

United States Department of Transportation FY 2020 Annual Modal Research Plans (2020/2021)

Cover Page

MARITIME ADMINISTRATION

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Executive Summary (META)

Existing META Program Summary - The Maritime Environmental and Technical Assistance (META) Program was established by Congress to engage in research and other activities to foster innovation within the U.S. maritime transportation industry and to improve competitiveness through increased efficiencies and technology adoption. 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 environmental improvement. META's achievements inform not only industry but provide data for development of national and international maritime environmental policy mechanisms and assessing potential regulatory and permitting reforms.

The META program promotes the research, demonstration, and development of technologies and processes that improve maritime industry environmental sustainability. Since its inception, META's primary focus areas have been control of non-indigenous aquatic species transported by vessels, and reduction in vessel and port air emissions. These two areas present significant continuing challenges for ship owners and operators, the regulatory community, and the public.

Aquatic invasive species are one of the greatest threats to marine and coastal biodiversity worldwide. 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 have grown 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 standards. These facilities also conduct research and development into improved technology and processing to control the spread of non-indigenous aquatic species.

Air pollution results in substantial economic, environmental, and human health costs. Criteria pollutant and greenhouse gas emissions from large marine engines have the potential to affect not just coastal and port 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 META 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. With respect to alternative fuels landside infrastructure and colocation for multi-modal use must be considered.

META 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.

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.

Through the Program we are working towards a long-term outcome of field operational testing of the 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 Business Case Assessment project in October 2017. The team conducted outreach with stakeholders, and developed a portfolio of business case assessments for four candidate ITS solutions.

The Program expects to complete the ITS MARAD Truck Staging study in Spring 2019. The study objectives are 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 is creating Professional Capacity Building (PCB) materials that relate to ITS in a port environment that will be completed during Spring/Summer 2019. As part of knowledge transfer of ITS technologies into the port environment, MARAD is working with the ITS-JPO and the American Association of Port Authorities on the Port Planning & Investment Toolkit ITS Module, expected to be completed in Spring 2019. The objective of the new module is to assist ports in the planning, feasibility, funding, and deployment of ITS applications.

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.

MARAD is seeking to publish a Request for Information to solicit the public's views on a range of issues related to the opportunities, challenges and impacts of automated transportation in a port environment to inform potential research projects.

Chapter 1. Introduction / Agency-Wide Research Approach (META)

Federal Role/Continued Relevance

MARAD will continue to implement the META program by continuing oversight of existing projects and continued outreach with stakeholders to maintain continuity through FY2020.

The META Program is designed to identify, study, evaluate, test, demonstrate or improve emerging marine technologies and practices that are likely to achieve environmental improvements by reducing air emissions, water emissions or other ship discharges, increasing fuel economy or the use of alternative fuels and alternative energy, and controlling non-indigenous aquatic species.

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, the Great Waters Research Collaborative, and the University of Maryland Maritime Environmental Resource Center. In addition, underwater hull fouling and in-water cleaning projects started with pre-FY2019 funding 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 META program.

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

Research Portfolio Information

Through the DOT RD&T Planning Team, MARAD staff coordinates with OST-R 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 META 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.

Acquisition/Assistance

The META program uses a variety of different vehicles/methods to establish research projects and collaborations. Multi-year cooperative agreements have been the primary vehicle used to date because they provide flexibility in managing efforts in targeted areas while adjusting to and building upon information learned in various project or project phases. Project scopes of work are developed within the cooperative agreements.

Competitive procurements are also used where possible and appropriate, typically through requests for proposals. Sole source agreements are used where appropriate. Because of the limited availability of commercial platforms for testing and demonstration projects and/or technical expertise in an area, MARAD may entertain an unsolicited proposal that provides a unique opportunity for furthering the program area objectives.

The program uses both single and multi-year acquisitions. Typically, cooperative agreements are up to five years. Projects typically take multiple years to complete, but funding obligated for the project is single fiscal year.

Interagency agreements are also used, particularly where there are multiple government agencies involved with a project. Various partners include DOD, DOE, EPA, and USCG.

Most all META projects require funding and/or in-kind services. Cost sharing is typically more than 50% from the collaborating entities.

Technology Transfer (T2)

While not a primary function within the META program, technology testing, validation and verification does play a role with select projects. 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, META 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.

In addition, MARAD participates and contributes to the DOT Topical Research Working Group on Technology Transfer/Deployment & Evaluation/Performance Measurement to support and foster DOT research coordination and collaboration.

Evaluation/Performance Measurement

The legislative language defines the goal of the META 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 challenges exist, the development of baselines, broad goals and metrics has been difficult. The program does not have defined objectives that cross the overarching program. Rather, 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. 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, META 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 information on research and technical assistance needs are identified and discussed with both industry and government partners.

In addition, MARAD sponsors workshops, such as the 2016 high-energy battery workshop, and META program public forums.

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

Chapter 1. Introduction / Agency-Wide Research Approach (MARAD ITS-JPO)

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 will develop recommendations for the USDOT on ports and maritime ITS topics.

The law for the Port Infrastructure Development Program is at 46 USC 50302.

Research Portfolio Information

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.

Acquisition/Assistance

Through ITS-JPO's acquisition practices, MARAD uses a variety of different vehicles/methods to establish research projects and collaborations, including but not limited to cooperative agreements, competitive procurements through requests for proposals, sole source agreements where appropriate, single and multi-year acquisitions, and interagency agreements.

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.

The Port Planning & Investment Toolkit ITS Module is a tool for knowledge transfer of ITS Technologies into the port environment. The ITS Module is expected to be completed in Spring 2019.

In addition, MARAD participates and contributes to the Automation Research Working Group to support and foster USDOT research coordination and collaboration.

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 Infrastructure Development Program work follows specific project scopes of work, with milestones and deliverables, which are monitored by a program technical representative.

Chapter 2. High Priority Project Descriptions (META)

AIR EMISSIONS PROJECT ACTIVITIES FY2018/2019:

The META program wrapped up an air emissions testing campaign aboard a cargo ferry operating on LNG. The campaign measured criteria pollutant and methane emissions and was supported through a partnership that included government, industry, and academia.

BALLAST WATER PROJECT ACTIVITIES FY2018/2019:

Great Lakes/Fresh Water:

Current focus is on providing laboratory-based testing services for developers with the hope of accelerating development for future large-scale testing of the most promising technologies.

Projects include:

- Evaluation of the Amglo Kemlite Bench-Scale Ballast Water Treatment Technology Module (Amglo Kemlite BWMS) which was completed during the first half of the fiscal year. This bench-scale testing included a novel application of the Most Probable Number (MPN) method of sample analysis that is being implemented through the 2019 Vessel Incidental Discharge Act requirements.
- A Request for Applications (RFA) for Bench-Scale Testing Services was issued during the first half of the FY19. The resulting applications for bench-scale testing services and several inquiries from developers interested in laboratory land-based, and shipboard testing were received suggesting that technology developers are still designing creative solutions to ballast water treatment and are seeking independent, freshwater testing.

West Coast/Fresh/Brackish/Marine Water:

Primary focus is on land-based and shipboard testing of ballast water treatment systems aboard the TS GOLDEN BEAR.

- In FY18 two systems were (Envirocleanse and Panasonic) evaluated/tested.
- In FY19 three systems were/are being (GenSys, Kurita, and Evoqua) evaluated/tested.

IN-WATER CLEANING

Ship biofouling, or the colonization of surfaces exposed to water by microbes, protists and higher organisms, present significant problems for the maritime industry. The biofouling of vessels can interfere with operations and result in increased corrosion, drag and fuel consumption. Vessel biofouling is also a significant, if not the most dominate, vector for the global-scale transfer and introduction of non-native aquatic species, which can have enormous ecological and economic impacts on coastal environments. Thus, there is a critical need to identify emerging in-water biofouling cleaning systems and to quantify their efficacy and reliability in removing fouling organisms, and capturing material from complex vessel structures.

With the two basic types of technologies/systems - reactive in-water *cleaning and capture* (IWCC) and proactive in-water *grooming* (IWG), the focus has been on developing and testing IWCC evaluation protocols and testing one IWCC system in FY2018. In FY2019 efforts focused on in-water grooming (IWG) protocols and the testing of two IWG systems.

The goal of the two efforts together is to (1) develop consensus on a standardized approach for the evaluation of IWCC and IWG systems for approval/permitting/use in ports around the US and world; (2) provide the critical scientific foundation for determining what is feasible and practical for the use; and (3) assessment of these technologies/systems as regulations evolve in the US and at the IMO.

Chapter 2. High Priority Project Descriptions (MARAD ITS-JPO)

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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.

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Chapter 3 – FY 2020 Program Descriptions

FY 2020 RD&T Program Funding Details

RD&T Program Name	FY 2020 Enacted (\$000)	FY 2020 Basic (\$000)	FY 2020 Applied (\$000)	FY 2020 Development (\$000)	FY 2020 Technology (\$000)
META*	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0
Totals					

* The Maritime Environmental and Technical Assistance (META) program operates by authority of 46 USC 5037. META 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. META expenditures are, however, 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 2020 RD&T Program Budget Request by DOT Strategic Goal

RD&T Program Name	FY 2020 Enacted (\$000)	SAFETY (\$000)	INFRA-STRUCTURE (\$000)	INNOVATION (\$000)	ACCOUNT-ABILITY (\$000)

META*	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0
Totals					

**META 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 budget submittal.*

META Program

Funding Request (\$0)

Program Description/Activities/Objectives:

Regulations on ballast water discharge and air emissions continue to be a challenge for the commercial maritime industry. With developing and evolving technologies being fielded and deployed to support compliance, as resources allow the META program stands ready to support the maritime industry with verification and testing of systems and equipment with data driven result and analysis to ensure effective performance.

For FY2020, 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, and hull fouling were possible. Funding for FY2020 was not requested. MARAD will continue to implement the META program by continuing oversight of existing projects and continued outreach with stakeholders to maintain continuity through FY2020.

Areas of continued interest include:

- Shipboard system efficiency and management
- Low sulfur maritime fuel
- Environmental, economic, and employment impacts of port electrification
- Aquatic Invasive Species in Ballast Water and Underwater Hull Fouling
- Analysis of blockchain technology for maritime environmental policy

Statutory Requirements:

The META Program is authorized but not mandated. Per 46 USC 50307, the Secretary (delegated to MARAD) is authorized to establish META to “identify, study, evaluate, test, demonstrate or improve emerging marine technologies and practices that are likely to achieve environmental improvements by reducing air emissions, water emissions or other ship discharges, increasing fuel economy or the use of alternative fuels and alternative energy and controlling aquatic invasive species.” The META Program supports MARAD’s statutory mission to “foster, promote and develop the merchant maritime industry of the United States” (49 USC 109(a)). As described in other sections the program, projects and activities align closely with the statutory mandate.

Program Alignment with Strategic Goals:

DOT Strategic Goal	topical research areas
Safety Innovation Accountability	Systemic Safety Approach Environmental Stewardship Emerging/Enabling Technologies Technology Transfer

USDOT Research Priorities:

META’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 maritime environmental capabilities and requirements, providing insight regarding innovative and evolving technologies that address air emissions and ballast water management compliance, critical to the competitiveness of the U.S. maritime industry.

Research Collaboration Partners:

Most of META’s project have been developed because of an expressed need from the maritime industry. The META 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 META projects provide for substantial cost sharing with other governmental, academic, and private industry partners.

In addition, MARAD is an active participant and key contributor on DOT Topical Research Working Groups for Environmental Stewardship and Emerging/Enabling Technologies in support of DOT research coordination and collaboration.

**MARAD ITS-JPO Program
Funding Request (\$0)**

Program Description/Activities/Objectives:

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.

Statutory Requirements:

This is not a statutory requirement for MARAD but is a collaborative partnership that includes ITS-JPO, FHWA, FMCSA and other partners designed to improve freight movement and multimodal efficiencies.

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
Infrastructure Innovation	Automation Emerging/Enabling Technologies Mobility Innovation

	Technology Transfer/Deployment Economic Competitiveness
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USDOT Research Priorities:

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

Research Collaboration Partners:

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

Chapter 4 – FY 2021 Program Descriptions

Maritime Environmental and Technical Assistance Program

Program Description/Activities:

46 USC 50307 authorizes the Secretary of Transportation to “identify, study, evaluate, test, demonstrate or improve emerging marine technologies and practices that are likely to achieve environmental improvements by reducing air emissions, water emissions or other ship discharges, increasing fuel economy or the use of alternative fuels and alternative energy, and controlling aquatic invasive species.” The Secretary has delegated responsibility for this program to MARAD.

Projects undertaken in the META program are decided upon annually, after careful review of the maritime industry’s most significant technological challenges and opportunities and 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 META plan with other agencies interested in maritime technology, 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).

Anticipated Program Activities:

MARAD will continue to manage existing projects and support new projects within the META program area to the extent possible.

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/Activities/Objectives:

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. 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.

MARAD is seeking to publish a Request for Information to solicit the public’s views on a range of issues related to the opportunities, challenges and impacts of automated transportation in a port environment to inform potential research projects.

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

MARAD is seeking to publish a Request for Information to solicit the public’s views on a range of issues related to the opportunities, challenges and impacts of automated transportation in a port environment to inform potential research projects.

[END]