United States Department of Transportation
Annual Modal Research Plans FY 2022
Program Outlook FY 2023

Cover Page

MARITIME ADMINISTRATION (MARAD)

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Michael Carter/Todd Ripley/Dan Yuska (META)/Travis Black (ITS-JPO/WFAM), POC's

Note: The FY 2022-2023 AMRPs will be certified using the President's budget numbers and revised with enacted budget numbers after the budget passes.

Executive Summary

Executive Summary (META)

Existing META Program Summary - The Maritime Environmental and Technical Assistance (META) program was established by Congress to engage in the environmental 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. META 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. META's achievements inform and support not only industry but provide data for development of national and international maritime environmental policy mechanisms and assess potential economically achievable regulatory and permitting reforms.

Since its inception, META's primary focus areas can be divided into three broad categories: 1) vessel and port emissions reductions; 2) the use of alternative fuels, technologies, and energy efficiency applications for maritime platforms; and 3) the control of non-indigenous aquatic species transported by vessels. 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), META program language was expanded to include efficiency and safety of domestic maritime industries as well as ship-generated underwater noise.

META has broad authority to coordinate and carry out projects. MARAD works with industry stakeholders, other government agencies, and academia to design and develop projects based on pressing domestic and international environmental issues and challenges. To disseminate information and data relevant for stakeholders, the majority of META project results are made publicly available through media outlets such as the META website, National Transportation Library, trade publications, peer reviewed journal articles, and other public platforms.

Technology Transfer (T2)

Technology testing, validation and verification is a key component of the META program. As such, much of the work supports T2 opportunities and the dissemination 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. Through META, MARAD provides opportunities for *in-situ* testing of

technologies aboard MARAD-owned training vessels and other shipboard/marine platforms.

Evaluation/Performance Measurement

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 the nature of this program 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 5-year outlooks, consistent with Agency goals, that identify program focus areas and potential projects to support those areas.

As a practical matter, focus areas are reviewed at least annually through 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 other work developed 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 industry and government-led forums throughout the year, where program information on research and technical assistance results and needs are discussed and identified. In addition, MARAD sponsors workshops and META program public forums, and participates in many other venues to facilitate dialog and input on program activities and direction.

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 Intelligent Transportation Systems-Joint Program Office (ITS-JPO) and MARAD with modal participation from Federal Highway Administration (FHWA) and Federal Motor Carrier Safety Administration (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 Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) 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 ITS MARAD program we are working toward 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 2023, with potential project add-on activities which would take the project beyond the FY 2023 timeframe.

The program also has initiatives underway with port/freight data projects. The scope of the potential National Data Architecture Standard for Port Community Systems (PCS) project involves research, development, and knowledge transfer for a national data standard to guide port community systems development and data sharing among port and freight stakeholders.

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 the ITS-JPO research roadmap and tracking documents. The roadmap is discussed with 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 through FY 2021 to continue the project, and currently anticipates requesting additional funding for FY 2022 of $1,500,000 for further project development. The project is on schedule for initial demonstrations in early FY 2022.

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.

Waterfront Asset Management (WFAM) Tool Programming (multi-phased project Contract A – Engineering underway, and Contract B – Programming planned FY 2022) will create an integrated tool for use as a guide for capital planning for maritime facilities. The tool will incorporate the influence of structural risk, port resilience, residual service life, current value, and replacement cost in alignment with the unique cultural values of a port enterprise and MARAD. The tool's decision-making algorithm balances emergent business opportunity and the maintenance of an in-water structures inventory in a state of good repair.

Maritime Transportation Research and Education Center (MarTREC) Transportation and Maritime Analytics Partnerships (TransMAP) Hub (University of Arkansas). The research objectives of the TransMAP Hub are to:

- Curate, archive, and disseminate transactional and dynamic data across multiple software platforms to make a variety of transportation data sets accessible on a real-time basis to government agencies, industry and citizens based on the following:
    - Open source data management software tools, and
    - An open-access online visualization platform to collect, analyze, and disseminate transportation system performance data that supports efficient and accessible multimodal transportation.
- Improve visualization of physical and socioeconomic data related to multimodal transportation in three-dimensional space and over time through the development of cartograms for visualizing human geography, area-value data, and time as a cartographic variable.
- Develop interactive map animations so researchers, citizens, and current and future industries can access data-rich maps to make informed decisions for effective planning,

management, and advancement of efficient, resilient, and sustainable multimodal transportation systems including highway, rail, maritime, and pipeline when data is available for public access.

Table 1 - FY 2022 RD&T Program Funding Details

RD&T Program Name	FY 2022 Pres. Budget* ($000)	Applied ($000)	Technology Transfer ($000)	Facilities ($000)	Experimental Development ($000)	Major Equipment, R&D Equipment ($000)
META*	0	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0	0
WFAM*	0	0	0	0	0	0
Totals						

** The Maritime Environmental and Technical Assistance (META) program is authorized under 46 U.S.C. § 50307. 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 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.*

** MARAD WFAM Activities are not included in the MARAD or DOT budgets, and subject to the availably of funding.*

Table 2 - FY 2022 RD&T Program Budget Request by DOT Strategic Goal

RD&T Program Name	FY 2022 Pres. Budget ($000)	Safety ($000)	Economic Strength and Modernization ($000)	Equity ($000)	Climate and Sustainability ($000)	Transformation ($000)
META*	0	0	0	0	0	0
MARAD ITS-JPO*	0	0	0	0	0	0
WFAM*	0	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.*

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Chapter 1 – FY 2022 RD&T Programs

High Priority Project Descriptions (META)

($0*)

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Program Description:
The META program is designed to provide financial and technical assistance to maritime stakeholders for purposes that include identifying, studying, evaluating, testing, demonstrating or improving emerging marine technologies and practices that are likely to achieve maritime environmental, safety, and transportation system efficiency improvements. As such, most of the program's efforts support directly or tangentially recent DOT priorities such as climate and resilience, safety, economic strength, and future proofing.

Program Objectives:

- The primary objective of the META program is to provide assistance to maritime stakeholders in an effort to address environmental challenges.

Anticipated Program Activities:

- **Maritime Decarbonization, Alternative Energy Technology, and Energy Efficiency.** This includes demonstration projects and testing to analyze marine use of domestically produced alternative fuels and energy conservation technologies/methods with a goal of advancing zero-emission operations and decarbonization in the maritime sector.

  Funding in FY 2022 will enable MARAD to pursue innovation and the evaluation of cost effective and environmentally sound alternative and renewable energy, and to advance energy efficiency improvements for the maritime industry. MARAD will seek to emphasize work with hydrogen fuel cells and high-powered batteries, further explore the use of alternative fuels for maritime applications and explore sustainable micro grid applications at ports. Use of these alternatives in the maritime market expands the market demand for these types of fuels and technologies and may provide economical alternatives to industry for achieving compliance with environmental standards. META projects that support the advancement and development of alternative energies for maritime applications also help to support American job growth in clean energy and maritime transportation fields. These projects will also support domestic technology development and associated American manufacturing jobs. MARAD will also look at additional opportunities to adapt and scale technologies from other transportation modes and landside industries.

- **Aquatic Invasive Species Mitigation:** META funding will also support advancement of ballast water treatment technology and discharge compliance monitoring tools, as well as methods for managing/mitigating hull fouling. Since its inception, the control of aquatic invasive species (AIS) has been a principal META focus area. AIS can cause significant infrastructure damage and can degrade the value of waterbodies and ecosystems for various beneficial uses. In FY 2022, META will continue to build upon and implement a key MARAD initiative by measuring the effectiveness of multiple commercial Ballast Water Management Systems (BWMS). Such systems are critical to preventing the spread of non-native aquatic species in rivers, lakes, and coastal waters. Funding will be used to maintain the two MARAD-supported BWMS facilities necessary for U.S. Coast Guard certification and International Maritime Organization compliance testing and associated scientific teams involved with the testing. Funding will also support ongoing innovation and demonstration of technologies and methods to monitor installed ballast water treatment systems' operational effectiveness, and to examine technology that could be used to remove and capture bio-fouling on underwater hulls as well as pollutants associated with anti-fouling coatings.

Expected Program Outcomes:

Most META 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 its webpage throughout 2022.

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 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.

Collaboration Partners:

Most META projects 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 supports broader DOT research coordination and collaboration efforts such as the Center for Climate Change, Environmental Stewardship working group, and others.

High Priority Project Descriptions (MARAD ITS-JPO)

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** 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 U.S.C. § 50302.

Expected Program Outcomes:

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The Program also has initiatives underway with port/freight data projects. The scope of the potential National Data Architecture Standard for Port Community Systems (PCS) project involves research, development, and knowledge transfer for a national data standard to guide port community systems development and data sharing among port and freight stakeholders.

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enterprise and MARAD. The tool's decision-making algorithm balances emergent business opportunity and the maintenance of an in-water structures inventory in a state of good repair.

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- Develop interactive map animations so researchers, citizens, and current and future industries can access data-rich maps to make informed decisions for effective planning, management, and advancement of efficient, resilient, and sustainable multimodal transportation systems including highway, rail, maritime, and pipeline when data is available for public access.

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 support to DOT research coordination and collaboration led and coordinated by OST-R.

Chapter 2 – FY 2023 RD&T Programs

Maritime Environmental and Technical Assistance Program

Program Description:

The META program is designed to provide financial and technical assistance to maritime stakeholders for purposes that include identifying, studying, evaluating, testing, demonstrating or improving emerging marine technologies and practices that are likely to achieve maritime environmental, safety, and transportation system efficiency improvements. As such, most of the program's efforts support directly or tangentially recent DOT priorities such as climate and resilience, safety, economic strength, and future proofing.

Program Objectives:

- The primary objective of the META program is to provide assistance to maritime stakeholders in an effort to address environmental challenges.

Anticipated Program Activities:

Maritime Decarbonization, Alternative Energy Technology, and Energy Efficiency

Funding in FY 2023 will enable MARAD to pursue innovation and evaluation of cost effective and environmentally sound alternative and renewable energy and to advance decarbonization and support energy efficiency improvements for the maritime industry. Specifically, META will focus on:

- Investigating and demonstrating the use of technologies to get to zero emissions for vessels and port applications;
- Supporting efforts to identify, test, and implement the use of low carbon fuels; and
- Investigating and demonstrating alternative energy applications at ports and terminals to reduce power grid demands.

Aquatic Invasive Species Mitigation

FY 2023 activity will build upon research that supports aquatic nuisance species monitoring in discharged ballast water and efficacy testing of ballast water management systems and promising state-of-the-art treatments. Work will also continue in efficacy evaluations of technologies that clean and capture hull bio-fouling.

Ship-Generated Underwater Noise

As of January 2020, through the National Defense Authorization Act (NDAA), META program language was expanded to include investigation into ship-generated underwater noise. For FY 2023, META will work with NOAA and other government agencies as well as the industry and academia to support associated efforts that include:

- Gathering noise-specific data on a variety of ship types and platforms; and
- Assessing the relationship between alternative or non-conventional fuels/technologies and vessel-generated noise

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. 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 through FY 2021 to continue the project, and currently anticipates requesting additional funding for FY 2022 of $1,500,000 for further project development. The project is on schedule for initial demonstrations in early FY 2022.

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