

# Science and Technology Capability Roadmap for the **Maritime Safety and Security Program**

The Science and Technology Directorate's Maritime Safety and Security (MS&S) program develops and transitions technical capabilities that enhance U.S. maritime border security. These technical capabilities will safeguard lawful trade and travel and help prevent illegal use of the maritime environment to transport illicit goods or people. To guide program development and investments over the next ten years (through 2032), MS&S worked with the Homeland Security Operational Analysis Center (HSOAC), operated by the RAND Corporation, to develop a program capability roadmap. The HSOAC team documented its work in a detailed report to MS&S; this document provides an overview of the roadmap.



## Homeland Security

Science and Technology

# From Missions and Capabilities to Research and Development Investments

Department of Homeland Security (DHS) missions anchor the roadmap.

HSOAC worked with the MS&S Program to construct a process whereby Science and Technology Directorate research and development (R&D) investments can be traced to DHS strategic objectives. The roadmap is composed of activities that are designed to fill capability needs identified from DHS missions in the MS&S area.

Fifteen maritime missions were the launching point of the roadmap. Rigorous evaluation that compared the capabilities needed to perform these missions with current MS&S capabilities identified forty capability gaps or needs. The roadmap aligns and prioritizes more than one hundred current and proposed R&D activities with one or more of these defined needs.



The five-step, repeatable process will allow the MS&S Program to update the roadmap to reflect changing strategic objectives, emerging technologies, and capability development.

## STEPS TO DEVELOP THE CAPABILITY ROADMAP

MISSION	NECESSARY CAPABILITY	CURRENT CAPABILITY	NEED	ACTIVITY
Define MS&S missions based on DHS strategic objectives	Decompose missions into tasks and subtasks, then identify capabilities to complete tasks and subtasks	Compile a catalog of existing DHS maritime capabilities (aircraft, vessels, sensors, software) and link them to necessary capabilities	Examine the gaps between necessary capabilities and current capabilities to identify a set of maritime needs	Identify activities that would potentially fill the needs through technology scouting, partnering, and existing DHS initiatives



## Capability Roadmap Projects Fill MS&S Needs

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The roadmap's R&D activities are grouped into seven projects. The projects are prioritized on the basis of the size of the gap between needed capabilities and current ones. Subject-matter-expert and stakeholder perspectives on the criticality of the need and the feasibility of meeting the need influenced how priorities were set.

Like the roadmap itself, priorities will change over time, but they can usefully guide planning and investment decisionmaking for the next decade.

The MS&S R&D program currently has six projects that have been supporting the DHS maritime missions and the broader maritime community for several years. There is still R&D to be done in these areas, but they do not cover all the topics that the maritime community needs for MS&S.

The roadmap proposes seven projects. These new projects expand the MS&S Program's portfolio to include additional aspects of the DHS maritime missions. Maritime border security is a major focus, however, there are additional areas MS&S addresses such as search and rescue, maritime transportation systems, and maritime communication. Some projects focus on the support that DHS furnishes to the safety and security of the maritime marketplace, which provides goods and energy to the United States, including fishing areas and offshore wind farms. Others focus on modernizing the MS&S capabilities to handle the changing threats and hazards and incorporate newer technologies, such as artificial intelligence and machine learning and unmanned platforms. These projects provide clarity about the types of R&D that the MS&S Program oversees or the R&D and Test and Evaluation efforts in its support of the broader maritime community.

# Summary of Roadmap Projects and Objectives

Project	Objectives
Coastal, Port, and Waterway Security	<ul style="list-style-type: none"> <li>• Communicating restricted zones</li> <li>• Disabling maritime threats</li> <li>• Countering unmanned systems</li> <li>• Boarding noncompliant vessels</li> </ul>
Maritime Environment, Climate, and Economy	<ul style="list-style-type: none"> <li>• Assessing mission impacts of changing climate</li> <li>• Updating equipment and methods for efficiently responding to oil spills</li> <li>• Automating detection of oil spills and other pollution</li> <li>• Maritime domain awareness and intelligence for all fishing vessels</li> <li>• Automated mapping of fishing areas</li> <li>• Maintained safety and security of offshore infrastructure</li> <li>• Alternative energy for maritime assets</li> <li>• Marine resources data use and analysis</li> </ul>
Maritime Location and Communication and Emergency Management	<ul style="list-style-type: none"> <li>• Communication among assets in all domains and across all components</li> <li>• Precise position location from any source</li> <li>• Automated location of distress notifications</li> <li>• Integration of multiple sources</li> <li>• Meeting search and rescue needs in new environments</li> <li>• Modernizing search and rescue equipment and approaches</li> <li>• Real-time data communication across all assets in all locations</li> </ul>
Maritime Analytics and All Domain Sensors	<ul style="list-style-type: none"> <li>• Data fusion and artificial intelligence and machine learning analytics</li> <li>• Accessing and updating the interagency operating picture in real time in the field</li> </ul>
Enhanced Maritime Characterization	<ul style="list-style-type: none"> <li>• Automated classification of sensor data</li> <li>• Automated threat prioritization</li> <li>• Automated vessel recognition</li> <li>• Automated identification and prioritization of threats using real-time data</li> <li>• Detection, mitigation, and recovery from cyber threats</li> <li>• Comprehensive sensor coverage and awareness across the maritime environment</li> </ul>
Multi-Domain Information Sharing	<ul style="list-style-type: none"> <li>• Data sharing across federal, state, and local agencies</li> <li>• Real-time data communication across all assets in all locations</li> <li>• Accessing references and input mission data in real time via portable devices</li> </ul>
Mariner Mission Performance	<ul style="list-style-type: none"> <li>• Updating the workforce with new technologies</li> <li>• Measurements of operational tactics effectiveness</li> <li>• Metrics of DHS mission performance</li> <li>• Utilizing marinized deployable sensors as force multipliers</li> </ul>