

**MARITIME TRANSPORTATION RESEARCH AND EDUCATION CENTER  
TIER 1 UNIVERSITY TRANSPORTATION CENTER  
U.S. DEPARTMENT OF TRANSPORTATION**



**REQUEST FOR PROBLEM STATEMENTS**

**College of Engineering  
University of Arkansas**

**Announcement Date: March 7, 2018  
Submission Deadline: April 6, 2018**

**4190 BELL ENGINEERING CENTER  
FAYETTEVILLE, AR 72701**

**HEATHER NACHTMANN, DIRECTOR  
AMY SHELL, CENTER COORDINATOR**

**[hln@uark.edu](mailto:hln@uark.edu); 479-575-3484  
[shell@uark.edu](mailto:shell@uark.edu); 479-575-6021**

**REQUEST FOR PROBLEM STATEMENTS**  
**MARITIME TRANSPORTATION RESEARCH AND EDUCATION CENTER**  
**U.S. DEPARTMENT OF TRANSPORTATION**

The Maritime Transportation Research and Education Center (MarTREC) is soliciting problem statements for research and education projects related to our center theme of *Preserving the Nation's Transportation System through Efficient, Resilient, and Sustainable Maritime and Multimodal Logistics and Infrastructure*.

**Background**

MarTREC is a Tier 1 University Transportation Center (UTC) established by a 2016 grant from the U.S. Department of Transportation (USDOT). The new USDOT Strategic Plan for FY 2018-2022 is located at <https://www.transportation.gov/dot-strategic-plan>. MarTREC is led by the College of Engineering at the University of Arkansas in Fayetteville, Arkansas. MarTREC consortium members include Jackson State University, Louisiana State University, Texas A&M University, Texas Transportation Institute, University of New Orleans, and Vanderbilt University. Additional information is available at [martrec.uark.edu](http://martrec.uark.edu).

**Research Focus**

The vision of MarTREC is to be recognized as the nation's premier source for expertise on maritime and multimodal transportation research and education. To this end, MarTREC's research program is organized into three research areas:

**Maritime and Multimodal Logistics Management**

Multimodal supply chains have evolved into complex systems due to globalization and decentralization. These systems depend on the configuration of their primary components (suppliers, warehouses, service centers, staging areas, ports of debarkation, and transportation modes). The location, transportation mode selection, and supply chain partner identification constituting these components are strategic decisions with major cost implications that have a fundamental impact on freight flow patterns of national and regional transportation systems. These decisions must create robust, reliable, and resilient supply chains while not compromising financial goals.

The Beyond Traffic 2045 report recognizes that investing in maritime infrastructure can reduce roadway congestion and pollution impacts. The report also recognizes the critical need for maritime infrastructure planning that considers increasing throughput to avoid future shipment delays, intermodal transfer point congestion, and increased costs. A key aspect is modal shifts to the Nation's Marine Highway Routes to maximize freight efficiency and preserve existing transportation infrastructure. Events such as Hurricane Katrina and the 2012 West Coast port closure highlight the need for new supply chain design models, tools, and techniques. The projects conducted in this area will advance current understanding and facilitate improved operations within the nation's multimodal supply chain networks. Advancements in the knowledge surrounding modal shift opportunities, resource allocation, facility location, vulnerability

assessment, and real-time decision making in multimodal supply chain management will be disseminated to practitioner and academic transportation communities.

It is critical to consider the transportation challenges of our low socioeconomic and rural communities. Low socioeconomic communities are often burdened by the transportation system but do not receive an equal share of the benefits. It is critical that freight management models and tools support future logistical demands while ensuring equal access to goods and services, jobs and economic opportunities, and healthy food and places. Improved freight routing from intelligent logistics management can mitigate negative impacts on low socioeconomic communities and better connect these communities to the rest of the country and the world, spurring economic development opportunities. The economy welfare of rural communities depends on a robust and resilient multimodal freight network.

#### *Example Research Project Objectives*

- Design resilient and sustainable multimodal supply chain networks to optimize resource allocation, minimize congestion points through modal shifts, and maximize transportation system efficacy including container-on-barge, shipping cycle time, reliability, safety, and environmental preservation
- Optimize multimodal utilization of Marine Highway Routes to relieve congestion and reduce demand on landside intermodal connectors and the highway and rail systems
- Develop decision support tools to enable innovative operations and funding portfolios to support efficient multimodal freight movement and preserve existing transportation infrastructure
- Assess Panama Canal expansion impacts and other global marine shipping route changes on the nation's transportation system.

#### **Maritime and Multimodal Infrastructure Preservation**

Multimodal transportation systems are critical infrastructure components that are essential to promoting and preserving the nation's economic health and general societal welfare. These assets facilitate efficient movement of people, goods, and services, and their operations are highly interconnected with numerous other infrastructure systems including communications, emergency response, energy, water supply, agricultural production, and manufacturing. A lack of performance from any one system can have immediate and significant detrimental effects on the performance of the interrelated systems. It is generally understood that the present operational status and condition of many critical transportation infrastructure systems are considered unsatisfactory even under normal service level demands. Rapidly growing commerce places a heavy burden on the aging infrastructure of the multimodal system, which already struggles with capacity issues.

Future multimodal transportation infrastructure preservation efforts strive for efficiency and resiliency in order to maintain performance under normal conditions and in the case of unplanned events. Sustainability is the ability to efficiently adapt a system or a set of interdependent systems to changes in demands on performance over time in an ecologically responsible and cost efficient manner, which is an important priority of future transportation systems. Sustainable design employs low-impact materials, energy efficiency, quality, durability and recyclability principles, and design impact measures. Transportation agencies need to know how to estimate and implement

the most efficient utilization of existing multimodal transportation systems to minimize environmental impacts, reduce fuel consumption, and mitigate congestion. Preservation of our transportation system also requires the design of new multimodal infrastructure to focus on how transportation assets can be made more sustainable.

MarTREC's research in this area must assess and prioritize existing inequities so that infrastructure investments reduce rather than worsen disparate conditions. New infrastructure design must accommodate safe and efficient first- and last-mile urban freight delivery which greatly impacts goods movement efficiency and economy prosperity. It is critical that our new research methods and information do not lead to adverse impacts on pollution and noise levels or livability in low socioeconomic communities. Underinvestment in freight infrastructure prevents rural businesses and farmers from reliably and efficiently moving their products to market which increases consumer costs. Underinvestment also decreases transportation safety, and notably traffic fatalities occur disproportionately in rural communities. Freight bottlenecks decrease freight efficiency and negatively impact the environmental condition of adjacent communities.

#### *Example Research Project Objectives*

- Develop, investigate, and refine structural health monitoring technologies and procedures to enable more rapid and reliable evaluations of critical transportation infrastructure elements under normal conditions and in the case of extreme events
- Develop advanced materials to preserve and enhance the durability, service performance, and resilience of transportation infrastructure elements
- Investigate the state of art and state of practice instrumentation components/packages to provide real-time condition assessments of critical transportation infrastructure elements, considering local and site requirements, economics, data collection protocols and standards, and data adequacy for engineering decision making
- Develop models to optimize maintenance of existing infrastructure to maximize the system capacity and minimize the failures through optimal allocation of federal funds
- Develop best practice performance measures and analytical models and tools for infrastructure asset preservation and management, optimal maintenance and rehabilitation strategies for transportation infrastructure, and material performance management and benchmarking
- Develop environmental and economic life cycle assessment model and sustainability metrics to assess preservation of transportation infrastructure
- Develop potential data system/repository to support long, medium, and short term infrastructure planning and operations on a real-time continuous basis.

#### **Disaster Response and Transportation Planning for Coastal and River Valley Communities**

The freight transportation system is heavily utilized due to increasing economic activities among/within countries as the result of product specialization and globalization. The U.S. has the world's largest transportation network including 25,000 miles of navigable waterways, four million miles of public roads, 140,000 miles of railways, and considerable transportation infrastructure. Only ten ports account for 85 percent of our nation's containerized international trade. This dependence and vast infrastructure makes our freight transportation system vulnerable to disruptions and delays due to natural disasters and security incidents. The high demand and frequency of cargo carried by transportation system suggests significant impacts will result from

future disrupted freight movement. It was reported that the major bridge collapse in Minneapolis influenced approximately 140,000 daily vehicle trips and led to \$400,000 daily cost to the commercial vehicles and road users for rerouting. A series of events including gate failure and inspection closed the Ohio River at Hannibal Locks and Dam for five days and resulted in a conservative estimated cost of \$5.1 million according to the USACE. Other recent events such as Hurricane Katrina, Superstorm Sandy, and recent flooding and drought events highlight disruption impacts on system performance. To improve system response to disruptive events, data analytics, decision support tools, and emergency transportation plans are needed to increase transportation system resilience in terms of economic value, societal benefit, and customer satisfaction as time elapses during disruption response period.

Low socioeconomic and rural communities are vulnerable to being disproportionately affected by climate change impacts and limited resources to mitigate and recover from disasters. MarTREC's research activities will provide resilient, emergency, and evacuation-related transportation solutions to support disaster response and post-event transportation planning as these damaging events disproportionately and adversely impact economically-disadvantaged and low-mobility populations as was observed in the evacuation and emergency response to Hurricane Katrina and perhaps even more so during the years of recovery.

#### *Example Research Project Objectives*

- Investigate effective use of transportation facilities and modal infrastructure assets to facilitate movements under disaster response, evacuation, and other major events
- Develop modeling and analysis techniques, innovative design and control strategies, and travel demand estimation and planning methods that can be used to predict and improve travel under periods of immediate and overwhelming demand
- Develop practical systems engineering and analytical support methods and tools to enable resilience to disasters and improved emergency logistics preparedness of multimodal transportation systems
- Explore approaches to evaluate maritime transportation system risk and vulnerability to catastrophic natural disasters and assess the impact of extreme weather forecasts using climate modeling in emergency planning
- Focus specific efforts on the historically underserved areas of rural, carless, special needs, and other vulnerable populations in disaster response, evacuation, and emergency logistics planning.

## Education and Outreach

In addition to funding research projects in the above areas, MarTREC is accepting problem statements related to maritime and multimodal transportation education and workforce development activities including

- Develop instructional modules and case studies related to the engineering, logistics, and planning of maritime and multimodal transportation systems and practices
- Develop resource banks of pertinent data sources, publications, organizations, educational programs, and other information pertinent to the study of maritime and multimodal transportation
- Develop and offer short courses and workshops related to the engineering, logistics, and planning of maritime and multimodal transportation systems and practices
- Develop and provide new online maritime and multimodal transportation information and educational resources for K-12 teachers and students

## Application Procedures

- Eligibility: Academic researchers may apply as principal investigators of MarTREC projects by responding to this request for problem statements. Applicants must be in good standing with all previously funded MarTREC, Southern Plains Transportation Center and Mack-Blackwell projects; applicants with overdue center deliverables are not eligible. Provide status of five most recent projects funded in past five year on page 3 of problem statement form.
- Problem Statements: Applicants must pre-qualify by submitting complete research problem statements using the accompanying form (can also be found at [martrec.uark.edu](http://martrec.uark.edu)).
- Formal Proposals: MarTREC will review all project problem statements submitted by April 6, 2018. Researchers whose proposed projects are consistent with the theme and goals of MarTREC and whose projects are highly rated by the problem statement evaluators will be invited to submit a formal proposal. An invitation to submit a formal proposal in no way obligates the Center to fund the project and should not be interpreted as project approval or pre-approval.

Applicants should email completed problem statement forms by **April 6, 2018** to:

Ms. Amy Shell  
[shell@uark.edu](mailto:shell@uark.edu)

Please address questions to Ms. Amy Shell at 479.575.6021 by phone or email to [shell@uark.edu](mailto:shell@uark.edu).

## Instructions for MarTREC Problem Statement Form

The MarTREC Problem Statement Form is used to pre-qualify a proposed project before a formal proposal is solicited. This ensures that only those researchers whose projects are determined to be most consistent with the theme and vision of the MarTREC research program will be asked to devote the time and effort required to prepare a full proposal. **Researchers must use the required form to submit Problem Statements.** The numbered instructions below correspond to the required items on the form.

- 1) Date the problem statement is submitted to [shell@uark.edu](mailto:shell@uark.edu)
- 2) Please select from the dropdown menu which MarTREC Project Area that your proposed work falls into:
  - Maritime and Multimodal Logistics Management
  - Maritime and Multimodal Infrastructure Preservation
  - Disaster Response and Transportation Planning for Coastal and River Valley Communities
- 3) Project Title
- 4) Please select from the dropdown menu whether your project is considered applied research, advanced research, or education and workforce development.
  - Applied Research is research accessing and using accumulated theories, knowledge, methods, and techniques for a specific, often client-driven purpose.
  - Advanced Research is research that involves and draws upon basic research results to provide a better understanding of phenomena and develop innovative solutions – sometimes referred to as exploratory research in order to convey its more fundamental character, its broader objectives, and the great uncertainty in expected outcomes compared to problem-solving research.
  - Education and Workforce Development
- 5) Explanation of the problem/need to be addressed by the proposed project (limited to 1500 characters).
- 6) Outline of the proposed project objectives: What will the investigator accomplish if the project is funded? What methodological approach will be taken? (limited to 1500 characters)
- 7) Contribution of this project to the existing body of knowledge: How will this project affect or enhance the maritime industry? Who are the customers or users of the project findings? How will maritime stakeholders be involved in the project? How will the results benefit industry, society, and/or academia? (limited to 1200 characters)
- 8) The total requested funds is the sum of the MarTREC (USDOT) funds being requested and

the matching funds to be provided by *non-federal source(s)*. The total will be used to determine whether the project's cost is reasonable in relation to its potential benefits. For “MarTREC Funds Requested,” enter the anticipated USDOT federal funding necessary to complete the project. All USDOT funds expended in the MarTREC USDOT Tier 1 UTC program require 50% matching funds from at least one source (*non-federal*). Enter the anticipated individual sources and associated amounts of matching funds for the proposed project. Documentation of matching funds commitment will need to be provided at the full proposal phase. Requested project start and end dates. Project dates must fall between August 13, 2018 and August 14, 2020.

- 9) Name(s) of principal investigator (PI) and any co-principal investigators. Correspondence from MarTREC will be sent to the PI. Organization is the institution and department of the investigators. The PI email address and phone number must be included.
- 10) Explain what evidence you have that your proposal work is novel and will make a contribution to the maritime and multimodal body of knowledge? (limited to 1500 characters)
- 11) Describe what data will be used for and generated from this proposed research. Verify that you know the required data is available or can be generated, and list the data sources that you plan to use to collect the data necessary to complete this research (include web links whenever possible) (limited to 1500 characters).
- 12) Review the provided MarTREC Data Management Plan and confirm that you will adhere to the plan’s requirements and you understand that your final data set and all project deliverables will be publically share as per federal guidelines. You will be required to develop a project-level data management plan in accordance with the center’s plan if you are invited to submit a full proposal (limited to 500 characters).
- 13) List the external stakeholder contact names and agencies that you will work with and describe their role in the proposed work. If you do not have known contacts, what is your plan for developing these relationships and what assistance can MarTREC provide to support this? (limited to 1000 characters).