MarTREC

Maritime Transportation Research & Education Center

USDOT Tier 1 University Transportation Center

Program Progress Performance Report #4

Agency:	USDOT Research and Innovative Technology Administration
Federal Grant #:	DTRT13-G-UTC50
Project Title:	Maritime Transportation Research and Education Center (MarTREC)
Program Director:	Heather Nachtmann, Ph.D., Professor, Department of Industrial Engineering, University of Arkansas, hln@uark.edu, 479.575.6021
Submission Date:	October 30, 2015
DUNS:	1914297450000
EIN:	71-6003252
Recipient Organization:	University of Arkansas
Project/Grant Period:	Start Date September 30, 2013 End Date: September 30, 2018

PPPR#4 Reporting Period Start Date: April 1, 2015
PPPR#4 Reporting Period End Date: September 30, 2015

Report Term or Frequency: six months

Signature: Heather Nachtmann

Maritime Transportation Research & Education Center (MarTREC)

MarTREC is a USDOT Tier 1 University Transportation Center funded in September 30, 2013 under MAP-21. 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. Each institution is strategically located to support the MarTREC theme and consists of renowned maritime transportation researchers dedicated to transferrable research and inclusive education and workforce development.

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.

1. Accomplishments

1.1 Consortium-Level Accomplishments

1.1.1 Research

Goal: MarTREC will conduct research that contributes to building economic competitiveness through efficient, resilient, and sustainable maritime and multimodal transportation systems.

Objectives:
R1) Conduct research projects related to MarTREC's research goal
R2) Engage a diverse set of faculty and students in MarTREC research activities
R3) Disseminate research findings

Accomplishments:

Metric	Achieved PPPR#4	Objective Addressed
# of ongoing projects in each MarTREC research area	16	R1
# of peer-reviewed journal articles (published, accepted, submitted)	12	R3
# of conference presentations	13	R3
# of tenure track faculty who conduct MarTREC research activities	16	R2
# of external partners involved in center research activities	12	R3
# of research activities that impact diversity through participants and/or outcomes	25	R2
# of UG/G students participating in transportation research projects funded by UTC	38	R2
# of MS/PhD transportation-related advanced degree programs	11	R2
# of MS/PhD graduate students supported by MarTREC	23	R2
# of MS/PhD students supported by MarTREC who received degrees	4	R3

1.1.2 Leadership

Goal: MarTREC will become the premier source for expertise on maritime transportation research, education, and workforce development.

Objectives:
L1) Demonstrate academic leadership towards MarTREC's leadership goal
L2) Demonstrate industry leadership towards MarTREC's leadership goal

Accomplishments:

Metric	Achieved PPPR#4	Objective Addressed
# of national and regional leadership positions held	29	L1
# of conference planning positions held	7	L1
# of invited talks given	5	L1
# of leadership and research awards received	7	L1
# of impactful research citations by stakeholders	1	L2
# of UG/G students participating in transportation research projects funded by UTC	38	L1
# of junior faculty mentored	2	L1
# of leadership workshops held	1	L2
# of external grant proposals submitted	2	L2

1.1.3 Education and Workforce Development

Goal: MarTREC will develop educational resources to elucidate scientific and engineering practices involved in maritime and multimodal transportation systems and practices.

Objectives:
EWD1) Conduct education and workforce development (EWD) projects related to the EWD goal
EWD2) Educate college students within MarTREC theme
EWD3) Conduct workforce development related to MarTREC theme
EWD4) Conduct outreach activities related to MarTREC theme
EWD5) Make societal impact related to EWD goal

Accomplishments:

Metric	Achieved PPPR#4	Objective Addressed
# of projects in MarTREC educational and workforce development areas	3	EWD1
# of UG/G transportation-related courses associated with UTC	10	EWD2
# of distinguished lectures & seminars offered	3	EWD3
participant count of distinguished lectures & seminars offered	152	EWD3
# of short courses and workshops offered	0	EWD3
participant count of short courses and workshops offered	0	EWD3
# of times technician certification programs are offered	8	EWD3
participant count of technician certification programs offered	342	EWD3
# of educational modules and case studies developed	1	EWD2
# of student-authored publications	7	EWD2
# of student-presented presentations	7	EWD2
# of K-12 programs offered	7	EWD4
participant count of K-12 programs (events) offered	418	EWD4
% of female participants in K-12 programs	47%	EWD4
% of minority participants in K-12 programs	63%	EWD4
# of pre-college programs offered	3	EWD4
participant count of pre-college programs offered	90	EWD4
# of online K-12 educational resources posted	2	EWD4

1.1.4 Technology Transfer

Goal: MarTREC consortium institutions will participate in national, regional, and local education and workforce development outreach to provide state-of-the-art knowledge to private and public transportation organizations and provide a forum where government employees, academic researchers, and private sector can exchange ideas on current issues.

Objectives:
TT1) Transfer MarTREC outcomes into practice
TT2) Develop products in support of MarTREC technology transfer goal

Accomplishments:

Metric	Achieved PPPR#4	Objective Addressed
# of peer-reviewed journal articles (published, accepted, under review)	12	TT2
# of conference presentations	13	TT2
# of technical briefs	0	TT2
# of guidebooks	0	TT2
# of short courses and workshops offered	0	TT1
participant count of short courses and workshops offered	0	TT1
# of conference planning positions held	7	TT1
# of editorial journal positions held	12	TT1
# of technician certification programs offered	8	TT1
participant count of technician certification programs offered	342	TT1

1.1.5 Collaboration

Goal: MarTREC will continue our existing partnerships with maritime and multimodal transportation stakeholders and develop new partnerships at the consortium, institution, and project levels to facilitate our planned research, leadership, education, workforce development, and technology transfer activities.

Objectives:
C1) Develop external partnerships related to MarTREC's collaboration goal
C2) Develop collaborative products related to MarTREC's collaboration goal
C3) Engage faculty and students in achieving MarTREC's collaboration goal

Accomplishments:

Metric	Achieved PPPR#4	Objective Addressed
# of collaborative partnerships formed	25	C1
# of collaborative activities conducted	12	C2
# of collaborative deliverables completed	4	C2
# of collaborative team events	0	C1
# of collaborative outreach events held	3	C2
# of faculty involved in collaborative activities	4	C3
# of students involved in collaborative activities	6	C3

1.1.6 Plans for Next Reporting Cycle

MarTREC had sixteen research projects up and running during this reporting period. The faculty researchers will continue to engage with industry experts to ensure that these projects are making transformational contributions. Four of the sixteen projects were completed during this time period. The consortium will continue to expand our collaborative partnerships to support this. We will continue to increase our focus on educational and technology transfer activities. We are holding our annual meeting of our Advisory Board on November 13, 2015.

1.2 Project-Level Accomplishments

1.2.1 Maritime and Multimodal Logistics Management Projects

Regional Economic Impact Study of the McClellan-Kerr Arkansas River Navigation System
Accomplishments: The project implemented a multiregional social accounting matrix framework to estimate the economic impacts of the McClellan-Kerr Arkansas River Navigation System (MKARNS) and found that the total economic impacts of the MKARNS nationwide are $8.5 billion in sales, $4.3 billion in gross domestic product (GDP), and $2.5 billion in labor income.
Project plans: Conducted by UA, this project, funded by the Arkansas State Highway and Transportation Department as a MarTREC match project, was completed in August 2015. Final project report was submitted on time and distributed as per grant guidelines.

Dynamic Decision Modeling for Inland Waterway Disruptions
Accomplishments: Collected and studied various reports on lock and dam closure, duration of disruptions, and their impacts on different stakeholders and developed a Markov decision process model to decide whether it is optimal to unload and change transportation mode or stay on the water from a barge owner perspective.
Project plans: Develop optimal solution approach in the event of a weather-related disruption to minimize the barge owner's loss, incorporating the uncertainty associated with reopening the waterway and incoming traffic as well as potential risk of accidents and congestion on the waterway.

Efficient Dredging Strategies for Improving Transportation Infrastructure Resilience
Accomplishments: Developed mathematical modeling approaches to explore cost-efficient maintenance strategies for hardening inland waterway infrastructure against the possible impacts of shoaling, weather events, and lock degradation are in progress.
Project plans: Extend the models to schedule maintenance projects dynamically over time as new information about hydrologic conditions becomes known.

Economic Impacts of Lock Usage and Unavailability

Accomplishments: Analyzed commodity groups within Mississippi waterway locks and handled missing data by fitting statistical models a) with and without years 1993-1999 and b) with and without scheduled and unscheduled unavailabilities.
Project plans: Currently diagnosing final statistical models of commodity groups and searching for consistent results.

Supporting Secure and Resilient Inland Waterways

Accomplishments: Extended CPTAP model through expanded experimentation and improved solution approach development.
Project plans: Enhance the optimization approach to CPTAP to provide real-time decision support for disruption response stakeholders to minimize the total value loss of cargo disruptions on the inland waterways.

1.2.2 Building Resilient and Sustainable Multimodal Infrastructure Projects

Identifying High-Risk Roadways for Infrastructure Investment Using Naturalistic Driving Data

Accomplishments: The final report reveals that clusters of high magnitude jerk events while decelerating were significantly correlated to long-term crash rates at these same locations, and these events can be used as surrogate measures of safety and as a way of predicting safety problems before even a single crash has occurred.
Project plans: Conducted by LSU, this project was completed in June 2015. Final project report was submitted on time and distributed as per grant guidelines.

Optimal Dredge Fleet Scheduling within Environmental Work Windows

Accomplishments: Expanded optimization tools to allow for multiple dredge resources to work on a single job, resources that dredge in non-consecutive intervals, and environmental windows to be enforced in a dredge-specific fashion.
Project plans: Enhance the capabilities of these tools to allow for large-scale planning to take place at the USACE system level.

Rapid and Non-Destructive Assessment of Levees for Strength and Liquefaction Resistance

Accomplishments: A comprehensive literature review has been compiled which identified main levee failure mechanisms, the corresponding defects associated with these failures, and the non-destructive geophysical methods that have been used to evaluate levee conditions or detect defects in the levee or foundation soil.
Project plans: A portion of this literature and data gathering process is still being conducted through collaborations with the USACE to obtain additional information regarding previous trials and potential use of equipment currently unavailable to the PIs. Results from the geophysical tests can be compared and/or calibrated against the more traditional geotechnical tests used in design.

In-Situ Monitoring and Assessment of Post Barge-Bridge Collision Damage for Minimizing Traffic Delay and Detour

Accomplishments: Modal analysis was performed on the damaged and undamaged bridge models to obtain the simulated responses as training dataset and testing data. In total, there are 40 training and 40 testing data obtained from the simulation. We are now
Project plans: Concentrating upon the optimization study of sensor deployment that can efficiently capture effective information on collision damages with minimum sensors.

Exploration of Novel Multifunctional Open Graded Friction Courses for In-situ Highway Runoff Treatment

Accomplishments: Samples have been tested for permeability, air voids, and unconfined compressive strength, and results all meet the property requirements of typical PFC payments.
Project plans: Produce PFC samples containing the selected additives and to test the removals of the heavy metal Cu and Zn from simulated highway runoff water by PFC samples.

LNG Bunkering for Marine Vessels at the Port of New Orleans: Siting and Facility Components

Accomplishments: Have looked at LNG as a marine fuel and options for LNG bunkering and have assessed the state of LNG within Louisiana as a vessel fuel, as an industrial feedstock and as an export commodity with its attendant infrastructure. A recent paper submitted to the Transportation Research Board (TRB) by UNOTI investigates the status of various LNG projects within the State of Louisiana and natural gas in the United States during summer 2015.
Project plans: Consider new and expanded industrial activity along the Mississippi River between New Orleans and Baton Rouge and plant expansions and new builds within this corridor along both banks of the river.

1.2.3 Livability and Emergency Management of Coastal and River Valley Communities Projects

Road Sign Recognition during Computer Testing versus Driving Simulator Performance for Stroke and Stroke+Aphasia Groups

Accomplishments: Research results show that poststroke aphasia significantly impacted accuracy and response time of road sign interpretation, and as language and symbol complexity increased on road signs, the aphasia-affected drivers performed with less accuracy and required more time indicating that designers of road signs and healthcare professionals should consider this when making decisions related to when those impacted to safely return to driving.
Project plans: Conducted by LSU, this project was completed in June 2015. Final project report was submitted on time and distributed as per grant guidelines.

Development of a Large-Scale Traffic Simulation Model for Hurricane Evacuation of Mississippi Coastal Region

Accomplishments: This project studied improved traffic flow assignment within an evacuation network and indicates that implementation of a gate control strategy could effectively decrease the total travel cost and reduce the degree of conflicts related to traffic movements and trip routes inside the network and improve evacuation performance.

Project plans: Conducted by JSU, this project was completed in July 2015. Final project report was submitted on time and distributed as per grant guidelines.

National Inventory and Analysis of Transit Oriented Development in Proximity to Coasts and Port Facilities

Accomplishments: Progress on quantifying and examining the number of jobs and residents in station areas near coastal areas, major rivers, and near port facilities across the United States
Project plans: Forecast future development and job potential of underbuilt station areas and identify the number and type of jobs located in all types of stations and compare and contrast by typology.

Evaluating Coastal and River Valley Communities Evacuation Network Performance Using Macroscopic Productivity

Accomplishments: Progress made on quantifying and describing the operational conditions of evacuation traffic network productivity.
Project plans: Model evacuation productivity of coastal and River Valley communities to assist in the planning, mitigation, response, and recovery of these areas from disasters.

Vulnerability of Fuel Distribution Systems to Hazards in Coastal Communities

Accomplishments: Examined fuel distribution disruptions from past storms and the time for restoration of fuel availability after coastal hazard events.
Project plans: Causes and mitigation of damaged fuel networks will be determined, and new designs and methods will be proposed to minimize disruption during coastal hazards.

2. Products

2.1 Publications

Journal Articles

1. Bu, L. (student), Wang, F., & Yin, C., "Evaluation of Evacuation Corridors and Traffic Management Strategies for Short-Notice Evacuation using Dynamic Traffic Assignment Simulations," Journal of Transportation Safety and Security (under review).
2. Bu, L. (student), Wang, F., & Yin, C., "Development of Gate Control Model for Traffic Management in Localized Emergency Evacuation," International Journal of Transportation (under review).
3. Bu, L. (student), Wang, F., & Yin, C., "Graphical visualization of traffic condition of Mississippi gulf coast area," Advances in Transportation Studies: an International Journal (under review)
4. Donovan, N., C. Brown., M. Savage, C. Varnado, S. Parr and B. Wolshon, "Recognition and Interpretation of Road Signs in Post-Stroke Aphasia Effected Older Drivers," Submitted for publication in the Transportation Research Record, Journal of the Transportation Research Board, (under review).

5. Farhadi, N. (Student), S. Parr, K. Mitchell and B. Wolshon, “Quantifying Resiliency of Maritime Transportation Systems using NAIS Data,” submitted for publication in the Transportation Research Record, Journal of the Transportation Research Board, (under review).
6. Gedik, Ridvan (former student), Chase Rainwater, Heather Nachtmann, and Ed Pohl, Analysis of a Parallel Machine Scheduling Problem with Sequence Dependent Setup Times and Job Availability Intervals,” Submitted to European Journal of Operational Research (under review)
7. Plant, Jeremy and Bethany Stich, “ASPA’s Section on Transportation Policy and Administration: A Look Back” Public Works Management & Policy, Volume 19. Issue 4, (2014).
8. Stich, Bethany and Kyle Griffith, ““Ending Transportation Neglect in America” Public Works Management & Policy, Volume 19, Issue 4, (2014).
9. Tong, Jingjing (former student), Heather Nachtmann, and Edward A. Pohl, “Value-Focused Assessment of Cargo Value Decreasing Rate,” Engineering Management Journal, Vol. 27, No. 2 (2015), pp. 73-84.
10. Tong, Jingjing (former student) and Heather Nachtmann, “Cargo Prioritization and Terminal Allocation Problem for Inland Waterway Disruptions,” Submitted to Maritime Economics and Logistics (under review)
11. Zhang, Z., S. Parr, H. Jiang, and B. Wolshon, “Optimization Model for Regional Evacuation Transportation Systems Using Macroscopic Productivity Function,” submitted for publication in Transportation Research, Part B, (Accepted).
12. Zhang, Z., S. Parr, and B. Wolshon, “Application of a Productivity Function to Assess Network Performance during Mass Evacuations,” submitted for publication in the International Journal of Transportation, (under review).

Conference Papers

1. Delgado Hidalgo, Liliana (student), Heather Nachtmann, and Jingjing Tong (former student), “Analytic Hierarchy Approach to Inland Waterway Cargo Prioritization and Terminal Allocation,” American Society for Engineering Management Conference Proceedings, (accepted).
2. Bu, L. (student), Wang, F., Zhou, X., and Yin, C. "A Managed Gate Control Strategy for Localized Emergency Evacuation" was submitted to 2016 TRB.
3. Zheng, Wei and Feng Qian "Probabilistic Machine Learning Approach to Promptly Assessing Probability of Barge-Bridge Collision Damage of Piers". Submitted to 2016 TRB Annual Meeting, under review.
4. Farhadi, N. (student), S. Parr, K. Mitchell and B. Wolshon, "Quantifying Resiliency of Maritime Transportation Systems using NAIS Data," accepted for presentation at the Annual Meeting of the Transportation Research Board, Jan. 2016.
5. Donovan, N., C. Brown., M. Savage, C. Varnado, S. Parr and B. Wolshon, "Recognition and Interpretation of Road Signs in Post-Stroke Aphasia Effected Older Drivers," Submitted for presentation at the Annual Meeting of the Transportation Research Board, Jan. 2016 (under review).

6. Mousavi, S. M. (student), S. Parr, A. Pande, and B. Wolshon, "Identifying High-Risk Roadways Through Jerk-Cluster Analysis, Presented at the 2015 Road Safety and Simulation International Conference, Orlando FL, Oct. 2015.
7. Yin, C, F. Wang, D. McWilliams, and L. Bu "Nucleolus Cost Allocation of Vehicle Routing Problem with Split Delivery", submitted to 2016 TRB and is under review.
8. Jackson, A. (student) and L. Li, summer 2015 TRB paper submitted to the 2016 TRB meeting "Innovative Bio-Mediated Particulate Materials for Sustainable Maritime Transportation Infrastructure" under TRB review.
9. McKenzie, C. (student) and F. Wang, summer 2015 TRB paper submitted to the 2016 TRB meeting "Laboratory Study of SediMeters™ in Determining Turbulent Sediment Accumulation during Dredging Operations" under TRB review.

Conference Presentations

1. Madadi, Mahboubeh (former student), Shengfan Zhang, Heather Nachtmann, Dynamic Decision Modeling for Inland Waterway Disruptions, IIE Annual Conference, Nashville, TX, May 2015.
2. Nachtmann, Heather, Ph.D., Kenneth N. Mitchell, Ph.D., Chase E. Rainwater, Ph.D., Corey Winton, Ph.D., Fereydoun Adbesh (student), M.S., Dredging Equipment and Environmental Windows Optimization of Navigation Systems in the Gulf of Mexico, 92nd Coastal Engineering Research Board Meeting, Galveston, TX, September 2015 (invited).
3. Oztanriseven, Furkan (student), Heather Nachtmann, and Othman Boudhoum (former student), “Economic Impacts of Potential Disruptions on McClellan-Kerr Arkansas River System,” IIE Annual Conference, May 2015
4. Parr, Scott (former student) and Brian Wolshon “Application of a Productivity Function to Assess Network Performance During Mass Evacuations,” Session 595, 94th Annual Meeting of the Transportation Research Board, Washington, DC, January 2015.
5. Rainwater, Chase, Heather Nachtmann, Fereydoun Adbesh, Kaitlin Denny, and Kenneth Mitchell, “Optimal Dredge Fleet Scheduling within Environmental Work Windows,” IIE Annual Conference, May 2015.
6. Renne, John, “A Decade of Lessons since Hurricane Katrina in Creating a Resilient Transportation System: A Basis for a New National Framework in Transportation Policy”. June 17, 2015. Washington, D.C., USDOT, Office of the Secretary Invited Keynote Lecture
7. Stich, Bethany, (2015) “Trends in Transportation – Truck, Rail, Barge & Ocean Vessel” Critical Commodities Conference. New Orleans, LA, April 8. (Invited);
8. Stich, Bethany, (2015) “Big Data in Transportation Research” Big Data Conference, University of Zygreb, Croatia, July 13.
9. Sullivan, Kelly and Khatereh Ahadi (student), “Selecting Inland Waterway Maintenance Projects under Consideration of Random Disruptions,” IIE Annual Conference, May 2015.
10. Tolford, Tara, “Biking the Big Easy:” Promoting Recovery, Resilience, and Revitalization through Active Transportation in New Orleans, LA. Brasov, Romania for International Sustainable Transportation Engagement Program, June 2015.

11. Tong, Jingjing (speaker & former student) and Heather Nachtmann, 'Heuristic Comparison for the Cargo Prioritization and Terminal Allocation Problem," IIE Annual Conference, May 2015.
12. Wolshon, Brian and Scott Parr "Evolving to Address Resilience, Reliability and Response to Disasters," Critical Infrastructure—From Protection to Resilience: An Evolution to Meet the New Threats, Workshop 189, 94th Annual Meeting of the Transportation Research Board, Washington, DC, January 2015.
13. Wolshon, Brian "Forecasting Long-Term Crash Patterns on Interrupted-Flow Roadways Using Naturalistic Driving Data," Session 752, 94th Annual Meeting of the Transportation Research Board, Washington, DC, January 2015.

Books/Other One Time Publications

1. Nachtmann, Heather, "Estimating Cash Flows," The Economic Analysis of Industrial Projects (3rd Edition; New York, New York: Oxford University Press, 2015) (published).
2. Remon Perez, Valeria Alejandra, "Maritime Transportation Resource Bank," Undergraduate Honors College Thesis, University of Arkansas, May 2015 (published).
3. Denny, Kaitlin, "Sensitivity Analysis of Dredge Fleet Scheduling," Undergraduate Honors College Thesis, University of Arkansas, May 2015 (published).
4. Boudhoum, Othman, "Value Focused Inland Waterway Infrastructure Investment Decisions," Masters Thesis, University of Arkansas, August 2015 (published).

2.2 Websites

Website Title	Web Address
MarTREC	http://martrec.uark.edu/
Institute for Multimodal Transportation	http://www.jsums.edu/imtrans/
Gulf Coast Center for Evacuation and Transportation Resiliency	http://www.evaccenter.lsu.edu/
Merritt C. Becker Jr. UNO Transportation Institute	http://transportation.uno.edu/

2.3 Technologies or Techniques

- Dredge Scheduling Optimization Tool actively being used during U.S. Army Corps of Engineer dredge planning.

2.4 Inventions

Nothing to report

2.5 Other Products

1. Valeria Remon (former student) and Heather Nachtmann, Maritime Resource Bank, online resource bank, May 2015.

2. Jingjing Tong (former student) and Heather Nachtmann, Economic Analysis of Disruptions on the Mississippi River: An Engineering Economy Educational Case Study, undergraduate engineering teaching case study, July 2015.

3. Participants & Collaborating Organizations

3.1 Partnerships

Organization Name	Location	Collaboration
Arkansas State Highway and Transportation Department	Little Rock, AR	funded $40k MKARNS project (match)
Dr. Dennis Phillip Robinson, University of Arkansas at Little Rock	Little Rock, AR	research collaborator
Mr. Gene Higginbotham, Executive Director, AR Waterways Commission	Little Rock, AR	research collaborator
Ms. Deidre Smith, Waterways Branch Manager, ODOT	Muskogee, OK	research collaborator
Mr. Matthew Tyler Henry, Regional Economist at the U.S. Army Corps of Engineer	Muskogee, OK	research collaborator(s)
Dr. Jingjing Tong, Assistant Professor, Southeast Missouri State University	Cape Girardeau, MO	research collaborator
Dr. Kenneth Ned Mitchell, Research Civil Engineer, US Army Engineer Research and Development Center Coastal and Hydraulics Laboratory	Vicksburg, MS	research collaborator
Mr. Christopher King, United States Department of Agriculture, Natural Resources Conservation Service (NRCS)	Little Rock, AR	collaborative research Co-data collection at Kinion Lake
Dr. Chuanzhong Yin from Shanghai Maritime University	Shanghai, China	joint research effort to investigate the optimization of vehicle routing in freight and supply chain problem
Port of New Orleans	New Orleans, LA	collaborator
Mr. Kevin Williams/Burns Cooley Dennis, Inc.	Ridgeland, MS	in-kind support to the project by testing samples from the project using their equipment
Mr. Ian Lan Cour/Mississippi Department of Transportation, Materials Division, Geotechnical Lab	Jackson, MS	in-kind support by testing samples for the project using their equipment

3.2 Other Collaborators

Organization Name	Location	Collaboration
Dr. Jingjing Tong, Assistant Professor, Southeast Missouri State University	Cape Girardeau, MO	case study development
Dr. Melissa Tooley, Director, Texas Transportation Institute	College Station, TX	center collaborator
Mr. Trevor Timberlake, Arkansas Natural Resources Commission (ANRC)	Little Rock	discuss arkansas levees
Mr. Brian Brasher and Ms. Anita Branch, U.S. Army Corps of Engineers Fort Worth District	Fort Worth, TX	levee soil data and possible testing locations
Mr. Bryant Robbins, U.S. Army Corps of Engineers Engineering Research and Development Center	Oklahoma City, OK	prior geophysical testing data and equipment and possible testing locations
California State University, Fullerton	Fullerton, CA	center collaborator
Army Corps of Engineering's	Baton Rouge, LA	collaborator
International Freight Forwarders & Customs Brokers Assn. of N.O.	New Orleans, LA	contact
World Trade Center Transportation Committee	New Orleans, LA	contact
Louisiana Complete Streets	New Orleans, LA	contact
Bike Easy	New Orleans, LA	contact
American Society of Civil Engineers	New Orleans, LA	contact
New Orleans Sustainable Transportation Advisory Committee	New Orleans, LA	contact
RIDE New Orleans	New Orleans, LA	contact
Regional Transit Authority	New Orleans, LA	contact
Women Transportation Seminar (WTS)	New Orleans, LA	contact
Regional Planning Commission	New Orleans, LA	contact
Louisiana Center for Women in Government & Business; Traffic & Transportation Club of Greater New Orleans	New Orleans, LA	contact
Greater New Orleans Inc.	New Orleans, LA	contact
Port Safety Committee	New Orleans, LA	contact
Ports Assn. of Louisiana	New Orleans, LA	contact
Propeller Club of the U.S. Port of New Orleans	New Orleans, LA	contact
Coastal Cargo	New Orleans, LA	contact
West Coast Corps	Portland, OR	collaborator
Mrs. Lauren Brand, Associate Administrator of Intermodal System Development Maritime Administration	Washington, D.C.	contact

4. Impacts

4.1. Impacts on Principal Discipline

- Arkansas State Highway and Transportation Department is expanding research based on the problem statement of Dr. Justin Chimka, *Locating Trans-Load Facilities to Ease Highway Congestion and Safeguard the Environment*.
- The decision tools produced from MarTREC *Optimal Dredge Fleet Scheduling within Environmental Work Window* are now actively being used at multiple US Army Corps of Engineer dredge planning locations. Decision-makers have gained notable confidence in quantitative approaches to planning their operations.
- The *Regional Economic Impact Study of the McClellan Kerr Arkansas River Navigation System* found that that the total economic impacts of the MKARNS nationwide are $8.5 billion in sales, $4.3 billion in gross domestic product (GDP), and $2.5 billion in labor income. In addition, 55,872 jobs are created due to the activities related to the MKARNS. Port Activities are the largest component of the total economic impacts of the MKARNS followed by Shippers' Activities and Transportation Cost Savings. The Arkansas Waterways Commission and Oklahoma Department of Transportation are utilizing the results of this study to inform maritime stakeholders and funding agencies about the value of the MKARNS.
- Louisiana State University conducted collaborative research (*Roadway Sign Recognition During Computer Testing versus Driving Simulator Performance for Stroke and Stroke with Aphasia Group*s) with a Speech Pathologist at Southeastern Louisiana University to determine whether a group of people with stroke compared to a group of people with stroke + aphasia perform differently on computer-based road sign recognition tasks, following directions, attention, and decision making than they perform on similar tasks while in a driving simulator. The results showed that aphasia significantly impacted accuracy and response time of road sign interpretation. More importantly, however, as language and symbol complexity increased on road signs, the aphasia-affected drivers performed with less accuracy and required more time.
- MarTREC directors hold an impressive number of leadership positions that are directing the future of our Nation's transportation system such as: 1. Chair, Transportation and Land Development Committee, Transportation Research Board; 2. Member City of New Orleans Pedestrian and Bicycle Safety Advisory Committee; 3. Member, New Orleans Sustainable Transportation Action Committee; 4. Advisory Committee, Louisiana Council, Urban Land Institute; 5. Board Member, Evacuteer.org; 6. Member Emergency Evacuation Committee, TRB; 7. Member, Committee on Social and Economic Factors in Transportation, TRB; 8. TRB, University Representative; 9.Transportation Choices for Sustainable Communities Research & Policy Institute, San Francisco, CA, Board of Directors. 10. Transportation Research Board: Intermodal Freight Committee; 11. Transportation Research Board: Committee on Transportation and Economic Development; 12. Transportation Research Board: Logistics of Disaster Response and Business Continuity; 13. Past President and Board Member: Mississippi Heritage Trust;

14. American Society for Public Administration Member – a) Women in Public Administration; b) Executive Committee Public Administration Research; c) Past President Transportation Policy and Administration; 15. Past Board Member, Industry Advisory Council (IAC) - Center for Logistics, Trade and Transportation at the University of Southern Mississippi; 16. Greater Starkville Development Partnership Convention and Visitors Bureau – Vice Chair.

4.2. Impacts on Other Disciplines

- The statistical, optimization, planning and economic models being developed and disseminated from the MarTREC research are also contributing to the general systems engineering field. These operations research and planning techniques add value to researchers and practitioners outside of the transportation field.

4.3 Impacts on Transportation Workforce Development

- At the University of Arkansas, Center for Training Transportation Professional (CTTP), certified 342 students in 23 transportation-related classes during reporting period.
- At the University of Arkansas, 24 students participated in semester-long transportation related internships during reporting period, 3 of which were multi-modal focused.
- University of Arkansas reached over 1500 K-12 students and educated these students about STEM careers in the transportation-related fields.
- The University of New Orleans has a new Master of Science in Transportation Degree. The Louisiana Board of Regents has approved a new Master of Science in Transportation (MST) degree program at the University of New Orleans, making it the first degree of its kind in the State of Louisiana. The new MST program, launched in the fall semester of 2015, is one of the first in the U.S. that trains students in multimodal freight and passenger transportation systems, so they can create the most technically advanced, secure, efficient, accessible, competitive, dynamic and environmentally responsible systems for moving goods and people.
- At Jackson State University, Dr. Robert Whalin contributed to the coastal engineering education in two recent publications: “A New Coastal Engineering Graduate Program”, American Society for Engineering Education (ASEE) Annual Conference Proceedings, Seattle, Washington, June 2015; Pang, Qing, “Summer Engineering Enrichment Program Results Exceed Expectations”, ASEE Annual Conference Proceedings, Seattle, Washington, June 2015.
- At Jackson State University, The Mississippi Summer Transportation Institute was funded by Mississippi DOT, FHWA, and JSU. We received 70 applications, and eventually 32 high school students from under-represented ethnic minority groups attended the program.
- Established in 2006, the LSU Math Circle summer enrichment program is a four-week summer program at LSU geared toward rising 9th-12th graders interested in investigating concepts in mathematics that are not usually introduced at the high school

level. The program focuses on developing problem-solving abilities, critical thinking, and logical reasoning by exposing the students to interesting problems and ideas in various branches of mathematics, including combinatorics, number theory, probability, topology, and dynamical systems.

- The Gulf Coast Center for Evacuation and Transportation Resiliency hosted the 2015 REHAMS Summer Camp. Recruiting into Engineering High Ability Multi-Cultural Students (REHAMS) gives multi-cultural students an opportunity to explore the various disciplines offered by the College of Engineering, including biological, chemical, petroleum, industrial, civil, electrical and computer engineering, computer science and construction management. The first REHAMS program was held at LSU in 1977, and it was one of the first programs in the country to target minorities and recruit and retain them in STEM disciplines. REHAMS provides pre-college students an opportunity to explore engineering disciplines through a holistic overview of the field by presenting both the academic structure and career possibilities.
- The Gulf Coast Center for Evacuation and Transportation Resiliency in conjunction with LSU's College of Engineering Office for Diversity Programs held the seventh annual eXploration Camp Inspiring Tomorrow's Engineers (XCITE). XCITE, featured a residential program for high school girls who will be entering the ninth and tenth grades. These students were introduced to the various types of engineering through engineering curriculum, hands-on activities, engineering design projects, while professional engineers shared their work environments.
- At Jackson State University, Dr. Feng Wang served as the TRB representative and Minority Research Fellow program coordinator. Summer 2015, senior student Alesha Jackson (Advisor: Dr. Lin Li) and graduate student Charles McKenzie (Adviser: Dr. Feng Wang) were selected to participate in the minority research program. The students submitted papers to the 2016 TRB meeting.
- MarTREC was a sponsor at the National Waterways Conference in Little Rock, Arkansas. The mission of the conference is to effect common sense policies and programs, recognizing the public value of our Nation’s water resources and their contributions to public safety, a competitive economy, security, environmental quality and energy conservation. The conference provided beneficial information regarding our local waters as a national economic resource. A professional contact was made with Mrs. Lauren Brand, Associate Administrator of Intermodal System Development Maritime Administration.

4.4 Impacts on Physical, Institutional, and Informational Resources

- MarTREC Director, Heather Nachtmann, presented to the U.S. Army Board on Coastal Engineering Research at the 92nd Coastal Engineering Research Board Meeting in Galveston Island, Texas on September 1, 2015. The Board functions to review programs relating to coastal engineering research and development and to recommend new research areas.
- On April 8, 2015, Dr. Brian Wolshon, one of the leading experts in America on

evacuation planning, presented in Sydney, Australia. Wolshon, Professor in the Department of Civil and Environmental Engineering at Louisiana State University and MarTREC Site Director, has conducted numerous studies on evacuation. Professor Wolshon's presentation highlighted a recent U.S. DOT supported project that applied the state-of-the-art traffic simulation modeling for future evacuation plan assessment and improvement. As part of this work, a regional multimodal model for the southeast Louisiana highway network was developed to replicate the temporal and spatial travel movements of metropolitan New Orleans prior to Hurricane Katrina in 2005.

- In May 2015, Ms. Valerie Remon and Dr. Heather Nachtmann developed a Resource Bank of Maritime Data Sources.
- In July 2015, Dr. Jingjing Tong and Dr. Heather Nachtmann at the University of Arkansas developed an educational case study on the Economic Analysis of Disruptions on the Mississippi River: An Engineering Economy Educational Case Study.

4.5 Impacts on Technology Transfer

- At the University of Arkansas, Center for Training Transportation Professional (CTTP), certified 342 students in 23 transportation-related classes during reporting period.
- At the University of Arkansas, *Optimal Dredge Fleet Scheduling within Environmental Work Window* research project, led to installation of and use of software optimization tools designed by MarTREC team for the US Army Corps of Engineers.
- At Louisiana State University, Dr. Brian Wolshon is Guest Editor, Special Issue on "Interdisciplinary and Multimodal Nature of Evacuations: Nexus of Research and Practice," Natural Hazards Review, American Society of Civil Engineers, Vol. 14, No. 3, 61 pp. and Special Issue on "Emerging Developments in Evacuation Methods, Planning, and Analysis" International Journal of Mass Emergencies, Vol. 31, No. 1, 104 pp.
- Dr. John Renne, at the University of New Orleans is part of the Executive Speaker Series video youtube.com - Captain Douglass Grubbs, Retired River Pilot, Crescent River Port Pilot's Association, spoke about E-Navigation and Maritime Transportation Policy and Billy App, CEO, JW Allen & Co, spoke about the Maritime Industry, Global Trade and the Evolution of the Industry.
- In April 2015, the University of New Orleans hosted the University of New Orleans Transportation Institute (UNOTI) Lunch & Learn Series: "Achieving Regional Fare Integration in New Orleans: Innovative Cost Sharing Arrangements and Technologies; students, faculty, staff, community members.
- In May 2015, over 200 high school/undergrad/graduate students, industry partners, faculty, and staff participated in "Who Works the Rivers" Program.
- In July 2015, Dr. Jingjing Tong and Dr. Heather Nachtmann at the University of Arkansas developed an educational case study on the Economic Analysis of Disruptions on the Mississippi River: An Engineering Economy Educational Case Study
- At Jackson State University a paper titled "Nucleolus Cost Allocation of Vehicle Routing Problem with Split Delivery", coauthored by Yin, C, F. Wang, D. McWilliams, and L. Bu, was submitted to the 2016 TRB and is under review.

4.6 Impacts on Society beyond Science and Technology

- Engagement in MarTREC research activities develops life-long learning and professional leadership skills in our current and graduating students. These students are becoming the next generation transportation workforce. Their training will contribute to a more efficient and effective transportation system which in turn leads to a more productive and economically and physically healthy society.

5. Changes/Problems

- The first eight months' worth of Federal FY15 (FFY15) funding were awarded and added to the grant. Our Tier 1 UTC received an additional $923,700. The termination date of the grant was extended by an additional year to September 30, 2018.

6. Special Reporting Requirements

Nothing to report