TIER 1 CENTER
FY 2013 GRANT APPLICATION

Maritime Transportation Research & Education Center

Addressing USDOT Strategic Goal: Economic Competitiveness

Submitted by
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to the
Research and Innovative Technology Administration
U.S. Department of Transportation

March 14, 2013
1. APPLICANT INFORMATION AND EXECUTIVE SUMMARY

The University of Arkansas, located in Fayetteville, AR, is the grantee university requesting a Tier 1 Center entitled the Maritime Transportation Research & Education Center (MarTREC) that will focus on building Economic Competitiveness. Our consortium consists of the University of Arkansas (UARK), Fayetteville, AR; Jackson State University (JSU), Jackson, MS; Louisiana State University (LSU), Baton Rouge, LA; and University of New Orleans (UNO), New Orleans, LA. JSU is a Minority Serving Institution (MSI), and AR, LA, and MS are EPSCOR States collaborating to meet the EPSCOR goal of stimulating competitive research.

MarTREC’s theme is building economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems. Our vision is to be recognized as the Nation’s premier source for expertise on maritime and multimodal transportation research and education. Our MarTREC consortium was formed based on nationally-renowned expertise supporting the MarTREC theme, strategic location along a major navigable river or in a coastal area, and dedication to transferrable research and inclusive education and workforce development.

MarTREC will conduct research activities in three research domains: 1) Maritime and Multimodal Logistics Management, 2) Building Resilient and Sustainable Multimodal Infrastructure, and 3) Livability and Emergency Management of Coastal and River Valley Communities. Section A (p. 2) describes the background, research project objectives, analytical approach, and research outcomes for six MarTREC research areas within these domains and associated consortium capabilities.

Section B (p.13) describes MarTREC’s leadership vision and demonstrated leadership in professional service, research dissemination, and transportation problem solving. Section C (p.17) provides convincing evidence that MarTREC is dedicated to transportation education and workforce development through discussions of planned future activities in Multimodal and Multidisciplinary Transportation Educational Resource Development, Transportation Professional Development and Training Programs, and Future Transportation Workforce Diversity through K-12 Outreach and descriptions of existing programs at the MarTREC consortium institutions.

The MarTREC consortium is extensively networked through existing collaborative partnerships as discussed in Section E (p. 28). Section D (p. 25) describes how these established partnerships will support MarTREC’s technology transfer activities in Research Dissemination, Educational and Workforce Outreach, Information Exchange Mechanisms, and Technology Innovation. MarTREC’s commitment to broadening participation and increasing diversity in transportation is discussed in Section G (p. 34). Due to dedicated leadership, institutional demographics, and existing programs, MarTREC is ideally situated to support this cause.

Dr. Heather Nachtmann will serve as MarTREC Center Director assisted by Dr. Kevin Hall, MarTREC Executive Committee Chair; Dr. Stacy Williams, MarTREC CTTP Director; and a team of MarTREC institution directors and support staff. With twenty years of experience operating a UTC, UARK has proven capabilities in program efficacy as described in Section F (p. 31). As a Carnegie Foundation RU/VH institution, UARK has more than sufficient research support and infrastructure to lead a Tier 1 Center and appreciates the opportunity to submit this application to do so.
2. RESPONSE TO EVALUATION CRITERIA

A. RESEARCH ACTIVITIES AND CAPABILITY

Our economic vitality and competitiveness are more connected with maritime transportation today than ever before.

Secretary Ray LaHood, April 2011

A.1 MarTREC Research Rationale
MarTREC’s planned research activities directly support our theme of building economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems. Maritime and multimodal transportation research is a national priority that is critical to future economic competitiveness. U.S. Army Corps of Engineers (USACE) data reports that total waterborne commerce in 2010 was 2,334 million tons, consisting of 26% domestic cargo. Each institution is strategically located to support the MarTREC theme with UARK, JSU, LSU, and UNO located along the Mississippi River. JSU, LSU, and UNO are located along the Gulf Coast. Proximity to the navigable waterways, as shown in Exhibit 1, makes this consortium uniquely suited to address our theme.

Exhibit 1: MarTREC Institution Proximity to Navigable Waterways

A.2 Planned MarTREC Research Activities
MarTREC’s planned research activities will be conducted in six research areas under three domains within the field of maritime and multimodal transportation that directly support its theme, USDOT strategic goals, the MAP-21 research priorities, and leverage existing expertise, research facilities, and partnerships. A search of the TRB RiP database confirms that while existing UTC programs consider multiple transportation modes, very few emphasize or even consider the maritime mode.

The MarTREC consortium institutions have a primary or supporting role in each research domain based on their current capabilities. MarTREC emphasizes research leading to the implementation of solutions to identified problems, where stakeholder input is essential throughout the research process. All MarTREC consortium institutions have strong records in conducting translational research. This section describes the background, research objectives, analytical approach, and research outcomes for the six MarTREC research areas and the current consortium capability in each research domain. The MarTREC Project Lifecycle describing MarTREC’s research project selection and management process is provided in Section F on p. 33.
A.2.1 Maritime and Multimodal Logistics Management Research Domain

<table>
<thead>
<tr>
<th>USDOT Strategic Goal Addressed</th>
<th>Economic Competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Institutions</td>
<td>UARK, JSU, UNO</td>
</tr>
<tr>
<td>Supporting Institution</td>
<td>LSU</td>
</tr>
</tbody>
</table>

A.2.1.1 Multimodal Supply Chain Efficacy Research Area

*Background*
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 non-trivial associated costs. These strategic decisions should make supply chains robust, reliable, and resilient while not compromising financial goals. Events in this decade such as Hurricane Katrina and the 2012 West Coast port closure highlight the need for new supply chain design models, tools, and techniques.

*Research Project Objectives*
- Design resilient and sustainable multimodal supply chain networks to optimize resource allocation, minimize congestion points, and maximize transportation system efficacy including shipping cycle time, reliability, safety, and environmental impacts
- Optimize multimodal utilization of America’s Marine Highway Corridors to relieve congestion and reduce demand on landside intermodal connectors and the overall highway and rail systems

*Analytical Approach*
Research projects in the *Multimodal Supply Chain Efficacy* (MSCE) area will share the following approach:
- Work with public and private stakeholders within the multimodal supply chain to ensure realistic representation of network components, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect appropriate cost, throughput, commodity, safety, environmental, and economic data for the supply chain network under study via expert interviews, data collection and mining, and literature review of available, pertinent sources
- Develop mathematical models that support analysis and decision making in complex, multi-echelon supply chain environments
- Conduct experimental testing and validation of model functionality
- Disseminate multimodal supply chain models, tools, and/or techniques according to MarTREC’s technology transfer plan.

*Research Outcomes*
The projects conducted in *MSCE* will advance current understanding and facilitate improved operations within the Nation’s multimodal supply chain networks.
Advancements in the knowledge surrounding 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. In addition, case studies, optimization models, and decision support tools will be developed and disseminated.

A.2.1.2 Economic Competitiveness through Waterborne Freight Research Area

Background

Inland waterways are a tremendous asset to the Nation’s transportation system, providing an economical and environmentally sound mode for moving cargo. The USACE is responsible for nearly 12,000 miles of commercial, navigable U.S. inland and intracoastal waterways which serve thirty-eight states. Waterborne freight directly and indirectly contributes to U.S. economic growth by contributing to economic value, earnings, and employment. The Nation’s waterways are used to transport approximately 20% of America’s coal, 22% of U.S. petroleum products, and 60% of the Nation’s farm exports. There is limited information available on the economic impacts of waterborne commerce at national, regional, and local levels or how disruptions affect these economic factors. Better information about economic benefits of waterborne freight can inform private and federal investment in port development and infrastructure improvements, which can increase competitive advantages without negatively affecting social and environmental outcomes. Of particular interest over the next two years is the Panama Canal expansion, due for completion in 2014, and how this expansion could impact the Nation’s waterborne freight system.

Research Project Objectives

- Provide current, reliable, and accurate information regarding the economic impacts of the Nation’s inland and intracoastal waterway transportation systems under normal operations and disruptive occurrences
- Forecast the Panama Canal expansion impact on waterborne commerce within the United States

Analytical Approach

Research projects in the Economic Competitiveness through Waterborne Freight (ECWF) area will share the following approach:

- Work with stakeholders within the water transportation system including the USACE, U.S. Coast Guard (USCG), USDOT Maritime Administration (MARAD), American Association of Port Authorities, American Waterways Operators to ensure realistic valuation of waterborne commerce, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect appropriate valuation, commodity, and economic impact data for waterborne freight via expert interviews, data collection and mining, and literature search of available, pertinent sources. Important data providers include the U.S. Department of Commerce, the U.S. Economic Census, the USACE Navigation Data Center, and the USACE Planning Centers for Expertise
• Develop economic valuation and demand forecast models that fairly and accurately represent current and future contributions of waterborne freight in terms of economic value
• Conduct experimental testing and validation of model functionality
• Disseminate waterborne freight economic models, tools, and/or techniques according to MarTREC’s technology transfer plan.

Research Outcomes
Research in ECWF will advance the current understanding of and facilitate increased investment into the Nation’s water transportation system. Advancements in the knowledge surrounding economic impact and forecasted demand in waterborne freight will be disseminated to practitioner and academic transportation communities. In addition, case studies, economic valuation and demand forecast models, and decision support tools will be developed and disseminated.

A.2.1.3 Current Consortium Capabilities in MMLM
As the primary institutions involved with Maritime and Multimodal Logistics Management (MMLM), UARK, JSU, and UNO have multiple faculty members in engineering and planning whose core expertise includes transportation systems engineering, economic and operational analysis of inland waterways, multimodal network optimization, freight data analysis and modeling, port operations and productivity analysis, inland waterways containerships, and Post-Panamax ship characteristics. LSU will provide supporting expertise through Federal Highway Administration (FHWA) research on congestion pricing and experience in travel demand modeling respectively. Exhibit 2 provides a representative sample of MarTREC’s current research capability in MMLM.

<table>
<thead>
<tr>
<th>Evidence Area</th>
<th>Existing MarTREC Resources and Demonstrated Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities</td>
<td>UARK Foust Computation Laboratory, Arkansas High Performance Computing Center; JSU Mississippi e-Center; LSU Supermike Supercomputer</td>
</tr>
<tr>
<td>Active partnerships</td>
<td>UARK Center for Engineering Logistics and Distribution, Supply Chain Management Research Center, Center for Advanced Spatial Technologies, Supply Chain Management Center; UNO National Ports and Waterways Initiative; USACE; U.S. Coast Guard; Ports of Catoosa, Little Rock, New Orleans, Pittsburgh, and St. Louis; J.B. Hunt Transport; Union Pacific; Arkansas Waterways Commission; New Orleans Regional Planning Commission; Louisiana Department of Transportation and Development; Capitol Regional Planning Commission; ABF Freight System; FHWA; American Transportation Research Institute; Arkansas Trucking Association</td>
</tr>
<tr>
<td>Research presentations</td>
<td>Industrial Engineering Research Conference, INFORMS Annual Meeting, Arkansas Regional Waterways Conference, American Society for Engineering Management</td>
</tr>
<tr>
<td>Stakeholder research impacts</td>
<td>Dr. Nachtmann has testified before the House and Senate Public Committees on Public Transportation, City, County &amp; Local Affairs, and Agriculture, Forestry and Economic Development of the Arkansas General Assembly on UTC research about economic impacts of waterborne transportation; Operational changes at J.B. Hunt Transport and ABF Freight Systems due to UARK UTC-funded research outcomes and workforce development efforts</td>
</tr>
</tbody>
</table>

Exhibit 2: MarTREC Current Capabilities in MMLM
A.2.2 Building Resilient and Sustainable Multimodal Infrastructure Research Domain

<table>
<thead>
<tr>
<th>USDOT Strategic Goals Addressed</th>
<th>Economic Competitiveness, State of Good Repair, Environmental Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP-21 Research Priorities Addressed</td>
<td>(5)(A)(v) improve economic competitiveness, (3)(A)(i) maintain infrastructure integrity</td>
</tr>
<tr>
<td>Primary Institutions</td>
<td>UARK, JSU, LSU</td>
</tr>
<tr>
<td>Supporting Institution</td>
<td>UNO</td>
</tr>
</tbody>
</table>

A.2.2.1 Multimodal Infrastructure Asset and Material Resiliency Research Area

**Background**
Multimodal transportation systems are critical national infrastructure components that are essential to promoting and maintaining the nation’s economic health and general societal welfare. These assets facilitate efficient movement of people, goods, and services, and their operation is 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 for even normal service level demands. Future multimodal transportation infrastructure design, repair, and construction must strive for resiliency in order to maintain performance under normal conditions and in the case of unplanned events.

**Research Project Objectives**
- Develop advanced materials to enhance the resilience and protection of transportation infrastructure elements
- 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
- Investigate the best existing instrumentation components/packages to provide real-time condition assessments of critical transportation infrastructure elements, considering site characteristics, economics, and other pertinent factors
- Develop best practice performance measures and analytical tools for infrastructure asset and new material performance management and benchmarking

**Analytical Approach**
Research projects in the Multimodal Infrastructure Asset and Material Resiliency (MIAMR) area will share the following approach:
- Work with multimodal infrastructure stakeholders to assess infrastructure-related priorities, identify design specifications, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect infrastructure asset and material characterization and performance data via laboratory research, prototype evaluations, and full-scale field-testing experiences
- Evaluate results of laboratory research, prototype evaluations, and full-scale field-testing experiences to assess the effectiveness and reliability of each approach for establishing structural and functional resiliency and safety
Disseminate advanced material design specifications and procedures and analytical and information technologies according to MarTREC’s technology transfer plan.

Research Outcomes
The projects conducted in MIAMR will advance state-of-the-art resilient multimodal transportation infrastructure enhancement, repair, design, and construction. Enhanced monitoring system architectures, components, sensors, and the associated capabilities of each will be disseminated to practitioner and academic transportation communities to help with the goal of technology transfer. In addition, advanced material design specifications and procedures and analytical and information technologies relevant to health monitoring will be developed and disseminated.

A.2.2.2 Sustainable Multimodal Infrastructure Research Area
Background
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. Design of new multimodal infrastructure must focus on how transportation assets can be made more sustainable. Green construction research is needed to identify the sustainability of materials, construction methods, and long term maintenance needs.

Research Project Objectives
- Develop sustainable construction practices and materials for multimodal infrastructure that enable environmental quality similar to the LEED rating system
- Develop next generation design concepts for multimodal infrastructure that consider ecological, sustainability, and safety impacts of climate and other natural and human-induced hazards
- Develop an environmental life cycle assessment model and sustainability metrics to assess the related performance of transportation construction projects
- Develop alternative fuels, renewable energy, and other sustainable technology solutions to support multimodal transportation

Analytical Approach
Research projects in the Sustainable Multimodal Infrastructure (SMI) research area will share the following approach:
- Work with multimodal infrastructure stakeholders to assess the best fit of infrastructure to the natural environment, identify design specifications, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect resource efficient material, renewable energy resource, infrastructure asset and material characterization, green performance, and life-cycle cost data via laboratory research, prototype evaluations, and full-scale field-testing experiences
• Evaluate results of laboratory research, prototype evaluations, and full-scale field-testing experiences to assess cost effective design decisions that minimize environmental impacts while offering the longest service life possible
• Disseminate green strategies and construction practices and procedures for sustainable multimodal infrastructure according to our technology transfer plan.

Research Outcomes
The projects conducted in SMI will advance the sustainability of infrastructure design, construction, maintenance, and operations and facilitate reducing adverse environmental impacts through environmental stewardship. Such advances can be transmitted to the appropriate venues in order to impact this important area. Technological innovations to solve specific sustainability problems including alternative fuels, new infrastructure materials, next generation design concepts, and green production techniques will be developed and transferred as new technologies.

A.2.2.3 Current Consortium Capabilities in BRSMI
As the primary institutions in the Building Resilient and Sustainable Multimodal Infrastructure (BRSMI) research domain, UARK, JSU, and LSU have multiple faculty in civil and environmental engineering whose core expertise includes structural design, modeling, and health monitoring; advanced pavement and structural materials; pavement design, construction, evaluation, and rehabilitation; and foundation/soil-structure interaction modeling and design; alternative fuel and energy production; weather condition and modeling; interaction of transportation systems and global climate change; life cycle assessment modeling; and green design and construction. Exhibit 3 provides a sample of MarTREC’s current research capability in BRSMI.

<table>
<thead>
<tr>
<th>Evidence Area</th>
<th>Existing MarTREC Resources and Demonstrated Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities</td>
<td>UARK Structural Modeling Laboratory, Computational Mechanics Laboratory, Renewable Energy Laboratory, Large-Scale Vibroseis Shaker Truck; LSU Transportation Laboratory, Accelerated Loading Facility, Engineering Materials Characterization and Research Facility, Modeling, Simulation and Visualization Laboratory, Remote Sensing and Image Processing Facilities, Environmental Engineering Facility, Geotechnical Engineering Laboratory; LSU Driving Simulator</td>
</tr>
<tr>
<td>Active partnerships</td>
<td>UARK Applied Sustainability Center, ReliaSoft Risk, Reliability, and Maintainability Research Alliance; LSU Engineering Research Incubation Center; AR DOT; MDOT; FHWA; USACE Engineer Research and Development Center; Louisiana Department of Transportation and Development; Louisiana Transportation Research Center; Capitol Regional Planning Commission</td>
</tr>
<tr>
<td>Research presentations</td>
<td>Transportation Research Board, Institute of Transportation Engineers, Association of State Highway and Transportation Officials, Journal of Transportation Engineering</td>
</tr>
<tr>
<td>Stakeholder research impacts</td>
<td>Based on UARK UTC research, Hot Springs Village implemented 4.75 mm mixes in their pavement maintenance program; AR DOT routinely uses UARK UTC research outputs in their Multimedia-based Highway Information System and soil liquefaction analyses tools; UARK UTC research on lightweight self-consolidating concrete was referenced in the ACI 318 Building Code and led to design changes of prestressed members</td>
</tr>
</tbody>
</table>

Exhibit 3: MarTREC Current Capabilities in BRSMI
A.2.3 Livability and Emergency Management of Coastal and River Valley Communities Research Domain

| USDOT Strategic Goals Addressed | Economic Competiveness, Livability, Safety |
| MAP-21 Research Priorities Addressed | (5)(A)(v) improve economic competitiveness, (5)(A)(i) address congestion problems, (4)(A)(i) minimize cost of transportation planning and environmental decision making |
| Primary Institutions | UARK, LSU, UNO |
| Supporting Institution | JSU |

A.2.3.1 Livability and Transit-Oriented Development of Coastal and River Valley Communities Research Area

Background
Transportation systems are essential to the livability of coastal and river valley communities. Improved livability through transportation can reduce travel needs and congestion and increase the use of public transit and non-motorized transportation. An increasing focus on transit-oriented development (TOD) where mixed-use, pedestrian-friendly areas are designed to maximize public transit access supports community livability, resource efficiency, and transportation equity by increasing accessibility and modal choice. Many major U.S. cities including New Orleans, Pittsburgh, St. Louis, and Portland are located along major rivers. According to NOAA (National Oceanic and Atmosphere Administration), 39% of the nation’s total 2010 population lived in coastal areas with an expected increase of 37% by 2020. Investment in transportation and land use planning in coastal and river valley communities is essential to support livability.

Research Project Objectives
- Develop community-based transportation data mining, integration, and visualization tools to support livability research and practice
- Develop performance measurement and management systems to evaluate social, economic, and environmental consequences of transportation systems and planning
- Plan for enhanced social equity, mobility, and accessibility through Smart Growth and TOD
- Design multimodal systems including traditional, transit, and non-motorized transportation modes to address community environmental and congestion impacts

Analytical Approach
Research projects in the Livability and Transit-Oriented Development of Coastal and River Valley Communities (LTODCRVC) area will share the following approach:
- Work with state and local governments and other coastal and river valley community stakeholders to ensure realistic representation of community-based transportation needs and regional priorities, identify lessons learned, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect appropriate travel demand, transportation system characteristics and performance, mapping, and resource data for the communities under study via expert interviews, data collection from users and state and local governments, and literature search of available, pertinent sources
Develop plans, management systems, economic development models, and/or decision support tools to promote social equity, mobility, and accessibility.

Disseminate livability and TOD plans, policies, techniques, and/or decision support tools according to MarTREC’s technology transfer plan.

**Research Outcomes**

The research conducted in LTODCRVC will improve the livability, accessibility, and transportation equity of coastal and river valley communities. It is anticipated that research outcomes will be scalable to communities outside of the research scope. This research will improve accessibility and mobility, customer service within the transit system, and interagency coordination within the planning process. In addition, case studies, lessons learned, plans, techniques, and decision support tools will be developed and provided to economic development and planning agencies.

**A.2.3.2 Evacuation and Emergency Logistics for Coastal and River Valley Communities Research Area**

**Background**

Transportation processes under emergency conditions such as evacuation and other major events require the planning, design, management, operation, and maintenance of transportation systems to economically, efficiently, and safely respond to the changing conditions and demands that may be placed upon them. Under emergency conditions, the amount and timing of the travel demand that is generated often quickly and overwhelmingly exceeds the ability of the transportation network to serve it. Research has shown that the movement of people, vehicles, and cargo can benefit greatly from the implementation of special control and management measures that affect the movement in and out of an area by prioritizing certain vehicles, directions of flow, or other issues of need. America’s vast marine landscape contains urban and rural communities which have differing emergency management needs. The challenges of evacuation and emergency logistics for rural communities are frequently different from those of urban areas due to limited resources, geographical dispersion, and varying population density. It is because of these challenges that the Federal Emergency Management Agency states that the mobilization, tracking, use, sustaining, and demobilization of physical and human resources require an effective logistics system that supports both the residents in need and the teams that are responding to the incident.

**Research Project Objectives**

- Investigate effective use of transportation facilities and modal assets to facilitate movements under 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.
- Create methods to identify personal mobility chokepoints and mitigation strategies and policies for multimodal transportation to alleviate them.
- Develop practical methods and tools to enable improved emergency logistics preparedness of transportation systems in coastal and river valley communities.
Focus specific efforts on the historically underserved areas of rural, carless, special needs, and other vulnerable populations in evacuation and emergency logistics planning

**Analytical Approach**

Research projects in the *Evacuation and Emergency Logistics for Coastal and River Valley Communities (EELCRVC)* area will share the following approach:

- Work with coastal and/or river valley community and emergency management stakeholders to ensure realistic representation of emergency scenarios, validate assumptions and research findings, and facilitate rapid technology transfer
- Collect appropriate travel demand, hazard vulnerability, mapping, and resource data for the communities under study via expert interviews, data collection from users and emergency management and transportation agencies, and literature search of available, pertinent sources.
- Develop techniques, tools, and/or technologies that show how to more effectively use transportation assets to facilitate movements under emergency and major event conditions
- Conduct sensitivity analysis to evaluate model robustness and assess how often recommended practices will need to be updated to account for changes in community transportation characteristics
- Disseminate evacuation and emergency logistics techniques, tools, and/or technologies according to the MarTREC’s technology transfer plan.

**Research Outcomes**

The research conducted in *EELCRVC* will enable the safety, efficiency, and effectiveness of coastal and river valley transportation systems during times of emergency or other major events. It is anticipated that research outcomes will be scalable to communities outside of the research scope and adaptable to fit any local region and transportation system. Advancements in the knowledge surrounding evacuation, emergency logistics, and contingency transportation solutions will be advanced and disseminated to practitioner and academic transportation communities. In addition, case studies, emergency planning techniques, tools, and technologies will be developed.

**A.2.3.3 Current Consortium Capabilities in LEMCRVC**

The primary institutions in the Livability and Emergency Management of Coastal and River Valley Communities (LEMCRVC) domain are UARK, LSU, and UNO. These institutions have multiple researchers in engineering, and planning whose core expertise includes transportation and land use planning including livable communities, sustainable transportation, evacuation planning, TOD, vulnerable population emergency management, and emergency logistics planning. The primary institutions will be supported by JSU who adds additional capability in transit route optimization, travel demand modeling, disaster response management, and consideration of vulnerable populations. Exhibit 4 provides a representative sample of MarTREC’s current capability in LEMCRVC.
A.3 Research Effectiveness Metrics

MarTREC will collect and report all progress report information via quarterly project performance report forms as required by the UTC grant. These are anticipated to include a variety of metrics associated with: 1) accomplishments; 2) products; 3) participants & other collaborating organizations; 4) impact; and 5) changes/problems. In conjunction with performance measurement grant requirements, the metrics shown in Exhibit 5 will be collected and reviewed on a quarterly basis to measure the effectiveness of MarTREC research activities. MarTREC’s annual goal for each metric is also provided.

<table>
<thead>
<tr>
<th>Research Effectiveness Metric</th>
<th>Annual Goal</th>
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</thead>
<tbody>
<tr>
<td># of ongoing projects in each MarTREC research area</td>
<td>&gt;1/area</td>
</tr>
<tr>
<td># of peer-reviewed journal articles (published, accepted, submitted)</td>
<td>25/yr</td>
</tr>
<tr>
<td># of conference presentations</td>
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</tr>
<tr>
<td># of tenure track faculty who conduct MarTREC research activities</td>
<td>12/yr</td>
</tr>
<tr>
<td># of external partners involved in center research activities</td>
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</tr>
<tr>
<td># of research activities that impact diversity through participants and/or outcomes</td>
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</tr>
<tr>
<td># of UG/G transportation-related courses offered</td>
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<tr>
<td># of UG/G students participating in transportation research projects funded by UTC</td>
<td>20/yr</td>
</tr>
<tr>
<td># of MS/PhD transportation-related advanced degree programs</td>
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</tr>
<tr>
<td># of MS/PhD graduate students supported by MarTREC</td>
<td>16/yr</td>
</tr>
<tr>
<td># of MS/PhD students supported by MarTREC who received degrees</td>
<td>8/yr</td>
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Exhibit 5: MarTREC Research Effectiveness Metrics and Annual Goals