



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

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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.

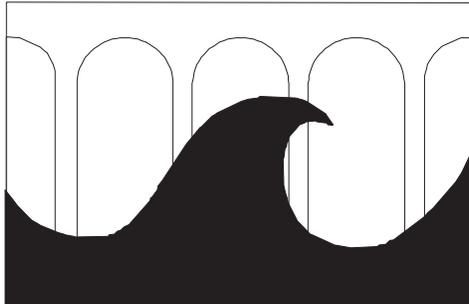
The **Transportation Research Board** is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation through research. In an objective and interdisciplinary 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 5,000 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.
2005
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MESSAGE FROM THE CHAIRS



Outgoing Chair
R. Keith Michel



Incoming Chair
Geraldine Knatz

In the past 18 months, two major reports on the world's oceans and a major report on national security in the wake of the September 11, 2001, terrorist attack have been issued. These independent commission reports have stimulated wide and thoughtful discussion of the issues raised, problems defined, solutions posed, and actions recommended. The Marine Board's mission for its nearly 40 years of existence—identifying, responding, and offering advice on major issues relating to water transportation and maritime industries and associated national policies—gives the Board a unique role in the critical areas of ocean policy and security. [The Board's forerunner in the National Research Council (NRC) was the Maritime Transportation Research Board; in 1999, the Board became a subsidiary unit of the Transportation Research Board (TRB).]

The 2003 report of the Pew Oceans Commission, *America's Living Ocean: Charting a Course for Sea Change*, and the 2004 report of the U.S. Commission on Ocean Policy, *An Ocean Blueprint for the Century*, describe an array of rapidly escalating problems that affect the nation's coastal regions and the global oceans as a result of the increasing pressures of population growth and expanding uses of coastal areas, waters, and resources. Toxic and nutrient pollutants, oil spills, and inadequate safeguards from coastal development threaten water quality in wetlands, estuaries, and even the ocean itself. Fisheries are being rapidly depleted, and there are numerous threats to other marine resources from invasive species and human impacts. Recommendations in both reports include (a) a need for a unified national ocean policy, comprehensive and coordinated governance of ocean resources and uses, protection of habitat, and better management of coastal development and (b) controls on all sources of pollution, including oil spill prevention and better clean-up techniques and technologies. For many years, the Marine Board has provided expert advice on these important issues: preventing and cleaning up of oil spills, reducing and treating contaminated sediments, minimizing environmental impacts from dredging, eliminating the introduction of nonindigenous species, improving stewardship, and managing marine resources and areas. [See Recent Reports (1999–2004) at the end of this report.]

In 2004, the Marine Board conducted a workshop to explore the ability of the nation's marine salvage capabilities to respond to possible terrorist incidents at major U.S. port complexes; the workshop resulted in advice to the U.S. Navy and the U.S. Coast Guard on how to improve the nation's organizational and physical readiness to clear port channels and to restore and maintain operations in the nation's ports and waterways (*Conference Proceedings 30: Marine Salvage Capabilities: Responding to Terrorist Attacks in U.S. Ports—Actions to Improve Readiness*, TRB, 2004). Also in 2004 TRB published an assessment and recommendations for improved coordination among federal agencies with responsibilities in support of the nation's marine transportation system (MTS) (*Special Report 279: The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement*, TRB, 2004). Fostering a longstanding interest in addressing economic and environmental improvements in MTS, the Marine Board cosponsored with marine-related committees of TRB a workshop on alternative freight capacity at the 2004 TRB Annual Meeting and, with a committee of the Society of Naval Architects and Marine Engineers (SNAME), a workshop on the economics of short sea shipping in September 2004. The Marine Board also cosponsored a session, "Green Ports, Green Ships," at the 2004 TRB Annual Meeting. (See the TRB website for presentations.)

A new study is currently under way with the NRC's Water Science and Technology Board on controlling the introduction of nonindigenous species into the Great Lakes. Projects are in development to evaluate marine transportation safety risks for energy imports, specifically liquefied natural gas (LNG), the importation of which is projected to increase substantially in the future. Another activity is under



Coast Guard Cutter *Bainbridge Island*, home ported in Sandy Hook, New Jersey, stands watch over the Statue of Liberty in New York Harbor. (Photo by PA3 Mike Lutz, courtesy of U.S. Coast Guard)

consideration to facilitate the participation of a broad spectrum of marine and maritime users in the integrated ocean observing system (IOOS) that will enhance and expand the collection and application of ocean data for a variety of uses, including protection and restoration of marine ecosystems and resources and ensuring national security in maritime transportation and commerce.

National security in the global transportation sector is an important issue raised in *The 9/11 Commission Report* (2004) of the National Commission on Terrorist Attacks upon the United States. MTS—including the vast global network of containers, ports, and interconnected rail and highway links—is a vital component of both the global transportation system and the global and national economy, as the majority of goods traded in the world are transported by water. The Marine Board has the capability to assemble individuals with expertise and experience in the technical, economic, and policy dimensions of this enterprise. Working closely with the relevant federal agencies and the leaders of the U.S. and international marine transportation sectors, the Marine Board is poised to offer assistance to new initiatives currently under way, such as the U.S. Coast Guard’s (USCG’s) maritime domain awareness (MDA), to expand and improve the safety and security of all activities associated with the global maritime environment. We look forward to contributing to the nation’s efforts to improve and protect all dimensions of the ocean and maritime domain in the years to come.

R. Keith Michel, *Chair*, 2002–2004
 Geraldine Knatz, *Chair*, 2004–2006



THE MARINE BOARD

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Geraldine Knatz, Port of Long Beach, California, *Chair*

Martha R. Grabowski, Le Moyne College, Syracuse, and Rensselaer Polytechnic Institute, Troy, New York, *Vice Chair*

Kenneth E. Arnold, Paragon Engineering Services, Inc., Houston, Texas

Charles R. Cushing, NAE, C. R. Cushing & Co., Inc., New York

Larry L. Daggett, Waterway Simulation Technology, Inc., Vicksburg, Mississippi

Robert A. (Tony) Dalrymple, Johns Hopkins University, Baltimore, Maryland

Paul S. Fischbeck, Carnegie Mellon University, Pittsburgh, Pennsylvania

Stephen E. Flynn, Council on Foreign Relations, New York, New York

Rodney Gregory, IBM Global Services, Fairfax, Virginia

I. Bernard Jacobson, IBJ Associates, LLC, Shelter Island Heights, New York

Ronald K. Kiss, Webb Institute, Glen Cove, New York

Sally Ann Lentz, Ocean Advocates, Clarksville, Maryland

Malcolm MacKinnon III, NAE, MacKinnon–Searle Consortium, LLC, Alexandria, Virginia

Reginald E. McKamie, Sr., Houston, Texas

Robert C. North, North Star Maritime, Inc., Queenstown, Maryland

Craig E. Philip, Ingram Barge Company, Nashville, Tennessee

Edwin J. Roland, Seaworthy Systems, Inc., Houston, Texas

Jerry R. Schubel, Aquarium of the Pacific, Long Beach, California

Richard H. Vortmann, National Steel and Shipbuilding Company (NASSCO), San Diego, California

David J. Wisch, ChevronTexaco, Houston, Texas

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R. Keith Michel, Herbert Engineering, Alameda, California, *Chair*

Geraldine Knatz, Port of Long Beach, California, *Vice Chair*

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, *Vice Chair*

Rodney Gregory, IBM Global Services, Fairfax, Virginia

I. Bernard Jacobson, IBJ Associates, LLC, New York

Ronald K. Kiss, Webb Institute, Glen Cove, New York

Sally Ann Lentz, Ocean Advocates, Clarksville, Maryland

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Richard H. Vortmann, National Steel and Shipbuilding Co., San Diego, California

E. G. (Skip) Ward, Offshore Technology Research Center, College Station, Texas

David J. Wisch, ChevronTexaco, Bellaire, Texas

Transportation Research Board Staff

Joedy Cambridge, Staff Director

Beverly Huey, Senior Staff Officer

Mary Kissi, Senior Project Assistant

Peter Johnson, Consultant

Susan Garbini, Consultant



ABOUT THE MARINE BOARD

MISSION



A Homeland Security boat from U.S. Coast Guard Station Boston provides an escort for the liquefied natural gas (LNG) tanker *Matthew* in Boston Harbor. Escorts of LNG tankers are a multiagency priority, here of the U.S. Coast Guard, local and state police, and the Massachusetts Environmental Patrol. (Photo by PA3 Kelly Newlin, courtesy of U.S. Coast Guard)



Lockage at the Bonneville Lock and Dam on the Columbia River.

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 providing evaluations and advice 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 relating to new technologies, laws and regulations, economics, the environment, and other issues affecting the marine transportation system, port operations, coastal engineering, and marine governance.

With the continuing support of sponsors and the benefits of its affiliation with the TRB, the Marine Board maintains its unique role in identifying and responding to critical issues. In 2004, the Marine Board's work was carried out at the request of units of the Departments of the Army (Corps of Engineers), Navy [Office of Naval Research (ONR) and Office of the Supervisor of Salvage and Diving], Transportation [Maritime Administration (MARAD)], Homeland Security (USCG), Commerce [National Oceanic and Atmospheric Administration (NOAA)], Interior [Minerals Management Service (MMS)], and the National Science Foundation. The Departments of the Army, Homeland Security, Energy, Commerce, Interior, and Transportation provide financial support from pooled resources through a cooperative agreement administered by MARAD of the U.S. Department of Transportation (DOT). The combination of a multiyear cooperative agreement managed by MARAD and a complementary grant administered by the U.S. Navy provides the participating federal agencies with a source of independent and objective information on marine and maritime affairs and the administrative flexibility to obtain it.

During 2004, the Marine Board carried out a variety of activities for its federal agency sponsors on topics related to marine and maritime issues. Board activities and meetings are directed through TRB's Technical Activities Division, and policy studies are conducted under TRB's Division of Studies and Information Services. The Marine Board nurtures ideas for new projects, develops proposals, identifies potential sponsors, suggests prospective committee members, and maintains involvement in studies and activities related to its mission. The Board also coordinates with other NRC boards on issues of common interest.

The Marine Board provides a forum for discussion of and strategic thinking about emerging issues important to the maritime community. The Board conducts business primarily at semiannual meetings (spring and fall) and through the support of Marine Board and TRB staff. This Annual Report summarizes the Board's activities in 2004.

ORGANIZATION AND MEMBERSHIP

The chair of NRC appoints Marine Board members at the recommendation of the TRB executive director in consultation with NRC. Nominations are based on recommendations from current and former Marine Board members, related sections of the National Academy of Engineering (NAE), sponsor agencies, staff, and other members of the marine and maritime communities. Chosen for exceptional professional qualifications and relevant areas of expertise, members serve staggered 3-year terms and may be



Marine Board members and guests hear a presentation on high-speed vessel safety at the 2004 Spring Meeting in San Diego.

reappointed for a second 3-year term. The Board comprises representatives of technical disciplines associated with maritime activities and marine engineering as well as related environmental interests, law, economics, industry, 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. An executive committee of the Marine Board, composed of four to six Board members who serve at the request of the current Board chair, provides guidance to staff on the operations and activities of the Board.

Board members participate 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 progress of studies, serve on study committees, function 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.

TRB standing committees and task forces that have a maritime–water transportation focus are part of the TRB Marine Group, which is overseen by the executive committee of the Marine Board. There are currently two standing committees (Inland Water Transport and Ports & Channels) and one task force (Marine Environmental Issues) within the TRB Marine Group. Additional committees, while formally assigned to other groups, maintain a liaison relationship to the Marine Group and include Ferry Transportation, which falls under the Public Transportation Group; Military Transportation, Intermodal Freight Transport, Intermodal Freight Terminal Design and Operations, Agricultural Transportation, International Trade and Transportation, all of which are part of the TRB Freight Systems Group; and Critical Transportation Infrastructure Protection, which is part of the TRB Management and Administration Group.

PROGRAM SCOPE

The Marine Board’s program responds to immediate national needs and anticipates future issues that affect both 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 the following:

1. Safety and security issues associated with maritime transportation and ports;
2. Engineering research and technology for commercial and recreational uses of oceans, coastal regions, and inland waterways;
3. Environmental issues arising from marine operations and port activities;
4. Technology of ships and marine systems;
5. Maritime law;
6. Maritime economics;
7. Offshore industries; and
8. Training and education.



MEETINGS IN 2004

Spring Meeting

San Diego, California, May 5–7, 2004

The two major focus areas of the 2004 Spring Meeting were (a) current and future applications of autonomous underwater vehicles (AUVs) and (b) safety and environmental compliance of high-speed craft for naval and commercial interests:



Marine Board members and guests toured the Scripps Institution of Oceanography during the 2004 Spring Meeting and were briefed about autonomous climate-research floats, deployed from commercial ships, research vessels, and C-130 aircraft.

- The focus session Current and Future Applications of AUVs explored development, applications, and uses of AUVs in both the military and commercial sectors. It considered potential applications and their benefits, identified opportunities and constraints to future development, and investigated key issues that might warrant further study. When the Marine Board published its report on undersea vehicles in 1996, AUV technology was in its infancy, with most applications for military purposes and most development funded by the military. Experience with AUVs at the time was primarily in support of scientific missions, with very limited experience in the commercial sector. A shift toward commercial applications is apparent in some recent work, and new developments have specific practical benefits for commercial interests.
- The focus session Safety and Environmental Compliance of High-Speed Craft for Naval and Commercial Interest concentrated on the current state of safety and environmental issues, regulations, and compliance success for high-speed craft. Presenters provided an introduction to both the newest high-speed commercial passenger-vehicle craft and new high-speed military vessels. Discussions also addressed design and construction standards, training issues, crewing and operations standards, and vessels under development.



One of the highlights of the 2004 Spring Meeting was a tour of the NASSCO shipyard in San Diego, California.

Board members and guests also toured the Scripps Institution of Oceanography and the NASSCO shipyard. There were also updates and presentations from Marine Board sponsor agencies. Presentations from the 2004 Spring Meeting are posted on the Marine Board website.

Fall Meeting

Washington, D.C., November 15–17, 2004

The Marine Board held its Fall Meeting in conjunction with the 7th Marine Transportation System (MTS) Research & Technology Coordination Conference, an event that TRB and the Marine Board cosponsored with the Research and Technology Subcommittee of the Interagency Committee for the Marine Transportation System (ICMTS). Several Board members were either conference presenters or session moderators (see the conference summary on Page 10 of this report). Two major focus areas of the conference were (a) the report *The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement*, which was the topic of the Day 1 keynote address and was followed by a federal agency discussion panel, and (b) identifying needs and coordinating transportation security research, which was the topic of the Day 2 keynote address and was followed by an industry stakeholder panel.

A major topic of discussion at the business meeting was the survey of Marine Board sponsors, completed in October 2004. The federal agency responses to the survey included a list of issues and research topics for the Board to consider in the future. This list was complemented by topics Board

members suggested at the meeting. Board members also reviewed projects under way and discussed several new project and activity areas, which are covered later in this report.

At the Marine Board dinner, E. G. (Skip) Ward gave a presentation about the impact of Hurricane Ivan on the offshore industry in the Gulf of Mexico. The Board recognized the contributions of the outgoing chair, R. Keith Michel, and the outgoing members, Peter J. Finnerty, Philip Li-Fan Liu, and Skip Ward, and welcomed the new members, Kenneth E. Arnold, Charles R. Cushing, Robert A. (Tony) Dalrymple, and Stephen E. Flynn.

PROJECTS AND ACTIVITIES COMPLETED OR UNDER WAY IN 2004

Marine Salvage Capabilities: Responding to Terrorist Attacks in U.S. Ports



The capability to respond quickly to oil spills from capsized ships is an important aspect of marine salvage. (Photo by PACS Tod Lyons, courtesy of U.S. Coast Guard)

Since the September 11, 2001, terrorist attacks, national attention has focused on the security of U.S. ports and on questions about how best to prevent future attacks. Equally important, however, are concerns about capabilities to respond adequately in case of attack. Ports and waterways are vital to the nation's economic well-being, and the possible closure of major harbors or waterways would have an enormous impact on U.S. commercial and military operations. This concern led the Navy to request that the Marine Board conduct a workshop to explore 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.

A study committee was appointed to plan the workshop and prepare a report on the results. The workshop was held in August 2003 and included evaluation of organizational and interagency coordination and of response capabilities. The workshop addressed economic, legal, forensic, environmental, and human casualty issues related to salvage. The principal goals of the workshop were (a) to share information among relevant agencies, organizations, and other interested parties concerning current salvage response capabilities and (b) to determine whether any major gaps or concerns exist with respect to current capabilities and agency roles.

The committee concluded that further work in four areas is necessary to improve the nation's marine salvage readiness and capabilities:

1. Maintaining an inventory and evaluation of available physical salvage assets,
2. Conducting tabletop exercises to test physical and organizational readiness postures,
3. Improving salvage expertise and input to the planning and response networks, and
4. Conducting further study of related legal, regulatory, and policy issues.

Detailed recommendations are provided in the report, which is available online.

Publication

Conference Proceedings 30: Marine Salvage Capabilities: Responding to Terrorist Attacks in U.S. Ports—Actions to Improve Readiness.
Transportation Research Board, Washington, D.C. 2004.

Committee Members

Malcolm MacKinnon III, NAE, MacKinnon–Searle, LLC, *Chair*
Paul S. Fischbeck, Carnegie Mellon University

Sally Ann Lentz, Ocean Advocates
 Reginald McKamie, Sr., Houston, Texas
 R. Keith Michel, Herbert Engineering Corp.
 Robert C. North, North Star Maritime, Inc.

Marine Transportation System and the Federal Role



One task of the TRB–Marine Board study of the U.S. MTS was to review the major roles and responsibilities of the various federal agencies in the provision of infrastructure and support services needed for MTS to accommodate the nation’s commerce.



The study on MTS recommended that DOT begin developing reports on the use, condition, performance, and demands of MTS. (Photo courtesy of U.S. Army Corps of Engineers)

The Marine Transportation System (MTS) of the United States is not a system in the formal sense of the word but a loosely integrated collection of waterways, ports, and supporting systems (such as security, navigation, rescue, and environmental protection). The components of 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, USCG, the U.S. Army Corps of Engineers (USACE), NOAA, MARAD, and the U.S. Customs Service.

The purpose of this study, which was funded by 11 agencies, was to develop an analytical framework for use by federal agencies in identifying capital and operating needs and coordinating federal investments and spending on the MTS infrastructure. Five specific tasks were undertaken in developing the analytical framework:

- Review of how federal investments in MTS are now made, including the basis for the investments, the degree of interagency coordination, and the policy issues associated with those patterns of investment;
- Review and interpretation of projections for future maritime freight and passenger demand;
- Assessment of plans for MTS maintenance and expansion by industry, state, and local governments and federal agencies (including consideration of plans for environmental protection);
- Description of the likely impact on MTS over the next two decades if federal funding remains constant; and
- Identification of options for federal funding of MTS.

The task relating to federal funding included a comparative analysis of the federal financial role in support of other modes, particularly aviation, and identified critical factors and trade-offs that must be taken into account in considering alternate federal financing roles. It also included an assessment of how these options for federal funding contribute to the national goals, standards, and performance measures set in the MTS strategic plan.

The committee made a number of recommendations for improving the capability of federal agencies to target federal investments and spending on the MTS infrastructure. Among these are that DOT should take the lead in assessing the performance of and improving the nation’s entire marine transportation system. In particular, the report recommended that DOT should begin immediately to develop information on the condition, performance, and use of MTS and seek a mandate from Congress to produce such reports on a regular basis, as DOT already does for the nation’s highway and transit systems.

Publication

Special Report 279: The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement. Transportation Research Board, Washington, D.C., 2004.

Committee Members

Mortimer L. Downey III, PB Consult, *Chair*
 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
 Thomas D. Larson, Consultant
 Sally Ann Lentz, Ocean Advocates
 Henry S. Marcus, Massachusetts Institute of Technology
 James R. McCarville, Port of Pittsburgh
 Reginald E. McKamie, Sr.
 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

Short Sea Shipping



Short sea shipping is one alternative suggested as a way to relieve increasing congestion on U.S. highways. (Photo courtesy of Mike Nicholls)

Short sea (coastal) shipping is waterborne freight service operations that carry either containerized or trailerized cargoes (or empties), in particular those services of which there is a true intermodal choice available to the shipper between moving units by water and using one or more land-based alternatives (i.e., highway, rail, or both). Increasing congestion on the nation's highways is the driving force behind the renewed and increasing interest in short sea shipping. The necessary ingredients for a successful service are reliability, frequency, and competitive pricing.

Efficient short sea shipping could provide the following benefits:

- 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 thereby improving fuel efficiency for all remaining vehicles;
- Reduce the cost of road maintenance;
- Delay the need for major road improvements;
- Reduce air pollution by lowering truck traffic in exchange for lesser commensurate water-borne-vessel pollution in less affected areas;
- Provide economic uplift to cities that allow or provide newly developed off-load and on-load terminals;
- Improve highway safety; and
- Improve port terminal efficiency.

At the 2004 TRB Annual Meeting in January, the Marine Board sponsored a workshop that focused on the opportunities for and barriers to development of alternative freight capacity, including rail and water options. The workshop explored issues of highway congestion and alternative modes for transporting highway freight, with short sea shipping proposals highlighted. Selected presentations from the workshop are posted on the Marine Board website.

In addition, the Marine Board and TRB cosponsored a workshop with SNAME on September 28, 2004, to explore the economics underlying development of short sea shipping in the United States. In this workshop, an economic framework was developed after the market was defined and options were proposed for financing successful short sea shipping ventures. With this information as a foundation, participants discussed case studies that examined the economic and financial challenges existing domestic operators face. An authored summary of the workshop is available on the Marine Board website.

Green Ports, Green Ships

Pollution or environmental degradation as a result of waterborne shipping has been the subject of several Marine Board and Ocean Studies Board reports, on topics such as oil spill response and prevention, oil in the sea,



The *Alaskan Frontier* is an example of an environmentally friendly tanker. (Photo courtesy of NASSCO)

vessel-generated waste disposal, and introduction of invasive species through ballast water. More recently, air emissions from ships and port operations have become an issue of increasing concern. Air emissions also become a factor with respect to short sea shipping operations as a strategy to relieve highway and rail congestion and improve the efficiency of domestic shipping systems. Several ports have taken steps to reduce emissions by retrofitting truck and towboat engines, cold-ironing of vessels while in port, and expanding gate hours. Some states have instituted air quality management districts in an effort to enforce or improve air quality conditions, and there have been questions raised about whether adequate consideration is given to the economic impact of such regulations.

At the 2004 TRB Annual Meeting, the Marine Environmental Task Force sponsored a session titled Green Ports, Green Ships. The session's presentations related to the current status of the marine transportation system in relation to environmentally sound and responsible operations and focused on ships and ports. The session leader was Thomas H. Wakeman, Port Authority of New York and New Jersey. Speakers and topics included the following, with links to the presentations available on the Marine Board website:

- Green Ships: Fact or Fiction? Kathy Metcalf, Chamber of Shipping of America;
- Green Tomorrow: Toward Greater Environmental Responsibility in the Maritime Community, Sally Ann Lentz, Ocean Advocates;
- Toward Environmental Stewardship: Charting the Course for Marine Transportation, James J. Corbett, University of Delaware;
- Setting the Federal "Green" Pace, Craig Vogt, U.S. Environmental Protection Agency (EPA); and
- Green Ports: Achieving Excellence Through World-Class Management, Tom Chase, American Association of Port Authorities.

The Marine Board is considering further activities to examine these issues from the perspectives of both port operations and vessel designs.

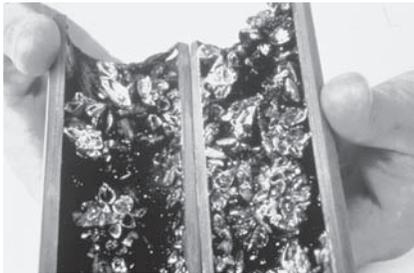
MTS Research and Technology Coordination Conference

The 7th MTS Research and Technology Coordination Conference, sponsored by ICMTS, was held at the National Academy of Sciences Building in November 2004. The Marine Board and the TRB Marine Group hosted, provided program input for, and participated in the conference, whose theme was securing the future vitality of MTS through cooperative research. Keynote speeches were delivered by Mortimer L. Downey, of PB Consult, on the federal role in MTS, who was followed by a federal agency discussion panel, and by Charles McQueary, Undersecretary for Science and Technology in the Department of Homeland Security, on identifying needs and coordinating transportation security research, who was followed by an MTS industry stakeholder panel. Technical sessions were held on the following topic areas:

- Maritime domain awareness,
- Maritime security,
- Safe and efficient navigation,
- MTS capacity,
- Maritime economics,
- Port operations and intermodalism,
- Environmental topics,
- Advanced technologies and human factors, and
- Cooperative research.

Additional plenary sessions focused on coordination as the key to the future of MTS and on how cooperative research can help measure performance and target improvement of the nation's MTS. A link to the more than 80 presentations and research papers from the conference is available on the Marine Board website.

**St. Lawrence Seaway:
Options to Eliminate
Introduction of
Nonindigenous Species
into the Great Lakes**



The zebra mussel is one example of a non-indigenous species invading the Great Lakes and causing numerous environmental and operating problems. (Photo courtesy of Tom Maddox, Environmental Technologies, Inc.)

Joint Project with the Water Science and Technology Board

The St. Lawrence Seaway contributes to the commerce and industry of the Great Lakes region, serving as a conduit for delivery and export of agricultural, mining, and industrial products for the United States and Canada. In addition to its commercial importance, the St. Lawrence Seaway plays a key role in determining the health of the Great Lakes ecosystem. The Great Lakes make up Earth's largest freshwater system and account for about 20% of the world's fresh surface water.

While the passage of oceangoing vessels along the seaway has contributed to the region's economy, it has also provided a vector for the introduction of nonindigenous aquatic species via the ballast water and hulls of oceangoing ships. Invasions of species such as the sea lamprey and European zebra mussel have brought changes to Great Lakes ecology and increased incidences of dead zones—areas depleted of oxygen where most fish and aquatic species cannot survive. As potential upgrades to the seaway are considered, factors affecting the balance between economic and environmental demands will need to be addressed.

The Great Lakes Protection Fund (GLPF) is a permanent environmental endowment that supports collaborative actions to improve the health of the Great Lakes ecosystem. GLPF asked TRB and the Water Science and Technology Board of the National Academies to convene a committee of experts to examine options for eliminating further introductions of non-indigenous species into the Great Lakes. The centerpiece of the committee's work will be a design competition to identify promising transportation options and concepts for the Great Lakes region. Marine Board member Jerry R. Schubel chairs the project committee.

In Phase I of the two-phase study, the committee developed a detailed plan for eliciting a wide range of transportation options and concepts for the Great Lakes region that would promote international commerce and eliminate the introduction of additional nonindigenous species and pathogens into the Great Lakes by oceangoing vessels transiting the St. Lawrence Seaway. The committee is assembling statistics on the Great Lakes region's economy, trade, transportation, and environment and is using these statistics to develop baseline assumptions and specific criteria for a design competition. The committee is also planning a conference at which competing designs and concepts will be presented and discussed and the best awarded prizes.

In Phase II, the committee will hold the design competition, award prizes, identify a list of promising options, and prepare its final report.

Committee Members

- Jerry R. Schubel, Aquarium of the Pacific, *Chair*
- Stephen B. Brandt, NOAA Great Lakes Environmental Research Laboratory
- Jerry E. Fruin, University of Minnesota
- J. Richard Hodgson, Dalhousie University
- Philip T. Jenkins, Philip T. Jenkins and Associates, Ltd.
- Catherine T. Lawson, State University of New York (SUNY) at Albany
- Kenneth J. Leonard, Wisconsin Department of Transportation
- Walter R. Lynn, Cornell University
- Hugh J. MacIsaac, University of Windsor

Henry A. Olson, Matson Navigation Company, Inc.
 Evelyn A. Thomchick, Pennsylvania State University
 Thomas D. Waite, University of Miami and the National Science
 Foundation
 M. Gordon Wolman, Johns Hopkins University

ACTIVITIES IN DEVELOPMENT OR UNDER CONSIDERATION

Assessment of USCG Polar Icebreaker Roles and Future Needs



The U.S. Coast Guard's *Polar Star* breaks an ice path for supply ships in McMurdo Sound, Antarctica. (Photo courtesy of U.S. Coast Guard)

Joint Proposal with Polar Research Board

The United States has strong interests in the polar regions—in the Arctic, because of the state of Alaska and geopolitical relations with the other Arctic nations, and in the Antarctic, because of obligations under the 1961 Antarctic Treaty and a suite of geopolitical positions. Repeated high-level reviews over the decades have reaffirmed the importance of U.S. presence and leadership in the polar regions. These regions are also leading indicators for pronounced environmental change, yet they are among the least studied and understood. Demand for and use of the polar regions for scientific research, commerce, and transit are expected to increase, and thus demands on associated support operations required by treaties, laws, and other internal and external U.S. policies related to polar ice operations capability and capacity.

Since 1965, when the polar icebreaker program transferred from the U.S. Navy, USCG has been the principal provider of polar icebreaking services for the nation. USCG polar icebreakers provide a capability for national defense, search and rescue, maritime law enforcement, marine environmental protection, and scientific research and logistics support in the polar regions. Planning is needed for the USCG to be prepared to accomplish the full range of its missions in the polar regions and in particular to determine whether assets are and will be available to meet needs in the near, middle, and long terms; whether alternative methods of providing the needed services are available; and how to provide the required services in the most cost-effective way.

Given the challenges facing the USCG and the many stakeholders reliant on icebreaker support in the Arctic and the Antarctic, the aging condition of the icebreaker fleet, and the significant investment that will be needed to continue the fleet's service, Congress passed legislation in the fall of 2004 requiring the USCG to request a study from the National Academies that explores the role of the USCG icebreakers in supporting U.S. operations in the polar regions. This study, to be conducted under the joint auspices of the Polar Research Board and TRB, will complement past and ongoing related activities by providing a comprehensive overview of the U.S. requirements for polar operations and giving full consideration to the international context in which polar operations are conducted.

LNG Imports: An Evaluation of Transportation Safety Risks

Many experts project substantial growth in LNG imports into the United States over the next few decades because domestic gas production is declining, gas is an environmentally attractive fuel, and a large amount of foreign gas reserves are now available. Some predict that LNG might grow from about 1 percent of the U.S. gas supply today to about 20 percent by 2025. Accommodating this growth would require a major expansion of LNG shipping to the United States and the construction of many more large terminals with related facilities. Federal agencies have recently received numerous proposals for building and expanding the U.S. LNG infrastructure. At the same



A shipment of liquefied natural gas arrives at Cove Point, Maryland, with the U.S. Coast Guard providing security. (Photo by PA3 Donnie Brzuska, courtesy of U.S. Coast Guard)

time, some have questioned the magnitude and pace of this development, citing concerns about safety, land use, conflicts with other offshore uses, and other public policy issues.

New LNG import terminals—both onshore within major port complexes and offshore near coastal pipeline systems—are planned for all three U.S. coastal regions. Some of these plans have gone through preliminary reviews and been rejected by those controlling local land use; others have received initial approvals; and still others are in the review process. No national planning mechanism exists to evaluate the relative risks and benefits to local and national interests, and each project is being judged on its own merits. Therefore, even though the demand for natural gas is focused in certain major regions, the supply of LNG may not be distributed to meet that demand efficiently. The questions of transportation safety risks and how they are evaluated could be major factors in determining whether LNG imports are handled in the most efficient manner for the nation as a whole.

The Marine Board sponsored a 1-day planning meeting on LNG transportation safety issues in August 2004. It was attended by government and private sector leaders in LNG development and experts on marine safety issues. As a result of the meeting discussions, the Marine Board prepared a prospectus and circulated it to the participants. It discussed the possibility of a study to focus on transportation risks and benefits and credible methods of analyzing safety questions about the design, location, and operation of LNG marine terminals and the operation of LNG ships in U.S. waters. Such a study could also evaluate the processes that existing federal, state, and local government agencies use to develop their safety guidelines. The board continues to work with appropriate federal agencies to determine whether and when this study would be useful and effective.

Integrated Ocean Observing System

IOOS is a coordinated national and international network of observations, data management, and analyses that systematically acquires and disseminates data and information on past, present, and future states of the oceans and the nation's exclusive economic zone. The global component is part of an international collaboration. The coastal component focuses on U.S. national interests; it is made up of a national system and set of nested regional observing systems.

Within the United States, the IOOS is being proposed and supported by a wide range of governmental agencies interested in and concerned with oceanographic research under the auspices of the National Ocean Research Leadership Council (NORLC). NORLC includes 12 federal agencies active in oceanographic monitoring and research such as NOAA, the National Aeronautics and Space Administration, ONR, and the National Science Foundation. The many agencies supporting the development of IOOS have formed an organization, Ocean.US, to facilitate the design and implementation of the system.

The national system of IOOS includes a “national backbone” and a set of regional associations, which are partnerships or consortia responsible for the development, operation, and improvement of regional systems. These associations consist of (a) user groups that specify data requirements and products and (b) data providers responsible for the design, implementation, and operation of the regional observing systems. Maritime and navigation interests are among the primary user groups that are or should be involved in regional associations and that may be asked to support and perhaps help fund the regional data collection and reporting efforts. The Marine Board has discussed with NOAA and the National Ocean Service its willingness to

help get this diverse set of potential users to elicit their views about the IOOS concept, the proposed governance and funding of regional associations, and the proposed national backbone and regional measures designed to be of interest to marine users. These views could be obtained through a workshop, seminar, or similar activity, from which a summary would be prepared.

National Freight Policy Framework

The United States is the world's largest trading nation, and its economy is increasingly tied to global trade. National-level trade agreements, especially affecting North America, and bilateral agreements on air freight are the most important ones for influencing demand for transportation within the United States. Although the federal government does not own or operate transportation facilities, national policies directly affect freight transportation. Such policies include deregulation of air, motor carrier, rail, and maritime industries; provision of funding for highway and airport infrastructure; and many other actions. States play an increasingly important role in freight operations, especially through infrastructure investment, operation and maintenance of highways, and truck regulations. Some states are directly involved in ocean ports through ownership and management and in the inland system through subsidies and cost sharing for waterways facilities. Increasingly, states are also investing in rail and marine intermodal facilities.

Policy decisions and actions affecting freight made at all these levels are often made in isolation from the consequences for other modes or even for competing firms within the same mode. In addition, many freight policies are made without full appreciation of the long-run economic and environmental consequences. The proposed study, an outgrowth of a recommendation by the Marine Board, is being considered by the TRB Executive Committee, which appointed a working group (including Marine Board Chair Geraldine Knatz) to further examine and develop specific research components. In the context of growing and shifting global trade, the study may address how to maximize the efficiency of transportation across all modes to help ensure national competitiveness and to assist states and regions in making appropriate investments in freight facilities and in managing their infrastructure capacity. Identification of gaps in understanding, knowledge, and data would lead to recommendations for research and data collection.

Environmental Windows for Dredging

Deepening and maintaining navigation channels are necessary actions for efficient 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. A recent joint Marine Board–Ocean Studies Board report titled *A Process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects* provides valuable insights into these issues, as well as a template for resolving controversies that involve multiple agency jurisdictions. The board is considering a follow-on activity to examine how this process has been applied in various parts of country.

Maritime Domain Awareness

MDA has been defined as the effective knowledge of all activities associated with the global marine environment that could affect the security, safety, economy, or environment of the United States. USCG is currently leading efforts to develop a comprehensive national MDA plan and system architecture, to be based on recommendations in the 9/11 Commission's report that

the government identify and evaluate transportation assets needing protection; set risk-based priorities for defending them; select the most practical and cost-effective ways of doing so; and develop a plan, budget, and funding to implement these efforts. NOAA also has responsibilities for MDA in providing the basic geophysical observations, including both measurement of tides and currents necessary to implement MDA activities and hydrographic mapping.

Tsunami Research



Marine Board member Robert A. (Tony) Dalrymple, of the Johns Hopkins University, discusses aspects of the December 2004 tsunami disaster at a special session of the TRB 2005 Annual Meeting.

Since the recent earthquake–tsunami disaster in the Indian Ocean, there has been a heightened awareness of tsunamis for both the East and the West Coasts of the United States, which suggests that there may be an opportunity for the Marine Board to develop a study or other activity related to these. Relevant questions that could be addressed include these:

1. What are the risks and probabilities of such an event in the United States (especially the East Coast)? This question relates to the historical slope failures off Virginia, North Carolina, and Canada.
2. What should be done to prepare the East Coast?
3. How prepared is the West Coast? What would have happened if the earthquake had been in the Pacific? Would public warnings have been effective?
4. How prepared and how well designed are the nation's ports and other critical infrastructure (e.g., hospitals, police, and communications and transportation lifelines)?
5. How can structures be designed to withstand the effects of a tsunami? Inundation maps for the West Coast and some National Tsunami Hazard Mitigation Program reports offer general guidance.
6. What can be done to resolve the problem of insufficient knowledge about tsunami generation and behavior (e.g., breaking, run-up, overwash) on land? What research is needed? NOAA is the major participant in that it runs the two Pacific warning centers. The National Science Foundation funds a modest amount of tsunami research and has recently funded the Oregon State University tsunami basin study under the Network for Earthquake Engineering Simulation. The Federal Emergency Management Agency and the U.S. Geological Survey are also agencies that may be interested in examining these questions.



MARINE BOARD MEMBERS BIOGRAPHICAL INFORMATION

Geraldine Knatz (*Chair, 2004–2006*) 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 and oversees the port's engineering, properties, and planning divisions. Knatz has more than 20 years of experience in dealing with port policy and strategic concerns. She 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 recently served on the NRC Water Science and Technology Board Committee to consider the review process for USACE water resources projects and the TRB study on the "Federal Role in the Marine Transportation System." Knatz is active in the American Association of Port Authorities and chaired 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 an international treaty body known as the London Convention, which regulates international ocean dumping practices. She has been a member of the National Sea Grant College Program Review Panel since 1994 and chaired the panel in 2001–2002. Knatz received a Ph.D. in biological sciences and a master's degree in environmental engineering from the University of Southern California and teaches in its Civil Engineering Department. She has served on the Marine Board since 2000 and was previously vice chair.

***R. Keith Michel** (*Chair, 2002–2004*) is president of Herbert Engineering Corporation. In his 30 years with the company, he has worked on design, specification development, and contract negotiations for container-ships, bulk carriers, and tankers. Michel has served on industry advisory groups developing guidelines for alternative tanker designs, including groups advising the International Maritime Organization and USCG. His work has included development of methodology, vessel models, and oil outflow analysis. He was project engineer for the USCG report on oil outflow analysis for double-hull and hybrid tanker arrangements, which was part of the DOT's technical report to Congress on the Oil Pollution Act of 1990. He has also worked on the development of salvage software used by the U.S. and Canadian Coast Guards, the U.S. Navy, the National Transportation Safety Board, MARAD, the American Bureau of Shipping, Lloyd's, and numerous oil and shipping companies. Michel holds a B.S. in naval architecture and marine engineering from the Webb Institute of Naval Architecture.

Martha R. Grabowski (*Vice Chair, 2004–2006*) is director of the Information Systems Program at Le Moyne College and is research professor of decision sciences at Rensselaer Polytechnic Institute. She sailed as licensed deck officer for several shipping companies following her graduation from the U.S. Merchant Marine Academy and is a retired lieutenant commander in the U.S. Naval Reserve. She previously served as marketing advanced programs manager at General Electric's Corporate Research and Development Center. Her teaching and research interests cover embedded intelligent information systems, risk mitigation, human and organizational error, and safety of large-scale systems. Grabowski is widely published in these research areas in journals, reports, and books. She received a B.S. in nautical science and marine transportation from the U.S. Merchant Marine Academy and an M.B.A. and a Ph.D. in management and information systems from Rensselaer Polytechnic Institute. Grabowski is a member of the American Bureau of Shipping. She has served the Marine Board on the Committee on Crew Size and Maritime Safety, as chair of the Committee on Ship Navigation and Piloting, and as chair of the Committee on Shipboard Automatic Identification Systems Displays.

Kenneth E. Arnold is chief executive officer (CEO) of Paragon Engineering Services, Inc., which he founded in 1980. He previously spent 16 years as engineer and engineering group manager for Shell Oil Company. Arnold has served on numerous American Petroleum Institute (API) committees and task groups and has taught in-house production facility design courses for major oil companies. He was the first director of facilities and construction on the board of the Society of Petroleum Engineers (SPE) and was executive editor of *SPE Production and Facilities*. He was twice selected as distinguished lecturer by SPE and received its 1998 Production Engineering Award as well as a Citation for Service Award from API for his work in offshore safety. Arnold is coauthor of a two-volume textbook series and numerous technical articles and has taught facilities design at the University of Houston. He has a B.S. from Cornell University and an M.S. from Tulane University, both in civil engineering; he serves on the advisory committees of both universities. He was named Houston's Engineer of the Year in 2003 by the Texas Society of Professional Engineers.

Charles R. Cushing has served as president of C. R. Cushing & Co., Inc., a firm of naval architects, marine engineers, and transportation consultants, since its formation in 1968. He has been responsible for the design

and construction of more than 250 oceangoing vessels of all types in the United States, Europe, and the Far East. He has also been responsible for risk analyses, safety audits, energy audits, and the preparation of the USCG Tankerman's Manual. Cushing previously was employed by Sea-Land Service, Inc., where he was responsible for the design and construction of containerships and the development of cranes and cargo handling systems. He holds a number of patents in maritime and intermodal technology. Cushing has received numerous awards and citations for excellence from maritime organizations and is a member of the International Maritime Hall of Fame. He is currently visiting professor at the World Maritime University and is a member of the U.S. Naval Reserve. Cushing holds a B.S. from the U.S. Merchant Marine Academy and from the Massachusetts Institute of Technology, an M.S. from SUNY Maritime College, and a Ph.D. from Cardiff College, University of Wales. He is a member of NAE.

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. Daggett retired from USACE in 1997, after serving as chief of the Navigation Division at the Waterways Experiment Station (WES) in Vicksburg, Mississippi. His work at WES included developing a numerical ship and tow simulator, applying ship and tow simulators to navigation channel project designs and operational problems of specific projects, applying physical scale-model remote-controlled vessels to navigation channel project designs, and implementing and applying waterway system modeling, including the waterway analysis model and tow capacity model. Daggett is chairman of the Inland Waterway Committee of the International Navigation Association, serves on the TRB Ports and Channels Committee, and served for 6 years as the 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 a Ph.D. in engineering from Arizona State University.

Robert A. (Tony) Dalrymple is Willard and Lillian Hackerman Professor of Civil Engineering at the Johns Hopkins University, where he teaches and conducts research on water waves, nearshore hydrodynamics, and coastal processes. He previously was Edward C. Davis Professor of Civil and Environmental Engineering and professor of marine studies and civil engineering at the University of Delaware. Dalrymple received the American Society of Civil Engineers (ASCE) International Coastal

Engineering Award in 1999 and the ASCE Moffatt-Nichol Harbor and Coastal Engineering Award in 1996. Dalrymple has a B.A. in engineering sciences from Dartmouth College, an M.S. in ocean engineering from the University of Hawaii, and a Ph.D. in civil and coastal engineering from the University of Florida. He was chair of the NRC Committee on Coastal Engineering Research and Educational Needs.

***Peter J. Finnerty** has spent most of his professional career in commercial shipping, currently as president of American Ocean Enterprises, Inc., and previously as vice president of Sea-Land Service, Inc. He has worked on and contributed to major U.S. maritime and policy legislation over the past three decades and has served in leadership positions with a number of professional organizations, including the U.S. Coast Guard Foundation, the Propeller Club of the United States, the Navy League of the United States, the Naval War College Foundation, and the American Maritime Congress. He is a graduate of the SUNY Maritime College, holds a third-mate USCG license and was a lieutenant (jg) in the U.S. Naval Reserve. He also 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, Engineering and Public Policy and Social and Decision Sciences, at Carnegie Mellon University. Widely published, Fischbeck has served on a number of national research committees and review panels, including the TRB Committee on School Travel Safety, the National Science Foundation Proposal Review Committee, the NRC Committee on Evaluating Alternative Tanker Design, the Marine Board Symposium on the Application of Risk Management in the Marine Transportation System, and the NRC Ship Structures Committee. He is involved with a number of professional research organizations, including 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. Fischbeck holds a B.S. in architecture from the University of Virginia, an M.S. in operations research and management science from the Naval Postgraduate School, and a Ph.D. in industrial engineering and engineering management from Stanford University.

Stephen E. Flynn is senior fellow with the National Security Studies Program at the Council on Foreign Relations and is inaugural occupant of the Jeane J. Kirkpatrick Chair. Flynn recently served as director and principal author of the report *America: Still Unprepared*,

Still in Danger, issued by a task force co-chaired by former Senators Gary Hart and Warren Rudman and is the author of *America the Vulnerable*. Flynn is the founder of an innovative public-private partnership to advance global container security known as Operation Safe Commerce and serves as adviser to public and private organizations on homeland security issues. Flynn served in the White House Military Office during the George H. W. Bush administration and as director for global issues on the National Security Council staff during the Clinton administration. A graduate of the U.S. Coast Guard Academy, Flynn received an M.A.L.D. and a Ph.D. in international politics from the Fletcher School of Law and Diplomacy, Tufts University. Flynn served two tours as commanding officer in the USCG and one tour as operations officer. He has received a number of professional awards, including the USCG Achievement Medal and the U.S. Coast Guard Academy's Distinguished Alumni Achievement Award.

Rodney Gregory is a managing consultant with IBM Business Consulting Services and has over 25 years of experience in the maritime industry. In his current position, he is responsible for business development and delivery of supply chain management services. Since joining IBM, he has managed business process reengineering projects for the Office of the Secretary of Defense, the U.S. Transportation Command, and the Strategic Distribution Deployment Command. Before joining IBM, Gregory was vice president of Red River Shipping Corporation. He is also a former assistant professor at the U.S. Merchant Marine Academy. He holds a B.S. from the U.S. Merchant Marine Academy and an M.B.A. from the Wharton School of Business; he is a licensed master mariner. He is a member of the National Defense Transportation Association and a former member of the Navigation Safety Advisory Council.

I. Bernard Jacobson is founder and general manager of IBJ Associates, LLC, a management consultancy that specializes in domestic passenger vessels such as ferries and excursion boats. He retired after serving 12 years as general manager and CEO of North Ferry Co., Inc. 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 and its Office of Operations and in the DOT Office of the Assistant Secretary of Transportation for Policy, Plans and International Affairs. Jacobson also served as an assistant professor of operations research and economics at the U.S. Coast Guard Academy. He has a B.S. in engineering from the U.S.

Coast Guard Academy and an M.S. in management from the U.S. Naval Postgraduate School. Jacobson holds a USCG master's license and is active in a number of professional organizations, including the Passenger Vessel Association. He has served on various TRB committees and subcommittees.

Ronald K. Kiss is president of the Webb Institute of Naval Architecture. Before joining the Webb Institute, he was consultant on the joint U.S. Navy-Department of Defense Arsenal Ship Program and on the Navy's aircraft carrier and surface combatant ship programs. 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 for Research, Development and Acquisition. From 1986 to 1990, he was director of ship programs in the Office of the Assistant Secretary of the Navy for Shipbuilding and Logistics. Earlier, Kiss served with the Naval Sea Systems Command as executive director, amphibious, auxiliary, mine and sealift directorate, and as assistant deputy commander for surface ship acquisition. He served nearly 20 years with MARAD, culminating as acting associate administrator for Shipbuilding and Ship Operations for 2 years. Kiss is a member of numerous professional organizations and has received many awards and honors. He holds a B.S. in naval architecture and marine engineering from the Webb Institute and an M.S. in naval architecture from the University of California, Berkeley. He has participated in postgraduate programs at Harvard University and the Massachusetts Institute of Technology.

Sally Ann Lentz is 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. Lentz has served as adviser 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 and represents these organizations at international conventions related to oil pollution from tanker accidents. Lentz has a diploma in European integration from the University of Amsterdam, a J.D. from the University of Maryland, and a B.A. in sociology and anthropology from Oberlin College. Lentz served on the NRC committees that recommended oil spill prevention strategies and considered alternative tanker designs to minimize damage from oil spills. 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 National University of Singapore, National Taiwan University, Osaka City University, and Technical University of Denmark and a visiting scientist at Delft Hydraulics Laboratory. He has served as consultant on projects involving harbor design and planning, flood and channel erosion, breakwater design, and groundwater and river flow. Liu has published extensively, including a number of studies done 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 a Sc.D. in hydrodynamics from the Massachusetts Institute of Technology.

Malcolm MacKinnon III is president of MacKinnon-Searle Consortium, a firm that specializes in ship design and acquisition. MacKinnon held various executive and command positions with the U.S. Navy from 1955 until his retirement in 1990, including deputy commander of NAVSEA Ship Design and Engineering; chief engineer of the U.S. Navy; and vice commander, Naval Sea Systems Command. He was project officer for the design and construction of SeaLabII, an underwater habitat, and directed the conceptual design efforts for the TRIDENT class nuclear submarines. He is active in the Society of Naval Architects and Marine Engineers and the American Society of Naval Engineers. 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 served on the Marine Board Committee to Review NOAA's Fleet Replacement and Modernization Plan and on the Committee on Marine Transportation of Heavy Oils. MacKinnon is a member of NAE.

Reginald E. McKamie, Sr., is a practicing maritime attorney in Houston, Texas, and a certified public accountant. He received a B.S. from the U.S. Merchant Marine Academy in 1975; an M.B.A. from the University of Southern California (USC) in 1976; and a J.D. from the University of Houston in 1986, where he was a member of 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. Following graduation from USC, he accepted a position as an able-bodied seaman aboard an oceangoing vessel. In 1981, 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

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.

Robert C. North 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 regulatory issues. He served for 34 years as a commissioned officer in the USCG, involved in all aspects of domestic and international programs in those same areas. He led the effort involving 14 federal agencies and public and private sector stakeholders to develop the concept of 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. North directed the creation of Qualship 21, a unique safety and environmental protection quality incentives program for foreign vessels calling in U.S. ports. He also 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. North is a graduate of the SUNY Maritime College with a degree in marine engineering and has participated in postgraduate studies at the U.S. Army War College and the National Defense University.

Craig E. Philip is president and CEO of Ingram Barge Company, the largest U.S. inland waterway carrier headquartered in Nashville, Tennessee. Philip served on a Marine Board study on vessel traffic systems. He also has served as a member of TRB's Executive Committee and the Subcommittee on Planning and Policy Review, is past chairman of both the American Waterways Operators, Inc., and the National Waterways Conference, Inc. Before his current position at Ingram, he was vice president, intermodal, for the Southern Pacific Transportation Company. Philip is active in many professional organizations and the academic community and has taught at Princeton and Vanderbilt Universities. He holds a master's and a Ph.D. in engineering and management from the Massachusetts Institute of Technology and a B.S. in civil engineering from Princeton.

Edwin J. Roland is a consultant with Seaworthy Systems Inc., a maritime consulting practice based in Essex, Connecticut. He previously served as president of Bona Shipping (U.S.), Inc., a tanker operating company based in Houston, Texas, and was vice president, operations, planning, and transportation for Amoco Oil Company, at which he was responsible for water, rail, and pipeline transportation; president of Amoco Trans-

port Company, a wholly owned subsidiary tanker company of Amoco Corporation; vice president, Holland America Line; vice president (marine), Coastal Corporation; and vice president (commercial), Conoco Shipping Company. He also served 11 years in USCG in various engineering and seagoing assignments. Roland is a member of the American Bureau of Shipping, the Webb Institute Board of Trustees, and the Board of the Houston Marine Association. He has served as a board member of numerous marine and tanker-related organizations, including as chair of the API Marine Committee. Roland has a B.S. from the U.S. Coast Guard Academy, an M.S. in nuclear engineering and an M.S. in naval architecture and marine engineering from the University of Michigan, and an M.B.A. from Iona College. Roland served on the Marine Board Committees on Oil Spill Risks from Tank Vessel Lightering and Options for Naval Engineering Cooperative Research.

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. Before his current position, he was president and CEO of the New England Aquarium and earlier spent 20 years at the SUNY at Stony Brook, including service as dean and director of the Marine Sciences Center. Schubel has served on a number of 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 served previously on the Marine Board and was chair from 1990 to 1992. Schubel has a B.S. in physics and mathematics from Alma College, 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 became vice president of General Dynamics in November 1998, when it acquired NASSCO (based in San Diego, California), of which he continues as president, a position he held—along with chairman and CEO—for the previous 10 years. Vortmann began his career in 1969, serving in various 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. He later served as the shipyard's vice president of production and became executive vice president of operations in 1980. From 1986 to 1988, he also served as chairman of the board of

Emkey Development, a real estate development subsidiary of Morrison Knudsen Corporation, of which he was a member of the board of directors in 1987 and 1988. Vortmann is currently a member of the board of the American Shipbuilding Association; council member of the American Bureau of Shipping; chairman of the American delegation to the annual Japanese, European, Korean, Chinese, and United States shipbuilding conference; trustee of the San Diego City Employees Retirement System; and director of both the San Diego Chamber of Commerce and the San Diego Economic Development Council. He earned a bachelor's degree in finance in 1966 and an M.B.A. in 1967 from the University of California, Berkeley, where he was a member of the business school faculty from 1967 to 1969.

***E. 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 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. Ward spent 30 years with Shell in the development, application, and management of technology for deep-water offshore structures. His experience also spans related technology topics, including recent deepwater development projects and trends, drilling, construction, pipelines, subsea well systems, and operations. He has served on numerous API technical committees and has been active in API's activities to develop and maintain recommended practices for the offshore industry. Ward received an M.S. and a Ph.D. in mechanical engineering from the University of Houston.

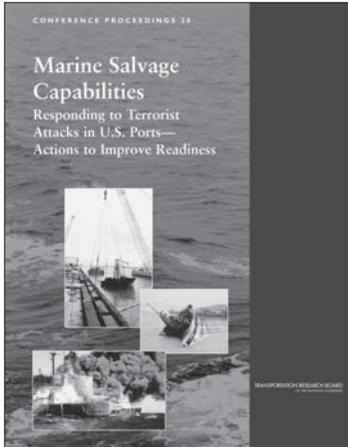
David J. Wisch is a ChevronTexaco Fellow with Exploration and Technology Production Company, for which he is responsible for core technology, R&D coordination, codes and standards, industry committee activities, structural engineering, computer operations, and administrative support. He is a member of API task groups on installation, fatigue, desk leg design, and assessment of existing facilities, and he chairs the API Committee for Standardization of Offshore and Arctic Structures and Standardization of Offshore and Subsea Structures. Wisch holds a B.S. and an M.S. in civil engineering from the University of Missouri and has participated in the doctoral program at Tulane University.

**Outgoing Board Members*



Conference Proceedings 30: Marine Salvage Capabilities: Responding to Terrorist Attacks in U.S. Ports—Actions to Improve Readiness

Committee for Marine Salvage Response Capability, Transportation Research Board, 2004. Available through the TRB Publications Office.

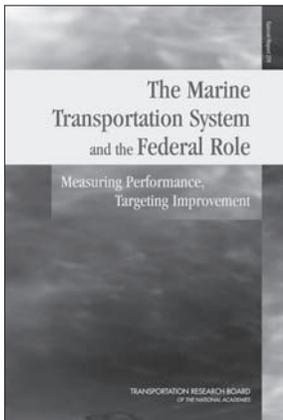


These proceedings present the results of a workshop held August 5–6, 2003, to explore the ability of the nation's organizational and physical marine salvage capabilities to respond to possible terrorist incidents at major U.S. port complexes. Issues considered include organizational and interagency coordination as well as response capabilities.

The workshop addressed economic, legal, forensic, environmental, and human casualty issues related to salvage. The principal goals of the workshop were to share information among relevant agencies, organizations, and other interested parties about current salvage response capabilities and to determine whether any major gaps or concerns exist with respect to current capabilities and agency roles. The report suggests ways to improve the nation's marine salvage readiness and capabilities.

Special Report 279: The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement

Committee for a Study of the Federal Role in the Marine Transportation System, Transportation Research Board, 2004. Available through the TRB Publications Office.



The purpose of this study was to develop an analytical framework for federal agencies to use to both identify capital and operating needs and coordinate federal investments and spending on the MTS infrastructure. The report recommends that DOT should take the lead in assessing the performance of and improving the nation's marine transportation system by developing and issu-

ing information on the condition, performance, and use of that system.

Special Report 273: Shipboard Automatic Identification System Displays: Meeting the Needs of Mariners

Committee for Shipboard Display of Automated Information Systems (AIS), Transportation Research Board, 2003. Available through the TRB Publications Office.

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. This study examined technical and human factors aspects of shipboard display of AIS information and identified the most significant ones to consider when specifying a shipboard display system for vessels 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 aspects associated with operating these systems.

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

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

This report provides the best available estimate of oil pollutant discharge into marine waters, including an evaluation of the methods for assessing petroleum load and a discussion about the concerns these loads represent. Featuring close-up looks at the Exxon Valdez spill and other notable events, the book identifies important research questions and recommends ways to better analyze and more effectively combat pollutant discharge. The book discusses (a) input—where the discharges come from, including the role of two-stroke engines used on recreational craft; (b) behavior or fate—how oil is affected by processes such as evaporation as it moves through the marine environment; and (c) effects—what is known about the effects of petroleum hydrocarbons on marine organisms and ecosystems.

Special Report 266: Naval Engineering: Alternative Approaches for Organizing Cooperative Research

Committee on Options for Naval Engineering Cooperative Research, Transportation Research Board, 2002. Available through the TRB Publications Office.

This report identifies options for ONR to structure programs in naval engineering research that would provide a venue for stakeholders (government, industry, and

academia) to collaborate, cooperate, and guide research and development of naval and maritime technology. Such programs could assist the U.S. Navy in maintaining and developing the necessary human capital in naval engineering to meet future national defense needs.

Spills of Emulsified Fuels: Risks and Response

Committee on Spills of Emulsified Fuels: Risks and Response, National Research Council, 2002. *Available through the National Academies Press.*

As the demand for energy grows in the United States, power generators are looking for alternative fuels and stable prices. Among the alternatives being considered are a group of multicomponent fuels referred to as emulsified fuels. One such fuel is known as Orimulsion, produced by Bitumenes Orinoco, S.A. (BITOR), a subsidiary of the Venezuelan national oil company Petroleos de Venezuela S.A. Congress, through the FY 1997 appropriations bill, directed EPA to initiate research into the qualities and characteristics of Orimulsion and its potential environmental impact. Proposals to import Orimulsion into the United States have generated environmental concerns due, in part, to limited information on the impact of potential spills. The committee's evaluation focused on what information was needed to improve oil spill contingency planning and response.

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

Committee for Environmental Windows for Dredging Projects, Transportation Research Board, 2001. *Available through the TRB Publications Office.*

Deepening and maintaining navigation channels are necessary actions for efficient 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 provides valuable insights into these issues, as well as a template for resolving controversies that involve multiple agency jurisdictions.

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

Committee for Evaluating Double-Hull Tanker Design Alternatives, Transportation Research Board, 2001. *Available through the TRB Publications Office.*

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

developed a risk-based methodology that uses the environmental consequences that follow a spill as means to compare performance of proposed alternatives against similar environmental consequences of a spill from a standardized double-hull vessel for each comparable size. The committee's methodology is divided into three main components: structural damage and oil outflow calculation, consequence assessment, and design comparison. The committee then applied the proposed methodology to double-hull tankers and alternative designs to demonstrate whether the methodology could be used for an assessment. The committee's charge also included provisions to refine and adjust existing tanker damage-extent functions for measuring crashworthiness of tank vessel structures and to develop a generalized oil spill cost database for use in calculating an environmental index.

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

Transportation Research Board, 2000. *Available through the TRB Publications Office.*

With support from 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 MTS. 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 of, presentations and resource papers given at, and synopses of discussion sessions from the conference.

Spills of Nonfloating Oils: Risk and Response

Committee on Marine Transportation of Heavy Oils, National Research Council, 1999. *Available through the National Academies Press.*

In the Coast Guard Authorization Act of 1996, USCG was directed by Congress to assess the risk of spills for oils that may sink or be negatively buoyant, to evaluate clean-up technologies, and to identify and appraise technological and financial barriers to a prompt response to such spills. At the request of USCG, the Marine Board established the Committee on Marine Transportation of Heavy Oils to conduct the study. Using the findings and conclusions in the report, the committee outlined recommendations for improving the capability to respond to spills of nonfloating oils. These recommendations included developing appropriate response plans; developing and implementing methods for tracking, containing, and recovering nonfloating oil spills; testing area contingency plans and industry response plans; and monitoring spill rates from tank barges.

Meeting Research and Education Needs in Coastal Engineering

Committee on Coastal Engineering Research and Education Needs, National Research Council, 1999. Available through the National Academies Press.

Following discussions with USACE, NOAA, the U.S. Geological Survey, and ONR, an expert committee convened to examine national needs in coastal engineering research and education and to assess the adequacy and effectiveness of existing institutions in meeting those needs. The committee reviewed relevant reports; gained further knowledge of 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 on these topics. The committee found that, while coastal engineering is important to the vitality of the nation's shorelines and ports, a lack of sufficient funding has limited the level of academic research, affected the availability and quality of laboratory facilities, and adversely affected academic programs in training new professionals in this field. To ensure meeting national needs in this important area, the report recommends ways to maintain a healthy and vigorous program in coastal engineering education and research.

Applying Advanced Information Systems to Ports and Waterways Management

Committee on Maritime Advanced Information Systems, National Research Council, 1999. Available through National Academies Press.

The safety of maritime transportation in the United States depends heavily on the quality of port and waterways information systems. This report concentrates on

maritime information systems that promote safety and outlines a strategy for overcoming the major barriers to and deficiencies in providing a minimum level of maritime safety information nationwide. The report accomplished three major tasks: first, it identifies ways in which advanced maritime information systems could ameliorate current shortfalls and maintain or improve environmental protection and waterway safety; second, 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 third, it provides a vision of how advanced information management systems can enhance vessel safety and waterway efficiency.

Conference Proceedings 19: National Symposium on Contaminated Sediments: Coupling Risk Reduction with Sustainable Management and Reuse

Transportation Research Board, 1999. Available through the TRB Publications Office.

At the request of the Marine Board, TRB organized and hosted a symposium to evaluate the state of practice in managing and remedying contaminated marine sediments in the United States and to provide recommendations for future action. These proceedings highlight stakeholder responses to and comments on a Marine Board report published in 1997 titled *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies* (included in the following list of Marine Board publications). The document summarizes case studies, roundtable discussions, and workshops on remediation technologies, project implementation, and decision making.

A list of reports published before 1999 is available on the Marine Board website.



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