United States Department of Transportation
Annual Modal Research Plans FY 2021
Program Outlook FY 2022

Cover Page

MARITIME ADMINISTRATION (MARAD)
August 18, 2020
Michael Carter/Todd Ripley/Travis Black, POC's

Chapter 1 – Executive Summary

MARAD Self-Certification – MARAD certifies that its RD&T activities are non-duplicative with known prior or current projects within DOT, and there is no intra-agency duplication.

Executive Summary (MTA)

Existing MTA Program Summary - The Maritime Technical Assistance (MTA) Program was established by Congress to engage in technical assistance to support innovation and technology demonstration, validation, and verification that supports environmental and safety performance and efficiencies within the U.S. maritime transportation industry. The Program is executed through collaboration among the private and public sectors to identify, evaluate, and demonstrate promising new technologies and practices that are likely to result in enhanced system performance. MTA's achievements inform and support not only industry but provide data for development of national and international maritime environmental policy mechanisms and assessing potential economically achievable regulatory and permitting reforms.

Since its inception, MTA's primary focus areas have been control of non-indigenous aquatic species transported by vessels, energy alternatives and efficiency, and reduction in vessel and port air emissions. These areas present significant continuing challenges for ship owners and operators, the regulatory community, and the public. As of January 2020, through the National Defense Authorization Act (NDAA), program language was expanded to include efficiency and safety of domestic maritime industries as well as underwater noise generated from vessels.

Aquatic Invasive Species: Aquatic invasive species continue to be one of the greatest threats to marine and coastal biodiversity world-wide. Aquatic invasions can destroy native ecosystems, overwhelm native species, reduce recreational opportunities, and adversely impact sport and commercial fisheries. Although there are many pathways through which these invasions can occur, transportation in ships' ballast water and in hull biofouling are known contributors.

The Maritime Administration (MARAD) works with the maritime community to address issues related to the introduction of non-indigenous aquatic species through ballast water and hull biofouling. The Agency established its Ballast Water Initiative to assist industry and government agencies in moving treatment technologies from the laboratory to shipboard application as rapidly as possible.

MARAD's ballast water efforts grew into a multi-state and multi-agency cooperative effort that supports the development of technical and scientific protocols for technology testing and verification, and operation of independent testing facilities to provide the needed data for ultimate certification of ballast water management systems (BWMS) to International Maritime Organization (IMO) and U.S. Coast Guard (USCG) standards. These facilities also conduct research and development into improved technology and processing to control the spread of non-indigenous aquatic species.

Vessel and Port Air Emissions: Air pollution results in substantial economic, environmental, and human health costs. Criteria pollutant and greenhouse gas emissions from large marine engines and port operations have the potential to affect not just coastal and near-shore communities, but also to impact populations hundreds of miles away.

For clean emissions initiatives to advance, there must be a process for assisting stakeholders in making decisions on the most beneficial and practical approaches. Whether selecting alternative fuels or technologies, the investment by industry is significant. Therefore, an important component of MARAD's MTA Program is to test, evaluate, and demonstrate the viability and applicability of alternative fuels and technologies with the objectives of improving fuel efficiency, compliance with national and international fuel and air emissions regulations, and reduction in vessel operating costs.

Over the years, MTA has worked closely with maritime vessel operators, ports, and other stakeholders to engage in studies and demonstration projects related to emissions reductions, energy efficiency and conservation, and alternative fuel and technologies.

More recently in response to the COVID-19 Pandemic, MTA is discussing with maritime stakeholder's possible application of Unmanned Aerial Vehicles (UAVs) to serve as part of the portfolio of options for vessel owners and crews for delivery and retrieval of test kits, Personal Protective Equipment (PPE) and other materials to support response to the virus, and at the same time reduce transmission by minimizing person-to-person contact. The MTA team will continue to pursue demonstration opportunities with operators, labor and researchers for UAV technologies, where its effectiveness can be assessed, further refined, and integrated to be part of a productive delivery and retrieval solution in response to the COVID-19 Pandemic.

Partnerships: MTA is authorized to coordinate with other federal, state, and local agencies to carry out its goals. Over time MARAD has partnered with numerous agencies, industry, and academia to complete research and demonstration projects. Regarding non-indigenous aquatic species, MARAD has partnered with the U.S. Coast Guard, Naval Research Lab, US Naval Sea Systems Command, and state agencies such as the California State Lands Commission and the Maryland Port administration. Pertaining to air emissions reductions and energy conservation, MARAD works closely with the US EPA, USCG, DOE, state agencies such as the Maryland Department of Transportation/Maryland Port Administration, research universities, and maritime academies.

Technology Transfer (T2)

Technology testing, validation and verification is a key component of the MTA program. As such, much of the work supports T2 opportunities and the distribution of information about the costs, benefits, and performance of technologies to assist industry in making decisions regarding capital investments and choosing among technology options that best fit their operations. At the same time, MTA provides opportunities that are otherwise unavailable to innovators to perform some R&D outside of the laboratory in real or near real operations.

Test results, reports, studies and industry guidelines are available through MARAD's website, the Research Hub and most partners' websites. Technical papers from the projects are regularly presented to journals, industry magazines, TRB and other public venues.

Evaluation/Performance Measurement

The legislative language defines the goal of the MTA program as "Foster collaborative efforts amongst Federal agencies, academia, industry, and the public to address critical marine transportation issues." Because of the nature of this program, which is focused on providing technical assistance in areas where environmental, safety and efficiency challenges exist, the development of baselines, broad goals and metrics has been difficult. Considering this, the program office manages 3-year outlooks, consistent with Agency goals that identify program focus areas and potential projects to support those areas.

As a practical matter, areas of focus or concentration are reviewed at least annually in developing spend plans, plus throughout the year as input is received from stakeholders. Priorities are guided or influenced by stakeholder input, lessons learned from previous research, regulatory changes, and an effort to complement or build on work of others, both nationally and internationally. In addition, MTA takes advantage of "projects of opportunity," where MARAD will add to projects that are being undertaken or planned by others. For example, MARAD might perform pre-and post-emissions testing when a ship owner performs a repower or switches fuel types.

As designed, the program is largely driven by stakeholder needs. As such, MARAD participates in numerous forums throughout the year, such as the Ship Operation Cooperative Program, CMTS, AAPA, IMO, ISO/ASTM, and TRB where program information on research and technical assistance results and needs are discussed and identified with both industry and government partners.

In addition, MARAD sponsors workshops and MTA program public forums, and participates in many other venues to facilitate dialog and input on program activities and direction.

Finally, at the project level, MTA work follows specific project scopes of work, with milestones and deliverables, which are monitored by a program technical representative.

Executive Summary (MARAD ITS-JPO)

MARAD ITS-JPO Collaboration Research Activities Summary – The ITS MARAD Program is a joint USDOT initiative, co-led by the ITS JPO (Intelligent Transportation Systems Joint Program Office) and MARAD with modal participation from FHWA and FMCSA. The goal of the Program is to use ITS to improve the performance of maritime ports and terminals along with the larger freight network. MARAD currently does not have a budget for any of the projects, but by working jointly with the ITS-JPO and FMCSA, we have directed work benefiting our port stakeholders and communities.

We continue to work on identifying a portfolio of projects that agencies, including port authorities, can implement through ATCMTD (Advanced Transportation and Congestion Management Technologies Deployment) and other grants to address port and freight-related challenges.

Technology Transfer (T2)

MARAD works with the ITS-JPO's Professional Capacity Building (PCB) program to coordinate knowledge transfer of project results using webinars and postings of project materials, in addition to ITS-JPO posting it to the DOT Research Hub.

Through the Program we are working towards a long-term outcome of field operational testing of technology solutions, one of which may include automated truck queuing at ports. Working closely with relevant maritime stakeholders will help ensure effective Technology Transfer (T2) activities of the completed products and tools, and assist in developing plans for future evaluation activities.

The Program completed the ITS MARAD Truck Staging study in May 2019. The study objectives were to determine the state of the practice regarding truck staging, including access, queuing, and parking, at maritime ports and to identify port operators' and trucking industry needs; and to perform an economic feasibility study of automated truck queuing as a technology solution. Additionally, the ITS-JPO created Professional Capacity Building (PCB) materials that relate to ITS in a port environment that were completed Summer 2019. As part of knowledge transfer of ITS technologies into the port environment, MARAD worked with the ITS-JPO and the American Association of Port Authorities on the Port Planning & Investment Toolkit ITS Module that was completed in June 2019 delivering a tool for knowledge transfer of ITS Technologies into the port environment. The objective of the module is to assist ports in the planning, feasibility, funding, and deployment of ITS applications.

The Port Autonomous/Connected Drayage Truck Development and Testing project will include knowledge transfer activities for the demonstration of ITS Technologies in a port environment. The project is expected to be completed in FY 2021.

Evaluation/Performance Measurement

We continue to work on identifying a portfolio of projects that agencies, including port authorities, can implement through ATCMTD and other grants to address port and freight-related challenges. MARAD works with the ITS-JPO to track such activities using yearly updates to a program roadmap. The roadmap is presented to relevant ITS-JPO stakeholders in consideration of funding opportunities.

At the project level, MARAD's port development work follows specific project scopes of work, with milestones and deliverables, which are monitored by a MARAD technical representative.

For FY 2019, ITS-JPO budgeted $300,000 for FHWA, with support from MARAD and FMCSA, to start the Port Autonomous/Connected Drayage Truck Development and Testing project. The project seeks to demonstrate autonomous/connected vehicles in a port environment in a multi-year phased approach, to increase efficiencies and safety, and decrease emissions. ITS-JPO budgeted $1,500,000 for FY 2020 and $1,000,000 (preliminary) for FY 2021 to continue the project. The project is on schedule for initial demonstrations in early FY 2021.

As part of knowledge transfer of ITS technologies into the port environment, MARAD worked with the ITS-JPO and the American Association of Port Authorities on the Port Planning & Investment Toolkit ITS Module, completed in June 2019. The objective of the module is to assist ports in the planning, feasibility, funding, and deployment of ITS applications.

The Program completed the Business Case Assessment project in October 2017. The team conducted outreach with stakeholders, and developed a portfolio of business case assessments for four candidates ITS solutions.

FY 2021 RD&T Program Budget Enacted Funding Details

RD&T Program Name	FY 2021 Enacted* ($000)	Basic ($000)	Applied ($000)	Development ($000)	Technology ($000)
MTA*	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0
Totals	0	0	0	0	0

** The Maritime Technical Assistance (MTA) program operates by authority of 46 USC 5037. MTA funding is a line item in MARAD's Operations and Training budget; this funding is not provided under a designated Research and Development (R&D) account. MTA expenditures are primarily used for maritime transportation technology and operational innovation and demonstration projects. This plan is nevertheless provided in order to provide OST visibility of this program.*

** MARAD ITS-JPO Activities are funded from and in cooperation with the Intelligent Transportation Systems Joint Program Office (ITS-JPO) funded under the Federal Highway Administration and aligns with their budget submittal.*

FY 2021 RD&T Program Budget Enacted by DOT Strategic Goal

RD&T Program Name	FY 2021 Enacted* ($000)	SAFETY ($000)	INFRASTRUCTURE ($000)	INNOVATION ($000)	ACCOUNTABILITY ($000)
MTA*	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0
Totals	0	0	0	0	0

**MTA funds do not fit neatly into the above categories; there is some overlap. For example, a project exploring the use of domestically produced liquefied natural gas (LNG) for vessel propulsion would have safety, mobility improvement, infrastructure and environmental dimensions.*

** MARAD ITS-JPO Activities are funded from and in cooperation with the Intelligent Transportation Systems Joint Program Office (ITS-JPO) funded under the Federal Highway Administration and aligns with their budge submittal.*

Chapter 2 – FY 2021 RD&T Programs

High Priority Project Descriptions (MTA)

($0*)

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Program Description/Objectives/Activities:

Federal Role/Continued Relevance

MARAD will continue to implement the MTA program by providing oversight of existing projects, working with partners to develop new projects, and foster outreach with stakeholders to maintain continuity through FY2021.

The MTA Program is designed to identify, study, evaluate, test, demonstrate or improve emerging marine technologies and practices that are likely to achieve maritime environmental, safety, and transportation efficiency improvements.

Non-indigenous aquatic species -- MARAD will maintain its support for the BWMS testing, validation and certification process with established facilities and scientific teams, including the California Maritime Academy school ship Golden Bear and the Great Waters Research Collaborative Center. In addition, underwater hull fouling and in-water cleaning projects through the University of Maryland Maritime Environmental Resource will be ongoing. In all cases, one element of the projects is to support commercialization of economical technologies that will assist the maritime industry in achieving environmental requirements and enhance environmental performance.

Alternative Fuels and Energy Efficiency – MARAD will continue oversight of existing projects and engagement in maritime focused efforts related to bio-fuels, fuel cells, liquefied natural gas, and energy efficiency. That work supports the industry and innovation efforts to address port and vessel operating costs, technology transfer to the maritime transportation sector, and opening new markets for technology and alternative fuels development.

MARAD will maintain and expand upon its collaboration with other Federal, state and local governments, such as the U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), U.S. Navy, National Oceanic and Atmospheric Administration (NOAA), the U.S. Army Corps of Engineers and the Department of Energy (DOE) and maritime stakeholders to provide the maritime technical expertise on projects outside the MTA program.

Finally, because MARAD school ships and NDRF vessels play an important role in supporting MARAD innovation and MTA related projects, we will continue to work with industry and other stakeholders to provide opportunities for technology testing and demonstration on these assets.

For FY2021, MARAD will continue to partner with industry, Federal, state and local governments, and academia to investigate air emissions reductions, vessel and port energy efficiencies, alternative fuels and technologies, ballast water management, hull fouling, maritime safety and efficiency where possible, and as resources allow. Funding for FY2021 was not requested. MARAD will continue to implement the MTA program by continuing oversight of existing projects and continued outreach with stakeholders to maintain continuity through FY2021.

Areas of continued interest include:

- Shipboard system efficiency and power management
- Zero/low emissions vessels and marine engines
- Energy efficient port operations and applications of new technologies at ports
- Aquatic Invasive Species in Ballast Water and Underwater Hull Fouling
- Improved vessel and port data driven system integration
- Near real time weather reporting and improved forecasting

AIR EMISSIONS PROJECT ACTIVITIES FY2020/2021:

The MTA program continued to support various energy efficiency, emissions reductions, and alternative fuel studies and demonstration projects on vessels and at ports. Examples include:

- Verification of emissions detection technologies versus in-situ emissions testing aboard a MARAD RRF Vessel
- Determining emissions reductions/energy efficiency from automated systems integration aboard a workboat
- Studying spill and release characteristics for alternative marine fuels
- Demonstrating waste heat efficiency technology aboard a training vessel
- Demonstrating next generation hybrid technology aboard a workboat.
- Demonstrating a 100Kw fuel cell for vessel shore power.

BALLAST WATER PROJECT ACTIVITIES FY2020/2021:

The MTA program continued to support various projects related to the mitigation of introduction and spread of non-indigenous aquatic species. Examples include:

- Continuation of the validation of a methodology for verifying the cleaning and capture efficiency if in-water cleaning technologies
- Development and validation of a methodology for verifying the cleaning and capture efficiency if in-water grooming technologies
- Validation of ballast water compliance monitoring devices in Great Lakes water
- Bench-scale testing of promising ballast water treatments in fresh water
- Examining Toxicological Response of Freshwater Organisms in Treated Ballast Water Based Upon Size.
- Exploring Options for Real-Time Monitoring of Water Quality within Great Lakes Ports: Implications for Uptake Avoidance
- Verifying operational and biological performance of UV and EC ballast water treatment systems on board the MV Cape Washington
- Conducting land-based and shipboard type approval testing of ballast water treatment systems on board the TS Golden Bear

Expected Program Outcomes:

Most MTA projects are forward-facing with results posted to the Agency's webpage to inform the industry, sister agencies, and other stakeholders. MARAD will continue posting project results and data on it's webpage throughout 2021.

In addition, MARAD staff coordinates with OST-R, through the DOT RD&T Planning Team, and provides input to the DOT Research Hub on an annual basis. In addition, the DOT Research Hub has imbedded links to the MARAD website where information regarding MTA research activities is available to the public. This information includes project descriptions, funding amounts, links to final reports, datasets, and summary descriptions of research outputs, outcomes, and impacts.

Collaboration Partners:

Most of MTA's project have been developed because of an expressed need from the maritime industry. The MTA program is built on the premise of public-private partnerships and collaboration with Federal, state and local government, academia, maritime industry and non-governmental organizations. Many MTA projects provide for substantial cost sharing with other governmental, academic, and private industry partners.

In addition, MARAD participates and contributes in support of DOT research coordination and collaboration under categories of Infrastructure, Safety, Innovation and Accountability that include on the DOT Topical Research Working Groups for Automation, Systemic Safety Approach, Human Factors, Environmental Stewardship, Emerging/Enabling Technologies including the Artificial Intelligence (A.I.) Task Group, Cybersecurity, and Technology Transfer/Deployment.

Program Alignment with Strategic Goals:

DOT Strategic Goal	topical research areas
Safety Infrastructure Innovation Accountability	Automated/remote controlled systems Systemic Safety Approach Human Factors Environmental Stewardship Emerging/Enabling Technologies Cybersecurity Technology Transfer

USDOT Research Priorities:

MTA's works with commercial industry, technology developers, researchers and government agencies in the production, collection and analysis of data to inform maritime environmental policy that contribute to shaping the evolving regulatory landscape and enabling regulatory reform, both at the national and international level. More specifically this program contributes to informing industry on maritime environmental capabilities and requirements, providing insight regarding innovative and evolving technologies that address air emissions and ballast water management compliance that are critical to the competitiveness of the U.S. maritime industry.

High Priority Project Descriptions (MARAD ITS-JPO)

($0*)

** MARAD ITS-JPO Activities are funded from and in cooperation with the Intelligent Transportation Systems Joint Program Office (ITS-JPO) funded under the Federal Highway Administration and aligns with their budget submittal.*

Program Description/Objectives/Activities:

Federal Role/Continued Relevance

MARAD, in conjunction with Intelligent Transportation Systems – Joint Program Office (ITS-JPO) research programs, seeks to increase cargo capacity and reliability of freight moving through ports. MARAD is engaged in a multi-year research program that seeks to achieve two primary goals:

1) To identify opportunities to conduct research that addresses critical freight movement and ITS infrastructure gaps
2) To identify opportunities for pilot projects and programs to be deployed including T2.

U.S. Maritime Transportation System National Advisory Committee (MTSNAC) Port Subcommittee develops recommendations for the USDOT on ports and maritime ITS topics.

The law for the port development is at 46 USC 50302.

Expected Program Outcomes:

For FY 2019, ITS-JPO budgeted $300,000 for FHWA, with support from MARAD and FMCSA, to start the Port Autonomous/Connected Drayage Truck Development and Testing project. The project seeks to demonstrate autonomous/connected vehicles in a port environment in a multi-year phased approach, to increase efficiencies and safety, and decrease emissions. ITS-JPO budgeted $1,500,000 for FY 2020 and $1,000,000 (preliminary) for FY 2021 to continue the project. The project is on schedule for initial demonstrations in early FY 2021.

Collaboration Partners:

The ITS MARAD Program is a joint USDOT initiative, co-led by the ITS-JPO and MARAD with modal participation from FHWA and FMCSA. MARAD works with ITS-JPO for project information reporting.

U.S. Maritime Transportation System National Advisory Committee (MTSNAC) Port Subcommittee develops recommendations for the USDOT on ports and maritime ITS topics.

In addition, MARAD participates and contributes in support of DOT research coordination and collaboration under categories of Infrastructure, Safety, Innovation and Accountability that include DOT Topical Research Working Groups for Automation, Economic Competitiveness including the Resilience Task Group, Emerging/Enabling Technologies, Technology Transfer/Deployment, Evaluation/Performance Measurement, and Data.

Program Alignment with Strategic Goals:

The goal of the Program is to use ITS to improve the performance of maritime ports and terminals along with the larger freight network.

DOT Strategic Goal	USDOT Research Priorities
Safety Infrastructure Innovation Accountability	Automation Economic Competitiveness Emerging/Enabling Technologies Technology Transfer/Deployment Evaluation/Performance Measurement Data

USDOT Research Priorities:

The program seeks to increase cargo capacity and reliability of freight moving through ports.

Chapter 3 – FY 2022 RD&T Programs

Maritime Technical Assistance Program

Program Description/Activities:
46 USC 50307, and amended under Section 3503 of NDAA for FY20, the Secretary of Transportation, acting through the Maritime Administrator, shall engage in the study, research, development, assessment, and deployment of emerging marine technologies and practices related to the marine transportation system through the use of public vessels under the control of the Maritime Administration or private vessels under United States registry, and through partnerships and cooperative efforts with academic, public, private, and nongovernmental entities and facilities.

Specifically, the Secretary of Transportation shall identify, study, evaluate, test, demonstrate, or improve emerging marine technologies and practices to improve-

(1) environmental performance to meet United States Federal and international standards and guidelines, including-

(A) reducing air emissions, water emissions, or other ship discharges;

(B) increasing fuel economy or the use of alternative fuels and alternative energy (including the use of shore power);

(C) controlling aquatic invasive species; or

(D) reducing propeller cavitation; and

(2) the efficiency and safety of domestic maritime industries.

Projects undertaken in the MTA program are decided upon annually, after careful review of the maritime industry's most significant technological challenges and opportunities, with consideration of related work being done elsewhere in the United States and abroad. To preclude duplication of effort and ensure maximum synergy, MARAD coordinates each year's MTA plan with other agencies interested in maritime technology, the U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (EPA), U.S. Navy, National Oceanic and Atmospheric Administration (NOAA), the U.S. Army Corps of Engineers, and the U.S. Department of Energy (DOE).

Anticipated Program Activities:
MARAD will continue to manage existing projects and support new projects within the MTA program area to the extent possible, and resources are available.

Program Alignment with Strategic Goals:

DOT Strategic Goal	USDOT Research Priorities
Safety Innovation Accountability	Systemic Safety Approach Environmental Stewardship Emerging/Enabling Technologies Technology Transfer

MARAD ITS-JPO Collaborative Research Activities

Program Description/Objectives/Activities:
For FY 2019, ITS-JPO budgeted $300,000 for FHWA, with support from MARAD and FMCSA, to start the Port Autonomous/Connected Drayage Truck Development and Testing project. ITS-JPO budgeted $1,500,000 for FY 2020 and $1,000,000 (preliminary) for FY 2021 to continue the project. Additional funding could be available from ITS-JPO in future years for further project development. The project seeks to demonstrate autonomous/connected vehicles in a port environment in a multi-year phased approach, to increase efficiencies, increase safety, and decrease emissions.

Program Alignment with Strategic Goals:
The goal of the Program is to use ITS to improve the performance of maritime ports and terminals along with the larger freight network.

DOT Strategic Goal	DOT RD&T Critical Transportation Topic
Infrastructure Innovation	Automation Emerging/Enabling Technologies Mobility Innovation Technology Transfer/Deployment Economic Competitiveness

[END]