The Maritime Security Center (MSC)

at Stevens Institute of Technology
Hoboken, NJ

Year 5 Work Plan:
July 1, 2018 – June 30, 2019

APPROVED June 28, 2018

Table of Contents

1. Overview and Mission Relevance

The Maritime Security Center (MSC) will continue to develop both fundamental and applied research to support DHS's and other agencies' maritime security mission goals, including improved detection and interdiction capabilities, enhanced capacity to respond to catastrophic events, and a more secure and efficient marine transportation system. MSC will focus on interdisciplinary research, education, and technology transition in maritime security, maritime domain awareness, and extreme and remote maritime environment issues. The goal is to develop and transition research and technology solutions and educational programs to DHS maritime stakeholders to improve capabilities and capacities for preventing and responding to events in the maritime domain.

MSC led by Stevens Institute of Technology (SIT) is composed of a consortium of internationally-recognized research universities, including SIT, MIT, the University of Miami, the University of Puerto Rico, American Bureau of Shipping (ABS), Louisiana State University, Florida Atlantic University, and Elizabeth City State University. Henceforth in this document, MSC will refer to the efforts led by SIT and carried out with its partner institutions delineated above.

The MSC strategy to achieve its mission centers on the creation and sustainment of a truly collaborative research and education enterprise that draws on the strengths of each partner, as well as their leveraged relevant DHS and non-DHS research and education activities. We believe that these unique attributes – collaborative; integrated research and education; and leveraged relationships with Federal, State, local government, and industry stakeholders – continue to position the MSC for continued long-term success and impact.

DHS stakeholder components include the U.S. Coast Guard, Customs and Border Protection and Immigration and Customs Enforcement. Specific areas articulated by the National Strategy for Maritime Security: National Maritime Domain Awareness Plan include priorities/gaps in dark vessel detection and tracking, anomalous behavior monitoring and information sharing.

The focus for Year 5 will be to manage projects awarded as a result of the RFP issued in Year 4, solicit new projects through an RFP and other means, facilitate transition of appropriate projects to DHS components, organize an annual meeting with DHS and relevant stakeholders, engage in a variety of education activities, and report on the annual activities of the Center.

2. Management Plan

Extending the reach of MSC and facilitating the close collaboration of the faculty, research staff, and students of each partner institution, as well as the essential interaction with DHS, the component agencies, State and local agencies, federal

laboratories, and other DHS Centers of Excellence, is a primary task of the Management Plan. Our management plan and organizational structure also ensure that the MSC research and education activities will be relevant to stakeholders, with strong linkages to government customers and industry partners, and establish a pathway for transitioning knowledge, technology products, algorithms and processes that will be of use in the field. The MSC management team includes:

- A Director/Principal Investigator
- A Deputy Director
- A Director of Education
- A Management Committee

Director/Principal Investigator: Dr. Hady R. Salloum, ECE Professor in the Charles V. Schaefer Jr. School of Engineering & Science at Stevens Institute of Technology will serve in this capacity. Dr. Salloum will function as the primary POC for the DHS Program Manager, and the primary liaison between the MSC team members and DHS and other Federal, State and local agencies as well as industry and non-governmental organizations. He will be responsible for the strategic direction of the MSC, and will serve as Chair of the Management Committee, which has the responsibility for evaluating project progress and providing input for the allocation of MSC resources. Dr. Salloum will also be responsible for overall quality assurance, and for the adherence of the MSC to all contractual obligations under the Cooperative Agreement, including information assurance, information sharing, ITAR/EAR regulations, IRB processes, and health and safety plans. Also, among the Director's responsibilities will be engagement with DHS Stakeholders, facilitating transition of projects that are ready, communications with DHS and its Stakeholders, and outreach to the Center stakeholders. At Stevens, the Director will report directly to the Dean, a reflection of the high priority of this position within the Stevens Administration.

The Deputy Director assumes many day-to-day management of the Center and is involved in all aspects of strategic planning and stakeholder engagement. This function assists the Director in Center activities including the preparation of project reports, plans, proposals, meetings, conferences, and workshops, and the coordination of activities at the partner institutions, government labs, and other DHS Centers of Excellence (COEs). The Deputy will also assist in the preparation of new project Workplans (e.g., projects awarded via the RFP) and Annual Reports and scheduling and conducting face-to-face meetings and conference calls among MSC investigators, as well as all meetings with the MSC Science and Education Advisory Committee (SEAC), all Stakeholder meetings, and other meetings as requested by the DHS Program Manager or as deemed necessary by the Director. The Deputy also works closely with the Director of Education to coordinate outreach activities and to ensure that students are represented in research and stakeholder endeavors. The Deputy will also assist in the preparation, issuance, and analysis of Center

solicitations (White Papers and RFPs). This position/function will be filled based on funds availability.

Director of Education and Outreach: The Director of Education will develop the overall vision and strategy for the education programs of the MSC, including Undergraduate, Graduate, and Professional (including certificate) programs, summer experiential programs, and specialized technology transfer meetings, tabletop exercises and other short programs tailored to the needs of the DHS component agencies. The Director of Education and Outreach coordinates, organizes, and implements all education and training-related activities. She will also be responsible for all reporting of education and training-related activities of the MSC, to the MSC SEAC, the Stakeholders, and the DHS Program Manager. Working with the Management Committee and the individual Investigators, the Director of Education will also be responsible for the development of all publications and presentations related to education and training, and all education- and training-related proposals and initiatives. Additional responsibilities include the recruitment, retention, and subsequent placement of students in the various educational programs and in field-based internships and employment. As the lead for outreach, this person is responsible for Center communications, including the Center's newsletters, public and professional outreach engagements and networking opportunities, and coordination with the DHS communications personnel. Ms. Beth Austin-DeFares, Stevens Institute of Technology, will serve as the Director of Education and Outreach.

Management Committee (MC): The MC is responsible for top-level coordination of the MSC activities. The MC will be chaired by the Director and will consist of one representative from each of the partner institutions (typically the co-PI), along with the Deputy Director and the Director of Education. The MC will also include the DHS OUP Program Manager. The MC will be responsible for the review of MSC projects and the allocation of funds, and the responsiveness to the DHS biennial review. The MC will meet by conference call approximately on a monthly basis, and face-to-face on a semi-annual basis when possible. The MC will facilitate – through their personal contacts within their own organizations – strong communication among the individual faculty, researchers, and students that make up the MSC, and responsive interactions with DHS and the various stakeholder communities.

Advisory Board (Science and Education Advisory Committee or SEAC). The SEAC consists of representatives from the maritime industry, relevant state and local agencies, academia, and national labs. The SEAC advises the MSC on present and future research projects and educational programs from the perspective of the current state-of-the-art in relevant science and technology, and present and future needs of the MSC stakeholders and end users. The current SEAC Members, listed below, will meet semi-annually face-to-face, or via conference call. We anticipate to review the current membership and identify potential new members to add or replace existing members:

- Admiral James Loy (USCG ret), Chair
- Vice Admiral Robert Parker (USCG ret)
- Ms. Lillian Borrone, former Director of the Port of New York and New Jersey
- Mr. Steven Carmel, VP, Maersk Sealand
- Dr. John Montgomery, Director, Naval Research Laboratory
- Ms. Sidonie Sansom, Chief of Security, Transbay Joint Powers Authority
- Ms. Bethann Rooney, Assistant Director of Port Commerce, Port Authority of NY and NJ
- Dr. Martha Grabowski, Professor, Rensselaer Polytechnic Institute

Facilities

MSC is headquartered at Stevens Institute of Technology in Hoboken, NJ. The physical infrastructure of Stevens includes direct access to NY Harbor via the Hudson River, a more than 30,000 square foot ocean engineering laboratory complex that houses the most advanced towing tanks and wave tanks in the nation, two fully equipped coastal and estuary research vessels, a Maritime Security Laboratory for real-time data visualization, and an operational ocean and weather observation and forecasting system that covers the region from Nantucket Island to the Chesapeake Bay. Stevens makes available office space, meeting rooms, and conference facilities on its campus, which is conveniently located near three major airports and rail, subway, ferry and bus transportation systems. The space includes offices for the Director, Deputy Director, Director of Education, Administrative Assistant, as well as up to six visitor offices for use by individuals from the partner institutions, DHS, and other organizations. The meeting rooms and conference facilities can accommodate groups ranging in size from 20 to 400 people.

Project Solicitation

MSC will continue to engage with the DHS stakeholders to discuss their high priority challenges. To address these challenges, we will solicit proposals on a regular basis via White Papers or Request for Proposals. The topics, research questions and knowledge gaps solicited will be drawn from the Center's original Funding Opportunity Announcement (FOA) as well as the Integrated Product Team (IPT).

We will also continue to socialize the Center's projects and encourage existing and prospective partners to submit new ideas that can help the Center in its research and education missions. Such new ideas for projects will be considered for funding when resourcing becomes available.

In July 2018, the Center will issue a Request for Proposals (RFP). Additional information regarding the RFP, is addressed in section 4.3.

Project Evaluation

MSC will continue to measure its progress towards both its short- and long-term objectives through a formal review process. The research evaluation cycle begins with an annual call to the PIs to submit their planned project work plans. These plans will be reviewed by MSC's Director. This process will be interactive between the research leads (PIs) and the MSC leadership, where feedback will be provided on the technical relevance in the context of the overall Center's themes and projects. Corrective actions required will also be provided when warranted. The Director will be responsible for tracking post-project developments and for providing measurements of MSC's progress in transitioning. The Director of Education will be responsible for evaluating specific education programs using metrics described below.

The progress of each project will be discussed during the management committee meetings as well as other meetings with the PIs. Milestones and project metrics will be reviewed with the PIs on an ongoing basis and evaluated. Deviations/delays will be discussed with the DHS Program Manager, and corrective action will be taken.

Our overall evaluation goal is to have a clear understanding by the end of each year as to which activities will be continued, which need to be modified (and perhaps even expanded) and which need to be ended. The reviews will gather data on the following topics/questions and a detailed discussion will be undertaken to establish the continued viability of each project. The discussion will take place with the project PI, and feedback will be consolidated and supplied to the project PI in written format. We expect that the members of the management committee will actively participate in the evaluation of the data gathered, and in the preparation of the feedback to the PI. This process will rely on email correspondence, and phone calls as needed. The issues/questions that need more clarification and/or work progress to address any concerns will be undertaken at the subsequent review.

Project-based evaluation criteria we will assess (also relevant for biennial review) include the following to continue to evaluate whether each project is good science, it is relevant to the DHS stakeholders, and is progressing as planned. We will use the following questions as a guide:

- Do reported performance metrics and milestones indicate adequate progress towards meeting objectives?
- Is there alignment with DHS stakeholder research gaps and needs?
- Does the project formulation and progress demonstrate an understanding of related studies? Has the PI demonstrated an understanding of previous studies?
- Does the data acquired support the best available and is the data verifiable?
- Has the research contributed to scientific knowledge in relevant fields? Do the findings advance knowledge and do they address the needs of the users?

- Does the project have the potential to create operational efficiencies and/or buy down risk?
- Do the project teams contain an appropriate mix of interdisciplinary skill sets and partners needed to achieve the research objectives within the proposed timeframe?

On an on-going basis, the MSC management team will continue to encourage the PIs to contribute to the following activities, with the understanding that these activities are also considered indicators of the quality of the research projects in the portfolio:

- Publications and joint publications, refereed articles, technical reports, books, and presentations (target at least 1)
- Number of graduate students involved in MSC and MSC-related research (target at least 1, based on available funds)
- Adoptions of MSC products by end-users
- Student/faculty exchanges (when feasible)
- Collaborative conferences and workshops (number and attendance)
- Total funding from external sources
- Patents
- Copyrights and trademarks
- Transitions and commercialized products

MSC will take input generated by DHS and reflect this feedback in our education and research projects. In particular, feedback provided by the DHS customers will be used to implement changes or corrective actions, as required. Mechanisms to achieve input include stakeholder meetings and other forms of communication. We will avail ourselves of Center outreach mechanisms and will also attend closely to agency/division roadmaps and pursue data-mining to better understand both the technology gaps and the possible non- MSC research performers. Importantly, one possible benefit of this approach would be that the MSC can "buy down" the risk for certain identified areas of R&D being pursued by the Borders and Maritime Division. Once we have identified the technology gaps and the areas of need, we plan to develop project proposals via White Papers or RFPs as needed.

A consolidated annual report will be produced detailing activities for the previous year, quantitative measurements of the progress towards objectives, and plans for the future. The annual report will detail the Center activities in the research, education and outreach areas that have occurred, specifically comparing outcomes with the lists of planned tasks detailed in the work plans. The MSC SEAC will be engaged to provide feedback on a semi-annual basis on the progress of the Center.

The following areas will continue to be monitored across the Center enterprise:

- Quality of research being conducted under various themes

- Relevance and operational impact of research on end-users
- Dissemination of findings, transition of products, and commercialization
- Diversity and work with Minority Serving Institutions (MSIs) and underrepresented communities.
- Education in homeland security, including graduate research support
- Production of homeland security researchers and professionals
- Outreach to other DHS centers; national laboratories; research and security organizations; and Local, State, and Federal agencies
- Organizational efficiency and management (streamlined processes – e.g., consolidated tracking of research progress, DHS research needs, and processes for new project initiation)

An additional cluster of metrics relates to the ability of the aggregated MSC research projects to impact stakeholders. These metrics provide a synergistic integrated layer to the metrics listed above, but overall, they represent a means of assessing the Center impact. The expectations will vary by project and stage of research, but overall include:

- Number of high-quality whitepapers produced for government/stakeholders to explain our research progress and/or experiments and outcomes
- MSC scientists used as Subject Matter Experts (SMEs) by stakeholders
- Advice and information provided to Federal, State, and local elected officials and decision-makers, via testimony and other means
- Joint activities with stakeholder organizations (conferences, committees, workshops, exercises, technology evaluations or deployments)

We will also have a cluster of Center-focused transition questions. These questions, which will be used to inform the various review processes, will include:

- How is the Center disseminating research results broadly to the public and to stakeholder end users to enhance their scientific and technological understanding (metrics to include newsletter frequency and readership stats; dissemination of 1-pagers)?
- Is the transition strategy and team composition adequate to ensure continued progress toward transition?
- How does the work stand on transition readiness path (e.g., USCG) (formal evaluation status)?
- Is the activity sustainable over along enough duration to ensure transition?

Transition Plans

The MSC transition strategy begins with stakeholder guidance, stimulates and sustains interest and confidence in technologies throughout product development, and leverages existing partnerships with industry to ensure timely transition. The

transition theme is always discussed with the DHS stakeholders, starting at the kick-off meetings. Our strategy has been and will continue to include the following:

- Interacting frequently with DHS stakeholders, primarily in the form of meetings and workshops, to repeatedly assess evolving needs and capability gaps;
- Establishing a chain of trusted agents between the technology developers and end users to ensure delivery of robust, fit-for-purpose systems and provision of reliable technical and operational support from the component level up through the system level;
- Engaging DHS stakeholders in joint ventures to the extent appropriate to ensure that dual-use and multi-use transition opportunities are fully considered and exploited. As an example, projects involving data collection have sought input from the DHS components to improve the product outcome and widen their applications to multiple components. The projects being conducted during Year 5 will look for opportunities to continue to do this.

Since transition will be a focus for Year 5, the MSC management team will work with individual PIs to help them transition their projects. We will specifically assist them through the following steps:

- Develop a viable transition plan at the outset of the project with the project champion
- Work with the project champion to identify the receiving organization of the product within the DHS component
- Work with the project champion to identify the requirements of this organization to receive the product as well as the hurdles that need to be overcome (this includes security, platform, and other potential areas)
- Identify steps and vehicle needed to make product available (e.g., licensing, other specific tasks, etc.)
- Work with the project champion to identify the steps/actions that need to be taken once the product is received.

A key goal of MSC will be to transfer data and knowledge (e.g., via journal and trade publications) and envision ways to transition technology to end-users in an operational environment – including DHS components, and state and local government users. Building the chain of trusted agents and nurturing long-term relationships with the end user communities based on mutual trust and demonstrated performance is essential to the success of the technology transfer efforts. MSC will continue to solicit DHS user input and feedback to help focus demonstrations of early research efforts and feasibility studies at Technology Readiness Levels (TRL) 1 to 3. Likewise, we envision field and/or tabletop experiments in support of the work described herein if new projects solicited through the RFP provide such an opportunity.

We note here that the Stevens Office of Innovation and Entrepreneurship is specifically chartered to facilitate technology transitioning, and this resource will be applied to assist MSC. In particular, this office will facilitate the development and execution of CRADAs, Memoranda of Understanding, Memoranda of Agreements, Licensing Agreements, patent disclosures, copyrights, etc.). Stevens Office of Innovation and Entrepreneurship includes individuals highly knowledgeable in intellectual property development, identification, protection, and commercialization. This office facilitated the commercialization of the Stevens passive acoustic underwater surveillance system in 2012 and the airborne border protection surveillance system in 2016. MSC will continue to work with this office to look for transition opportunities using all vehicles available.

For fundamental research, knowledge transfer will be accomplished via the traditional routes of peer review and dissemination. These will include conferences, proceedings volumes, books, and peer-reviewed articles in leading academic and professional journals. In particular, MSC will continue to submit abstracts and papers to the annual IEEE Homeland Security Conference, the Journal of Acoustic Society of America, and other scientific conferences and journals as well as component proceedings (the US Coast Guard Proceedings). A key component of this effort will be to transfer data and knowledge quickly and directly to the user community – NOT via technical journal publications – but rather via short, user-friendly documents tailored to the audience and describing the latest MSC results, e.g., a technology demonstration experiment, a new deployment, or the adoption of a new process or methodology. The intent of these documents is to facilitate rapid information exchange and possible collaboration and end-user opportunities, thereby accelerating the adoption of the portfolio tools and technologies. We will also utilize outreach mechanisms such as newsletters and 1-page research summaries to facilitate this process and keep potential and existing end-users informed, on a project-by-project basis. We will also continue to create abstracts and fact sheets for new projects and post them online.

As knowledge transfer is also inextricably tied to education, MSC will continue to provide means, motive and opportunities for students to transition from academia into the DHS workforce and for members of the DHS workforce to participate in MSC activities as guest speakers and students.

Other Activities

The management team will continually review activities to ensure compliance with federal regulations as well as the terms of the Cooperative Agreement. The MSC team promotes a culture of safety. To that end, we will institute a regular review of the established safety plan by forming an independent panel of experts. Our USCG Auxiliary contacts and advisory personnel will be important resources on this topic, and we intend to ensure that the safety priority is communicated and enforced at partner institutions through regular review of their practices and procedures. The

safety plan and information protection plan will be reviewed/updated once per year or as warranted and distributed among the Center partners and students.

The MSC management team will organize MSC participation in the MSC annual meeting. The MSC will coordinate activities with other Centers of Excellence, including any joint activities, as appropriate.

3. Stakeholder Engagement

The MSC will be pro-active in working in close coordination with the DHS Program Manager to ensure frequent and ongoing stakeholder engagement. The management team has developed extensive contacts within the homeland security community and has had more than seven years of experience in organizing and conducting highly impactful meetings, workshops and conferences. An objective for this year is to facilitate transition of appropriate projects to the DHS stakeholders and components. The transition theme will be discussed in all engagements. The following summarizes the plans for stakeholder engagement over the period of performance of this Workplan. Note that student internships, the Summer Research Institute, and participation in the workshops/meetings below will be the primary means of engagement of our students with the stakeholder organizations.

Stakeholder Engagement Meetings

The stakeholder engagement meetings will be held at various locations, including Stevens, the USCG Research and Development Center (RDC), and partner university campuses. Stakeholder Meetings will engage a broad array of USCG representatives (from Sector, District, Area, Headquarters, Academy and Fellows), other DHS components (Borders & Maritime, CBP and CBP Air and Marine Operations Center), and other federal stakeholders such as National Maritime Intelligence-Integration Office (NMIO), JIATF-S and National Urban Security Technology Laboratory (NUSTL), Navy and NOAA. Regional and local stakeholders such as Port Authority of NY/NJ, NYPD, NJ Office of Homeland Security and Preparedness (NJOHSP), NYC Office of Emergency Management are expected to attend as well. The meetings may also include industry representatives and academic partners, depending on the topics being covered.

A key objective of the stakeholder meetings is to gain insight on user needs. The purpose of the meetings is to present our research and transition progress in a manner that connects it directly to the potential end-users. The Stakeholder Engagement Meetings will be up to a day-long event, combined with other meetings when appropriate (e.g., workshops, annual meeting, etc.) and cover the following topics:

- A brief review of the progress on select Center projects, along with a report on the transition activities and plans related to each project.
- Feedback will be solicited from the attendees both at the time of the meeting and as follow-up by phone, e-mail, or by survey.

A goal of the meetings is to actively track the stakeholder response and make adjustments accordingly. The Stakeholder meetings are also valuable to identify potential challenges in transitioning projects, so we can anticipate and adapt/respond ahead of time. These discussions will be documented and reported in summary in the Year 5 Annual Report.

DHS Science and Technology (S&T) Outreach Events

MSC will participate in at least one DHS S&T outreach event to showcase our activities, tools and technologies and solicit feedback from potential end-users.

Other Stakeholder Engagements

MSC will seek a variety of other formal opportunities to interface with stakeholders such as Technical Interchange Meetings in coordination with the Coast Guard RDC, engaging in local Area Maritime Security Committees activities, meetings to work with our local law enforcement partners (e.g., NYPD, NJOHSP, and PANYNJ), and coordination and information exchange opportunities with the DHS National Urban Security Technology Laboratory, Sandia National Labs, CBP AMOC, among others. These meetings may include coordination on specific projects or opportunities to develop potential new projects.

Meetings of the MSC Science and Education Advisory Committee

MSC will invite the SEAC to its annual meeting to the Stevens campus or at the location of one of our partner organizations. We will also invite the members of the SEAC to some of the activities described above, as deemed appropriate.

Faculty Exchanges

We will ask the project leads and other faculty to participate in exchanges to stakeholder environments with a target of 1 exchange if all resources are available. Venues could include USCG operational settings or headquarters. Through these exchanges, MSC researchers would gain exposure to how the entity conducts its day-to-day operations in the mission space. Exchanges will last a week or longer and may include longer-term faculty sabbaticals.

Engagement with Potential User Groups

MSC research and education efforts will build upon existing collaborative, interagency and interdisciplinary relationships. In addition to the Port of NY and NJ, the MSC will work with several U.S. ports, including the ports of Los Angeles, Houston, New Orleans, Seattle, Honolulu, Everglades, San Juan, Miami, and San Francisco. Several organizations currently interact with MSC on a regular basis to determine the homeland security needs of individual critical infrastructure locations and their interdependencies to the region, and representatives of these essential organizations are often members of the MSC SEAC. For example, MSC has been involved with the NJOHSP to determine state and local homeland security needs and we have engaged in organized exercises as evaluators and participants. These activities will be continued and expanded. MSC will also work with local Area Maritime Security Committees (AMSC), an essential element of the DHS national strategy to prevent terrorist attacks, mitigate natural disasters impact, and reduce vulnerabilities to port safety and security.

Future engagement efforts will focus on expanding partnerships with DHS via CBP and ICE as well as increasing MSC's strong collaboration with USCG. We will also engage with the national labs. We will continue a multi-pronged approach to introduce MSC personnel and capabilities to new partners via:
- Meeting in small groups at their facilities to discuss their needs and capability gaps;
- Inviting them to participate in MSC workshops and annual meetings; and
- Attending broader meetings in their fields or at their local venues that pertain to homeland security.

4. Research Projects

The MSC research projects are conducted in areas related to maritime security, including Maritime Domain Awareness, Maritime Cyber Security, and Port Resiliency. The research activities to be conducted are outlined below.
- Predictive Port Resilience Tool
- Social Media Analysis Research and Training
- Other Projects (TBD – Solicited via White Papers and RFP)

In the following sections, we describe the activities to be conducted during the period of performance of the Workplan. For each project, the PI will be asked to develop a viable transition plan with the help from the Center as described in the "Transition Plans" Section above.

4.1 Predictive Port Resilience Tool [PROJECT NOT APPROVED, FUNDING RESTRICTED]

Florida Atlantic University

Lead Researcher: Manhar Dhanak

[WORKPLAN WILL BE INSERTED HERE WHEN APPROVED]

4.2 Social Media Analysis Research and Training

Purdue University
Lead Researcher: David Ebert

Abstract:

This research project will increase the understanding of information and intelligence integration within maritime operations, with a focus on advancements in technologies and command and control systems that utilize crowdsourced information.

The research project's objective is to explore how social media analytics can most effectively lead to improved safety outcomes during natural disasters, emergencies, and other important safety events. We will achieve this objective through structured interviews and targeted questionnaires of the previous use of social media, and the Social Media Analytics and Reporting Toolkit (SMART) during the past several years, including during the 2017 hurricane season. The outcome will be a report on the U.S. Coast Guard's use of SMART with lessons learned and suggestions for improvements and training.

1. Overview and Baseline

Baseline: The DHS Visual Analytics for Command, Control, and Interoperability Environments (VACCINE) Center developed the Social Media Analysis and Reporting Tool (SMART) (Figure 1) to utilize crowdsourced data to increase situation awareness during normal monitoring, special events, and unexpected situations, such as the four hurricanes in 2017.
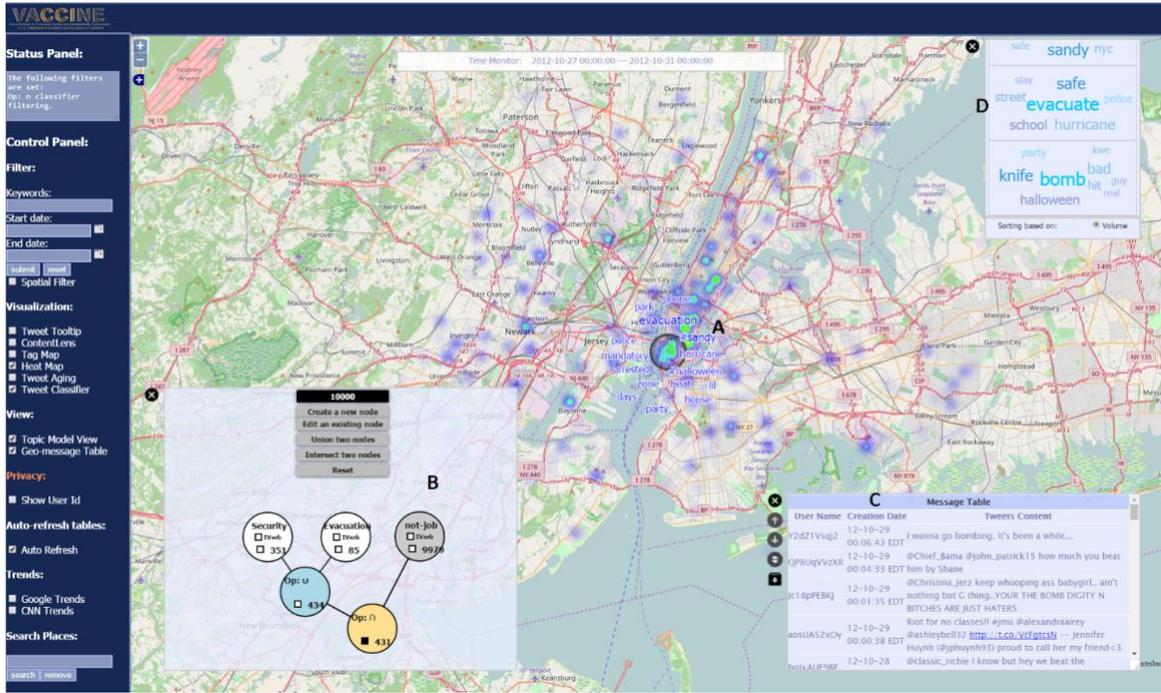

Figure 1: An example screenshot of the SMART software suite displaying social media feeds during Hurricane Sandy. The SMART technology includes a (A) map view, (B) stream classifier view, (C) message table, and (D) topic view. The Content lens in the map view (near the A in the Figure) visualizes in real-time prominent keywords extracted from social media data inside the lens.

     Currently, SMART provides users with scalable, real-time, and interactive social media data (e.g., Twitter and Instagram) analysis and visualization that includes heat mapping (Figure 1A), interactive topic lenses (Figure 1A), and task-tailored interactive message categorization. Additionally, SMART allows analysts to interactively configure classifiers (Figure 1B) to monitor their topics of interest and identify trends and anomalies from various social media channels at multiple scales of aggregation. SMART also provides users with the ability to search, examine, and further investigate relevant social media messages (Figure 1C) from the high volume data by utilizing smart aggregation, automated text analysis, and advanced filtering strategies. The system employs the use of several semi-automated text-analysis and probabilistic event detection tools together with traditional zooming, interaction, and exploration to enable the detection and exploration of abnormal topics (Figure 1D). Web and news media sources are also incorporated in the system so that users can search for relevant news articles of interest to further corroborate the intelligence acquired from social media data. Lastly, in order to not require continuous system monitoring, SMART provides an email alert/summary service to send emails related to user-defined topics automatically.

     The current iteration of SMART has been successfully deployed by DHS components and both local and regional public safety organizations to a variety of highly sensitive events (see Text Box 1). For example, SMART was deployed at the 2017 Presidential Inauguration in Washington, DC, the 2016 Republican National Convention in Cleveland, OH, Thunder-Over-Louisville, Cincinnati RiverFest, several state fairs by State Homeland Security Intel personnel,

crowded stadiums, maritime hoax call investigations and for disaster management/severe weather analysis. In each case, VACCINE personnel were able to train the perspective end-users regarding the operation of SMART in a one hour webinar. This highlights the intuitive interface of the system.

Text Box 1. Selected Examples of SMART Deployments

- *Presidential Inauguration* **–** An agency at the U.S. Government Security Operations Center used SMART to monitor and predict the movement of protests and crowds during the 2017 Presidential Inauguration. They discovered valuable information five to ten minutes faster than on the ground reports and public sources of information that enabled them to more quickly and accurately respond to evolving situations.
- *Republican National Convention* - law enforcement agencies and first responder groups used SMART at the Republican National Convention held in Cleveland in July 2016 to provide actionable intelligence and early-warning indicators of potential demonstrations, acts of violence, and disruptions during the event.
- *Thunder Over Louisville* – For the past four years, the U.S. Coast Guard has used SMART to monitor safety and security topics that appear on social media during the Thunder Over Louisville festival, a weekend-long celebration that draws up to 850,000 spectators. Using SMART's email alert system, Coast Guard personnel were able to quickly and efficiently identify suspects posting threatening Tweets that were passed to local law enforcement for investigation.
- *Crowded Stadiums* – Different agencies have used SMART to identify and act upon threats being made in crowded stadiums such as University Police Departments during football games (e.g., Ohio State Stadium, Purdue Stadium) or the Coast Guard during Thunder Over Louisville.
- *Hoax calls* - SMART has been used to support the investigative analysis of hoax distress calls by Coast Guard analysts in order to utilize social media data as another source of information. SMART has identified suspicious geo-tagged tweets and Instagram posts based on the spatial and temporal information of the hoax distress calls. Based on keyword collections and enriched data, SMART identified suspicious Twitter users and messages for review by analysts.
- *Disaster management and severe weather* – SMART has been explored by the American Red Cross for use during severe storms from tornados to hurricanes. SMART is currently being used to analyze movement trends during 2012 Hurricane Sandy and 2017 bushfires in New South Wales Australia. SMART has the real-time potential to corroborate "on-the-ground" reports from the public during disasters, which can provide emergency managers a more holistic perspective of an unfolding emergency event. Example images and posts for severe weather are shown in Figure 2 and 3.

However, SMART's use has been on a case-by-case basis by scattered personnel across the service and for each use by a new group, training sessions need to be run, accounts needs to be created, and situation specific information needs to customized.

Therefore, we will conduct an in-depth user study with the USCG in their use of the SMART software and overall social media analytics. From the study results, we will develop and deliver a report on the use of social media and SMART, lessons learned, best practices, and suggestions for future use of social media analytics.

2. Objective

The Objective of this project is the following:

- Explore how social media analytics can most effectively lead to improved safety outcomes during natural disasters, emergencies, and other important safety events.

Effective use and improved training in the use of social media analytics tools, such as SMART, will increase U.S. Coast Guard personnel situational awareness, as well as security and performance effectiveness.

3. Research Method

Our overall approach for this project is to utilize strong end-user engagement. The objective and task will be started with an understanding the end-user needs before beginning each task and proceeds with frequent engagement with the end-user, resulting in interactive refinement of the work product. This results in a final work product that delivers more value to the customer.. The specific methodology for Task 1 is described below.

4. Identified Task and Schedule

Task 1 – Report on USCG use of social media analytics: **June 15 to December 31, 2018**

This project requires direct interaction with personnel at the USCG and first responders who have used SMART to understand and enumerate the different ways they have used SMART and other social media analytics methods, with a focus on the 2017 Hurricanes, 2017 and 2018 National Security Events, and other recent events. We will use structured interview techniques to learn about how end users have engaged with SMART and social media platforms before, during, and after potential events. We will apply querying methods to determine a user's comprehension of the information provided. Measures of situation awareness are accomplished using targeted questions to determine whether users attain additional information to achieve desired outcomes. Our sample size will be a minimum of six end users at both USCG and first responder agencies. Each structured interview is expected to last between 30 minutes to one hour. A large focus of the interviews and queries will be on the temporal demands of information. In other words, the efforts will be to enumerate which pieces of information need to be delivered during training, accessible during an event, and extracted in a debriefing. Common gaps or issues with SMART will also be identified and addressed, where feasible, into a new release of SMART.

We will engage Purdue University personnel and personnel at Davista Technologies to perform these interviews and write the report.[1] The collective personnel have experience in knowledge elicitation with homeland security end-user communities, experience in social media analytics, and experience as first responders.

The information from the use of SMART by USCG and first will be disseminated to a broad community of first responders and feedback incorporated to improve the report on effective use of social media.

5. Outcomes and Outputs

Task 1 Outcome – Comprehensively report on how the USCG has used social media analytics, guidelines for use, and improvements to SMART.

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[1] IRB approval is pending. Similar previous review sessions have been considered minimal risk and received expedited approval.

- *Outcome 1a* – A white paper and briefing delivered to the Coast Guard Cyber Command & Assistant Commandant for Command, Control, Communications, Computers and Information Technology.
- *Outcome 1b* – Present research findings at conferences, such as the *2018 IEEE International Symposium on Technologies for Homeland Security* about the use of social media analytics in the 2017 hurricanes, and the *2018 IEEE International Conference on Information Systems for Crisis Response and Management* on more general lessons learned and output of Task 1.
- *Outcome 1c* – Deployment of some initial training material and small improvements to SMART for USCG use to increase its utility to USCG. Any simple changes to SMART will be implemented and deployed and a short ppt presentation explaining the use of SMART will be created. We will have SMART available through VACCINE's servers and website.

6. Project Milestones and Performance Metrics

#	Milestone Description	Decision Point (State the criteria and date for "go" decision)	Performance Metrics	Output
M1	USCG social media analytics study	N/A	Min. 8 USCG, 8 first responders participate in study	White paper for USCG to enable more effective use of SMART and social media. IEEE Conference paper 2019, Draft white paper will be completed by **September 1 2018**. After feedback, revised whitepaper will be delivered by **December 31, 2018**. IEEE conference paper deadline is TBD based on deadlines from the conferences.

7. Stakeholder Engagement

We will actively engage USCG personnel and our Midwestern Public Safety Consortium to ensure mission relevancy, effective utilization and dissemination. Stakeholders will be actively engaged in the study to understand the previous use of SMART and social media tools. We will interview stakeholders, have review phone calls, and solicit their feedback on drafts. Active and frequent engagement will continue throughout the entire project. Identified stakeholders from USCG and DHS include the following:

US Coast Guard –In the future engagements, we aim for a better understanding of how the USCG uses social media analytics and reincorporate our findings into training material. We will also explore dissemination through the Area Maritime Security Committees (AMSC) to engage port stakeholders within federal, state and local agencies, and industry.

First Responder Groups –In the future engagements, we aim to better understand how first responders use social media to support investigations and reincorporate our findings into training material. Our goal is to enable more effective use or SMART and similar tools to

19

increase situation awareness and performance during events. As new users of SMART come onboard, we will elicit feedback through questionnaires and hot washes for improvement suggestions to be included into the training material and software.

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Other USCG POCs
Rear Admiral   TBD
Title: USCG Commander
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9. Student Engagement

One graduate student will be involved in conducting the interviews and improving the SMART system. This student is working in visual analytics, computer engineering/industrial engineering, and computer science. The work on this project will increase their skills in knowledge elicitation, application-driven research, visual analytics, and technology transition. The work on this project will provide research training as part of their degree program, research credit toward their degree, and contribute to their dissertation.

10. Transition plan

The research project will support the utilization of social media analytics and transition of best practices and our report on utilization of social media analytics to the US Coast Guard and other end users in the maritime domain, disaster managers, and first responders groups. We have clearly identified goals of transitioning these material to USCG operations and will work with our USCG POC to design the detailed transition implementation

from the start, ensuring the materials and products are available to appropriate USCG personnel. VACCINE has already transitioned SMART to first responder community use and this project's material will increase that transition.

We are working with Captain Wright to determine the best paths and platforms for dissemination and transition of the report and lessoned learn material. Our current USCG transition plan is the following:

- Initially, we will provide the draft of the report to previous users of SMART within USCG, receive feedback, make revisions, and then disseminate the materials. The report and software will reside on VACCINE/Purdue servers and be accessible to USCG personnel. We will also work with Capt. Wright and CG-0922 Office of Public Affairs to identify any possible internal hosting and dissemination possibilities for the report material.
- Determine impact/integration of any of our material with new USCG social media use policy.
- Develop best-practices guide for USCG use of SMART and integrate into appropriate material for USCG.
- Disseminate this material to POCs in CG-0922; Command, Control, Communications, Computers and Information Technology, Coast Guard Investigations; and SAR.
- Work with each user group to explore paths within their office or sector to help determine a sustainable plan for use.

11. Programmatic Risks

The main programmatic risk of this project is the availability of personnel for the interviews. We have had over a dozen previous USCG users of SMART and a similar number of first responder users. However, we need to locate and check the availability of these personnel to participate in the interviews. As a mitigation strategy, we will expand the people we contact to people who have only used the system for a short time to get their experiences and feedback. We make our best efforts to engage the previous users for Task 1.

4.3 Other Projects

MSC will be soliciting new projects via a call for proposals in the form of a Request for Proposals (RFP) and a request for White Papers. The RFP will solicit proposals that address current stakeholder research questions (mostly derived from the Center Funding Opportunity Announcement). The call for White Papers will solicit new ideas that have not been addressed in the RFP to allow for projects that provide innovative research approaches that show potential promise in addressing the DHS Stakeholder concerns.

During Year 5, the RFP process (along with evaluation) will be conducted and a Request for Proposals will be issued, and the proposals will be evaluated. The effort will invite qualified researchers to propose projects that will provide DHS stakeholder with innovative research that addresses critical issues in the following theme areas:

- Maritime Risk, Threat Analysis, and Resilience Research;
- Maritime Domain Awareness (MDA) Research;

- Maritime Technology Research
- Integration of Science and Engineering with Maritime Security Governance and Policy Research.

MSC will specifically fund research for the purpose of improving the safety, security, and resilience of the maritime domain with the expressed outcome of improving the Nation's homeland security.

Proposals will be reviewed for scientific merit by the Center's Scientific Committee comprised of representatives from public and private sectors and academia. Projects recommended for funding will be scored, ranked and forwarded to DHS for mission relevancy and for final approval. Proposals that are interdisciplinary, highly collaborative and have strong potential for transition to the end user are encouraged.

5. Education and Outreach

Overview

MSC is committed to enhancing the knowledge, technical skills and leadership capabilities of the Nation's current and prospective maritime security workforce. At the core of the Center's mission is the transfer of its research and expertise into relevant, innovative educational programs. The Center's educational programs leverage the subject matter expertise and research assets of its academic partners and stakeholder network to provide multidisciplinary and experiential learning opportunities for students and tailored programs for professional audiences.

The Center's educational programs for Year 5 will include the following:

- The Summer Research Institute (SRI)
- Research Assistantships and Doctoral Fellowship
- MSI and Community College Engagement Workshop

All MSC education activities are managed by the Director of Education. This includes dedicating an effort level of 30% for the planning, coordination, and delivery of the Summer Research Institute (SRI), 10% of effort will be dedicated for overseeing the Doctoral Fellowship program, and 25% of effort will be dedicated for the student recruitment, project assignment, advising and oversight of the program, engaging students in stakeholder activities and networking, assistance with internship and job placement, and performance reporting. 35% of the Director of Education's effort will be dedicated to other Center educational activities. These other activities are separately identified in the budget and include the development and delivery of the MSI workshop, faculty and student recruitment and proposal discussions for engagement in the DHS MSI Summer Research Team Program, planning for and executing the MSI summer research team, educational program project reporting, preparation of the Center newsletter, interactions with non DHS-funded students, engagement in the Sector New York Area Maritime Security Committee (AMSC), meetings with stakeholders to discuss student

research projects and experiential learning opportunities, student and research PI participation in DHS events, and interactions and collaborations with MSC academic partners.

5.1 The Summer Research Institute

A. Project Description

MSC has developed an eight-week intensive HS-STEM focused summer research program designed to expose students to the maritime and homeland security domain and to engage them in research projects tailored to address critical issues in maritime domain awareness, emergency response maritime system resilience and maritime cybersecurity.

With the inclusion of its academic network, MSC will continue to build upon its successful Summer Research Institute and will expand its outreach to encourage student participation from each of the Center's academic partner schools. The Center will also maximize its efforts to conduct targeted recruitment from MSI schools to ensure diversity in the program and to facilitate enhanced opportunities for women and students from underrepresented communities.

This coming summer (June 4 – July 27, 2018), MSC plans to host 20 students from seven U.S. colleges and universities. The Center aims to continue the annual delivery of the program during the months of June and July during the 2018/2019 academic year.

B. Benefits to DHS Stakeholders

Prospective HS-STEM students: The summer research program engages STEM students in hands-on multidisciplinary research projects focused on critical issues in maritime security. The program exposes students to homeland security concerns and to new academic opportunities and careers within the homeland security enterprise. Students enhance their professional development by actively engaging in team-based projects, collaborating with academic researchers and networking with homeland security practitioners.

Homeland Security Enterprise: The Summer Research Institute provides a forum for high-achieving STEM students to network and engage with practitioners throughout the homeland security enterprise. The program provides opportunities for homeland security professionals to contribute to the development of relevant research projects and to the education of the future homeland security work force.

C. Methodology

Feedback from past student surveys and discussions with Center researchers and stakeholders have identified the following activities to have had tangible, long-term impacts on student participants, and will serve as the ongoing framework for the

program (a tentative agenda is provided in Appendix I):

- Participation in seminars provided by MSC research members, Stevens faculty members, and homeland security practitioners.
- Engagement in hands-on, multidisciplinary research projects focused on current maritime and homeland security issues.
- Field-visits and field-based activities with Federal, State, and Local homeland security practitioners. (e.g., USCG, CBP and NUSTL)
- Professional development activities, including oral presentations, team projects, report writing, and networking.

Lessons learned over the eight-year delivery of the Summer Research Institute will continue to inform and guide the implementation of the program in Year 5.

MSC researchers play a key role in the professional development and mentoring of SRI participants. Students in the 2018 and 2019 programs will be given the opportunity to learn first-hand from experienced researchers in the fields of maritime security, cybersecurity, robotics and remote sensing and surveillance. Students will be given unique access to state-of-the-science tools and technologies, data sources and an extensive network of industry and government homeland security experts and stakeholders.

The goal of the SRI program is to further connect students with homeland security professionals and to engage them in research projects that are responsive to and directly impact the knowledge and technology needs of the homeland security enterprise. During Year 5, the summer research program will build upon the Center's ongoing research to enhance maritime domain awareness (MDA) and will incorporate the Center's emerging projects in the areas of Maritime Cybersecurity and Unmanned Aerial Systems, among others. SRI student participants will contribute to the advancement of the Center's research and tool development through the summer research program and will assist in the transition of the Center's work through field-based activities and engagements with MSC's stakeholders.

The annual SRI will be organized and coordinated by MSC Director of Education, Beth Austin-DeFares, in conjunction with Dr. Barry Bunin (Director, Stevens Institute of Technology Maritime Security Program). Ms. Austin-DeFares serves as the primary program facilitator and student coordinator.

Dr. Bunin will participate as the lead faculty facilitator and curriculum developer. Dr. Bunin will also provide day-to-day SRI student team mentorship, along with other MSC research PIs and Stevens faculty. In addition, Dr. Bunin will serve as the technical lead on the SRI projects and provide assistance to students in both theoretical and practical implementation of the projects.

D. Project Milestones

1. Featured lectures by MSC researchers and invited guests (e.g. USCG, DHS, & RNT Foundation). (6/4/18 – 7/27/18) / (6/3/19 – 7/26/19)
2. Field-visits and field-based activities. (6/4/18 – 7/27/18) / (6/3/19 – 7/26/19)
3. Diversity of student participants. (6/4/18 – 7/27/18) / (6/3/19 – 7/26/19)
4. Research Reports, presentations and posters. (6/4/18 – 7/27/18) / (6/3/19 – 7/26/19)
5. Post-Program Student Survey. (7/16/18 – 8/3/18) / (7/15/19 – 7/26/19)

E. Performance Metrics

The performance metrics are mapped to the milestones listed above.

1. A minimum of three homeland security/maritime industry guest speakers will be hosted during the summer research program:

- 1a. A minimum of three faculty/guest lectures will be provided during the eight-week research program.
- 1b. The quality of and knowledge learned from the lectures will be assessed through a post-program student survey.

2. Students will engage in a minimum of two field-based activities during the summer research program. (e.g., participation in a stakeholder meeting/workshop/training, research experiments/deployments, operational facility tours)

- 2a. Impacts of the field-based activities and stakeholder engagements on student professional development and networking skills will be assessed through a post-program student survey.

3. Diversity will be measured according to the number of students from underrepresented communities (MSI schools, minority students and women), and to the number of STEM disciplines represented in the program. A minimum of four different disciplines will be represented.

- 3a. Student diversity will be measured by the percentage of women and minority students participating in the program. A diverse student population will include a minimum of 50% students from underrepresented communities. (e.g., women, students attending MSI's, or minority students.)

4. A minimum of two research summary reports and research posters will be prepared at the culmination of the SRI program.

- 4a. Students will engage in four research status update presentations (Weeks 3 – 7) during the SRI.
- 4b. Stakeholder engagement will be assessed by the inclusion of homeland

security representation in the student's research activities (field-based, in the classroom, interviews) and in attendance at the student's final research presentations.

- 4c. Quality of research outcomes will be assessed by MSC research mentor feedback and the number of projects submitted for presentation at conferences and/or for publication.
- 4d. Program impacts on professional development, technical skills learned, project teamwork, and expressed student interest in advanced academic study or careers in HS-STEM will be assessed by a post-program student survey.

5. A minimum of one student survey will be conducted at the end of the 2018 and 2019 SRI programs. The survey will be used to measure the strengths of the program and areas for improvement.

F. Outputs/Outcomes

MSC will provide a structured eight-week summer research program for STEM students to engage in hands-on homeland security-focused research. The program consists of faculty and invited guest lectures and field-based activities, and professional skills development exercises. Outcomes from the program will include student exposure and awareness to maritime and homeland security challenges, enhanced oral presentations skills, multidisciplinary project teamwork, and research reports and posters articulating the student's research activities and knowledge learned.

G. Transition Plans

Student team final summary research reports and presentation slides will be made available on the MSC website. The Center also actively pursues post-program opportunities for students to present their work at national conferences and DHS affiliated events. For example, student research conducted during the 2017 SRI was submitted and selected for presentation at the 174th Meeting of the Acoustical Society of America in December 2017.

Ongoing effort is also made to connect SRI program students and alumni with internships, scholarships and fellowships, and employment in the homeland security enterprise.

H. Stakeholder Engagement

Stakeholder engagement in the SRI has been a key facet to the summer research program since its inception. Representatives from the USCG (Sector New York, Research and Development Center) and Customs and Border Protection (Field Operations) have offered their support and participation in the Year 5 summer research program through the following activities: hosting field-visits and facility

tours (CBP Field Operations- Port of New York/Newark), and guest lectures (USCG PACAREA, NUSTL, and Plum Island Animal Disease Center).

I. Potential Risks to Completion

The SRI program occurs over an eight-week period. While past student groups have achieved significant outcomes, research progress and outcomes rely upon the availability of research assets (e.g. working and available equipment (ROVs, UAS, teaching expertise, etc.). In past cases where needed technologies have been broken and deployed, we have relied upon archived data sources and tools and technologies loaned to us from other Stevens departments. SRI mentors and administrators are flexible and agile to ensure that students are provided with alternative resources as needed throughout their research experience.

5.2 Research Assistantships and Doctoral Fellowships

A. Project Description

Established through the support of DHS Education Supplement awards and DHS Career Development Grants the Center has developed a highly-engaged Research Assistantship and Fellowship program. The homeland security-focused Fellows/Assistantship program have provided for full-tuition support, a monthly stipend, field-based internships and robust networking opportunities with homeland security decision makers and practitioners.

Collectively, the MSC has supported nine Maritime Security Master's degree Fellows, three multidisciplinary Doctoral Fellows, and during the 2017/2018 academic year provided Research Assistantships to three students (two graduate-level - Master's and Doctoral - students and one undergraduate student).

All nine of the Center's Master's Degree Fellows and one of its Doctoral Fellows have successfully completed their degree programs and have assumed homeland security related positions within the public and private sectors. One Doctoral Fellow will remain in the program throughout the 2018/2019 academic year, completing research in the area of Underwater Robots and Autonomous Navigation and the three remaining Research Assistants, will complete their degree requirements in May 2018.

During Year 5, the Center will seek to confer up to two new Master's degree-level Research Assistantships. The Research Assistants will engage in research projects related to the core research and education themes of MSC (e.g., maritime domain awareness, maritime risk, threat, and resilience, maritime technology, etc.). The Director will seek approval from the OUP PM on the research efforts to be pursued by the Research Assistants. At the end of the academic year, the students will prepare summary reports outlining their research activities and how they related to MSC and DHS's center objectives.

The Assistantships will provide tuition support and a monthly stipend throughout a one-year HS-STEM focused academic program. The Research Assistantship program will be interdisciplinary and integrate course work from Stevens School of Engineering and Science (e.g., Mechanical Engineering, Electrical Engineering, and Computer Science/ Engineering, etc.) with research activities and course work within the Stevens Maritime Security Graduate Certificate program. The interdisciplinary programs will leverage the faculty resources and research assets of the School of Engineering and Science to provide a robust and multifaceted academic experience. The goal of the Research Assistantship program is to provide a foundation for solving problems associated with maritime security challenges through the use of scientific approaches (e.g., optics, radar, acoustics, robotics, cybersecurity etc.), and to create a study pipeline of highly-skilled technology-focused students entering careers within the homeland security domain.

B. Benefits to DHS Stakeholders

HS-STEM career focused students: The Research Assistantship program will provide HS-STEM career focused students with a unique opportunity to complete their coursework on a full-time basis and to engage in multidisciplinary research projects with MSC research PIs and Stevens Institute of Technology faculty members. The program will facilitate opportunities to gain invaluable experience through hands-on research and extensive networking opportunities and interactions with homeland security practitioners.

Homeland Security Enterprise: The rigorous HS-STEM Research Assistantship program engages students in engineering and computer science coursework, hands-on research in the context of maritime and homeland security concerns, field-based activities within the homeland security enterprise, and homeland security-focused report and thesis preparation. The MSC program is committed to creating a steady pipeline of highly-skill STEM students entering technical leadership positions within the maritime and homeland security domain.

C. Methodology

The Research Assistantship program integrates course work from the School of Engineering and Science at Stevens Institute of Technology (e.g. Mechanical Engineering, Electrical Engineering, and Computer Engineering) with course work from the Stevens Maritime Security curriculum. The interdisciplinary program leverages the faculty resources and research assets across Stevens' School of Engineering and Science academic departments to provide a robust and multifaceted educational experience.

The goal of the Research Assistantship program is to provide a foundation for solving problems associated with threat detection and surveillance challenges in the maritime and homeland security domain, including maritime cybersecurity related concerns.

Students awarded Assistantships (one-year research-based programs) will participate full-time in an undergraduate or graduate-level degree program in any of the following fields: Electrical Engineering, Mechanical Engineering, Computer Science or Computer and Electrical Engineering at Stevens Institute of Technology. The educational objectives of the program are to:

- Provide students with the technical skills and organizational knowledge needed to assume positions of responsibility in homeland security organizations that deal with the threats posed to coastal borders, vessels, ports, and facilities.
- Enable students to acquire and apply knowledge of a broad range of technologies to maximize the effect in the field of homeland security.
- Provide the students with a practical knowledge of the operational and regulatory skills needed to manage and lead organizations responsible for port, facility, and vessel security.
- Provide students with the basic knowledge needed to pursue research in the maritime security arena.

At the completion of the HS-STEM focused programs, students will receive either a Master's or an Undergraduate Degrees in Mechanical Engineering, Electrical Engineering, Computer Science/Engineering, or Electrical Engineering.

To be considered for the Research Assistantship program students must meet the following criteria:

- U.S. Citizenship
- Cumulative GPA of 3.30 or better
- Students must be enrolled full time in an undergraduate or graduate-degree level Engineering or Science program.
- Research Assistantship students must commit to conducting research under the mentorship of MSC research PIs up to twenty hours per week during the fall and spring semesters.

Student recruitment efforts for the Assistantship program will include outreach within the Stevens Institute of Technology academic enterprise. Students recommended by Stevens research faculty will be given priority in the review process. The MSC Student Review Committee, comprised of MSC PIs and administrators, will conduct a two-phase approach in the selection of student candidates. The first phase will include an application and letter of recommendation review, and the second phase will include an interview. Successful candidates will be awarded one-year awards.

D. Project Milestones

1. Research Assistantship- prospective student outreach and recruitment. (7/1/18 – 09/1/18)
3. Students complete requisite coursework. (9/1/18 – 5/31/19)

4. Students present research at an MSC organized event or related DHS or stakeholder meeting (3/1/19 – 6/30/19)

E. Performance Metrics

1. Confer two Research Assistantships during the 2018/2019 academic year.
2. Research Assistants maintain GPA requirements and enroll full-time in coursework.
3. Research Assistants engage in up to twenty hours of MSC research per week during the fall and spring semesters
4. MSC will apply for additional education supplements, as they are made available through DHS OUP.

F. Outputs/Outcomes

The original MSC Research Assistant/Fellows program was developed to meet DHS workforce needs and to create a steady pipeline of highly-skilled STEM students entering technical leadership positions within the maritime and homeland security domain. To date, MSC Fellows have participated in summer internships with the USCG RDC, USCG LANT-Area, USCG Sector New York, U.S. Navy, and NYPD-CTD, and have obtained employment with the U.S. Coast Guard RDC, PNNL, NATO-CMRE, DNV-GL, and NUSTL/LMI.

Additional program outcomes include the completion of a maritime and homeland security-centric report or thesis.

G. Stakeholder Engagement

Students in the MSC Research Assistantship program routinely interact with homeland security stakeholders (e.g., USCG, CBP, NYPD-CTD, NJ OHSP, NUSTL and other DHS component agencies) through the Center's research projects, MSC Lab presentations, MSC and DHS hosted meetings and events, and field-based activities.

5.3 MSI Outreach and Workshop

A. Project Description

MSC aims to connect faculty and students from Minority Serving Institutions (MSI) and Community Colleges with the Center's research PIs, projects, assets, and technical knowledge in the maritime domain. As part of the Center's ongoing commitment to enhance the HS-STEM research capabilities and educational opportunities of MSI and Community College faculty and students, the Center will leverage the subject matter expertise of its PIs and affiliate faculty members from Stevens Institute of Technology to deliver a workshop focused on local and national maritime concerns.

Workshop topics may include one of the following areas of interest:

- Technology Applications for Maritime and Port Security (e.g. Passive Acoustics, underwater robotics, unmanned aerial systems.)
- Maritime Cybersecurity – Developing interdisciplinary curriculum and class room activities.

B. Methodology

The framework for the interactive workshop will include MSC-led lectures, group discussions, and instructional techniques and strategies for integrating the workshop topic into MSI and Community College program curriculums. Participants will receive resource materials and lesson plan development support. Opportunities for research collaboration will also be discussed.

C. Benefits to DHS Stakeholders

MSI and Community College Faculty: The workshop will engage faculty members in dialog focused on critical issues in the maritime and homeland security domain. The workshop will bring together representatives from underserved communities together with Center of Excellence research PIs and DHS component agencies to learn about cutting edge research in the field. Faculty members will have the opportunity to network and build relationships with DHS stakeholders, and will learn how to incorporate maritime and port security topics into their program curriculums.

Homeland Security Enterprise: The workshop will provide a forum for faculty representatives from underserved and underrepresented communities to network and engage with homeland security practitioners in the public and private maritime sector. The workshop will provide opportunities for COE research PIs and homeland security practitioners to broaden the awareness of homeland security concerns, inspire new educational programs and student engagement, and to contribute to the education of the future homeland security work force.

D. Project Milestones

1. Development of workshop topic and curriculum. (7/1/18 – 12/30/18)
2. Workshop held. (1/19 – 4/19)

E. Performance Metrics

1. Workshop topic to be determined by MSC and DHS stakeholders.
    1a. MSC will conduct outreach to USCG, CBP and other local stakeholders to define a timely and relevant workshop topic.

2. Workshop participation will include MSI and Community College educators and DHS stakeholders.

2a. Workshop attendees will include representations from a minimum of three MSI schools and community colleges.
2b. A minimum of one DHS stakeholder representative (USCG, CBP) will participate in the workshop event.

F. Outputs/Outcomes

MSC will facilitate a one-day multidisciplinary workshop with the intent of contributing to the research capabilities and educational opportunities of MSI and Community College faculty and students. The workshop will include MSC research PIs and DHS stakeholder engagement. Outcomes from the workshop will include enhanced awareness of maritime and homeland security concerns, curriculum materials and lesson plans, networking and opportunities for follow-on collaboration.

G. Transition Plans

Workshop participants will receive lesson plans and classroom materials that can be utilized to supplement or assist in the development of their STEM-based programs.

H. Stakeholder Engagement

MSC will leverage its stakeholder partnerships (e.g. USCG, CBP) to vet relevant workshop topics and to identify follow on opportunities for MSI and community college faculty and students (research, internships, and career placement).

I. Potential Risks

Outcomes of the workshop will depend on MSC's ability to target and convene relevant STEM- focused educators from MSI and community college schools. The workshop topic should complement existing programs and produce opportunities for follow-on collaboration and engagement.

6. Appendix 1 – SRI Example Agenda

Maritime Security Center Example Agenda/Curriculum for the 2019 SRI program

Program Start and End Dates: June 3 – July 26, 2019

Anticipated Program Lectures: Week One Orientation

Maritime Systems course lectures – Dr. Bunin, Chief Architect, Maritime Security Laboratory and Program Director, Maritime Security.
• Introduction to Maritime Systems
• Maritime Transportation System & Port Security

- How to conduct research – Research 101

Invited Guest Speakers: TBD

Research Projects: Project topics TBD with input from MSC stakeholders and research PIs.

Project Mentors: To be determined based on the research projects selected.

Project Requirements: Final report, presentation slides and a research poster. All research project materials will be uploaded to the SRI 2019 Google Drive.

Planned Field-visits:
- 4th annual Port Authority of NY/NJ Ferry Terminals Field Visit – June 2019
    - Make observations on visible security procedures, personnel, and surveillance and detection technologies in place.
- 8th annual Customs and Border Protection – Field Operations, Port of NY/Newark – June 2019
    - Observe the use of Non-intrusive inspection equipment, Radiological Detection devices, Remotely Operated Vehicles used for underwater inspections

Final Reports and Presentations:
- Students will present their research outcomes during the week of July 22, 2019.
- Invited guests will include representatives from local, state and Federal homeland security agencies.
- Project outcome materials to be posted on the MSC website following Mentor reviews and approvals.

Post Program Survey:
Distributed to students during the seventh week of the program.
Survey feedback shared and discussed among MSC administrators.