

Grant Completion Report

The Great Lakes Maritime Research Institute (GLMRI)

*A U.S. Department of Transportation, Maritime Administration
National Maritime Enhancement Institute*

November 2006

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Mission Statement

The Great Lakes Maritime Research Institute is dedicated to developing and improving economically and environmentally sustainable maritime commerce on the Great Lakes through applied research.

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Technical Report Documentation

1. Report No. GLMRI-2006-0001	2. Government Accession No.	3. Recipient's Catalog No: Catalog of Federal Domestic Assistance #20.000	
4. Title and Subtitle The Great Lakes Maritime Research Institute		5. Report Date: November 2006	
		6. Performing Organization Code	
7. Author/s Richard D. Stewart, Ph.D James P. Riehl, Ph.D Carol J. Wolosz Dale Bergeron Tab 1: Michael D. Parsons, Ph.D Tab 2: Peter Lindquist, Ph.D Tab 3: Randall K. Skalberg Tab 4: Abu R. Hasan, Ph.D , Daniel Pope, Ph.D, and James Skurla Tab 5: Steven M. Colman, Ph.D, and R. Douglas Ricketts, Ph.D Tab 6: Joan Schumaker Chadde		8. Performing Organization Report No.	
9. Performing Organization Name and Address The Great Lakes Maritime Research Institute 291 Marshall W. Alworth Hall 1023 University Drive Duluth, MN 55812		11. Contract or Grant No. DTOS59-05-G-00019	
		13. Type of Report and Period Covered End of Grant Period Report	
12. Sponsoring Organization Name and Address The United State Department of Transportation Office of the Secretary		14. Sponsoring Agency Code US DOT	
		15. Supplementary Notes	
16. Abstract The Great Lakes Maritime Research Institute (GLMRI) was established to pursue research efforts in marine transportation, logistics, economics, engineering, environmental planning and port management. The consortium also draws on expertise in a wide range of other areas through affiliations with other "Great Lakes" universities. In this initial year of funded support, the Institute established formal affiliations with seven other Great Lakes universities, set up an external advisory board, engaged in extensive outreach to stakeholders and developed a prioritized research focus. This publication provides reports on the progress against the initial research agenda.			
17. Key Words: Great Lakes, Maritime, Data, Harbor Maintenance Tax, Fuel Alternatives, MARAD, NMEI, US DOT		18. Distribution Statement: US Congress, US DOT, state DOTs, US Coast Guard, US Army Corps of Engineers, GL Port Authorities	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. Of Pages	22. Price -0-

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Overview and Background:

During March 2004, The University of Minnesota Duluth and University of Wisconsin-Superior formed the consortium, The Great Lakes Maritime Research Institute (GLMRI). Federal funding to support the GLMRI was received in May of 2005. The US Maritime Administration (MARAD) designated the GLMRI as a National Maritime Enhancement Institute (NMEI) on June 1, 2005.

\$750,000 was federally appropriated through the Transportation Act of 2005, specifically for Great Lakes Research by a NMEI. This appropriation provided partial funding to support of the research objectives in the Coast Guard and Maritime Transportation Act of 2004 authorizing a U.S. designated Great Lakes NMEI.

This report is the summary of research and effort accomplished through this grant, from the commencement of the program through the first year of funded research.

Consortium Partners:

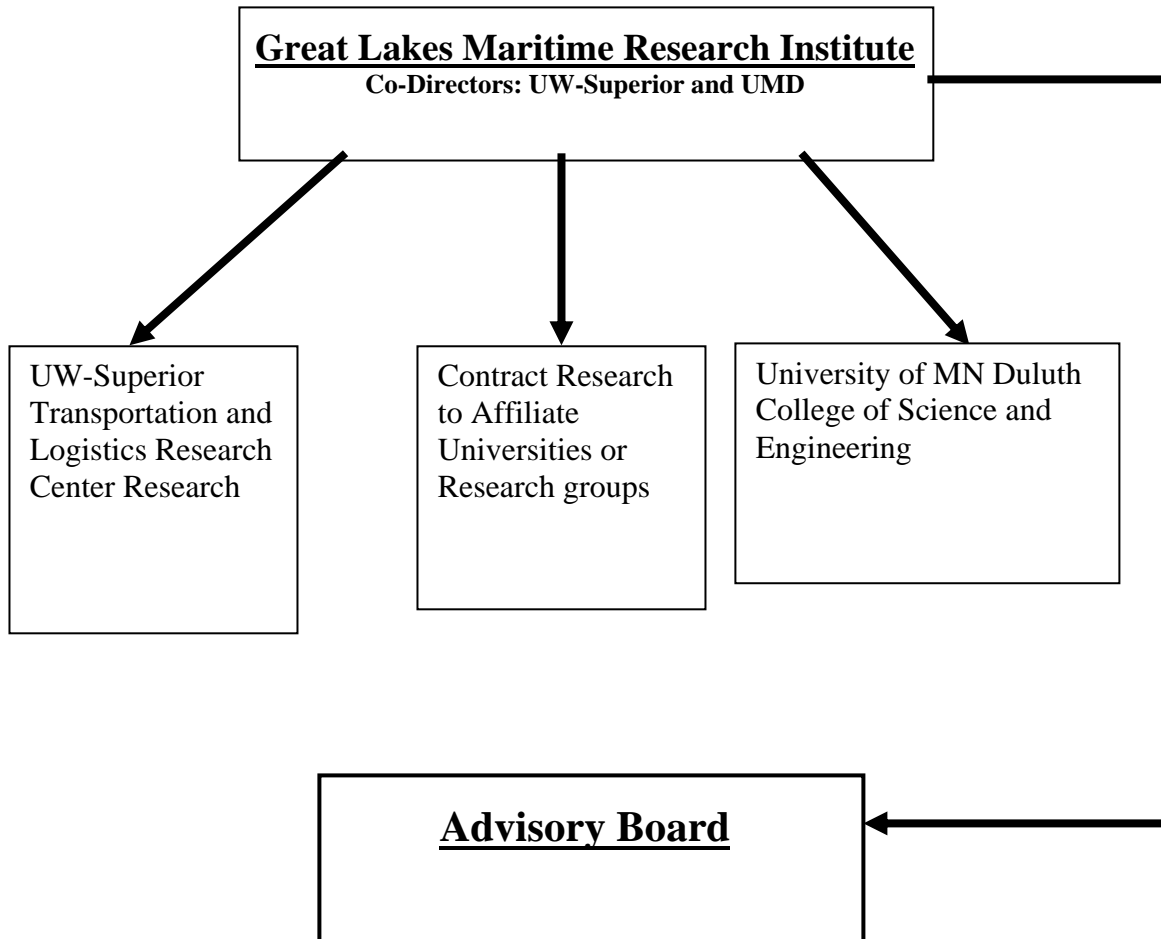
The transportation research centers of the **University of Wisconsin-Superior** and the **University of Minnesota Duluth** have for several years jointly pursued transportation and logistics research, public forums and funding. In March of 2004 these universities formally agreed to form a research institute that would focus on Great Lakes Maritime Research.

The two Universities are located in the largest port on the Great Lakes. The communities have been a transportation hub for over 150 years. In addition to the maritime industry, the Twin Ports have service by four class 1 railroads, the terminus of the longest pipeline in North America, headquarters to over thirty trucking companies, an international airport and the largest single engine airplane manufacturer in the US. The Twin Ports have a US Coast Guard Office of Marine Inspection and is the home port for the new USCG Cutter *Alder*. The Twin Ports are also a Port of Entry with the U.S. Customs Office and The Immigration and Naturalization Service.

The Great Lakes Maritime Research Institute combines the strengths of two universities and their respective Transportation Research Centers. This dynamic combination provides a program area with tremendous breadth as a National Maritime Enhancement Institute serving the Great Lakes Region. The University of Wisconsin-Superior and the University of Minnesota Duluth have formally joined together to pool the considerable resources available to the two institutions to continue and expand Great Lakes maritime research. The universities have a history of supporting each other in the area of transportation research.

The consortia that forms the GLMRI draws staff from two universities with experts in marine transportation, logistics, economics, engineering, technology, computer management, management, marine environmental, planning, geography and port management. The consortium can also draw on expertise in a wide range of other areas including among others, air and rail transportation management, operations research, mathematics and social sciences. Both universities are members of federally nominated University Transportation Research Centers.

The faculty and administrators of the GLMRI have had a long-term involvement with the maritime industry including shippers, carriers, ports and government agencies. The consortium is committed to improving the maritime system of the Great Lakes and the United States.



Advisory Board:

One of the first tasks of the Institute was to establish an advisory board. With input from the US DOT and the Maritime Administration, the Co-Directors of the Institute came up with a list of representatives who have expertise in maritime commerce, marine environmental issues or other segments of the Great Lakes Marine transportation system. The membership of the board was designed to bring together industry, academia and government leaders to advise the co-directors on the research agenda and to provide input on topical priorities. The Advisory Board can be expanded to include additional relevant stakeholders that agree to participate. The list of advisory organizations/board members is listed below:

- The Chairman of the Great Lakes Commission
- The Administrator of the St. Lawrence Seaway Development Corporation
- The US DOT Maritime Administration, Director of the Great Lakes Region
- The Chairman of the Society of Naval Architects and Marine Engineers, Great Lakes Section
- The Chairman of the American Great Lakes Ports Association
- The Commander of the Ninth Coast Guard
- The President of the Lake Carriers' Association
- The Army Corps of Engineers, Detroit District Engineer

Several of the organizations have delegated their membership to a specific person in their organization. The current membership of the Advisory Board is listed below:

Ms. Doris J. Bautch
Director, MARAD, Great Lakes Region
Schaumburg, IL 60173

Commander Gary Croot
U.S. Coast Guard, Marine Safety Office
Duluth, MN 55802

Dr. Thomas Huntley
Chairman, Great Lakes Commission
Duluth, MN 55812

Mr. Craig Middlebrook
Deputy Administrator, St. Lawrence Seaway Development Corporation
Washington, DC 20590

Mr. Al Horsmon
Chairman, Society of Naval Architects and Marine Engineers (SNAME)
Three Rivers, MI 49093

Lieutenant Colonel William Leady
US Army Corps of Engineers
District Engineer, Detroit District
Detroit, MI 48266

Mr. Adolph Ojard
Chairman, American Great Lakes Ports Association (AGLPA)
Duluth, MN 55802

Mr. James H.I. Weakly
President, Lake Carriers' Association
Cleveland, OH 44113

On October 7, 2005, the first meeting of the GLMRI Advisory Board was held in Duluth, MN. The Board members recommended that the research agenda include a solid communication strategy along with a balance of the research agenda topics. The Co-Directors agreed to keep the board members updated on the progress of the research areas.

The second meeting of the Advisory Board was held on October 6, 2006 in Duluth, MN. The Board members reviewed the progress that the Institute had made over the first year, and reviewed the research agenda for the future. The members were pleased with the progress that was made, and recommended that the Board continue to meet annually. Also, the members discussed the current make up of the Board, and agreed that the current membership was appropriate, but would consider/review other potential members at the annual meetings.

University Research Affiliations:

One of the tasks identified in the 2005 Statement of Work was to build the base of affiliate research universities to broaden the expertise. Universities in the Great Lakes region with expertise in the research focus areas were offered affiliations to partner in applicable areas. Researchers and other relevant affiliate assets from the affiliated universities are included as part of the research portfolio of the GLMRI, and the affiliate may serve as project researchers based on submitted proposals in response to an annual Request for Proposals. Research affiliates are encouraged to leverage GLMRI resources in efforts to secure independent and joint funding opportunities for Great Lakes maritime research. As of the end of this grant period, there are seven affiliate universities:

Great Lakes Maritime Academy
Admiral John Tanner
1701 East Front Street
Traverse City, MI 49686

Michigan Technological University
Dr. William Sproule
Dept. of Civil and Environmental Engineering
1400 Townsend Drive
Houghton, MI 49931

University of Michigan
Dr. Armin Troesch
Dept. of Naval Architecture and Marine Engineering
2600 Draper
Ann Arbor, MI 48109

Purdue University
Mr. Rick Evans
Assistant Director, Industrial/Foundation Administration
Young Hall
302 Wood Street
West Lafayette, IN 47907-2108

Purdue University North Central
Dr. Keith Schwingendorf
Dean, College of Science
1401 S. US Hwy 421
Westville, IN 46391

University of Toledo
Dr. Mark Vonderembse
Director, Intermodal Transportation Institute
2801 W. Bancroft St.
Toledo, OH 43606

University of Wisconsin-Madison
Dr. Teresa Adams
Midwest Regional University Transportation Center
1415 Engineering Drive, Rm. 2250
Madison, WI 53706

On October 8, 2005, the first meeting for affiliate universities was held in Duluth, MN to review possible collaborations and discuss opportunities for synergistic partnerships. With this information, combined with the feedback from the GLMRI Advisory Board meeting, a research agenda was finalized for this grant. A long-term communication and marketing strategy was also considered to develop an outreach program.

The second meeting of the affiliate universities was held on October 7, 2006 in Duluth, MN. The principle investigators from the GLMRI research projects presented reports on the accomplishments made throughout this initial period.

Initial Research Focus: After the initial meeting of the Advisory Board in October 2005, the consortium co-directors finalized the research agenda for the initial research pursued under the Institute. A call for proposals was released to affiliate universities, and proposals were submitted for consideration within the time and fiscal constraints of the initial grant. The Call for Proposals highlighted the following areas for research focus:

- **Economics and development of the Great Lakes (GL) marine transportation system (MTS)**

New Markets

Concepts to expand GL ship repair and ship building

Removing or streamlining regulatory barriers to maritime commerce

The use of smaller (handy size vessels)

GL Passenger trade market studies

- **Economic Issues concerning Great Lakes port development**

Impacts of gentrification of the waterfronts

Impact of lock closure on the Soo

- **Security issues relative to the Great Lakes marine transportation system**

The use of Intelligent Transportation Systems to track cargo and ships

The establishment of a cost-effective Great Lakes MTS security training program

- **Inter-modal transportation opportunities for Great Lakes transportation systems**

Hub and spoke MTS system

MTS Routes to relieve road congestion

Intelligent transportation systems for seamless intermodal movements

Freight Corridors roads to facilitate overweight, oversize trucks linked to the MTS

Distribution centers linked to the GL MTS

- **Marine transportation and port environmental issues**

Addressing the future impact of the clean air bill on GL vessels

Issues in shipboard management of proposed ballast water treatment systems

Ballast water free ship designs for GL and foreign trade

Establishing a Green Ship programs on the Great Lakes

- **Marine transportation and port education**

K-12 GL MTS education programs

Maritime Commerce public education and outreach

Other topics under consideration: Port Security Training and Research, Tourism, Intelligent Marine Transportation Systems, International Oceans Commission, Winter Shipping and Port Access/Winter Navigation

Specific Project Awards to University Researchers and Other Cooperative Efforts:

After review of the proposals received through the two consortium universities and the Call for Proposals to the Affiliate Universities, the following projects were selected for award. In addition to the direct funded research, GLMRI provided support to several other projects as cooperative arrangements to on-going research projects from other centers and institutes. The research proposals submitted exceeded the available funds and a grant review process was used to select the proposals. Research reports are provided as tabs to this publication on each of the completed efforts. Reports still pending will be available on the GLMRI website upon their completion. www.glmri.org

- 1) Evaluate new vessel designs: Seaway-Sized Bulk Carrier Model for Hydrodynamic Optimization of Ballast-Free Ship Design. Led by University of Michigan. (Tab 1)
- 2) Expanding Regional Freight Information Resources for the Upper Midwest through the development of a maritime information data delivery system. Led by University of Toledo. (Tab 2)
- 3) Review of the tax systems and other economic barriers to maritime commerce impacting the Great Lakes. Led by University of Minnesota Duluth. (Tab 3)
- 4) Research of Bio-Diesel Fuel Alternatives for Maritime Applications. Led by University of Minnesota Duluth. (Tab 4)
- 5) Perform lake level and/or sediment studies. Led by University of Minnesota Duluth's Large Lakes Observatory, utilizing the Research Vessel, *R/V Blue Heron*. (Tab 5)
- 6) Providing a marine transportation and port education program for K-12 teachers. Led by Michigan Technological University. (Tab 6)
- 7) Evaluation of a Great Lakes Short Sea Shipping Routes: Thunder Bay, Ontario to the Twin Ports Freight/passenger Ferry (Led by University of Wisconsin-Superior) (Report pending)
- 8) Review Ballast Water Commercial Operations – Cooperative program with UW-S Lake Superior Research Institute and the Great Ships Initiative, Northeast Midwest Institute
- 9) Study the potential for capacity expansion of the Detroit-Windsor Truck Ferry: Participants University of Toledo, Detroit Windsor Truck Ferry, Global Insights, and Transport Canada (Report pending)
- 10) Review and examine policy issues and barriers related to making rail and maritime modes more competitive for short haul freight in the upper Midwest as part of the Upper Midwest Freight Corridor Study (Cooperative effort led by the MRUTC, UW-Madison)

Outreach Events, Presentations and Participation

- GLMRI Co-Directors and staff participated on behalf of GLMRI and/or have made presentations on the benefits of short-sea shipping and other research projects to various Great Lakes audiences

- March 2, 2005 The Co-Directors presented an orientation of the Institute to The Lake Superior Harbor Technical Advisory Committee. Duluth MN
- April 11&12, 2005 Dr. Stewart presented an update on GLMRI to the Journal of Commerce Domestic Maritime Conference. Hilton Head Island, SC
- April 17&18, 2005 Dr. Riehl and Carol Wolosz participated in the The James L. Oberstar Transportation Forum. Minneapolis, MN
- April 20, 2005 Carol Wolosz presented a program overview at the MN Sea Grant Advisory Board. Duluth, MN
- June 4, 2005 Ms. Doris Bautch, Director of the Great Lakes Region for the US Maritime Administration, formally presented the letter to the co-directors designating GLMRI as a National Maritime Enhancement Institute (NMEI) at a public ceremony. Duluth, MN
- July 9&12, 2005 Dr. Stewart presents at Ports and Waterways section of the Transportation Research Board Semi-Annual Meeting. Boston, MA
- July 7, 2005 Drs. Stewart and Riehl and Ms. Wolosz attended the The Great Lakes Regional Collaboration Summit I. Duluth, MN
- August 1, 2005 Congressman David Obey's Visit and Briefings, University of Wisconsin-Superior. Superior, WI
- August 5, 2005 Drs. Stewart and Riehl presented an overview of GLMRI to Center for Freshwater Research and Policy. Duluth, MN
- September 1, 2005 Dr. Stewart presents at the St. Lawrence Seaway Development Corporation H₂O Wood Products meeting. Duluth, MN
- September 8, 2005 Dr. Stewart at the Northern Networks Trade Conference. Duluth, MN
- September 15, 2005 Dr. Stewart presented at the Wisconsin Commercial Ports Annual Meeting. Bayfield, WI.
- September 20, 2005 Dr. Riehl met with the University of Minnesota, Center for Transportation Studies, director. Minneapolis, MN
- September 26, 2005 Dr. Stewart at the Midwest Regional University Transportation Center Meeting. Chicago, IL
- October 7, 2005 GLMRI Advisory Board meeting, Duluth, MN

- October 8, 2005 GLMRI Affiliate Universities Meeting and R/V Blue Heron Tour. Duluth, MN
- November 2, 2005 Marine Industry Sustainability Initiative Group
- November 14-15, 2005 Midwest Transportation Coalition – Freight Corridor Study
Dr. Stewart presented. Milwaukee, WI
- November 17-18, 2005 Great Lakes Regional Waterways Management Forum.
Dr. Stewart presented. Point Edward, Ontario
- December 16, 2005 Meeting with the Port Authority for Intermodal Plan for the Twin Ports. Dr. Stewart and Mr. Skurla attended. Duluth, MN
- December 29, 2005 Dr. Richard Stewart and Adolph Ojard, the Duluth Seaway Port Authority Director, did an interview with “Almanac North” on Great Lakes Shipping. “Almanac North” is a local television show run through the Public Broadcasting System (PBS). Duluth, MN
- January, 11, 2006 Dr. Stewart presented at he Wood Products Conference hosted by the University of Minnesota Duluth. Duluth, MN
- January 20, 2006 Dr. Stewart presented an update of GLMRI research projects at the American Great Lakes Ports Association annual meeting. Toronto, Canada
- January 22-25, 2006 Transportation Research Board. Dr. Stewart presented on at the Short Sea Shipping in the United States and Canada Session. Dr. Riehl and Carol Wolosz also attended the conference. Washington, D.C.
- January 27, 2006 Carol Wolosz participated in the Society for Naval Architects and Marine Engineers (SNAME) Winter Meeting, Perrysburg, OH
- March 8&9, 2006 Dr. Stewart gave a presentation on “What Great Lakes Maritime Environmental Course Should We Steer?” at Maritime Day. Cleveland, OH
- March 27&28, 2006 Dr. Stewart and Carol Wolosz participated in the Northeast Midwest Institute’s planning meeting for the Great Ships Initiative demonstration project. Duluth, MN
- April 9&10, 2006 Dr. Stewart and Carol Wolosz attended The James L. Oberstar Forum on Transportation Policy and Technology. Minneapolis, MN
- April 25&26, 2006 Carol Wolosz participated in the Upper Midwest Freight Workshop. Columbus, OH
- May 17& 18, 2006 GLMRI co-sponsored The Great Lakes Maritime Academy’s T/S State of Michigan for local education and outreach tours in the Twin Ports harbor. A reception and harbor tour were provided to local dignitaries on May 17th. The ship was open for community tours on both days of the visit. Duluth, MN

- May 19, 2006 Dr. Stewart was keynote speaker at Duluth-Superior Maritime Day Community Ceremony, “The Future of Great Lakes Maritime Commerce”. Duluth, MN
- May 22, 2006 Dr. Stewart presented ideas and direction to the Taconite Aggregate Transportation Meeting Group at the Natural Resources Research Institute. Duluth, MN
- June 7, 2006 Dr. Stewart presented an update on the research projects at the Harbor Technical Advisory Committee. Superior, WI
- June 9, 2006 Drs. Stewart and Wang and Ms. Wolosz participated in the meeting of the Great Lakes Maritime Information Delivery System, a sponsored GLMRI research project. Detroit, MI
- June 27, 2006 Dr. Stewart presented on “Great Lakes Environmental Issues” at the Green Marine Conference. St. Catherines, Ontario
- June 28, 2006 Drs. Stewart and Riehl provided program updates to Congressman James L. Oberstar and staff members for Congressman David Obey. Washington, D.C.
- June 29, 2006 Drs. Stewart and Kwon and Ms. Wolosz provided program updates to members of US DOT, The Maritime Administration and the St. Lawrence Seaway Development Corporation. Washington, D.C.
- July 13, 2006 Dr. Stewart moderated a panel on Short Sea Shipping at Thor Fest. Duluth MN
- July 26&27, 2006 Dr. Kwon attended the Marine Transportation System National Advisory Council meeting. Norfolk, VA
- August 17&18 Ms. Wolosz participated in the Midcontinent Transportation Research Forum, hosted by the University of Wisconsin-Madison, with sponsorship from GLMRI. Madison, WI
- August 29, 2006 Dr. Stewart presented on Great Lakes Maritime Commerce to the TRB Committee on the St. Lawrence Seaway: Options to Eliminate Introduction of Non-indigenous Species into the Great Lakes, Phase II. Toronto, Canada
- October 3, 2006 Dr. Stewart provided an update on the GLMRI research projects to the Council of Great Lakes Research Centers. Duluth, MN
- October 4, 2006 Dr. Stewart provided an update on the GLMRI research projects to the Great Lakes Commission at their annual meeting. Duluth, MN
- October 6, 2006 The 2nd GLMRI Advisory Board meeting. Duluth, MN

- October 7, 2006 The 2nd GLMRI Affiliate Universities Meeting. Duluth, MN
- October 13, 2006 Dr. Stewart provided an update on the GLMRI research projects to the University Transportation Center meeting at the University of Wisconsin-Madison. Madison, WI

Extension Education and Outreach Support

GLMRI is developing an education and outreach program, tied with MN and WI Sea Grant. Mr. Dale Bergeron was hired in cooperation with MN Sea Grant to perform marketing and develop presentations to regional and governmental agencies. Ultimately, the goal of our outreach and educational efforts is to make sure information generated within the research community makes its way into the hands of those who need it, whether those individuals are industry experts, policy makers, or the citizens of the Great Lakes basin and beyond.

In its continuous effort to develop and improve economically and environmentally sustainable maritime commerce on the Great Lakes, GLMRI is not only supporting creative applied research, but is also working with existing organizations, like MN Sea Grant, to build new partnerships to promote constituent driven programs, and conduct educational activities that can effect both behavioral and economic change through local and regional, stakeholder focused programs. The primary goals are to continue to build and maintain significant relationships with constituent groups. A dedicated effort has been made to reach out for input, and to provide a neutral science-based resource for information.

Our outreach efforts are focused on providing constituents with access to university-based research and technologies to address specific technical and economic issues in relation to the optimization of maritime commerce in the Great Lakes. We will continue to use linkages to raise visibility, conduct conferences and workshops, present talks, design and produce educational and informational materials, raise awareness and work to change behaviors and improve creative public and private collaborations.

One of the key outreach methods is to present the research in academic and professional forums and journals. GLMRI funded research outcomes are being presented in 2007 at peer reviewed conferences and in journals.

Future Plan for GLMRI – Beyond this Grant:

In fiscal year 2006, \$2,000,000 was appropriated in the U.S. Transportation Bill to support maritime research through GLMRI. In accordance with the intent of the Authorizing legislation, the 2006 US DOT Appropriations have been routed through MARAD to support the Great Lakes NMEI. The FY 07 amount has been initially spread over two years, providing \$1 million per year with approximately \$400,000 designated for affiliate university research projects

A call for proposals was released in April 2006 for the first year of projects, against this 2-year funding (Oct 2006 – Oct 2008). Eighteen proposals from the affiliated universities and the 2 host-universities were received requesting over \$1.4 million. A review process that included outside reviewers from MARAD made the final selection. As of the final writing of this report the following projects have been awarded in support of the current research agenda:

- Testing Relationships between Propagule Pressure and Colonization Success of Invasive Species (University of Minnesota Duluth and the University of Wisconsin-Superior's Lake Superior Research Institute in cooperation with the Northeast Midwest Institute's Great Ships Initiative)
- Evaluating the impact of long term storage at low temperatures of Biodiesel fuel blends for consideration of use in marine vessels on the Great Lakes (University of Minnesota Duluth)
- Part II: Hydrodynamic optimization testing of the model built under the first grant for the ballast-free ship design (University of Michigan)
- Phase II of implementing the Great Lakes Maritime Information Delivery System (University of Toledo)
- A review of the Great Lakes shipbuilding and repair capability – Past, present and future (University of Michigan)
- Structure of Bacterial Communities Associated with Accelerated Corrosive Loss of Port Transportation Infrastructure (University of Minnesota Duluth)
- A multibeam bathymetry and sidescan-sonar survey of the Duluth-Superior Harbor and nearshore (University of Minnesota Duluth)
- Continued support from Minnesota Sea Grant for extension education and outreach projects
- Year 2 of a marine transportation and port education program for K-12 teachers (Michigan Technological University)

The Institute is becoming recognized in the area for leadership and its research capabilities. In its short existence, GLMRI has become an independent source for business studies as an “honest broker”. The Institute is evolving a permanent relationship with DOT and the Maritime Administration to maximize continued funding in support of maritime research on the Great Lakes through the National Maritime Enhancement Institute. During the next two years GLMRI will continue: outreach to stakeholders, hold advisory and affiliate university meetings, and collaborate with MARAD and other relevant government agencies and stakeholder in supporting GLMRI's mission.