Dedicated Funding for University Maritime Research: Issues and Opportunities

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Presented at METRANS Urban Freight Conference,
Long Beach, Ca, October 21, 2009

Abstract: Investment in transportation infrastructure takes place at several levels. One of the key components is university research. The value of university research for transportation systems is widely recognized, and dedicated federal funds exist for university research in highway, rail, and air modes. Research at the university level in maritime transportation does not have a dedicated source of funding. This paper explores the implications of the lack of dedicated maritime research funding on the nation's transportation policies, planning process, government agencies, and universities. The National Maritime Enhancement Institute system with its limited success will be compared to the successful University Transportation Center system. The author proposes solutions to the problem of dedicated federal funding for maritime research at universities.

I. Marine and Maritime Research Defined:

Maritime and marine research, while overlapping in many areas, are not considered the same discipline.

In 1973, the Panel for Support for Maritime Research and Education of the National Research Council, of the National Academies of Science defined maritime research as

"Short and long term research that is specifically concerned with the waterborne transportation of goods and people" (Panel for Support for Maritime Research and Education,1973).

The European Union (EU) has, as part of its strategic agenda for research, defined marine and maritime research as follows: (Commission of the European Communities,' 2008)

"Marine research addresses a branch of earth science that studies the oceans and seas including their flora and fauna as well as their interaction with coastal territories and with the atmosphere. It covers a wide spectrum of scientific knowledge and phenomena such as marine organisms, ecosystems dynamics, ocean currents, plate tectonics and geology. These diverse topics involve multiple disciplines to understand the underlying processes and the complexity of their interaction. Nowadays, one of the major concerns of marine research is the preservation of marine ecosystems."

"Maritime research aims at technologies and innovative solutions for a better exploitation of sea and ocean resources such as the design, building and operation of vessels, harbours, oil platforms and more widely any kind of human related activity centred around sea and ocean resources (e.g. tourism)."

There is a need to enhance the dialogue between marine, maritime, and transportation research communities. This would facilitate research, avoid duplication, leverage resources and ensure a clear distribution of roles and responsibilities between national, state and local authorities, and private enterprises.

II. The Need For University Maritime Research

The United States Marine Transportation System, (MTS), has over 26,000 miles of commercial navigation channels and 9,584 commercial ports; (U.S. Army Corps of Engineers, 2007). In 2007, vessels carried 77.7% by weight of all imports and exports of the United States. These marine movements were valued at $1,398,949 million and represented 44.9% of the total value of the nation's world trade. In 2006, our domestic MTS carried 561.6 billion short ton miles of cargo (Bureau of Transportation Statistics, 2009). It is estimated that 13 million jobs are supported by the MTS. Marine infrastructure takes decades to develop and the current flow of goods is expected to double or triple by 2020, overflowing the capacity of an already strained system that in some cases has not seen upgrades for over 50 years. Many of the segments of the MTS operate below 50% of their potential capacity during a time when other modes moving freight are congested. Port infrastructure is also important to America's national security by providing transportation of personnel and supplies that supports America's military services during national emergencies. The importance of the MTS to our domestic and

foreign trade is clearly evident and the need for research to support its infrastructure, operation, and equipment is needed.

During the last decade, there have been several studies and conferences that have identified maritime research and infrastructure needs. In The Changing Face of Transportation (Bureau of Transportation Statistics, 2000), many issues were identified as keys to the future of successful transportation systems. U.S. ports and their intermodal connectors were specifically mentioned as facing significant problems due to changing business practices, the need to preserve ecosystems threatened by present operations, and the need for expansion.

An October 2000 paper prepared for the U.S. Department of Agriculture, "21st Century Agricultural Transportation - A Blueprint to Meet the Challenges" raised concerns about the ability of the MTS to provide future transportation needs of that industry, (US Department of Agriculture, 2000).

Within the same time period, another high level group comprised of government, industry, and academic representatives was formed to study the longer-term future needs of the transportation system. This Federal Transportation Advisory Committee reviewed what research and development would have to be initiated them to enable an advanced transportation system in 2050. This effort resulted in a report "Vision 2050: An Integrated National Transportation System". The report stated a compelling need for research on the nation's MTS (Federal Transportation Advisory Group , 2001).

In the 2002 MARAD "Report to Congress on Maritime Research and Technology Development" then U.S. Secretary of Transportation Norman Y. Mineta stated:

"Increased investment in research and development efforts is critical to enabling necessary improvements in the marine transportation system. We must meet the nation's projected increased cargo flow demands in an efficient, safe, secure, and environmentally responsible manner."

The MARAD report reviews U.S. transportation research and technology development with special emphasis on the MTS. In summary, the report notes that more maritime research and development is needed to improve the ability to move goods, commodities, and people. Future improvements in production and business transactions

critical to the nation's economic success cannot be fully realized without innovations in the efficiency and quality of the marine transportation system.

The report highlights the fact that the amount of funding dedicated to maritime research and development is a fraction of the R&D budgets for other modes of transportation. In addition, funding designated for the development of maritime infrastructure, which would improve cargo flow capacity, safety, and security, is far less than funding for marine research.

The report notes that government and industry committees under the Department of Transportation's MTS initiative are starting to develop research needs in a collaborative fashion as part of a national plan with priorities and funding mechanisms. The report indicates that this process must be developed and coordinated to marshal resources to build a strong and versatile MTS.

DOT's congressionally mandated report, "An Assessment of the Marine Transportation System," represents the views of industry, stakeholders and academia. The assessment established guiding perspectives and made several recommendations regarding research; for instance establish a National Cooperative Research program in order to:

- Coordinate current and planned MTS related research by government agencies, educational institutions, and the private sector
- Foster research to assess and address mobility, safety, environmental protection, and security issues
- Ensure, through research and technology development, that the MTS has adequate capability to accommodate projected cargo and passenger traffic patterns

The report further adds that the European Community over a decade ago clearly saw the need for ongoing research in maritime commerce. The EU established joint bodies to guide the direction of the research and provided EU funding that would encourage private-public partnerships, university engagement, matching funding and non-governmental organization involvement. Since the publication of the 2002 DOT report, the EU has placed maritime research as a strategic goal.

Their efforts have evolved into the "European Union Research and Development Master Plan, (Commission of the European Communities, 2008). "The maritime research

portion is divided into six areas of research and development activities with two principal sections, the marine transport chain and marine resources."

III. A Lack of Federal Funding for Maritime Research

The value of research for transportation systems is widely recognized and generally well funded. Table 1 provides a profile of the US Department of Transportation's funding for transportation research from FY07 to FY08 with budgets for FY-09.

	In millions of dollars				
	FY 2007	FY 2008	**FY 2009**	Change FY 08-09	
	Actual	Estimate	**Budget**	Amount	Percent
Federal Aviation Administration	234	271	**335**	64	23.7%
- Research, Eng. & Development	*130*	*147*	***171***	*24*	*16.5%*
- Facilities and Equipment	*95*	*114*	***161***	*47*	*41.3%*
- All Other	*8*	*10*	***2***	*-7*	*-74.4%*
Federal Highway Administration	371	373	**393**	20	5.4%
- Surface Transportation Res.	*126*	*144*	***167***	*23*	*16.0%*
- Intelligent Transportation Sys.	*61*	*44*	***51***	*7*	*17.0%*
- State Planning and Research	*166*	*167*	***156***	*-11*	*-6.4%*
- All Other	*18*	*18*	***18***	*0*	*2.3%*
Federal Transit Administration	8	13	**18**	5	42.1%
Nat'l High. Traffic & Safety Adm.	79	83	**83**	0	0.2%
Federal Railroad Administration	37	39	**37**	-2	-4.8%
Office of the Secretary	15	14	**10**	-4	-27.2%
Pipeline and Hazardous Materials	12	11	**9**	-2	-21.2%
Research and Innov. Tech.	3	10	**10**	1	6.3%
Federal Motor Carrier Safety Admin.	9	8	**6**	-1	-16.7%
Total DOT R&D	767	820	**902**	81	9.9%

Table 1: DOT Research Funding, (Office of Management and Budget, 2009)

Conspicuous in its absence in Table 1 is funding for research and development for the nation's Marine Transportation System (MTS). The US Maritime Administration (MARAD) in their 2002 report to Congress on maritime research pointed out that from 1996-2001 dedicated funding for maritime technology or research and development investment was zero, (US Maritime Administration, 2002). The Federal Ocean and Coastal Activities Report to the US Congress for CY 2006 and 2007, (Interagency Committee on Ocean Science and Resource Management Integration, 2008), estimated that all federal agencies spent $2.648 billion supporting maritime transportation. The

report indicates that MARAD's funding does not include any support for any university research programs coming directly from MARAD's budget. MARAD does fund university research on a project basis or if funds are appropriated by congress.

The majority of DOT's R&D is performed by industrial performers and federal laboratories, with industry performing half and federal labs a third of all DOT R&D (see Figure 1). According to the American Association for the Advancement of Science (AAAS) funding Update on Research and Development in the FY 2009 Dept. of Transportation Budget, Universities perform just 7 percent of the research by dollar amount. The amount of DOT funded university research that is directed to maritime transportation is a tiny fraction of DOT's budget.

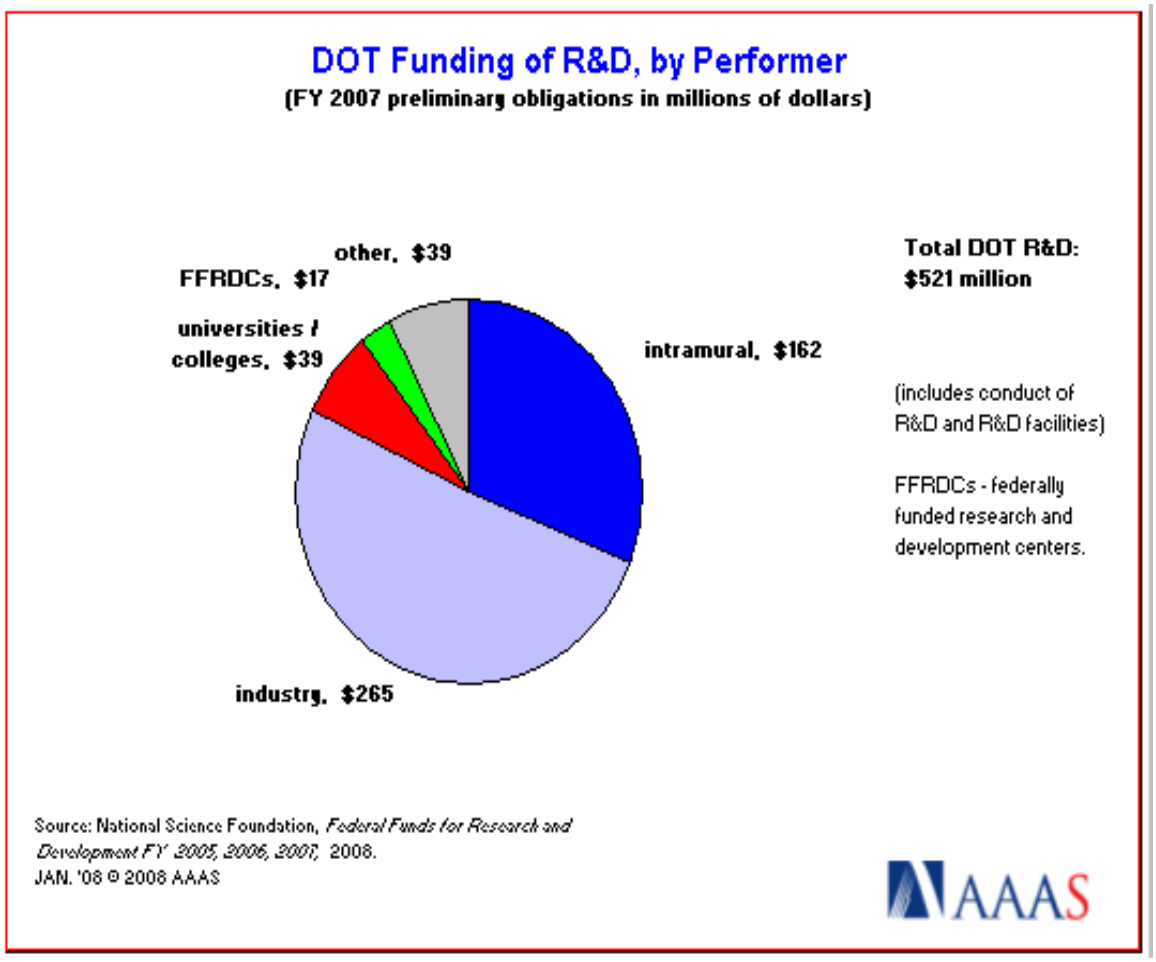

Figure 1: Breakdown of DOT Research Funding

This lack of funding from MARAD continued from 2001 through 2008. The nation now has over a decade of zero budgeted research funding for the principal agency

responsible for promoting and establishing policy for the maritime commerce of the nation's Marine Transportation System (MTS).

According to the DOT, from FY 2006-2009 the following universities were funded for ongoing maritime research.

Agency	Legislative source	School name	Subject area
RITA	Sun Grant Universities	University of Delaware	Marine Emissions Modeling
Office of the Secretary	Congressional appropriation	University of Wisconsin-Superior	Ballast water Treatment
Office of the Secretary	Congressional appropriation	Great Lakes Maritime Research Institute	Maritime Commerce
MARAD	Congressional appropriation	Great Lakes Maritime Research Institute	Maritime Commerce

Table 2: DOT Funding of Maritime Research 2006-2009. (Compiled from DOT list of On-Going DOT Funded university research, 2009)

The Department of Defense has funded maritime research through the US Navy in programs such as MARITECH-Advanced Shipbuilding Enterprise. The DOD also funds research for the construction and maintenance of waterways through the US Army Corps of Engineers. The US Coast Guard supports research that has benefit to the maritime industry, maritime safety and security. The US Department of Commerce through its own offices researches waterborne trade and the National Oceanographic and Atmospheric Administration (NOAA) provides research in charting, meteorology, and supports Sea Grant Universities which occasionally engage in maritime research. The US Department of Agriculture funds maritime transportation research in support of marketing agricultural product. The US Customs Marine R&D funding is specifically related to maritime security, inspection, and enforcement. Customs Marine R&D funding, however, is minimal and focused on evaluation and, if required, modification of available technologies for security. The Federal Highway Administration's Surface Transportation and Environmental (STEP) program will examine ports as they relate to intermodal connections but maritime transportation is not listed as one of the key research initiatives, (FHWA-HEP-08-016, 2007). None of these agencies have supporting

maritime commerce as a principal mission or have budgeted ongoing university maritime research programs.

The amount of funding allocated for research in these agencies primarily supports non-maritime commerce related missions or is embedded in an overall budget from which it is difficult to accurately extract the amount spent on maritime-related work. Frequently, the funding is project oriented and does not provide the long term stability that is vital for extended research.

IV. Issues in University Maritime Research

a. Fragmented Federal Direction of the Marine Transportation System

The research in the maritime industry mirrors the systemic problems found by the Committee for the Study of the Federal role in Marine Transportation's study, (The Marine Transportation System and the Federal Role, 2004):

"Federal responsibilities in the MTS are fragmented among several congressional committees and administering agencies. The resulting dispersion of program authorization, budgeting and funding has led to fragmentation in the information collected and analyzed by the federal government on the performance and needs of the system. Each agency has come to rely on different sets of information and analytical tools to inform its decisions."

Leadership in the DOT and MARAD has worked to address this issue by establishing two key committees: The (Interagency) Committee on the MTS (CMTS), with members from 17 federal agencies, a private sector advisory committee; and the MTS National Advisory Committee (MTSNAC), with representatives from 30 industry associations and non-Federal organizations. Both committees have initiated research and technology subcommittees to work together on assessing and improving research and technology to solve MTS-related problems. Currently, these subcommittees are assessing MTS R&D requirements in relation to designing a National Cooperative MTS Research Program. Among their other activities is the hosting of a biennial national MTS Research and Development Coordination Conference. Without a stable source of funding for research, however, the best laid plans of these committees will have little chance of success especially in times of budget constraints.

The MTS is closely akin to the nation's air transportation network where it involves long distance interstate movements and the principal routes are under federal regulation and control. Water ports, like airports, are often under local leadership but the level of funding for seaport research has lagged far behind funds devoted to support research in airports. The congestion in seaports is now impacting other modes along with the infrastructure that connects the ports to inland sites. This fact and the strong federal presence in the MTS means that state and local governments frequently rely upon the federal government to support and provide direction for maritime research.

As a result of this fragmentation there is no unified agenda for research. This situation can result in research that is reactive, serves only the mission of a single agency, not focused on maritime commerce, or wastefully duplicates other research projects. The fact is that well intentioned research is fragmented with no unifying body to give it direction or long range planning for the entire maritime transportation system. The federal agency that historically has been tasked with maritime research has been MARAD.

b. The US Maritime Administration and Maritime Research

The US Maritime Administration was established by Reorganization Plan No. 21, effective 24 May 1950, as one of the successor agencies to the US Maritime Commission. The agency was originally housed in the Department of Commerce and then 1981 moved to the Department of Transportation.

MARAD administers financial programs to develop and promote the US Merchant Marine. They regulate the transfer of US documented vessels to foreign registries, maintain equipment, shipyard facilities, and reserve fleets of Government-owned ships essential for national defense; operate the US Merchant Marine Academy at Kings Point, NY; and administer a Grant-In-Aid Program for State operated maritime academies. The agency also has the authority to determine services and routes for US flag ships in American foreign commerce, and conduct research and development activities in the maritime field.

The agency has an interesting history related to research and specifically university based research. MARAD has historically turned to the National Academy of

Sciences as one of the principal sources for input into research agendas and research management.

In 1959, the National Academy of Sciences' National Research Council, at the request of MARAD, formed a panel to look at research needs in the maritime industry. The panel recommended that MARAD actively employ the talents of universities to improve and expand maritime research. Two of the panels recommendations were explicit in regards to establishing an enduring university agency relationship, (Maritime Research Advisory Committee, 1960).

"1. The Maritime Administration should give favorable consideration to establishing five-year programs of sustained grants-in-aid to those universities which are particularly interested and well qualified to carry out maritime research.

2. The Maritime Administration should establish a program of 20 to 30 annual unconditional fellowships for advanced study in maritime or related fields."

These 1960 recommendations have not continued through the decades.

In 1973 again at the request of MARAD, the Panel for Support for Maritime Research and Education of the National Research Council address the question: *"What support, if any, should universities and non-profit institutions receive from the federal government and the maritime industry?"*

Their report concluded that universities had a significant role to play in both short and long term maritime research. The report also stated that the federal government's agencies were not supporting systematic long range maritime research by universities and that the federal government should provide increased research funding to universities. The Panel believed the annual budget for maritime research should be permanent and increased to a combined research investment rate comparable to the national average for other technological oriented industries.

The panel provided seven recommendations on maritime research. The first recommendation was that the MARAD should contract with and fund a consortium of universities to establish an institute for advanced maritime management studies. Another specific recommendation was to continuously provide federal funding to universities with marine engineering and naval architecture programs. The seventh recommendation was

for MARAD to establish and fund a program to respond to unsolicited research proposals from universities in a manner comparable to the National Science Foundation.

c. Examples of Current MTS University Research

The US DOT and Congress recognized that the Marine Transportation System was not well represented in the University Transportation Centers (UTC) structure and in 1990 created **National Maritime Enhancement Institutes (NMEIs).** The University Transportation Centers (UTC) program created in 1987 is a multimodal program where both Federal Highway Administration (FHWA) and the Federal Transit Authority (FTA) are provided funding to support transportation education and career development as well as R&D at universities.

MARAD was authorized under Public Law 101-115 to designate NMEIs at U.S. universities or university consortia with capabilities for providing leadership in the solution of national problems. The NMEIs were designated equivalent to UTCs under law but have never been integrated into The Research and Innovative Technology Administration (RITA) UTC system. Since 1990 MARAD has designated eight institutions throughout the U.S. as NMEIs, (US Maritime Administration Website, 2009).

These university based institutes are located on all coasts, the inland waterways and the Great Lakes. The purpose of the NMEIs is to create a research-oriented atmosphere that lends itself to providing effective input for addressing maritime issues. The institutes that were selected as NMEIs were capable of researching inter-disciplinary, intermodal problems, and have access to a broad spectrum of resources enabling them to address national problems within their individual program areas. UTC universities have partnered with NMEIs on research projects.

Unlike the UTC system there has been no dedicated funding allocated for the NMEIs, MARAD's website states that an NMEI should expect no funding from the agency. MARAD leadership believes that funding R&D by their agency is legislatively limited. US Code-Title 49, Sec. 109 Transportation, January 2003 limits funds to only those amounts specifically appropriated for the use of MARAD for expenses necessary for research and development activities. The lack of on-going funding and the ability to budget has resulted in this well intentioned program, set up by congress not realizing its full potential. Several NMEI's such as the component of the Intermodal Freight

Transportation Institute at University of Memphis have been dormant for years (Lipinski, Martin E., 2009). The University of California at Berkley's NMEI has been closed, (Bea, Robert, 2009). Some NMEIs have obtained MARAD contracts or non-MARAD federal, state, or private funding and are actively engaged in maritime research.

The following are current examples of other efforts of university research in maritime transportation. (This listing is representative of the programs.) Some universities and individual faculty engaged in maritime research have been left off not because of their operations, but due to the limitations of this paper. The inability to find a single source for listing all maritime research programs or funding for maritime research highlights the fragmentation in the field.

The Texas Legislature established the **Texas Transportation Institute's (TTI) Center for Ports and Waterways (CPW)** in 1995. The CPW is an NMEI that provides applied research at the local, regional, and national level, benefiting both the nation and the State of Texas. The CPW is a consortium of universities with extensive expertise in maritime issues which work together in research and development activities. Consortium members include: Lamar University, Texas A&M University, Texas A&M at Galveston, Texas A&M-Corpus Christi, and The University of Texas at Brownsville. MARAD has contracted with CPW to conduct studies.

The **National Ports and Waterways Institute** of the University of New Orleans was started in 1982 and in 1990 became an NMEI. The institute is also a UTC as part of the Gulf Coast Center for Evacuation and Resiliency Transportation Center which is a partnership between the Louisiana State University (LSU) and the University of New Orleans (UNO). According to Dr. Asaf-Ashar, the Co-Director of the Institute, UCT funds have been used for maritime research and the UTC has directed maritime research. The institute collaborates on research with other universities. The institute has seen an increase in maritime research funding during the past decade, (Asaf-Ashar, 2009).

The **Great Lakes Maritime Research Institute** (GLMRI) was established in 2004 to pursue research efforts in marine transportation, logistics, economics, engineering, environmental planning, and port management. The US Maritime Administration designated GLMRI as a National Maritime Enhancement Institute on June 1, 2005. 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, GLMRI represents a consortium of the University of Wisconsin-Superior and the University of Minnesota Duluth with 10 affiliate universities located in the Great Lakes watershed. Since 2005, GLMRI has funded over 30 research projects. The institute has congressionally appropriated funding that flows through the US DOT. Research agendas are coordinated through an advisory board composed of government agencies including MARAD, the Great Lakes maritime industry and non-governmental organizations. MARAD has provided technical expertise and administrative support to GLMRI.

In 1993, MARAD, partnering with industry, created the **Ship Operations Cooperative Program (SOCP).** The Cooperative was officially formed with the execution of a Cooperative Agreement between Sea-Land Service, Inc.; ARCO Marine, Inc.; Energy Transportation Group; National Oceanic and Atmospheric Administration (NOAA) and MARAD. The purpose of the SOCP is to promote beneficial innovations in ship operations through the identification, development, and application of new methods, tools, and technologies (Ship Operations Cooperative Program By-Laws, 2008). In November 2008, the SOCP opened its membership to include research universities. In 2009, there were 39 members composed of government agencies, shipping companies, maritime academies, and labor unions. Two of the members, Marshall University and Kings Point, are National Maritime Enhancement Institutes. SOCP has produced a number of highly regarded videos and CDs directed on improving vessel and shipyard safety and operations.

MARAD provides a variety of support to the **Marine Board** of the National Research Council (NRC). The Marine Board became part of the Transportation Research Board (TRB) on April 1, 1999. The Marine Board was previously part of the NRC's Commission on Engineering and Technical Systems (CETS). Formed in 1965, the Marine Board is an internationally recognized source of expertise on maritime transportation and marine engineering and technology. The Marine Board identifies research needs and provides a forum for exchange of information relating to new technologies, laws and regulations, economics, the environment, and other issues affecting the marine transportation system, port operations, coastal engineering, and

marine governance. The TRB, based on input from the Marine Board and relevant TRB committees, identifies maritime research needs and if funding is available, issues requests for proposals for which universities may apply.

The law that originated **Sea Grant** gave authority for initiating and supporting programs at Sea Grant colleges and other suitable institutes for marine resources research. In the original bill, (National Sea Grant College and Program Act of 1966), marine resources were defined to specifically include marine commerce and marine engineering as principal themes for research. During the early years of Sea Grant many of the Sea Grant colleges funded studies relating to maritime commerce. There are still some colleges, such as the University of Rhode Island and the University of Washington's School of Marine Affairs, that provide limited research funding for topics related to this field. The current eleven Sea Grant thematic areas for research, however, do not specify maritime transportation as part of the areas of research, (National Sea Grant, 2009).

The **Center for the Commercial Deployment of Transportation Technology (CCDoTT)** at the California State University Long Beach is a government approved and supported R&D center dealing with maritime-related transportation issues on behalf of both commercial and military interests. It was established in 1995 to address dual-use issues relating to emerging High-Speed Ships and their related Agile Port Systems. CCDoTT has since assumed an expanded role to also address the issues of Rapid Deployment, Decision Support Tools (Command & Control), and was involved with programs improving Security associated with marine related cargo movements before 9/11/2001, (Wheatley and Hinds, 2009). The principal sponsor for CCDoTT is the Department of Defense, Office of Naval Research which provided $2.4 million in FY08 and an additional expected $6 million in FY09. The Federal Railway Administration provided ECCO Program Funding in FY08 for $245k. The Center has managed over 155 projects since 1995. MARAD has provided technical expertise and support.

The Massachusetts Institute of Technology (MIT) has two principals centers housed in the school of Ocean Engineering that are engaged in maritime research. The **Ship Design & Technology Center** focuses on all phases of design related to ocean systems, including offshore platforms for petroleum recovery; merchant, research, and

submersible vehicles, especially robotic autonomous underwater vehicles (AUVs). Other maritime design challenges tackled by MIT ocean engineers are fishery facilities, harbor facilities, and port-transportation infrastructures. **The Ocean Systems Management** program at MIT addresses the management of shipping and other systems related to the sea. MARAD has provided technical expertise and support.

The **Center for Advanced Infrastructure and Transportation** is located at Rutgers, The State University of New Jersey, and has a **Freight and Maritime Program** (FMP). The FMP is a dedicated academic initiative incorporating research, education, and training activities FMP operates within Rutgers' Center for Advanced Infrastructure and Transportation, a U.S. Department of Transportation-designated University Transportation Center. MARAD has provided technical expertise and support.

V. Federal University Transportation Research Funding Models

Funding transportation research is always problematic and especially so in the maritime field because the results are long term and the nation's economic outlook is often short term. This is coupled with the fact that constituents frequently have little concept of the importance of the MTS in their lives. Legislated funding is necessary so that research responds to the needs of the constituents but there is also the need for a baseline source of funding to provide ongoing support for research. In difficult financial times agencies that do not have maritime commerce as their primary objective will curtail maritime research so that their key mission is supported.

The other modes of transportation have revenue sources for funding from trust funds and user fees. For example, the Highway Trust Fund (HTF) was created by the Highway Revenue Act of 1956 (Pub. L. 84-627), primarily to ensure a dependable source of financing for the National System of Interstate and Defense Highways and also as the source of funding for the remainder of the Federal-aid Highway Program.

The National Cooperative Highway Research Program (NCHRP) was created in 1962 as a means to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide. The state departments of transportation are the sole sponsors of the NCHRP. Support is voluntary and funds are

drawn from the states' Federal-Aid Highway apportionment of State Planning and Research (SPR) funds that come out of the highway trust fund.

The Research and Innovative Technology Administration (RITA) coordinates the UTC research programs on behalf of all Department of Transportation Agencies. The UTCs receive approximately $33 million in FWHA funding annually. The UTCs seek to focus universities on transportation research issues and develop students, teachers, and research areas that are of value to the transportation system. There are currently over 30 UTCs around the nation. While individual researchers in the UTCs may be involved in maritime research there are no UTCs that are primarily dedicated to research on the MTS.

The Federal Aviation Administration (FAA) has the Centers of Excellence where university core members enter into cooperative agreements with the FAA. Universities scientists are funded through matching grants and cost-share contracts to study aviation. By establishing major research centers throughout the United States, the FAA helps to finance graduate education and fosters collaborative R&D efforts. FAA Centers of Excellence may conduct research for, and receive funding from, industry and all federal, state and local governments, (Public Law 101-508 SEC. 9209, 1990).

VI. A National Maritime University Research Program

In 2004 the Transportation Research Board's Committee for the Study of the Federal Role in Marine Transportation made a clear and concise recommendation regarding maritime research.

"The Secretary of Transportation should seek from Congress the means to undertake, in collaboration with industry and other federal agencies, an applied research and technology program aimed at furthering the capacity, safety, environmental protection, and security of the nation's ports, intermodal connections, and other marine facilities and services.", (Committee for the Study of the Federal Role in Marine Transportation, 2004).

History has shown that without adequate ongoing funding to support a maritime research program, it will fail and the problems outlined in this paper will continue into the future. A National Maritime Cooperative Research Program, analogous to those

already established for highway, air and transit, should be created as recommended in the various reports dating from 1973 though 2008 cited in this paper

Just like the Highway Trust Fund that supports R&D sponsored by the FHWA, the MTS has a trust fund. The Harbor Maintenance Tax (HMT), also legally defined as a Harbor Maintenance Fee, was instituted in 1987 to recover a portion of the cost of operation and maintenance (O&M) dredging of the nation's deep-draft ports and waterways. Prior to 1987, the nation funded O&M dredging and new construction projects from general revenues. The HMT is applied based on the value of the cargo (*ad valorem*) transported on a commercial vessel, including passengers transported for compensation, and loaded or unloaded at certain ports. The Customs and Border Protection Agency defines and administers the list of ports subject to the HMT. These ports include those receiving federal funding for construction or operation and maintenance since 1977. The HMT is not imposed on any cargo associated with vessel movements on the inland waterways system, which is supported by a fuel tax. Ferry passengers and certain cargo are also exempt from the HMT. The HMT originally recovered approximately 40 percent of O&M costs, but the tax rate was tripled in 1991, ostensibly to fully fund O&M dredging. Revenues raised exceeded expenditures and the Harbor Maintenance Trust Fund (HMTF) began to amass a significant surplus.

In 2007, the HMT collected approximately $1.4 billion and agencies spent less than $1 billion of the annual revenue leaving a surplus of $506 million. Between fiscal years 2001 and 2007, the balance in the HMTF grew from $1.8 billion to $3.8 billion, (United States Government Accountability Office, 2008). The US Army Corps of Engineers told the US Government Accountability Office that they expect the HMT fund surplus to reach $8 billion in fiscal year 2011. Projections are for continued growth in maritime freight with added pressure on the MTS. One of the best uses of funded research is to find ways to maximize the efficient operation of the existing system before considering capacity expansion (Transportation Research Board, 2003). Research is crucial to advances in transportation that can save lives, time, and money. The HMT trust fund is designed to support operations as well as maintenance but would have to be amended to allow for University research funding.[1] Research is a proven way to leverage funds, provide tools to improve efficiency and re-invest user fees back into the MTS.

There is a historical precedent in Congress amending both the highway trust fund and the aviation trust fund to support research. These trust funds provide long-term contracting authority because the agencies can obligate research funds without waiting for annual appropriations. This encourages state and local government cost sharing because the parties know that the federal agency will be able to meet its commitments. Congress should consider the following funding plan to support the maritime research program called for by the numerous cited reports:

1) Amend the Harbor Maintenance Tax Act to authorize a portion of the HMT revenues to be dedicated for a Research and Development Program for the Marine Transportation System.

2) Authorize and appropriate on a five year basis approximately 3% of the HMT tax annual revenues for MTS University Research each of the five years.

a) Based on 2007 HMT revenues this would generate approximately $42 million annually for research and development.

b) Use 10% of the authorized pool of funds to provide administrative support for the principal federal agency that would operate the program. The program should participate in RITA Chapter 9 Partnerships.

c) The Committee on the Marine Transportation System, Marine Transportation System National Advisory Committee, the Transportation Research Board, along with relevant federal agencies would develop research agendas.

d) Authorize approximately 60% of the funding pool to provide a baseline budget for supporting the National Maritime Enhancement Institutes with five-year programs of sustained grants-in-aid to carry out maritime research. The funding should include annual unconditional fellowships for advanced study in maritime transportation.

e) The remaining 30% of authorized and appropriated funds would be used to establish and fund a program to respond to unsolicited maritime research proposals from universities in a manner comparable to the National Science Foundation. The successful FHWA National Cooperative Highway Research Program (NCHRP) could also serve as a model.

VII. Conclusions

Our nation will continue to depend on its Marine Transportation System as a key element of our national security, economic competitiveness, environmental improvement, and recreation. The MTS is overlooked and underfunded in the areas of short and long term research. We need to incorporate the creativity and innovation of the university research community to ensure that the MTS adapts to meet the nation's changing passenger and freight transportation requirements. An overarching National Maritime University Research Program (NMRUP) managed by a single federal agency is needed to harness and direct comprehensive university maritime transportation research and technology. A well designed NMURP structure will incorporate the work currently ongoing as part of Federally-sponsored research efforts in the MTS. The various federal maritime agencies responsible for overseeing the commercial maritime industry would continue to provide a leadership role in developing the MTS commercial infrastructure while protecting marine resources. The NMURP would recognize the interdependence and interrelationship of all parts of the transportation system and ensure the participation in research planning and development by all stakeholders of the MTS. Key to that vision coming to pass is action by the administration and Congress to create a stable long term funding mechanism to support the NMURP. History has clearly indicated that without stable long term funding maritime research at universities will be sporadic and disjointed.

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The authorizing statute limits expenditures from the HMTF to (1) eligible harbor operations and maintenance costs assigned to commercial navigation, (2) eligible operations and maintenance costs of certain portions of the Saint Lawrence Seaway, (3) certain rebates of tolls or charges, and (4) administrative expenses related to the administration of the fee, but not in excess of $5 million for any fiscal year (26 U.S.C. § 9505 and 33 U.S.C. § 2238).