



MARINE BOARD

Annual Report

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TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. William A. Wulf are chair and vice chair, respectively, of the National Research Council.

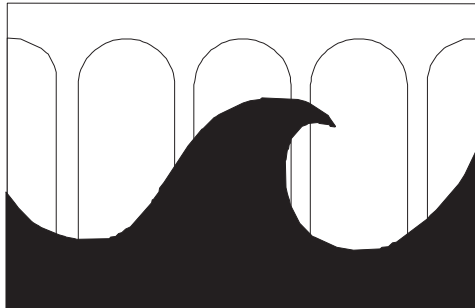
The **Transportation Research Board** is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, the Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation. The Board's varied activities annually engage more than 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. www.TRB.org



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OF THE NATIONAL ACADEMIES

Washington, D.C.
2003
www.TRB.org



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MESSAGE FROM THE CHAIR



R. Keith Michel
Marine Board Chair

For 38 years, the Marine Board of the National Research Council (NRC) has advised the nation on current and future uses of the ocean and the development of technology for the efficient, safe, and environmentally responsible use of marine resources. In 1999, the Marine Board moved to the Transportation Research Board (TRB), where it expanded its activities in maritime transportation, marine research, policy issues, and technology developments to the broader context and reconnected with the mission of its predecessor board, the Maritime Transportation Research Board.

TRB is a division of the NRC, with a mission to promote innovation and progress in transportation through research. The Technical Activities Division of TRB comprises approximately 200 standing technical committees with expertise in all modes of transportation. A recent revision of the organizational structure for these committees has given a more prominent role to marine and other non-highway modes.

In this new framework, the Marine Board will maintain its association with its sponsors and continue its efforts to initiate and support policy studies, and the Marine Board continues to coordinate and work closely with other NRC boards in areas of mutual interest. In addition, TRB committees and task forces with a primarily marine focus will now be part of the new Marine Group, which the Executive Committee of the Marine Board will oversee. Thus, the Marine Board will have a more direct role in the activities of TRB's standing committees, particularly those involved with ports and channels, inland water transport, planning, and the environment.

In 2001-2002, the Board fostered its relationships with its federal agency sponsors, the maritime community, and the TRB marine-related standing committees, meeting with representatives to learn about concerns related to maritime issues and inviting communication about the nation's maritime future. This led to major activities in 2002-2003 to explore in greater depth several issues, such as the federal role in the Marine Transportation System (MTS), shipboard display of automatic identification system (AIS) information, homeland security, coastal (short sea) shipping, and marine recreation and tourism. In the coming year, the Board will continue to develop policy studies and pursue other activities covering a wide range of issues.

In August 2003, a committee under the oversight of the Marine Board hosted a Workshop on Marine Salvage Response Capability to address economic, legal, forensic, environmental, and human casualty issues relative to salvage; and to promote discussion and identification of organizational and interagency coordination efforts needed for effective and efficient salvage response. Representatives of federal, state, and local agencies; the salvage industry; and environmental and public interest groups participated.

Through these and other programs, the Marine Board continues to be a vital participant in the nation's marine community, leading and supporting U.S. maritime enterprises and activities.

R. Keith Michel



THE MARINE BOARD

Members

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R. Keith Michel, *chair*, Herbert Engineering Corp., Alameda, California
Geraldine Knatz, *vice-chair*, Port of Long Beach, Long Beach, California
Larry L. Daggett, Waterway Simulation Technology, Inc., Vicksburg, Mississippi
Peter J. Finnerty, American Ocean Enterprises, Inc., Annapolis, Maryland
Paul S. Fischbeck, Carnegie Mellon University, Pittsburgh, Pennsylvania
Martha R. Grabowski, Le Moyne College, Syracuse, and Rensselaer Polytechnic Institute, Troy, New York
Rodney Gregory, IBM Global Services, Fairfax, Virginia
I. Bernard Jacobson, IBJ Associates, New York
Ronald K. Kiss, Webb Institute, Glen Cove, New York
Sally Ann Lentz, Ocean Advocates, Clarksville, Maryland
Philip Li-Fan Liu, Cornell University, Ithaca, New York
Malcolm MacKinnon, III, NAE, MSCL, Inc., Alexandria, Virginia
Reginald E. McKamie, Sr., Esq., Houston, Texas
Robert C. North, North Star Maritime, Inc., Queenstown, Maryland
Craig E. Philip, Ingram Barge Company, Nashville, Tennessee
Edwin J. Roland, Elmer-Roland Maritime Consultants, Houston, Texas
Jerry R. Schubel, Aquarium of the Pacific, Long Beach, California
Richard H. Vortmann, National Steel and Shipbuilding Co., San Diego, California
Emmett G. “Skip” Ward, Offshore Technology Research Center, College Station, Texas
David J. Wisch, ChevronTexaco, Bellaire, Texas

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Radoje (Rod) Vulovic, *chair*, U.S. Ship Management, Inc., Charlotte, North Carolina
R. Keith Michel, *vice-chair*, Herbert Engineering Corp., Alameda, California
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Billy L. Edge, Texas A&M University, College Station, Texas
Peter Finnerty, American Ocean Enterprises, Inc., Annapolis, Maryland
Martha R. Grabowski, Le Moyne College, Syracuse, and Rensselaer Polytechnic Institute, Troy, New York
Rodney Gregory, PricewaterhouseCoopers LLP, Arlington, Virginia
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David J. Wisch, ChevronTexaco, Bellaire, Texas

Staff

Joedy Cambridge, Principal Staff Officer
Beverly Huey, Senior Staff Officer
Peter Johnson, Consultant



ABOUT THE MARINE BOARD

Formed in 1965, the Marine Board is an internationally recognized source of expertise on maritime transportation and marine engineering and technology. In response to requests from sponsoring agencies—or on its own initiative—the Marine Board serves the national interest by evaluating and advising on the ability of the nation's marine and maritime industries to operate safely and efficiently in an environmentally responsible way. The Marine Board identifies research needs and provides a forum for the exchange of information on new technologies, laws and regulations, economics, the environment, and other issues affecting the MTS, port operations, coastal engineering, and marine governance.

With the continuing support of sponsors and the benefits of its affiliation with TRB, the Marine Board maintains its unique role in identifying and responding to critical issues in

- Water transportation (both ocean and inland waterways);
- Harbor and channel infrastructure and maintenance;
- Port engineering and management;
- Marine safety, security, and environmental protection;
- Shipbuilding, naval architecture, and marine engineering;
- Coastal engineering;
- Marine policy; and
- Maritime economics.

In 2002 and 2003, the Marine Board's work was carried out at the request of units of the Departments of the Army (Corps of Engineers), Energy (National Energy Technology Laboratory), Navy (Office of Naval Research and Navy Office of the Supervisor of Salvage and Diving), Transportation [the U.S. Coast Guard (USCG) and the Maritime Administration], Commerce [the National Oceanic and Atmospheric Administration (NOAA)], and the National Science Foundation. The Departments of the Army, Energy, and Transportation extend financial support from pooled resources through a cooperative agreement administered by the Maritime Administration of the U.S. Department of Transportation (USDOT). The combination of a multiyear cooperative agreement managed by the Maritime Administration on behalf of participating federal agencies and a complementary grant administered by the U.S. Navy gives the participating federal agencies a source of independent and objective information on marine and maritime affairs and administrative flexibility.

During 2002 and 2003, the Marine Board carried out activities for its federal agency sponsors on marine and maritime topics. Studies are conducted under the auspices of TRB's Division of Studies and Information Services. The Marine Board nurtures ideas for new projects, develops proposals, identifies prospective committee members, and maintains involvement in studies and activities related to its mission.

The Marine Board also serves as a forum for discussion of and strategic thinking on emerging issues important to the maritime community. The Board conducts business principally at semiannual meetings and through the support of the Marine Board and TRB staff. This Annual Report presents the Board's activities in 2002–2003.

ORGANIZATION AND MEMBERSHIP

The chairman of the NRC appoints Marine Board members at the recommendation of the TRB Executive Director in consultation with the NRC. Nominations are based on recommendations from current and former Marine Board members, sponsoring agencies, staff, and other members of the marine and maritime communities. Chosen for exceptional professional qualifications and their areas of expertise, members serve staggered 3-year terms and may be reappointed for up to 3 additional years. The Board comprises representatives of technical disciplines associated with maritime activities and marine engineering and with related environmental interests, law, economics, industrial experience, human factors, and marine science. The breadth of expertise reflects the complexity of the social, economic, technical, and scientific issues involved in marine and maritime activities.



Every Board member participates in framing and accomplishing program goals and in evaluating program performance. Members identify technical issues, define potential new projects, assess study plans and background papers, review the progress of studies, serve on study committees, act as liaison resources to study committees, and identify prospective committee and Board members. Members serve as individuals, not as representatives of organizations. NRC policy does not exclude individuals with valuable expertise from Board membership because of potential bias; established measures ensure fair treatment and a balanced perspective on the Board.

In March 2002, the TRB Technical Activities Division Council approved a recommendation to evaluate the organizational structure of the standing committees and, if needed, reorganize groups and sections on the basis of the inherent matrix structure of transportation. Committee scopes and relevance were strategically evaluated, and scopes were broadened where appropriate. As a result, the approximately 200 standing committees of TRB's Technical Activities Division have been reorganized from 5 to 11 groups. Six of the groups, consisting of approximately 150 committees, address functional components of transportation, with a major focus on highways. Each of the remaining five groups concentrates on a specific mode or purpose: public transportation, rail, marine, aviation, and freight systems. The combined functional and modal structure creates synergy among the groups and makes it possible for TRB standing committees to address the wide range of cross-cutting transportation research issues.

Committees and task forces that focus primarily on marine issues will now be part of the new Marine Group, to be overseen by the Marine Board Executive Committee. Two standing committees (Inland Water Transportation and Ports and Channels) and one task force (Marine Environmental Issues) will come under the Marine Group. While formally assigned to other groups, the following committees and task forces will also have a liaison relationship to the Marine Group: Ferry Transportation, which falls under the Public Transportation Group; Military Transportation, Intermodal Freight, Intermodal Freight Terminal Design and Operations, and Agricultural Transportation, all of which are part of the Freight Systems Group; and Critical Transportation Infrastructure Protection, a part of the Management and Administration Group.

Elevating marine transportation to group status and directly involving the Marine Board in the activities of selected TRB standing committees will help stimulate interest and expand research activities in all aspects of water transportation.

PROGRAM SCOPE

The Marine Board's program responds to immediate national needs and anticipates future issues that will affect the use of the nation's oceans, waterways, and coastal regions and the competitive performance of the marine and maritime industries. The Board's activities encompass a range of issues of concern to the maritime community, including

1. Engineering research and technology for commercial and recreational uses of oceans, coastal regions, and inland waterways;
2. Safety, security, and environmental issues associated with water transportation;
3. Technology of ships and marine systems;
4. Maritime law and economics;
5. Offshore industries; and
6. Training and education.



ACTIVITIES UNDER WAY IN 2002–2003

Marine Salvage Response Capability: A Workshop

In 1982, the Marine Board conducted a comprehensive study of salvage needs and capabilities, publishing its findings in the report, *Marine Salvage in the United States*. This was followed in 1994 by *A Reassessment of the Marine Salvage Posture of the United States*, which describes the Navy's salvage resources and contributions to U.S. salvage capabilities. Since then, the organization of the Navy's capabilities has remained much the same. However, the numbers of vessels and other resources has declined, a trend that appears to be continuing. In addition, public and private salvage capabilities have changed, as well as public expectations for the nation's ability to respond to major accidents at sea. A sharp drop in the number of maritime casualties in U.S. waters in recent years has reduced the demand for salvage in U.S. waters, raising the concern that salvage capabilities will be diminished. The major U.S. salvage companies recently formed the American Salvage Association with the intent of agreeing to and defining the joint interests of salvors for representation before federal agencies and the general public.

Maritime traffic and shipping in general in major U.S. ports and waterways have also changed substantially. For instance, in the state of Washington, escort tugs are used for certain tankers operating in Puget Sound, and the Navy was asked to provide the means to station a standby vessel near the entrance to the sound to respond to possible emergency towing requirements. While the Puget Sound situation has attracted attention, it is illustrative of the complexities of the salvage and rescue tug issues that can arise when the risk of accidents and oil pollution is perceived as high. The additional complexities associated with terrorist-related incidents heighten the need to examine these issues even more.

A committee was appointed to develop and conduct a workshop, held August 5–6, 2003, to explore the status of the ability of the nation's organizational and physical marine salvage capabilities to respond to possible terrorist incidents that could occur at major U.S. port complexes. Organizational and interagency coordination and response capabilities were considered.

The results of a hypothetical terrorist event scenario were presented, and participants discussed the most likely availability of needed equipment, personnel, and organizational readiness. Two panel sessions were organized—a federal agency panel and an industry panel. In the federal panel, representatives of key federal agencies with authority and responsibilities to respond to salvage incidents in U.S. ports and waterways were asked to discuss the anticipated salvage response to the scenario incident and to identify their agency's respective roles in the incident. They were asked to describe the procedures for managing and implementing a coordinated response and providing needed resources for such an incident and then to answer the following questions to the best of their knowledge:

- What are the specific roles and responsibilities of your agency in responding to an incident such as that presented to the workshop? Are these roles and responsibilities formally established and have they been updated recently?
- Has your agency developed a comprehensive plan for such a salvage response and clearly defined the agency's relationship to that of other responsible agencies as well as the private sector? Has this plan been tested?

- How will the National Response Plan, currently under development, affect your roles, responsibilities, and agency relationships?
- Would you anticipate any problems or shortfalls in capabilities to respond to the incident presented given your knowledge of both government and private equipment and resources available?
- What organizational or procedural problems would you anticipate in responding to the incident presented and how might these be addressed?
- What steps would you suggest be considered to improve the nation's readiness posture for responding to an incident such as that presented or to similar threats?

In the industry panel, representatives of the marine salvage industry were asked to first comment on the scenario's salvage problem and then discuss the expected salvage response, drawing on their knowledge and experience with the required type of salvage actions and any local knowledge they may have had of the Houston/Galveston and Lower Mississippi Port Complexes (the scenario scene). They were asked to address the following questions:

- What equipment and personnel are likely to be immediately available to respond to the scenarios presented?
- What are the key steps and the major types of resources that would be required for an adequate response effort?
- What would be best estimated times for initial mobilization, first emergency response, and final channel clearing?
- What shortfalls of either equipment or personnel might be expected and how might these be addressed?
- What organizational or procedural problems might be expected and how might these be addressed?
- What steps might be useful to consider for improving overall readiness posture before an incident such as this?

Breakout sessions, which followed these two panels, focused on (1) physical salvage and harbor clearance; (2) financial, economic, and political issues; (3) legal, forensic, and human casualty topics; and (4) the environment. The principal goals of the workshop were (a) to share information among relevant agencies, organizations, and other interested parties on current salvage response capabilities, and (b) to determine if there are major gaps in or concerns with current capabilities and agency roles. A summary report of the workshop is forthcoming.

Committee

Malcolm MacKinnon, III, NAE, MSCL, LLC, *chair*
 Paul S. Fischbeck, Carnegie Mellon University
 Sally Ann Lentz, Ocean Advocates
 Reginald McKamie, Sr., Esq., Houston, Texas
 R. Keith Michel, Herbert Engineering Corp.
 Robert C. North, North Star Maritime, Inc.

Liaisons

Marine Board Core Sponsors

Committee for a Study of the Federal Role in the Marine Transportation System



The MTS of the United States is not a system in the formal sense of the word, but rather a loosely integrated collection of waterways, ports, and supporting systems (for security, navigation, rescue, and environmental protection). The components of the MTS are owned and operated by states, local governments, and private entities. Nonetheless, several federal agencies play an important role in its operation, most notably the USCG, the U.S. Army Corps of Engineers (USACE), NOAA, and the U.S. Customs Service. The MTS infrastructure is financed and operated in myriad, complex ways involving federal, state, and local general revenues, user fees, taxes, and transactions between private entities. Substantial parts of the waterways are funded by federal sources, including infrastructure and supporting services. The federal share of infrastructure costs is partially covered by two dedicated trust funds to help pay the cost of dredging to maintain channels and harbors and to pay 50 percent of the cost of capital improvements to locks and dams on inland waterways. Supporting services are funded with general revenues.

The purpose of this study, which is funded by 11 agencies, is to develop an analytical framework for federal agencies in identifying capital and operating needs and coordinating federal investments and spending on the MTS infrastructure. The federal role in the MTS encompasses support for safe navigation (such as vessel traffic management, charting, marine safety, search and rescue, salvage, weather and oceanographic information); waterway maintenance (dredging of harbors and channels and maintenance and upgrading of locks and dams); environmental protection (oil and hazardous waste spill prevention and response, vessel discharges, wetlands and habitat protection, and air pollution); security; and customs services. The federal government also sets national goals and standards, identifies and implements funding mechanisms, and evaluates MTS performance.

Five tasks are being undertaken in developing the analytical framework: (a) review of how federal investments by agencies such as USCG, NOAA, USACE, and Customs are now made, including the basis for the investments, degree of interagency coordination, and policy issues associated with those patterns of investment; (b) review and interpretation of projections for future maritime freight and passenger demand; (c) assessment of plans for MTS maintenance and expansion by industry, state, and local government, and federal agencies (including consideration of plans for environmental protection); (d) description of the likely impact on the MTS over the next two decades if federal funding remains constant; and (e) identification of options for federal funding of the MTS. The study of federal funding options will

- Survey the federal financial role in support of other modes, particularly aviation (also an international system) for a comparative analysis;
- Identify critical factors and tradeoffs that must be taken into account in considering alternate federal financing roles; and
- Assess how these options for federal funding contribute to the national goals, standards, and performance measures set in the MTS Strategic Plan.



Committee Members

Mortimer L. Downey, *chair*, PBCConsult

William O. Gray, Gray Maritime Company

Elvin (Vald) R. Heiberg, III, Heiberg Associates, Inc.

Thomas D. Hopkins, Rochester Institute of Technology

Geraldine Knatz, Port of Long Beach, California

Thomas D. Larson, Lemont, Pennsylvania



Sally A. Lentz, Ocean Advocates
 Henry S. Marcus, Massachusetts Institute of Technology
 James R. McCarville, Port of Pittsburgh Commission
 Reginald E. McKamie, Sr., Esq., Houston, Texas
 Richard R. Mudge, Delcan, Inc.
 Robert C. North, North Star Maritime, Inc.
 John B. Torgan, Save The Bay—People for Narragansett
 Robert C. Waters, George Washington University

Liaisons

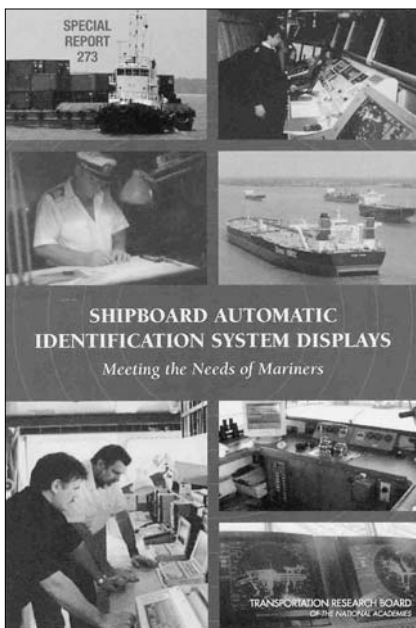
Ray Barberesi, Maritime Administration
 Daniel Floyd, U.S. Customs Service (Retired)
 MG Robert Griffin, U.S. Army Corps of Engineers
 Jeffrey High, U.S. Coast Guard
 Barry Holliday, U.S. Army Corps of Engineers
 Rajiv Khandpur, U.S. Coast Guard
 Captain David MacFarland, National Oceanic and Atmospheric Administration (Retired)
 Department of Homeland Security
 Office of the Secretary of Transportation
 U.S. Department of Agriculture

**Committee for
 Evaluating Shipboard
 Display of Automatic
 Identification Systems**

In recent years marine transportation has come under greater attention. Focus is on its safety and efficiency, prevention of and response to ship-caused pollution, and the use of vessels for inimical purposes, such as law-breaking (smuggling) or as a vehicle or target for terrorist acts. AISs have been developed in the last two decades in response to these concerns. Significant work has been accomplished to define AIS technical and communication requirements, resulting in worldwide mandatory carriage requirements for AIS aboard those vessels that must comply with the International Convention for the Safety of Life at Sea (SOLAS), and possibly for vessels that have non-SOLAS vessel carriage requirements in the United States. Despite these efforts, little has been said about shipboard display of AIS information.

Because USCG has the responsibility in the United States for determining if and what requirements should be established for shipboard AIS displays, it asked the Marine Board of TRB to investigate and analyze factors affecting the design, development, and implementation of shipboard AIS displays. TRB convened a committee to address USCG's request for guidance, in which USCG asked for an assessment of the state of the art in AIS display technologies, evaluation of current system designs and their capabilities, and review of the relevant human factors associated with operating these systems.

The introduction on vessels of AIS technology with effective displays can enhance the safety of vessel operations and the prudent management of waterway traffic. However, the benefits to the maritime community and the nation will depend on how well the industry, government authorities, and mariners work together to design effective systems, set comprehensive standards and guidelines, and leverage technologies to produce useful tools for the vessel operator. USCG should act to ensure an implementation process that meets safety improvement goals. This process includes preparing an implementation plan, determining requirements for displays and their functions, with human factors taken into account in the display design, addressing system limitations and shortfalls, developing training guidelines, setting human performance standards, designing a focused research program, and conducting operational tests and evaluations of display systems.





USCG cannot ensure that AIS technology will bring the promised benefits to all without the involvement and cooperation of all the stakeholders and without formal evaluation of such systems. Manufacturers, mariners, and the maritime industry must be a part of the process, if effective systems are to be developed and successfully implemented. While the report focuses on shipboard display of AIS information, the process of implementation and the human factors principles have application to many systems aboard vessels operating in U.S. waters. The report can be accessed from the TRB website or purchased from the TRB Publications Office.

Web Page

www.nap.edu/catalog/10708.html?se_side

Publication

Special Report 273: Shipboard Automatic Identification System Displays: Meeting the Needs of Mariners. TRB, National Research Council, Washington, D.C., 2003.

Committee Members

Martha R. Grabowski, *chair*, Le Moyne College and Rensselaer Polytechnic Institute
 Carl E. Bowler, San Francisco Bar Pilot
 Elizabeth J. Gedney, Victoria Express
 Douglas J. Grubbs, Crescent River Port Pilots Association
 Don K. Kim, M. Rosenblatt and Son Group
 John D. Lee, University of Iowa
 Robert G. Moore, Coastwatch, Inc.
 Roy L. Murphy, Kirby Corporation
 Nadine B. Sarter, The Ohio State University

Liaisons

Mike Sollosi, U.S. Coast Guard
 Edward LaRue, U.S. Coast Guard

**Annual Summer Ports,
 Waterways, Freight, and
 International Trade
 Conference**

Each year, TRB sponsors a summer conference on ports, waterways, freight, and international trade and transportation. The 27th Annual Conference was held in Pittsburgh, Pennsylvania, in June 2002; and the 28th Annual Conference was held in Portland, Oregon, in July 2003. Representatives attended from the port, waterway, offshore industry, ferry, and freight sectors. Topics and issues addressed at these conferences included

- Recent developments in port services and operations;
- Transportation infrastructure protection and border security;
- Coastal port, intercoastal, and inland waterway issues and corridor developments, including critical channel and infrastructure projects;
- Ferry developments, including passenger vessel security and terminal projects;
- Port and infrastructure financing, including examples of state financing programs and federal programs available for port and waterway-related projects;
- Trends and outlook for agricultural transportation, an important market for Gulf ports both in domestic and international trade;
- Transportation and environmental issues associated with the offshore industry and energy transportation;

- Military transportation needs and operations, across all modes and including security considerations; and
- Legislative and research updates on a range of topics and legislation.

Web Page

Presentations from the 2002 and 2003 summer conferences are available on the TRB website.

gulliver.trb.org/publications/mb/2002Ports/2002PORTS.pdf
gulliver.trb.org/publications/mb/2003Ports/2002PORTS.pdf

Committee on Oil in the Sea: Inputs, Fates, and Effects



Since the early 1970s, experts have recognized that petroleum pollutants were being discharged in marine waters worldwide from oil spills, vessel operations, and land-based sources. In 1985, the NRC published a comprehensive review of inputs, fates, and effects of petroleum in the marine environment from all known sources. However, in the last 18 years, the knowledge base, marine industry operational practices, and activities surrounding oil spills have all changed in major ways. Recognizing these changes and the considerable amount of oil discharged yearly into sensitive coastal environments, the Minerals Management Service (MMS) approached the National Academies in 2000 to undertake an update of the 1985 report. The resulting report was prepared by a committee under the auspices of the Ocean Studies Board and the Marine Board. It provides the best available estimate of oil pollutant discharge into marine waters and evaluates the methods for assessing petroleum load and the concerns these loads represent. Important research questions are identified, with recommendations for better analysis of and more effective measures against pollutant discharge.

Web Page

www4.nationalacademies.org/trb/homepage.nsf/web/current_reports

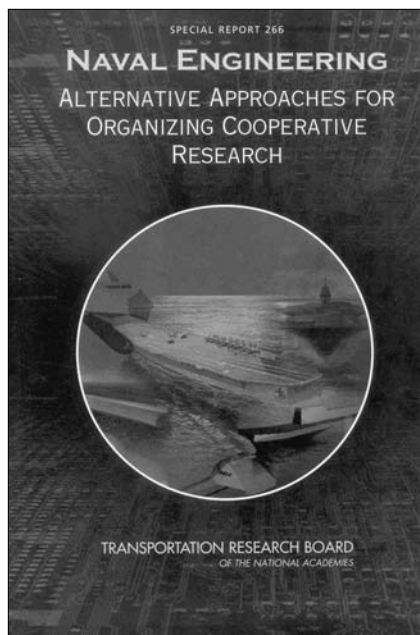
Publication

Oil in the Sea III: Inputs, Fates, and Effects, National Research Council, Washington D.C., 2003.

Committee

- James Coleman, *chair*, Louisiana State University
- Joel Baker, University of Maryland
- Cort Cooper, ChevronTexaco Exploration Petroleum Technology Co.
- Merv Fingas, Environment Canada
- George Hunt, University of California, Irvine
- Keith Kvenvolden, U.S. Geological Survey
- Keith Michel, Herbert Engineering Corp.
- Jacqueline Michel, Research Planning, Inc.
- Judith McDowell, Woods Hole Oceanographic Institution
- Jonathan Phinney, American Society of Limnology and Oceanography
- Robert Pond, U.S. Coast Guard
- Nancy Rabalais, Louisiana Universities Marine Consortium
- Larry Roesner, Colorado State University
- Robert B. Spies, Applied Marine Sciences and Biomark

Committee on Options for Naval Engineering Cooperative Research



At the request of the Office of Naval Research (ONR), the Marine Board convened a committee to investigate and evaluate alternative approaches for structuring cooperative research programs in naval engineering. ONR is concerned about the need for research products in “total ship design” and designers who are capable of designing complex warships according to this approach. In a fast-track study, the committee evaluated four approaches to structuring a cooperative research program. Each model was assessed for its ability to balance the perspective of stakeholders—the U.S. Navy, shipbuilding industry, and universities—in the development of a research agenda, the production of useful research, and the ability to attract students in the field.

Web Page

www4.nationalacademies.org/trb/homepage.nsf/web/current_reports

Publication

Special Report 266: Naval Engineering: Alternative Approaches for Organizing Cooperative Research. TRB, National Research Council, Washington, D.C., 2002.

Committee

Richard J. Seymour, *chair*, Scripps Institution of Oceanography

A. Bruce Bishop, Utah State University

John W. Boylston, Totem Ocean Trailer Express, Inc.

Roger H. Compton, Webb Institute

Peter A. Gale, John J. McMullen Associates

John B. Mooney, Jr., NAE, U.S. Navy (Retired)

J. Randolph Paulling, NAE, University of California, Berkeley

Irene C. Peden, NAE, University of Washington (Emerita)

Edwin J. Roland, Elmer-Roland Maritime Consultants

Malcolm L. Spaulding, University of Rhode Island

Richard W. Thorpe, Herbert Engineering Corp.

Liaisons

Albert J. Tucker, Office of Naval Research



Naval architects and students in laboratory at the Center for Innovation in Ship Design.

**Coastal (Short Sea)
Shipping Focus Session
(Spring 2003)**



ACTIVITIES PLANNED FOR 2003–2004

Short sea and coastal shipping is a U.S. national asset and can be valuable during U.S. national emergencies. As such, and within the existing framework of U.S. government facilitation and support concepts, it may be appropriate that these domestic services receive federal incentives.

The challenge is to relieve highway and rail congestion and the delivery delays it causes and accommodate the substantial volume growth indicated for the future, while providing timely pick-up and delivery service at a competitive price. The challenges of ocean shipping system market integration and ship operating include

- Establishing close business and operational relationships with trucking firms and shippers to increase their trucking throughput and profits at minimum investment cost to them;
- Implementing a relatively seamless single bill of lading interface with land-based distribution systems;
- Reliably meeting closely coupled schedules that match up to trucking, rail, and ocean containership roll-on and roll-off or barge connections; and
- Structuring and implementing a low-cost ship operating crew complement (special arrangements for coastal trade crewing) of 10 or 11.

Efficient short sea shipping could reduce the cost of transporting containers short distances from the main discharge port to the destination port and vice versa; attract heavy vehicles from major roads and highways, thus reducing congestion and improving fuel efficiency for all remaining vehicles; reduce the cost of road maintenance; delay the need for major road improvements; reduce air pollution by reducing truck traffic in exchange for lesser commensurate water-borne vessel pollution in less affected areas; economically uplift cities that allow or provide newly developed off-load and on-load terminals; improve highway safety; and improve port terminal efficiency.

A session at the Spring 2003 meeting of the Marine Board discussed such questions as

1. Would communities and governments provide for some type of incentives to encourage marine movements in exchange for the environmental or economic benefits of reduced road traffic?
2. Would shipboard and longshore maritime unions agree to lower-cost alternatives to create new business opportunities?
3. Can benefits be packaged so federal, state, and local governments find a way to support short sea movements?
4. What are current highway and rail system volumes and to what extent could they be aided to handle future growth?
5. What are the feasible types and sizes of vessels for short-sea and coastal services?

Web Page

Presentations made by the short-sea shipping panel at the 2003 Spring Meeting are available on the Marine Board website at www4.trb.org/trb/homepage.nsf/web/mbsm?OpenDocument

**Potential Impact of
Planned and Forecast
Liquefied Natural Gas
Activities in the Gulf of
Mexico on Continued
Outer Continental Shelf
Oil and Gas Development
Focus Session (Fall 2003)**



The MMS is responsible for promoting and regulating the safe development of outer continental shelf oil (OCS) and gas reserves. The Gulf of Mexico is the most important OCS source of domestic production and imports. Activity in the Gulf includes

- More than 4,000 shallow water platforms with an extensive pipeline infrastructure;
- A very active deepwater development program for exploration drilling in depths approaching nearly 10,000 ft; about 30 deepwater development systems (installed or being built) in depths approaching 7,000 ft; and a growing deepwater pipeline infrastructure to transport the oil and gas to the shallow water infrastructure or to shore;
- A new program to encourage the exploration and development of deep gas reserves from shallow water platforms;
- An extensive lightering program by which imported oil is transferred to very large crude carriers to shuttle tankers that can land at Gulf coast ports;
- An extensive network of refineries and chemical plants along the Gulf coast;
- An extensive infrastructure of onshore pipelines to transport oil, gas, and products inland throughout the United States; and
- Coastal transshipment of products.

There is considerable interest and activity in increasing the importation of natural gas, which would arrive in the Gulf as liquefied natural gas (LNG). This activity would result in additional offshore and onshore structures and facilities for offloading and storage and more ship traffic due to the large LNG carriers.

Additional LNG imports could affect the safety, pace, extent, and regulation of the development of future Gulf of Mexico offshore oil and gas reserves. Issues to consider include

- The potential for increased collisions and allisions in the outer continental shelf resulting from increased ship traffic and offshore facilities;
- Limitations or loss of the use of lease blocks due to the need for exclusion zones for additional facilities or fairways for LNG carriers;
- Capability of offshore pipeline infrastructure to handle gas from offshore LNG gasification;
- Impact of increased gas imports on the development of domestic reserves in the Gulf of Mexico and on MMS-generated revenues;
- Impact of increased gas imports on MMS programs to encourage the future development of domestic reserves in the Gulf of Mexico (e.g., royalty relief, deep gas); and
- Regulatory or policy needs.

The Focus Session, held October 30 during the Fall 2003 Marine Board meeting, provided information and input for defining the scope and needs for further study. The session included presentations on

- Gulf of Mexico oil and gas development (MMS)
- LNG development (oil and gas company)
 - Generic project
 - Business plan (gas reserves, market, distribution)
 - Facilities
 - Shipping
- Potential (perceived and real) shipping and marine-related hazards associated with LNG (USCG)
- LNG forecasts (Department of Energy)

MTS Research and Technology Coordination Conference

The biennial MTS Research and Technology Coordination Conference, sponsored by the Interagency Committee for the MTS, will be held at the NAS building in November 2004, and both the Marine Board and TRB standing committees will have input into the program. The conference will focus on recent and planned scientific and technical developments aimed at improving the safety, efficiency, or management of waterways, ports, inter-modal connections, or other aspects of the MTS. The 2004 event also will focus on cooperative research programs.

Marine Recreation and Tourism Roundtable

Tourism, including associated transportation and infrastructure, is the world's largest industry, much of it concentrated in coastal and marine areas. In the United States, coastal zones and waterways are heavily used for marine recreation and tourism, by both U.S. residents and foreign visitors. Together with commercial retail, hotel, and restaurant development in ports, marinas, and along coasts, these activities bring substantial social and economic value to the nation.



Tourism and recreation can be undermined by a degraded or poorly maintained environment. Tourism and recreation are affected by the transportation and other infrastructure that allows or precludes access and by the existence of public or private service. Increasingly, urban areas are encouraging and supporting development of their waterfronts and ports for expanded use for recreation and tourism, often creating conflicts with other more traditional commercial and industrial uses, such as shipping and commercial fishing, and potentially threatening the very environmental quality that attracts visitors.

Federal, state, and local agencies share responsibility for ensuring that marine and coastal recreation and tourism activities are conducted in a way that sustains long-term economic and environmental benefits for coastal and waterfront communities and the nation. Information and sound advice are needed to guide public management and governance of marine recreation and tourism and to lead to coordinated strategies to resolve conflicts and protect the environment.

The Marine Board convened a roundtable, in conjunction with its Spring 2002 meeting, to bring together representatives of federal and state agencies and stakeholder groups involved in marine recreation and tourism. The meeting identified key issues that require more investigation and generally agreed that dialogue should continue to engage a wider group of stakeholders throughout the country. The Marine Board took the results of this roundtable to develop a prospectus for a series of regional workshops.



ACTIVITIES IN DEVELOPMENT OR UNDER CONSIDERATION

Environmental Aspects of Shipping

Pollution or environmental degradation as a result of waterborne shipping has been the subject of several Marine Board and Ocean Studies Board reports, on such topics as oil spills, oil in the sea, vessel-generated waste disposal, and ballast water introduction of invasive species. More recently, air emissions from ships have become a subject of concern. All topics present opportunities for further refinement and collaboration between the Marine Board and other NRC units, using past study recommendations to highlight workable solutions that could be implemented if and when multi-agency jurisdictional issues are resolved. Depending on sponsors and other interest, the Board will consider possible seminar or workshop activities to continue the dialogue and seek solutions to key problems.

Great Lakes, Seaway, and Ballast Water Issues

The Great Lakes Protection Fund has requested TRB to examine commercial transportation options for the Great Lakes region, with particular attention on the intentional and unintentional introduction and spread of nonindigenous species to the Great Lakes Basin via the St. Lawrence Seaway. A Marine Board committee prepared a report in 1996, *Stemming the Tide: Controlling Introductions of Nonindigenous Species by Ships' Ballast Water*, and has a continuing interest in this topic. A provision in proposed legislation calls for an NAS study to (1) identify the relative risk of transfer of various taxonomic groups by different ship modes; (2) assess the extent to which a ballast water standard that virtually eliminates the risk of introduction of invasive species by ballast water may relate to the risk of introductions by all ship modes, and explain the degree of uncertainty in such an assessment; (3) recommend methods for reducing organism transfers by ships by addressing all parts and systems of ships and all related modes of transport of invasive species, and (4) identify the research, development, and demonstration needed to improve the base of information, including economic information, to support such methods,

Planning Group

Peter Finnerty, American Ocean Enterprises, Inc.

Martha Grabowski, Le Moyne College and Rensselaer Polytechnic Institute

Sally Ann Lentz, Ocean Advocates

Malcolm MacKinnon, III, NAE, MSCL, Inc.

Jerry Schubel, Aquarium of the Pacific

Air Emissions

The issue of air emissions from port operations and the trade-offs among pollution sources continues to gain greater attention, in relation to ships, waterside support operations, and landside transportation serving the ports. This could be a critical factor in short sea shipping operations. The Port of Long Beach, California, has taken steps to assist in retrofitting trucks to reduce truck emissions, and West Coast states have instituted air quality management districts in an effort to enforce and improve air quality conditions. Regulators need to be educated about the economic impact of regulations. New York State Energy Research and Development Authority has a demonstration program under way, with the involvement of the Maritime Administration and others, for hydrogen fuel cell research initiatives.

Planning Group

I. Bernard Jacobson, IBJ Associates
 Geraldine Knatz, Port of Long Beach, California
 Sally Ann Lentz, Ocean Advocates
 Reginald McKamie, Sr., Esq., Houston, Texas
 Robert North, North Star Maritime, Inc.
 Richard Vortmann, National Steel and Shipbuilding, Inc.

Liaison

Tom Wakeman, *chair*, TRB Marine Environmental Task Force

Offshore Wind Energy Development

The Marine Board has an ongoing interest in the technical and policy issues related to development of offshore wind energy. Along with sponsors and the maritime community, it has followed trends in this emerging technology. Wind turbines generate substantial amounts of electricity in many European countries, and the practice is growing in the United States. Offshore wind farms are operating or have been proposed in the Baltic Sea, the North Sea, offshore Australia, and along the U.S. East Coast. Proposals for wind farms have been announced for waters off Cape Cod, Massachusetts; Maryland; and Virginia. Proponents stress the benefits of renewable energy systems, while opponents stress the need to regulate the use of public resources on public lands.

Several Marine Board sponsors have an interest in offshore wind farms, including the MMS, which may have responsibilities similar to that related to offshore oil and gas development; the USCG, which has offshore navigation and safety missions; and the USACE, which has permitting and related missions. The Marine Board has also discussed this issue with other NAS and NRC boards, including the Board on Energy and Environment, which has been following this issue with congressional committees and some of their sponsors, including the Department of Energy. The prospect of expanded wind energy extraction offshore also highlights technical issues such as safety and reliability of these machines at sea, conflicts with shipping and other ocean uses, and environmental concerns.

The Marine Board will continue to be informed about offshore wind farm developments and consider the possibility of sponsoring meeting sessions, seminars, or workshops when they may be useful and productive.

The Marine Transportation System: Research and Education Needs

In addition to dealing with the lag in physical infrastructure investment for the MTS, the U.S. maritime sector also faces a critical shortage in human resources, particularly for the next-generation workforce in the traditional maritime industries. Recent Marine Board studies on coastal engineering and naval engineering research and education illustrate the necessity for cooperative efforts that take advantage of the opportunities offered by major research facilities and educational capabilities. The Board will continue to investigate this topic and explore whether a special seminar, workshop, or other activity could bring needed attention to these problems.

Dredging



The deepening and maintenance of navigation channels are necessary to maritime commerce. The Marine Board has been studying many aspects of dredging, including the management and potential reuse of contaminated dredged material and the application of environmental windows that limit construction periods as a way to minimize environmental impacts. A recent report of the Marine Board and Ocean Studies Board, *A Process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects*, provides valuable insights on these issues and a template for resolving controversies involving multiple-agency jurisdictions. The Board will consider how best to field-test this process through sponsoring seminars or other activity.

Beach Replenishment

The Marine Board conducted a multidisciplinary assessment of the engineering, environmental, economic, and public policy aspects of beach nourishment. This effort provided an improved technical basis for judging the use of beach nourishment and protection technology in shoreline stabilization, erosion control, recreational beach creation, dredged material placement, construction of coastal storm barriers, and protection of natural resources. Among other findings, the study found that an up-to-date design methodology and certain technical improvements are needed to advance the state-of-the-art practices in design, construction, and maintenance of shoreline improvement projects. The Board may consider future activity to bring the results of its past work to the attention of policy makers and planners, especially in the context of a national shoreline study under consideration by federal agencies.

Shipbuilding

While fulfilling military needs, the U.S. shipbuilding sector and support industries face considerable uncertainty about their ability to meet commercial objectives. U.S. shipyards have been striving to improve efficiency, and commercial shipyard annual revenues are in the billions of dollars. However, it is recognized that the yards continue to fall behind their international competitors in their ability to build large ships in a cost-effective and timely manner. These inefficiencies extend to both commercial and naval construction. A 1996 Marine Board report on shipbuilding technology identified ways to enhance the technology base and called for a comprehensive assessment of the shipbuilding industry. The Board may consider this topic a useful focus for future seminar or workshops.

Topics of Other Potential Future Activities



- Port and waterway security issues
- Marine transport of hazardous materials
- Pipelines in marine environments
- Future human resource needs of the USCG and maritime industries
- Risk-based decision making
- Ferry safety and operations
- Environmental and economic status of the nation's shoreline
- Ship and bridge collisions



The Marine Board members and sponsor liaisons aboard MV *Sam Houston* during the Fall 2002 meeting, Houston, Texas (*left to right*): Alex Landsburg, Larry Daggett, Paul Fischbeck, Ronald Kiss, Craig Philip, Rodney Gregory, Richard Vortmann, Marine Board Vice Chair Geraldine Knatz, Emmett "Skip" Ward, Admiral Robert North, Martha Grabowski, David Wisch, Reginald McKamie, Peter Bontadelli, Kathleen Dunn, Sally Ann Lentz, Marine Board Chair R. Keith Michel, Jeffrey High, Admiral Malcolm MacKinnon, I. Bernard Jacobson, Edwin Roland, TRB Executive Director Robert Skinner, and Peter Finnerty.

MEETINGS OF THE MARINE BOARD

- The Fall 2002 Meeting of the Marine Board was held in Houston, Texas, on November 19–20, 2002, in conjunction with the Global Forum on Marine Transportation on Energy.
- The Spring 2003 Meeting of the Marine Board was held at the NAS Keck Center in Washington, D.C., on May 19–21, 2003.
- The Fall 2003 Meeting of the Marine Board will be hosted by the Port Authority of New York and New Jersey and will be held in New York City on October 30–31, 2003.
- The Spring 2004 Meeting of the Marine Board will be held in San Diego, California.
- The Fall 2004 Meeting of the Marine Board will be held in Washington, D.C., in conjunction with the MTS Research and Technology Coordination Conference in November 2004.



MARINE BOARD MEMBERS BIOGRAPHICAL INFORMATION

R. Keith Michel (*Chair*) is president of Herbert Engineering Corporation. In his 30 years with the company, he has worked on design, specification development, and contract negotiations for containerships, bulk carriers, and tankers. Mr. Michel has served on industry advisory groups for developing guidelines for alternative tanker designs, including groups advising the International Maritime Organization and the USCG. His work has included development of methodology, vessel models, and oil outflow analysis. He was a project engineer for the USCG report on oil outflow analysis for double-hull and hybrid tanker arrangements, which was part of the U.S. Department of Transportation's technical report to Congress on the Oil Pollution Act of 1990. He has also worked on development of salvage software used by the U.S. and Canadian Coast Guards, the U.S. Navy, the National Transportation Safety Board, the Maritime Administration, the American Bureau of Shipping, Lloyd's, and numerous oil and shipping companies. Mr. Michel holds a B.S. in naval architecture and marine engineering from the Webb Institute of Naval Architecture.

Geraldine Knatz (*Vice Chair*) is managing director of development for the Port of Long Beach, California, where she is responsible for the expansion of the nation's busiest seaport. Appointed to her current position in March 1999 after 11 years as planning director, she oversees the port's engineering, properties, and planning divisions. Dr. Knatz directed the port's reuse planning for the former Long Beach naval complex and has been involved in the Alameda Corridor rail improvement project since its inception in the early 1980s. She is active in the American Association of Port Authorities and chairs its Harbor and Navigation Committee, which deals with dredging and environmental issues. In 1997, she was named to represent the International Association of Ports and Harbors on the international treaty body, The London Convention, which regulates international ocean dumping practices. In 1994, she was appointed to the National Sea Grant Panel, which directs certification and funding of Sea Grant Colleges. Dr. Knatz received a Ph.D. in biological sciences and an M.S.E. in environmental engineering from the University of Southern California. She teaches in the University of Southern California Civil Engineering Department.

Larry L. Daggett is engineer and principal with Waterway Simulation Technology, Inc., a private engineering consulting company specializing in navigation studies involving port, harbor, and channel design, systems

behavior, ship and tow maneuvering simulations, prototype measurements of ship and tow behavior, and hydrodynamic modeling. Dr. Daggett retired from the USACE in 1997, after serving as chief of the Navigation Division at the Waterways Experiment Station in Vicksburg, Mississippi. His work there included development of a numerical ship and tow simulator, application of ship and tow simulators to navigation channel project designs and operational problems of projects, application of scale physical models using remote controlled vessels to navigation channel project designs, and implementation and application of waterway system modeling, including the Waterway Analysis Model and Tow Capacity Model. Dr. Daggett is the chairman of the Inland Waterway Committee of the International Navigation Association, serves on the TRB Ports and Channels Committee, and was for 6 years chair of TRB's Inland Water Transport Committee. He holds a B.S. in civil engineering from Kansas State University and an M.S.E. and Ph.D. in engineering from Arizona State University.

Peter J. Finnerty has spent most of his professional career in commercial shipping. He is president of American Ocean Enterprises, Inc., and was vice-president of Sea-Land Service, Inc. He has worked on and contributed to major U.S. maritime and policy legislation over the past 3 decades and has served in leadership positions with professional organizations, including the U.S. Coast Guard Foundation, the Propeller Club of the United States, the Navy League, the Naval War College Foundation, and the American Maritime Congress. He is a graduate of the State University of New York Maritime College, holds a Third Mate USCG license, and was a Lieutenant (JG) in the U.S. Navy Reserves. He earned an M.B.A. from the Wharton School at the University of Pennsylvania and a J.D. from the Georgetown University Law Center.

Paul S. Fischbeck is director, Center for the Study and Improvement of Regulation, and associate professor of engineering and public policy and social and decision sciences at Carnegie Mellon University. With his work widely published, Dr. Fischbeck has served on national research committees and review panels, including the TRB Committee on School Transportation Safety, the National Science Foundation's Decision, Risk, and Management Sciences Proposal Review Committee and Small Business Innovative Research Proposal Review Committee, the TRB Marine Board Committee for Evaluating Double Hull Tanker Design Alternatives, and the Marine Board Committee on Risk Assessment

and Management of Marine Systems. He is involved with professional research organizations that include the American Society for Engineering Education, the Institute for Operations Research and Management Sciences, the Military Operations Research Society, and the Society of Risk Analysis. He holds a B.S. in architecture from the University of Virginia, an M.S. in operations research and management science from the U.S. Naval Postgraduate School, and a Ph.D. in industrial engineering and engineering management from Stanford University.

Martha R. Grabowski is director of the Information Systems Program and the Joseph C. George Endowed Professor at Le Moyne College. She is also a research professor at Rensselaer Polytechnic Institute, where she earned a Ph.D. in management and information systems, an M.S. in industrial and management engineering, and an M.B.A. in management information systems. She earned a B.S. in nautical science and marine transportation from the U.S. Merchant Marine Academy at Kings Point, New York. She holds a U.S. Coast Guard Merchant Marine license (Second Mate, Unlimited Tonnage, Any Oceans, Radar Observer) and retired as a Lieutenant Commander in the U.S. Naval Reserve. Her teaching and research interests cover management information systems, expert systems, decision support systems, telecommunications and networking, organizational impact of information technology, human and organizational error, safety of large-scale systems, and use of information systems for competitive advantage. Dr. Grabowski has previously served on the Marine Board and on Marine Board study committees.

Rodney Gregory is principal consultant with IBM Global Services in Washington, D.C. He has more than 20 years of experience in the transportation and logistics industry as a professional mariner, consultant, and corporate officer with an ocean carrier. His experience includes operations management, contract administration, strategic planning, human resources, regulatory compliance, labor negotiations, risk management, and quality assurance. He has managed several transportation services contracts with the Military Sealift Command and Military Traffic Management Command and served as a charter member of the Department of Defense Joint Planning Advisory Group. He was vice president of operations for the international shipping company Red River Shipping Corporation. He was assistant professor of financial management and international business at the U.S. Merchant Marine Academy and is a certified Master Mariner in the U.S. Merchant Service. He holds a B.S. in marine transportation from the U.S. Merchant Marine Academy and an M.B.A. from the Wharton School of Business, Uni-

versity of Pennsylvania. He is a member of the Marine Board Executive Committee.

I. Bernard Jacobson is the founder of IBJ Associates, LLC, a management consulting firm that specializes in passenger vessels. He recently retired after serving as general manager and CEO of North Ferry Co., Inc., in Long Island, New York. Before joining North Ferry Co., he was an industry consultant on projects involving vessel services, financing, maritime support services, demand forecasting, domestic barge operations, and economic impact assessments. He has also worked in the USCG Office of Marine Environment and Systems, Office of Operations, and Office of the U.S. Assistant Secretary of Transportation for Policy, Plans, and International Affairs. He was an assistant professor of Operations Research and Economics at the USCG Academy and has been a visiting professor and lecturer at the Maine Maritime Academy and the Massachusetts Institute of Technology. Mr. Jacobson holds a USCG master's license for near coastal vessels up to 100 tons with an endorsement for commercial towing. He also holds a B.S. in engineering from the USCG Academy and an M.S. in management from the U.S. Naval Postgraduate School.

Ronald K. Kiss is president of Webb Institute, a private four-year college providing men and women the opportunity to earn a B.S. in naval architecture and marine engineering. Before joining the Webb Institute, he was vice president of SYNTEK, assisting the Arsenal Ship Program, the Joint Navy and Defense Advanced Research Projects Agency aircraft carrier and surface combatant program. From 1990 to 1996, he served as Deputy Assistant Secretary of the Navy for Ship Programs in the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition), and from 1986 to 1990, he was director of ship programs in the Office of the Assistant Secretary of the Navy (Shipbuilding and Logistics). He served with the Naval Sea Systems Command as Executive Director, Amphibious, Auxiliary, Mine and Sealift Directorate; as Acting Deputy Ship Acquisition Program Manager; and as Assistant Deputy Commander for Surface Ship Acquisition. He spent nearly 20 years with the Maritime Administration, including as acting associate administrator for shipbuilding and ship operations. Before that he served as director, Office of Ship Construction; chief, Division of Ship Design; and chief, Preliminary Design Branch. Mr. Kiss is a member of numerous professional organizations and a recipient of various awards and honors. He holds a B.S. in naval architecture and marine engineering from Webb Institute and an M.S. in naval architecture from the University of California at Berkeley and has participated in postgraduate programs at Harvard University and the Massachusetts Institute of Technology.

Sally Ann Lentz is the executive director and general counsel of Ocean Advocates, Clarksville, Maryland, a national, nonprofit environmental organization dedicated to the protection of the marine environment. She represents environmental interests in national and international forums on ocean dumping, vessel source pollution, and other marine public policy issues. She has served as advisor to U.S. delegations to the International Maritime Organization. She develops and coordinates policy positions for coalitions of domestic and international environmental organizations on shipping, coastal, and marine issues. She represents these organizations at international conventions related to oil pollution from tanker accidents. Her previous positions include staff attorney for Friends of the Earth and the Oceanic Society, as well as private practice. She has a postgraduate degree in European integration from the University of Amsterdam, a J.D. from the University of Maryland, and a B.A. from Oberlin College. She is a member of the District of Columbia and Maryland bars. She has published extensively in professional and legal journals on marine and ocean environmental protection issues.

Philip Li-Fan Liu is professor of civil and environmental engineering at Cornell University. In addition to his teaching and research at Cornell, he has been a visiting professor at the National University of Singapore, National Taiwan University, Osaka City University of Japan, and Technical University of Denmark, and a visiting scientist at the Delft Hydraulics Laboratory of the Netherlands. He has consulted on projects involving harbor design and planning, flood and channel erosion, breakwater design, and groundwater and river flow. Dr. Liu has published extensively, including studies conducted under sponsored research grants from the National Science Foundation, the New York Sea Grant Institute, and the Environmental Research Center. He holds a B.S. in civil engineering from National Taiwan University and earned an S.M. in civil engineering and an ScD. in hydrodynamics from the Massachusetts Institute of Technology.

Rear Admiral Malcolm MacKinnon, III, (USN, Ret.), NAE, is a managing member of MSCL LLC, a firm that specializes in ship design and acquisition, salvage, technology insertion, and shipyard management. Admiral MacKinnon held executive and command positions with the U.S. Navy from 1955 until his retirement in 1990, including Deputy Commander of Ship Design and Engineering, Chief Engineer of the Navy, and Vice Commander, Naval Sea Systems Command. He was project officer for the design and construction of Sea-LabII, an underwater habitat, and directed the conceptual design efforts for the TRIDENT and SSN 688

classes of nuclear submarines. He is active in the Society of Naval Architects and Marine Engineers and the American Society of Naval Engineers. Admiral MacKinnon received a B.S. in naval science from the U.S. Naval Academy and an M.S. in naval architecture and marine engineering from the Massachusetts Institute of Technology. He is a Member of the National Academy of Engineering and has served on several NRC Committees, including the Marine Board Committee to Review NOAA's Fleet Replacement and Modernization Plan and on the Committee on Marine Transportation of Heavy Oils. Admiral MacKinnon is a member of the Marine Board Executive Committee.

Reginald E. McKamie, Sr., is a practicing maritime attorney in Houston, Texas, and certified public accountant. He received a B.S. from the U.S. Merchant Marine Academy at Kings Point, New York, in 1975; an M.B.A. from the University of Southern California in 1976; and a J.D. from the University of Houston in 1986, where he was a member of the Phi Delta Phi legal fraternity. He served as lead counsel for the Port of Houston Authority in a case involving a major maritime casualty and oil spill in Galveston Bay, which was considered by the court a case of first impression for the Fifth Circuit and is reported in *American Maritime Cases*. After graduation from University of Southern California, he accepted a position as an able-bodied seaman aboard an ocean-going vessel. While pursuing a seagoing career, he also worked with the accounting firm of Cook & Robinson, CPA. In 1981, Mr. McKamie earned his license as an unlimited master mariner and as a certified public accountant. He also worked for Exxon Shipping Company, where he held the positions of assistant fleet manning supervisor and senior financial specialist. He returned to sea in 1986 and served as captain of the S/S Exxon North Slope, S/S Exxon Philadelphia, and the S/S Exxon Benicia. He is a member of the American, Texas, and Houston Bar Associations and the Texas and Houston chapters of the Texas Society of Certified Public Accountants.

Rear Admiral Robert C. North (USCG, Ret.) is president of North Star Maritime, Inc., specializing in marine industry consulting in merchant marine safety, port safety and security, waterways management, merchant marine personnel qualifications and training, and marine environmental protection regulation. He served for 34 years as a commissioned officer in the USCG. His career culminated with service as the Coast Guard's Assistant Commandant for Marine Safety and Environmental Protection, where he directed national and international programs for commercial vessel safety, merchant mariner licensing and documentation, port safety and security, and waterways management. He led the effort of 14 federal agencies and public and private

sector stakeholders to develop the concept of the MTS, a project aimed at ensuring that U.S. ports, waterways, and intermodal connections are able to support anticipated increased levels of maritime trade in the coming years in a safe, secure, and environmentally sound manner. He also directed the creation of Qualship 21, a unique safety and environmental protection quality incentives program for foreign vessels calling in U.S. ports. He managed development of the Marine Information for Safety and Law Enforcement project to consolidate USCG commercial vessel databases for merchant marine safety and maritime law enforcement programs. Admiral North is a graduate of the State University of New York Maritime College with a degree in marine engineering and is a graduate of the U.S. Army War College of the National Defense University.

Craig E. Philip is president and CEO of Ingram Barge Company, a major inland waterway carrier headquartered in Nashville, Tennessee. Ingram Barge is part of Ingram Industries, the third largest marine transportation company in the United States, with associated sand and aggregate production companies, insurance, oil well equipment manufacturing, and distribution businesses. Before this, he was vice president (intermodal) for the Southern Pacific Transportation Company. Dr. Philip serves on the board of directors of the American Waterways Operators, Inc., and is vice chairman of the National Waterways Conference, Inc. He has taught at Princeton and Vanderbilt universities. He has an M.S.E. and Ph.D. in engineering and management from the Massachusetts Institute of Technology and an undergraduate degree in civil engineering from Princeton University. Dr. Philip served on the committee for a Marine Board study on vessel traffic systems and as a member of the TRB Executive Committee.

Edwin J. Roland is former president of Bona Shipping, Inc., a tanker operating company in Houston. He has extensive experience in the oil transportation business, having previously served as vice president of operations, planning, and transportation for Amoco Oil Company; president of Amoco Transport Company; and vice president of Holland America Line, the Coastal Corporation, and the Conoco Shipping Company. He served 11 years in the USCG. He is a member of the American Bureau of Shipping, Lloyd's American Committee, Webb Institute Board of Trustees, and boards of the U.S. Chamber of Shipping and Liberian Shipowners' Council. He has a B.S. from the USCG Academy, an M.S. degree in nuclear engineering and naval architecture from the University of Michigan, and an M.B.A. from Iona College. He served on the Marine Board Committee for the Oil Spill Risks from Tank Vessel Lightering study. He is currently a principal in ERMIC, Inc., a maritime consulting practice in Houston, Texas.

Jerry R. Schubel is president and CEO of the Aquarium of the Pacific in Long Beach, California. He is also a visiting professor of biology and environmental studies at Washington College in Maryland. Previously, he was president and CEO of the New England Aquarium for 6 years and before that spent 20 years at the State University of New York at Stony Brook, including serving as dean and director of the Marine Sciences Center. Dr. Schubel has served on NRC committees and most recently chaired the TRB Marine Board committee to formulate a process for setting, managing, and monitoring environmental windows for dredging projects. He has also served on the Marine Board, of which he was chair in the early 1990s. Dr. Schubel has a B.S. in physics and mathematics from Alma College in Michigan, an M.A.T. from Harvard University, a Ph.D. in oceanography from The Johns Hopkins University, and an honorary D.Sc. from the Massachusetts Maritime Academy.

Richard H. Vortmann is vice president of General Dynamics and president of National Steel and Shipbuilding Company (NASSCO). He began his career in 1969, serving in financial management and strategic planning positions with Kaiser Industries Corporation, then part owner of NASSCO. He joined NASSCO in 1976 as vice president of finance and information systems and later served as the shipyard's vice president of production before becoming executive vice president of operations in 1980. He is chairman of the board of the American Shipbuilding Association, a council member of the America Bureau of Shipping, and chairman of the American delegation to the annual Japanese, European, Korean, United States Shipbuilding Conference. He has previously served as chairman of the Shipbuilders Council of America. He earned a B.A. in finance and an M.B.A. from the University of California at Berkeley, where he also served for 3 years on the Business School faculty.

Emmett G. "Skip" Ward joined the Offshore Technology Research Center (OTRC) at Texas A&M University following his retirement from Shell Oil Company in 1998. As associate director of the OTRC, he is responsible for planning and coordinating the research program to meet the needs of the industry and MMS and serves as the key interface between the OTRC and these groups. Dr. Ward had 30 years of experience with Shell in the development, application, and management of technology for deepwater offshore structures. He is also familiar with deepwater development projects and trends, drilling, construction, pipelines, subsea well systems, and operations. He has served on numerous technical committees of the American Petroleum Institute and has been active in the Institute's activities to develop and maintain recommended practices for the

offshore industry. Dr. Ward received a Ph.D. and an M.S. in mechanical engineering from the University of Houston.

David J. Wisch of ChevronTexaco is ChevronTexaco Fellow with the Drilling and Production Systems Unit, Energy Technology Company, Houston, Texas. Focusing on structural and marine systems, he is actively involved in deepwater technology development and deployment and in the design of challenging marine facilities. He recently led the structural design of the world's tallest self-supporting structure—more than 2,000 feet high,

in 1,754 feet of water. He is active in the American Petroleum Institute's Standardization program, serving in several leadership positions for offshore structures and on the Executive Committee for Standardization. He is also active in the International Organizations for Standardization (ISO) as head of the U.S. delegation to the Subcommittee for Offshore Structures and as Convenor and Project Lead for ISO 19901: Fixed Steel Structures. He holds B.S. and M.S. degrees in civil engineering from the University of Missouri–Rolla and pursued postgraduate studies in the doctoral program at Tulane University.



Special Report 273: Shipboard Automatic Identification System Displays: Meeting the Needs of Mariners
Marine Board Committee for Shipboard Display of AIS, National Research Council, 2003.

The USCG is engaged in a rulemaking process that would require vessels to carry AIS information while operating in certain U.S. waterways. Installation of AIS on some classes of vessels will become mandatory in accordance with Safety of Life at Sea conventions and U.S. domestic regulations. These requirements specify that a vessel be able to receive, transmit, and display AIS information but are silent on what constitutes a proper display. This study examined technical aspects and human factors of shipboard display of AIS information and identified the most significant factors to consider when specifying a shipboard display system for vessels that are required to carry AIS under federal regulations. The committee assessed the state of the art in AIS display technologies; evaluated current system designs, their capabilities and limitations; and reviewed the relevant human factors associated with operating these systems.

Available through the TRB Publications Office.

Oil in the Sea III: Inputs, Fates, and Effects

Committee on Oil in the Sea: Inputs, Fates, and Effects, National Research Council, 2003.

This report provides the best available estimate of oil pollutant discharge into marine waters and evaluates methods for assessing petroleum load and discusses the concerns these loads raise. Featuring close-ups of the Exxon Valdez spill and other notable events, the book identifies important questions for research on, better analysis of, and more effective measures against pollutant discharge. The book discusses (1) input—where the discharges come from, including the role of two-stroke engines used on recreational craft; (2) behavior or fate—how oil is affected by processes such as evaporation as it moves through the marine environment; and (3) effects—what is known about the effects of petroleum hydrocarbons on marine organisms and ecosystems.

Available through the National Academies.

Special Report 266: Naval Engineering: Alternative Approaches for Organizing Cooperative Research
Marine Board Committee on Options for Naval Engineering Cooperative Research, National Research Council, 2002.

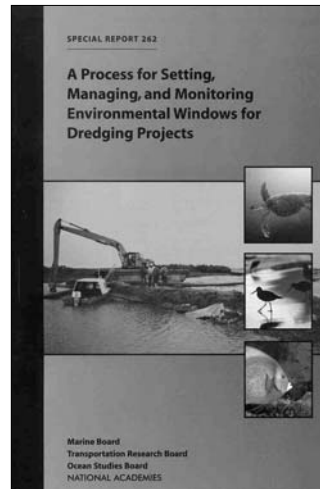
This report identified options for the ONR in structuring research programs in naval engineering that would provide a venue for stakeholders—government, industry, and academia—to collaborate, cooperate, and guide research and development of naval and maritime technology. These programs could assist the Navy in

maintaining and developing the human capital in naval engineering required for meeting future national defense needs.

Available through the TRB Publications Office.

Special Report 262: A Process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects

Marine Board Committee on Environmental Windows for Dredging Projects, National Research Council, 2001.



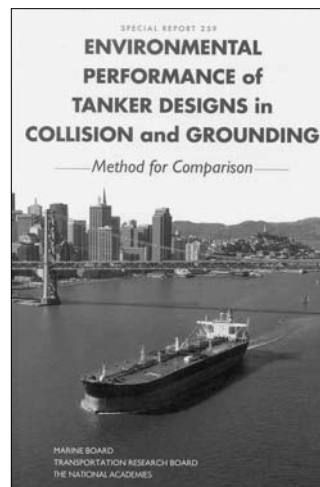
The deepening and maintenance of navigation channels is necessary to maritime commerce. The Marine Board has been involved in many aspects of dredging, including the management and potential reuse of contaminated dredged material and the application of environmental windows that limit construction periods in an effort to minimize environmental impacts. This

report offers valuable insights to these issues, along with a template for resolving controversies involving multiple-agency jurisdictions.

Available through the TRB Publications Office.

Special Report 259: Environmental Performance of Tanker Designs in Collision and Grounding: Method for Comparison

Marine Board Committee for Evaluating Double-Hull Tanker Design Alternatives, National Research Council, 2001.



Congress requested that an NRC study be undertaken to determine if a methodology could be established to measure the equivalency of alternatives to double-hull designs, notwithstanding the current interpretation of law. Combining the expertise of committee members with a review of risk analysis in other fields, the committee developed a risk-based methodology that

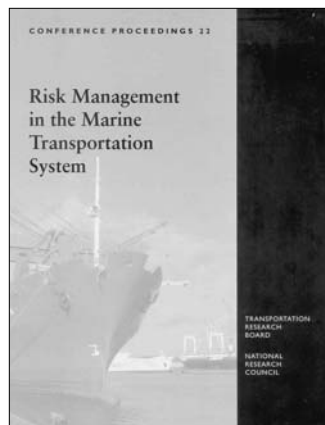
takes the environmental consequences following a spill as a means of comparing the performance of proposed alternatives against similar environmental consequences from a standardized double-hull vessel, for each of the comparable sizes. The methodology developed by the committee is divided into three main components: (1) structural damage and oil outflow calculation, (2) consequence assessment, and (3) design comparison. The committee then applied the proposed methodology to double-hull tankers and alternative designs to demonstrate whether or not it could be a tool for assessment. The committee's charge also included provisions to refine and adjust existing tanker damage extent functions for measuring crash-worthiness of tank vessel structures and to develop a generalized oil spill cost database for calculation of an environmental index.

Available through the TRB Publications Office.

Conference Proceedings 22: Symposium on the Application of Risk Management in the Marine Transportation System

Transportation Research Board, National Research Council, 2000.

With support from the USCG and the California Department of Fish and Game, the Marine Board hosted a symposium in March 1999 on the application of risk management in the marine transportation system. The symposium brought together risk assessment experts, port representatives, and marine transportation managers to examine ways to integrate risk assessment methodologies into the practical world of waterways management, given current data limitations. The proceedings include an overview, presentations and resource papers given at the conference, and synopses of discussion sessions.



Available through the TRB Publications Office.

Spills of Nonfloating Oils: Risk and Response

Marine Board Committee on Marine Transportation of Heavy Oils, National Research Council, 1999.

In the Coast Guard Authorization Act of 1996, Congress directed the USCG to assess the risk of spills for oils that may sink or be negatively buoyant, to evaluate cleanup technologies, and to identify and appraise technological and financial barriers to a prompt response to such spills. At the request of the USCG, the

Marine Board Committee on Marine Transportation of Heavy Oils was established to conduct the study. From the findings and conclusions presented in the report, the committee outlined recommendations intended to improve the capability to respond to spills of nonfloating oils, including development of appropriate response plans; development and implementation of methods for tracking, containing, and recovering nonfloating oil spills; testing of area contingency plans; industry response plans; and monitoring of spill rates from tank.

Available through the National Academy Press in paperback, \$18.00.

Meeting Research and Education Needs in Coastal Engineering

Marine Board Committee on Coastal Engineering Research and Education Needs, National Research Council, 1999.

Following discussions with USACE, NOAA, the U.S. Geological Survey, and ONR, an expert committee was convened to examine national needs in coastal engineering research and education and assess the adequacy and effectiveness of institutions in meeting those needs. The committee reviewed relevant reports, was briefed on federal and private sector activities related to coastal engineering research and education, and solicited information from expert researchers and practitioners from government, industry, and public interest groups. The committee found that while coastal engineering is important to the vitality of the nation's shorelines and ports, a lack of funding has limited the academic research, affected the availability and quality of laboratory facilities, and adversely affected academic programs that train new professionals in this field. To ensure that national needs in this important area are met, the report offers recommendations for maintaining a healthy and vigorous program in coastal engineering education and research.

Available through the National Academy Press, print on demand, \$23.00.

Applying Advanced Information Systems to Ports and Waterways Management

Marine Board Committee on Maritime Advanced Information Systems, National Research Council.

The safety of maritime transportation in the United States depends heavily on the quality of port and waterways information systems. In this report, the Committee on Maritime Advanced Information System concentrates on maritime information systems that promote safety and outlines a strategy for overcoming the major barriers to and deficiencies in producing a minimum level of maritime safety information nationwide. The report accomplished three major tasks: (1) it

identifies ways in which advanced maritime information systems could ameliorate current shortfalls and maintain or improve environmental protection and waterway safety; (2) it describes how those systems could minimize the costs and problems of adapting to changes in transportation and contribute to maintaining the nation's competitive position; and (3) it provides a vision of how advanced information management systems can enhance vessel safety and waterway efficiency.

Available through the National Academy Press, print on demand, \$23.00.

TRB Conference Proceedings 19: National Symposium on Contaminated Sediments: Coupling Risk Reduction with Sustainable Management and Reuse
Transportation Research Board, National Research Council, 1999.

At the request of the Marine Board, the TRB organized and hosted a symposium to evaluate the state of practice in the management and remediation of contaminated marine sediments in the United States and make recommendations for future action. This proceedings highlight stakeholder responses to and comments on a 1997 Marine Board report, *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies* (see separate listing below). The doc-

ument summarizes case studies, roundtable discussions, and workshops on remediation technologies, project implementation, and decision making.

Available through the TRB Publications Office.

Oil Spill Risks from Tank Vessel Lightering

Marine Board Committee on Oil Spill Risks from Tank Vessel Lightering, National Research Council, 1998.

Lightering safety became a topic of national interest in recent years because of public concerns about oil spills. The Coast Guard Authorization Act of 1996 required that USCG coordinate with the Marine Board to study the risks of oil spills from lightering off the U.S. coasts. The Marine Board committee evaluated current lightering practices and trends, analyzed the safety record, assessed the regulatory and standards-setting framework, analyzed accident and risk reduction measures, and recommended technical and institutional improvements. The report identifies major gaps in the availability, appropriateness, and accuracy of information available for examining lightering operations and sets forth recommendations for shipping companies and organizations and USCG and other federal agencies.

Available through the National Academy Press, in paperback, \$44.00.



2003

- *Shipboard Automatic Identification System Displays: Meeting the Needs of Mariners*

2002

- *Oil in the Sea III: Inputs, Fates, and Effects*
- *Naval Engineering: Alternative Approaches for Organizing Cooperative Research*

2001

- *A Process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects*
- *Environmental Performance of Tanker Designs in Collision and Grounding: Method for Comparison*

2000

- *Conference Proceedings 22: Symposium on the Application of Risk Management in the Marine Transportation System*

1999

- *Spills of Nonfloating Oils: Risk and Response*
- *Meeting Research and Education Needs in Coastal Engineering*
- *Applying Advanced Information Systems to Ports and Waterways Management*
- *Conference Proceedings 19: National Symposium on Contaminated Sediments: Coupling Risk Reduction with Sustainable Management and Reuse*

1998

- *Oil Spill Risks from Tank Vessel Lightering*
- *Review of the Prince William Sound, Alaska, Risk Assessment Study*
- *Double-Hull Tanker Legislation: An Assessment of the Oil Pollution Act of 1990*

1997

- *Review of the Methodology Employed by the U.S. Army Corps of Engineers to Assess Benefits of the Civil Works R&D Program (Phase 2 Report)*
- *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies*

- *Advancing the Principles of the Prevention Through People Program*
- *Striking a Balance: Improving Stewardship of Marine Areas*

1996

- *An Assessment of Techniques for Removing Offshore Structures*
- *Simulated Voyages: Using Simulation Technology to Train and License Mariners*
- *Shipbuilding Technology and Education*
- *Stemming the Tide: Controlling Introductions of Nonindigenous Species by Ships' Ballast Water*
- *Technical Issues in NOAA's Nautical Chart Program*
- *Undersea Vehicles and National Needs*

1995

- *Beach Nourishment and Protection*
- *Clean Ships, Clean Ports, Clean Oceans: Controlling Garbage and Plastic Wastes at Sea*

1994

- *Charting a Course into the Digital Era: Guidance for NOAA's Nautical Charting Mission*
- *Improving the Safety of Marine Pipelines*
- *Minding the Helm: Marine Navigation and Piloting*
- *Purposeful Jettison of Petroleum Cargo*
- *A Reassessment of the Marine Salvage Posture of the United States*
- *Restoring and Protecting Marine Habitat: The Role of Engineering and Technology*
- *Review of NOAA's Fleet Replacement and Modernization Plan*

1993

- *Review of the Interagency Oil Pollution Research and Technology Plan*

1992

- *Marine Aquaculture: Opportunities for Growth*
- *Shiphandling Simulation: Application to Waterway Design*
- *Working Together in the EEZ*

* This list includes publications issued since 1970 by the Marine Board and its predecessor organizations, the Maritime Transportation Research Board and the Committee on Ocean Engineering.

1991

- *Assuring the Safety of Innovative Marine Structures*
- *Fishing Vessel Safety: Blueprint for a National Program*
- *Tanker Spills: Prevention by Design*

1990

- *Crew Size and Maritime Safety*
- *Managing Coastal Erosion (with the Water Science and Technology Board)*
- *Managing Troubled Waters: The Role of Marine Environmental Monitoring*
- *Monitoring Southern California's Coastal Waters*
- *Safety of Tourist Submersibles*

1989

- *Alternatives for Inspecting Outer Continental Shelf Operations*
- *Contaminated Marine Sediments: Assessment and Remediation*
- *Measuring and Understanding Coastal Processes for Engineering Purposes*
- *Opportunities to Improve Marine Forecasting*
- *Our Seabed Frontier: Challenges and Choices*
- *Using Oil Dispersants in the Sea*
- *Strategies for Obtaining Ship Services: Alternatives for NOAA*

1987

- *Controlling Hydrocarbon Emissions from Tank Vessel Loading*
- *Responding to Changes in Sea Level: Engineering Implications*
- *Sedimentation Control to Reduce Maintenance Dredging of Navigational Facilities in Estuaries: Report and Symposium Proceedings*

1986

- *Improving Productivity of U.S. Marine Container Terminals*
- *NOAA Information Services for U.S. Arctic Marine Operations: An Assessment of Needs and Technology*
- *Strengthening Research and Innovation in the Maritime Industries*

1985

- *Advances in Environmental Information Services for Ports: An Assessment of Applications and Technology*
- *An Assessment of External Firefighting for Marine Structures*

- *Disposal of Offshore Platforms*
- *Dredging Coastal Ports: An Assessment of the Issues*
- *Toward More Productive Naval Shipbuilding*

1984

- *Effective Manning of the U.S. Merchant Fleet*
- *Ocean Disposal Systems for Sewage Sludge and Effluent*
- *The Role of Design, Inspection, and Redundancy in Marine Structural Reliability*
- *Safety Information and Management in the Outer Continental Shelf*
- *Toward an Integrated Design, Inspection, and Redundancy Program*
- *U.S. Capability to Support Ocean Engineering in the Arctic*

1983

- *Criteria for the Depths of Dredged Navigational Channels*
- *Drilling Discharges in the Marine Environment*
- *Navy Long-Range Deep Ocean Technology*
- *Report of the Committee to Assess the Computer-Aided Operations Research Facility*
- *Ship Collisions with Bridges: The Nature of the Accidents, Their Prevention, and Mitigation*
- *Ship Operation Research and Development: A Program for Industry*

1982

- *Critical Issues in Maritime Transportation*
- *Marine Salvage in the United States*
- *Ocean Engineering for Ocean Thermal Energy Conversion*
- *Proceedings of the Future Maritime Leaders' Seminar*
- *Productivity Improvements in U.S. Naval Shipbuilding*
- *Technologies for Measurement While Drilling*
- *Understanding the Arctic Sea Floor for Engineering Purposes*
- *Uses of the Ocean for Man's Wastes: Engineering and Scientific Aspects*

1981

- *Commercial Maritime Information: A Critical Appraisal*
- *Critical Issues in Maritime Transportation*
- *Engineering Safety in the Ocean Margin Drilling Program*
- *Maritime Services to Support Polar Resource Development*

- *Maritime Support for Ocean Resources Development*
- *Problems and Opportunities in the Design of Entrances to Ports and Harbors: Proceedings of a Symposium*
- *Reducing Tankbarge Pollution*
- *Research in Sea Ice Mechanics*
- *Research Needs to Reduce Maritime Collisions, Rammings, and Groundings*
- *Safety and Offshore Oil*

1980

- *Alternatives Fuels for Maritime Use*
- *Defense Utility of Commercial Vessels and Craft*
- *Engineering for Deep Sea Drilling for Scientific Purposes*
- *Environmental Exposure and Design Criteria for Offshore Oil and Gas Structures*
- *The Impact of Overseas Troop Reductions on the U.S.-Flag Merchant Marine*
- *Outer Continental Shelf Frontier Technology: Proceedings of a Symposium*
- *Personnel Requirements for an Advanced Shipyard Technology*
- *Symposium on Piloting and VTS Systems: Proceedings of a Symposium*
- *Workshop on Reducing Tankbarge Pollution: Proceedings of a Workshop*

1979

- *Critical Issues in Coal Transportation Systems*
- *Engineering at the Ends of the Earth: Polar Ocean Technology for the 1980s*
- *Implementing Best Available and Safest Technologies for Offshore Oil and Gas*
- *Innovation in the Maritime Industry*
- *Inspection of Offshore Oil and Gas Platforms and Risers*
- *Public Involvement in Maritime Facility Development*
- *Responding to Casualties of Ships Bearing Hazardous Cargoes*
- *A Strategy for Developing Fossil Fuel Extraction Drilling Technology: Review of a Draft Proposal by the U.S. Department of Energy*
- *A Summary of Wave Data Needs and Availability*

1978

- *Case Studies in Maritime Innovation*
- *Maritime Information Services: A Guide to Current Statistical Data*

1977

- *Priorities for Research in Marine Mining Technology*
- *Verification of Fixed Offshore Oil and Gas Platforms: An Analysis of Needs, Scope and Alternative Verification Systems*

1976

- *Human Error in Merchant Marine Safety*
- *The Manned Undersea Science and Technology Program: An Appraisal*
- *Maritime Metrification: Recommended Metric Conversion Plan for the U.S. Maritime Industry*
- *Port Development in the United States*
- *A Report on Selected Issues of the International Decade of Ocean Exploration Program of the National Science Foundation*
- *Seafloor Engineering: National Needs and Research Requirements*
- *Toward an Improved U.S. Merchant Marine: A Recommended Program of Studies*
- *Underwater Electrical Safety Practices*
- *Waste Management Concepts for the Assessment of Ocean Outfalls*

1975

- *An Appraisal of the National Oceanographic Instrumentation Program*
- *Fourth Report of the Review Committee on Safety of Outer Continental Shelf Petroleum Operations*
- *Information and Data Exchange for Ocean Engineers: An Approach to Improvement*
- *Mining in the Outer Continental Shelf and in the Deep Ocean*
- *The Sealift Readiness Program: The Commercial Implications of a Military Contingency Call-Up of U.S.-Flag Merchant Ships*
- *Third Report of the Review Committee on Safety of Outer Continental Shelf Petroleum Operations*

1974

- *Deepwater Oil Terminals*
- *Directions for Data Buoy Technology*
- *Second Report of the Review Committee on Safety of Outer Continental Shelf Petroleum Operations*
- *Nuclear Merchant Ships*
- *The Seagoing Workforce: Implications of Technological Change*
- *First Report of the Review Committee on Safety of Outer Continental Shelf Petroleum Operations*

1973

- *Civil Manned Undersea Activity: An Assessment*
- *Human Error in Merchant Marine Safety*
- *Merchant Marine Casualty Data*
- *Research and Education for Maritime Progress*
- *A Review of Selected Aspects of the National Science Foundation International Decade of Ocean Exploration Programs*
- *Shipbuilding Research and Development*

1972

- *Outer Continental Shelf Resource Development Safety: A Review of Technology and Regulation*

1971

- *Containership Underway Replenishment: Interim Report*
- *Documentation for Cargo Movement*
- *Foreign Maritime Policies: Study Definition*
- *The International Decade of Ocean Exploration: A Current Evaluation*
- *Legal Impediments to International Intermodal Transportation: Selected Problems, Options, and Recommended Solutions*

1970

- *Merchant Marine Safety*
- *Waste Management Concepts for the Coastal Zone: Requirements for Research and Investigation*



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