance profiles as determined by the purpose of the mission. Receipt of AIS data, discovery of illegal activity, and observation of trends and “normal activity” will be important parts of having full awareness of the maritime domain to identify anything that could impact the security, safety, economy, or environment of the United States.

3.1.2.2 Detection

Detection is an event during surveillance activity that is dependent upon the capability of the sensors and the characteristics of the target/TOI. In the covert scenario, it must be possible to detect all targets in the zone of interest without compromising the presence of the platform. Detecting small, low-profile targets such as go-fast boats, conventional pleasure craft, rafts, and yolas are of particular emphasis.

Detections are not generally reported unless the patrol platform is specifically tasked to do so or the target is of specific interest. The patrolling platform must be capable of supporting the efficient and effective detection of targets throughout the assigned area of operations.

3.1.2.3 Classification

Classification is the determination of the specific group or category to which a target belongs; fishing vessel, merchant vessel, naval vessel, small freighter, yola, go-fast, etc. The determination of the current activity of a target (e.g., a vessel dead in the water, fishing, smuggling contraband/undocumented migrants, discharging oil or hazardous substances etc.) is also an element of this function.

The Classification task can be divided into initial and active classification. Initial classification categorizes detections based on parameters such as target size, course/speed, and location. Initial classification is usually accomplished without diverting from the patrol search pattern and is maintained as part of the local operational picture. Active classification involves the categorization of those targets that meet the general characteristics of the mission TOI.

This phase may involve diverting to close the range, distance, or viewing angle to the target. Active classifications are reported as required to support the overall operational picture and to coordinate positioning of patrolling air or surface assets.

3.1.2.4 Identification

Identification is the determination of a characteristic or unique target discriminator which differentiates a particular vessel from others in the same classification category. The name/registration numbers of a vessel are the most common discriminators, but comparison pictures, profiles, and rigging may also be used. Identification is a further refinement of classification and aids the process by which targets are evaluated to differentiate a TOI from the large population of legitimate traffic that transits in the maritime region.

Identifying the true action and intentions of targets without alerting the occupants is a key element in MDA.

3.1.2.5 Prosecution

Prosecution is the action the patrolling unit takes based on the results of the sorting process, consistent with the purpose of the patrol (e.g., report sightings of TOI, continue surveillance of the patrol area if a non-TOI, vector an intercept unit, interdict smugglers etc.). The action taken is often that of command and control, operational advice, and the gathering of evidence.

If future criminal prosecution in the courts is an objective of the mission, the data collected must meet the tests set forth by the courts. It is generally required that all logs and records, video and still pictures, and recordings from the aircraft ICS and radios be preserved for use as evidence.

Some sensors like Radar and IR do not provide a true “picture” of a vessel or individual, but rather provide an image. To complete the evidence package, a (daytime) high-resolution electro-optical (EO) camera or (nighttime) an “electronic illumination” feature on the IR sensor must be part of the sensor suite.

High precision navigation information is a critical element in preparing evidence for prosecution. Global Positioning System (GPS) navigation data is the most common source of precision position fixing data.