Chairmen's Overview

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As the 21st century begins, the world is experiencing fundamental and rapid shifts in almost every sector because of the increasing pressures of globalization. Whether driven by trade, technology, or public opinion, leaders in government, business, and the community are examining their past practices and seeking better ways to meet international, national, and local mandates and to provide the services their citizens and customers expect. Economic development, natural environment, educational systems, national and international security, medicine, and many other sectors of today's world are being transformed as the new century unfolds.

The transportation sector is no exception. Rapid changes in the passenger and freight industries have occurred in response to demands for higher and better performance, and these will continue in the foreseeable future. This demand for improvement is particularly apparent in the maritime industry as products move from one part of the world to another. The steady growth of the global economy, the expansion of international trade, and the consolidation under way in the shipping industry have put increasing pressures on the collective performance of the maritime transportation community. Any interruptions or delays to the rapid movement of products or commodities between trading partners impair economic competitiveness and create inefficiencies in the marketplace. Of the multiple critical links in the global transportation and distribution network, the Marine Transportation System (MTS) offers the greatest opportunity for risk assessment and management to minimize the consequences of accidents on the environment and on the economy while striving to deliver a seamless flow of cargo.

Improving Decisions About Risks

The National Research Council (NRC) has been called on for decades to provide guidance for improving decisions about risks to public health, safety, and environmental quality. NRC has conducted many studies and investigations to help decision makers consider how society can understand and manage risk. The problem was of sufficiently broad interest among branches of the federal government that a special study of risk characterization was commissioned in the mid-1990s. A distinguished panel was assembled, called the Committee on Risk Characterization; after investigating a wide array of risk situations, the uses of risk characterizations, and decision types, the committee formulated general recommendations. In its 1996 report, *Understanding Risk: Informed Decisions in a Democratic Society* (National Academy Press), the committee defined the risk assessment process as "a synthesis and summary of information about a potentially hazardous situation that addresses the needs and interest of decision makers and of interested and affected parties." Risk assessment, therefore, must provide decision makers with information that allows them to make informed choices among available options.

Over the years, the NRC's Marine Board has applied risk assessment methodologies to specific studies. Following the 1989 *Exxon Valdez* accident in Prince Williams Sound (PWS), Alaska, the shippers who transport oil from the Port of Valdez by tanker formed a special study team to examine the current level of risk and proposed risk mitigation measures to reduce future incidents. The initiators of the study asked the Marine Board to provide

a peer review of the PWS risk assessment. The Committee on Risk Assessment and Management of Marine Systems was charged with reviewing the risk assessment methodology used by the PWS team. The report of the committee was published in 1998 as *Review of the Prince William Sound, Alaska, Risk Assessment Study* (National Academy Press).

During the same period, the United States Coast Guard (USCG) embarked on a more general process to apply risk assessment to many of its activities as part of its overall work-planning program. The agency emphasized risk management in evaluating and prioritizing decision making and began to include risk-based evaluation criteria in its regulatory requirements. In 1996, the Coast Guard dedicated the April–June issue of its publication *Proceedings* to the topic, "Risk Management in the Maritime Industry." Changes in the international regulatory environment prompted interest in risk-based safety requirements for marine transportation. For example, the International Maritime Organization (IMO) adopted the concept of using risk assessment as the basis for future decision making. At the same time, IMO also developed a formal safety assessment and high-speed vessel codes and requirements to comply with the International Safety Management Code. The need to look at the application of risk assessment to maritime activities was still a major requirement.

Developing the Symposium

Recognizing the need to review current knowledge and to formulate the next steps for the application of risk assessment to the maritime field, the Marine Board proposed a symposium on risk assessment and management applied to marine transportation. USCG and the Office of Spill Prevention and Response in the California Department of Fish and Game agreed to provide funding for this activity. The Marine Board convened a steering group, chaired by Martha Grabowski, that included the following members: Peter F. Bontadelli, Lillian C. Borrone, Paul S. Fischbeck, B. John Garrick, H. Thomas Kornegay, Jerome H. Milgram, and Anthony J. Taormina. Liaisons to the steering group from the USCG were Duane Boniface and J. Michael Sollosi. The steering group met in Washington, D.C., on October 2, 1998, to determine the general purpose and program of the symposium. The scope of the symposium was limited to waterways management, to focus more clearly on maritime factors. Three cochairs were selected for the symposium, representing different facets of the maritime community, including regulatory, management, and industry perspectives: Peter F. Bontadelli, Jeffrey P. High, and Thomas H. Wakeman III. The cochairs worked with the steering group in creating the technical program for the symposium. The program's goal was to gather experts on risk assessment methodology and its related data issues together with governmental and industry leaders in the management of maritime risk.

Several themes were considered for the symposium. All previous studies of the application of risk assessment to maritime activities had identified the lack of available data as a major problem. In many cases, this led to overreliance on "expert opinion," which has hindered the applicability of various methodologies to more general uses. Because of this problem (and the likelihood that it would not be resolved in the near term), one of the major goals of the meeting was to focus on the current status of data availability and the need to develop a set of more generally applicable (and replicable) methods and processes.

Participants in the symposium, including invited speakers, represented a broad array of interests and views from the marine transportation community, as well as the field of risk assessment and management. With this wide range of perspectives, the observations and suggestions expressed in the presentations and discussions were varied and sometimes at odds. The following overview presents a selection of the themes and concerns most frequently expressed during the conference. These are not to be construed as consensus findings or as recommendations of the participants or of the steering group.

Symposium Highlights

In the opening plenary session of the two-day symposium, three keynote talks aimed at capturing the perspectives of three different groups of stakeholders in the application and use of risk assessment in the maritime industry. The speakers representing these groups were Thomas Wakeman, Port Authority of New York and New Jersey; Gus Elmer, SeaRiver Maritime, Inc.; and Vice Admiral James C. Card, Vice Commandant, USCG.

Port Operations Perspective

Wakeman outlined the expanding and competing nature of the MTS from a port operations perspective. He also highlighted issues that were discussed at the National MTS Conference held in November 1998 and focused on the ever-increasing need to apply risk management to many aspects of the MTS.

He pointed out that risk assessment traditionally has focused on three categories: financial losses, natural disasters, or accidents; as a result, there has been an emphasis on loss prevention. Wakeman suggested a new emphasis on achieving desired results and improving performance. He also proposed using risk management as a tool for improving overall transportation system performance.

He applied this framework to the implementation of four management principles:

- Strong commitment throughout the organization—beginning with the senior management—to a shared risk management program;
- Open communication and teamwork among government and industry partners to promote successful implementation of these programs (risks do not observe political, governance, or geographical boundaries—nor does the ability to reduce them);
- Risk management that is actively implemented, since prevention is always better than a cure; and
- Acknowledgment within MTS that risk assessment and risk management are iterative—they must be open to appropriate revision and change.

Industry Perspective

Gus Elmer discussed the need for risk assessment and risk management from the perspective of those who are active participants in the marine transportation industry. Elimination of all risks is impossible, yet the requirements and expectations of customers and of the public are more demanding than ever. He noted that to operate competitively and effectively in today's MTS, a company must have a proactive, dedicated commitment to risk assessment and management. From the perspective of industry, an internal commitment is preferable to a system imposed through legislation or regulation.

Risk management was described as the process of weighing alternatives for controlling risks and selecting the most appropriate course of action. Although risk managers may use information from risk assessments when they make decisions, they also may consider information about engineering, economics, law, ethics, and politics. In addition, a risk assessment ideally should provide systematic results to evaluate and to manage technologies. It should answer whether evidence is sufficient to prove specific risks and benefits. Answers to questions about acceptability of risks, or when a risk situation merits regulation, clearly involve values. On the other hand, the information in the assessment of the risk level should be objective.

According to Elmer, key elements in an industry program include

- Management credibility, so that safety is a core value for the company;
- Unambiguous policies that are believed in and acted on by all employees;
- A company philosophy in which safety has its own learning curve—people learn from past actions and continually make improvements for the future;
- Full information for decision making; and
- A companywide commitment to share information, including approaches and lessons to learn and improve. This commitment must be embraced by the leadership if systems are to improve within a company or within the entire MTS.

A systematic process that ensures objectivity when deciding on risk levels is necessary to guarantee that standards for evidence are objective and scientific. This is critical for obtaining the commitment of all stakeholders to honor and implement the resulting outcomes and recommendations.

Elmer concluded that the preservation of natural resources, the development of a healthy port infrastructure, and the perpetuation of personnel safety and safe operations depended on adherence to the following management principles:

- Promotion of open dialogue and collaboration;
- Blending of the viewpoints of disparate entities;
- Commitment to proven processes;
- The generation of balanced, justifiable solutions; and
- The recognition that the process must embrace continuous improvement.

National Perspective

Vice Admiral James Card opened his presentation by observing that major incidents often create a political reality that can impose value judgments affecting our perceptions when applying risk assessment or risk management. He noted that there is a difference among data, information, and knowledge—there is probably a lot of data, a little less information, and a lot less knowledge. Card outlined the role of MTS to the nation both now and in the future, noting that we are at a critical point. The nation has an aging transportation infrastructure, which affects its competitiveness and increases the risks. The system is under stress, and that stress will increase as more users compete for the waterways—from commercial carriers to ferries to recreational users to people concerned about the overall quality of the environment. These competing users, along with the increased threats of crime, smuggling, and terrorism, as well as the potential needs of national defense, must all be factored in to any efforts to improve the MTS. He noted that unlike other nations, the United States has a port system that includes many local ports of different operating types and sizes and with different systems of management and multiple layers of government. These ports must compete with ports such as a Rotterdam and Hong Kong, which employ centralized systems of port management. To compete successfully, the United States will need a vision for its national MTS.

In an effort to develop this vision, the USCG held regional listening sessions around the country aimed at establishing a dialogue among various federal and local agencies and other stakeholders in the maritime community. The dialogue continued at a national conference on MTS, hosted by the secretary of transportation in November 1998. The conference's objectives included the development of a vision for a more demanding future of MTS and of a framework for national and local coordination; it recommended actions to achieve specific goals in the areas of safety, security, mobility, environment, competitiveness, and infrastructure. Card noted that this vision of a national MTS will succeed only if all stakeholders are involved in its development and implementation.

Following the 1998 conference, a task force was established to coordinate implementation of follow-up activities within federal agencies, including

- Assessing the capability of MTS for the next 20 years;
- Consulting senior public- and private-sector officials as well as users and organizations;
- Participating in public- and private-sector activities to refine and implement the strategies and recommendations and the plans for action;
- Determining the capability for disposing of dredged materials in response to projected increases; and
- Projecting future needs for navigational aids systems.

After completing these activities, the task force will report its findings to Congress (see note, page 6).

One of the recommendations from participants in both the regional listening sessions and the national conference was to implement risk-based decision making. USCG is trying to increase the understanding of the principles of risk assessment and risk management. Card stated that people are the key to success in all areas. There is also a need to apply technologies to improve the MTS, especially when a port with limiting physical constraints faces increasing demands. Leadership is crucial for success in addressing difficult problems. Communication and commitment are fundamental to good leadership.

Presentations and Case Studies

Following the three keynote speeches, which presented the framework for the remainder of the symposium, the primary focus was on specific areas of related interest. These areas were organized into three sections that included

1. Risk assessment methods and data needs;
2. Real-world and agency use of risk assessment and risk management; and
3. Case studies of the application of risk to specific risk assessments or risk management.

Following these presentations, participants gathered in small discussion groups to delve further into specific issues. The presentations appear on pages 17–35, and the summaries of the discussion group sessions on pages 83–101.

Risk Assessment and Data Needs

Karl Weick and Linda Connell introduced the topics of data and methods for risk assessment. Over the past 50 years a wide array of risk assessment approaches has developed, including descriptive and prescriptive models, analytical and behavioral methods, organizational and system models, and statistical and other techniques.

Weick exhorted the attendees to frame their questions carefully before they considered adopting risk assessment methodologies in a particular way. He recommended some fundamental approaches to framing questions effectively with respect to risk assessment methodology, emphasizing that it is important to think "outside the box" to select appropriate methods. This is especially true in looking at broader systems rather than discrete events. Weick specifically discussed one of his recent projects—an analysis of fire-fighting incidents—and concluded that even if we did not use a favorite tool, we can do a lot through intuition, feeling, stories, and experience.

Connell described the Aviation Safety Incident Reporting System, which uses the National Aeronautics and Space Administration as a neutral third party to report accidents and "near miss" incidents. She noted that it took several years for incident reporters to feel comfortable using the system and even longer for system managers to develop a useful database. The database is now at a stage where it will support some truly clinical work on the causes of incidents. Careful listening by project managers and open reporting by users are prerequisites for a viable system. She stated that this might serve as a valuable model for MTS data collection and development.

Real World and Agency Views

The next area of formal presentation was the interaction between real world events and current risk assessment practices and models. Karlene Roberts began by noting that although the marine community is unique, there are common impediments to safety that are closely related to those in other industries. She identified four questions to be addressed:

1. What things really need fixing (and how do I know)?
2. How do I fix them?

3. What are the impediments to fixing them?
4. How much will it cost me to fix them?

Each question had several subquestions framing the concept of risk assessment and management. Roberts noted that the largest impediment to fixing things was not always cost but frequently the culture of the organization itself.

Following this presentation, six representatives of federal agencies offered an overview of agencies' use of risk assessment in their marine and maritime activities (pages 38–52). Todd Bridges of the U.S. Army Corps of Engineers discussed the application of risk to dredging issues through the Dredging Operations Environmental Research Program. Nancy Foster, director of the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA), reviewed several programs relating to risk prevention and restoration of habitat. She observed that these NOAA programs, to be fully effective, must be integrated into those of other agencies and partners.

Alex Landsburg of the Maritime Administration discussed several agency programs and its progress in developing an information safety system for reporting events. Douglas Slitor of the Minerals Management Service (MMS) described how risk management is applied in targeting and analyzing information from the MMS offshore inspection program. Craig Vogt of the U.S. Environmental Protection Agency suggested that environmental concerns be taken into consideration at the beginning of maritime projects and that stakeholders also be involved from the beginning. He emphasized the need to harmonize competing concerns when addressing both a healthy economy and a healthy environment.

Rear Admiral Robert North, who served as chair of the panel, outlined several USCG programs implementing risk management.

Case Studies

The final set of formal presentations consisted of three case studies, found on pages 61–80:

- "The Practical Application of Risk Analysis in the Development of Harbor Safety Plans by California Harbor Safety Committees," by Suzanne Rogalin;
- "The Prince William Sound Risk Assessment: System Risk Analysis Using Simulation and Expert Judgment," by John Harrald; and
- "Oceans Risk and Criteria Analysis," by George Bushell.

Following these presentations, attendees divided into four discussion groups. Group 1, led by John Garrick, addressed risk assessment models and their practical applications. The second group, under the leadership of Paul Fischbeck, focused on the data and information necessary for risk assessment applications. Group 3, led by Anthony Taormina, addressed real world applications. RADM North moderated the Group 4 discussion of agency integration and cooperation. Following these breakout sessions, summary reports of each group's discussion were presented to a plenary session. The summaries are found on pages 83–101.

Summary of Themes

At the conclusion of the meeting, the symposium cochairs summed up the themes emphasized in the sessions. Foremost was the call for a more standardized risk assessment process for the maritime industry—one that would provide a consistent set of methods, standards, and data definitions before a project's start. Also deemed important was the inclusion of environmental considerations at an early stage in a project and the involvement of stakeholders as early as possible in the decision making. Comments indicated that a comprehensive database should be the starting point for doing things differently—and better—in the future. The real-world experience must be included in all of these approaches. For example, many ship crews don't speak English, and, therefore, are going to find it difficult to fill out questionnaires for a database.

The real world also involves competing demands on the marine transportation system and the marine environment from various users, interest groups, and the public. The stakeholders must participate and agree to the process in advance of decision making. It is important to involve stakeholders early and to educate them about the value of the risk assessment process. This will require presenting the processes in terms that nonexperts can understand.

Another often-expressed theme was the need to establish an incident reporting system with the liability protection to provide a data base for conducting reliable risk analyses.

Discussions of institutional responsibilities had acknowledged that a combination of international, national, regional, and local bodies should be involved in decision making and that each entity should adopt risk management as a decision-making tool. Many participants felt that an entity was needed that would be responsible and accountable for gathering all the data and making it available to the various decision makers. USCG was mentioned as the possible agent for this function.

During the closing session, it was observed that risk management was not something out of the ordinary. What many of the participants discovered was that risk assessment and risk management tools were used daily in most companies, agencies, and organizations, whether

on a formal or an informal basis. These applications have become the basis for most waterway management decisions made today. Unfortunately, because most of the applications have been informal, they cannot be replicated. A more systematic and formalized approach would provide a body of information and "lessons learned" to build on in the future.

There always are ways to improve the implementation of these useful tools. The array of excellent scientific and trade literature can help. But the keys to any successful risk assessment and management decision are the commitments of all concerned and their recognition of the need for professional expertise in applying risk management strategies. This symposium was a starting point for expanding the understanding and application of these approaches to the U.S. MTS; hopefully, the texts from these proceedings will prove useful in addressing the ongoing issues.

NOTE

The report of the task force, *An Assessment of the U.S. Marine Transportation System: A Report to Congress*, is available on the Internet at http://www.dot.gov/mts/report.