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Our 54th Year

Proceedings

of the Marine Safety Council

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Shared Lessons Learned

Features

Departments

RADM CARD SPEAKS . . .

By Rear Admiral James C. Card,
United States Coast Guard

Toward a National, Shared, Lessons-Learned Program

In this issue—the last that I shall have the pleasure of introducing before heading off to my new assignment as Commander, Pacific Area—we turn the corner on information technology themes in recent issues to focus on the specific application of information to safety management. All of us, whether in industry or government, face resource constraints and must constantly evaluate whether we are doing the right things with the resources we have. Our discretionary resources must be applied to best advantage if we are to succeed, and our margins are not very forgiving. Having the right information is crucial to achieving goals and, more fundamentally, to allocating our resources effectively.

Over the years I have often felt that safety programs, while rhetorically supported, failed to compete well with other demands for resources. Perceived safety risks simply did not indicate the problem was big enough or the solutions certain enough to command sufficient resources. While we have made tremendous strides in the last decade, internationally and nationally, safety information systems still do not serve our needs as they should. This issue of the *Proceedings* addresses one aspect of a more robust and useful information system. It explores the rationale for, design of and participation in a **national maritime lessons-learned program.**

Clearly, our casualty and near-casualty experiences present our greatest opportunity to understand the essential safety issues needed to prevent future accidents. Despite some acknowledged shortcomings, Coast Guard investigation files are replete with valuable information on how marine systems break down. Both industry and government spend significant resources investigating why things go wrong. Unfortunately, most of these investigative reports have a relatively brief life span. They may spawn bursts of interest and resolve about particular problems and even inspire institutional solutions, but all too often the problems resurface. With a few notable exceptions, yesterday's lessons are swallowed by the siege of present events. The experience and the knowledge, so arduously compiled, wanes over time and is largely forgotten by those who follow us. Therefore, an important goal for a national lessons-learned system is to expose the cache of information we currently hold in ways that are easy to retrieve, understand and apply.

Of particular interest is the burgeoning array of events, often called near-misses, that "telegraph" system vulnerabilities and weakness well before system failures, i.e. casualties, occur. The sheer volume of knowledge recoverable from a systematic analysis of these events promises to point the way to those key interventions that should prevent casualties. But first, we must find a systematic approach to competently analyze incidents, capture the right information and disseminated the results effectively.

Several "systems" are already in use in companies or independent organizations. They are blazing the trail that I hope will lead to a national system or network of systems that will give mariners and managers access to comprehensive data that reflects the safety problems, their probabilities and their causes. The backbone of a national system of this magnitude must be the vessel owners. Without question, company specific incident analysis and safety performance measures are important for a company's operations. In the near future, the ISM Code will drive many of you to implement formal incident analysis and feedback processes. The potential synergy from combining all of these independent efforts presents the greatest value for human and organizational improvement. However, without the support and participation of the owners, accurate and complete analysis will not be made, and the system will not generate the confidence necessary for management to allocate requisite resources to casualty prevention.

The opportunities before us are simply too great to ignore. As I leave Washington, I challenge each of you to consider carefully the concepts presented here and to participate—to the extent possible—in development of a national maritime lessons-learned program that will serve your needs.

BY THE WAY...
Editor's Point of View

By Cheryl Robinson

Proceedings magazine, as always, strives to keep you informed about all aspects of the maritime industry.

Our theme for this issue is "Safety Through Lessons Learned." This involves an extensive compilation of information – gathering the basic incident information; analyzing that information and the outcomes by taking a hard look at what was done and perhaps what could be done differently; and lastly, disseminating the information to the largest number of persons needing the information.

The Marine Safety Information System (MSIS), the Coast Guard data collection and retrieval system developed from reports and investigations, currently serves the maritime community as a vital source, but is only one of the many sources in the maritime industry. While the MSIS is an efficient system, several other software applications are being used and designed to enhance safety through lessons learned.

Our primary concern here at *Proceedings* magazine is to disseminate the information to the maritime community, and if we can quicken the process by devoting an entire issue to the topic, we gladly do so.

Please remember to send in your survey and opinions, so we can keep a finger on the pulse of the maritime industry.

A special thanks for all the calls and letters. We certainly appreciate the input and feedback from our audience. We have tried to respond to all of your inquiries in a timely manner.

NEXT ISSUE:

"PARTNERSHIPS/ALTERNATE COMPLIANCE"

UPCOMING ISSUES:

"PROPULSION FAILURES"

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Thoughts on a National Lessons-Learned System

By Scott P. Cooper, CAPT, USCG

INFORMATION—if it is not useful, it is worse than useless. It is a costly waste. Since we will all concede that information is necessary for survival in today's complex business environment, we MUST assure our information sources are optimally useful. This maxim is certainly true regarding safety information for marine transportation.

This article explores the development of a national lessons-learned information system for marine transportation. It describes present safety information systems and proposes a process to define the information needs in the marine sector and to design systems to deliver optimally useful information to the industry.

The State Of Marine Information Systems

In the United States, the Coast Guard maintains the most comprehensive data collection and retrieval system on marine transportation safety. The core of its system is known as the Marine Safety Information System (MSIS). It contains information on a variety of Coast Guard activities including: vessel and facility inspections, vessel casualties, personnel action cases, vessel documentation, civil penalty actions and pollution cases. The system was designed in the 1970's to meet perceived program management, law enforcement and safety requirements. The casualty information portion of MSIS is developed from reports and investigations of those events which are defined as "casualties" in federal regulations (46 CFR 4.05).

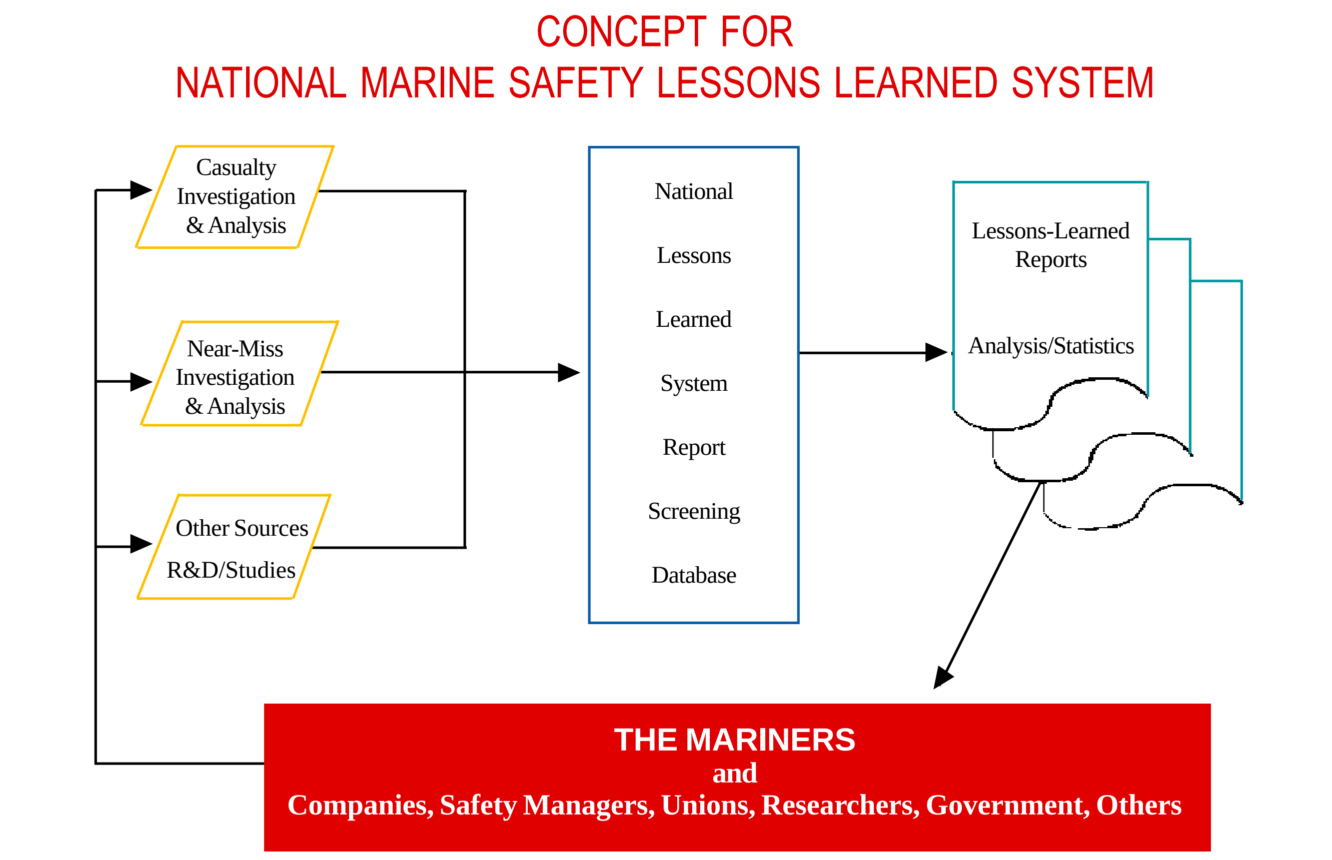
MSIS has served the marine community extremely well over the years, but let's not kid ourselves, twenty year-old approaches in today's information intensive climate simply do not cut it. To extend the utility of MSIS, the Coast Guard uses several software applications for casualty data analysis. The final section in this edition presents MSIS data from a new application which will permit streamlined access to casualty data through the convenience of a spread sheet. We intend to make the spreadsheet available electronically for use by anyone with the appropriate software.

While we are making marine safety information more useful through creative approaches, MSIS is extremely limited. Its hardware and software components are no longer on the market and support is becoming less and less available. Fortunately, the follow-on system, the Marine Safety Network (MSN), is in the design stages now. It will employ state of the art technology for information collection, retrieval and analysis. Most importantly system design is focusing on the utility of the information for safety and resource management and for measurement of our progress towards a safer marine transportation system.

A number of other information systems augment the Coast Guard's system. Many companies and industry associations maintain safety databases designed to serve their specific needs. Internationally, IMO maintains a database of casualties involving those vessels which must conform to international standards. Lloyd's of London compiles data on casualties from around the world and reports them in its daily periodical, Lloyd's List, as well as in a separate volume. Other sources include a variety of professional journals which report marine casualties and, in some cases, present highly sophisticated analysis and lessons-learned.

The Human Factors Group of Linthicum, Maryland provides a voluntary reporting system modeled after the Aviation Safety Reporting System (ASRS). Their Marine Safety Reporting System (MSRS), described in detail in a subsequent article, is not affiliated with the government and is designed to preserve the anonymity of the reporting source. Their database is compiled from reports of accidents and incidents submitted on a pre-printed form. The system provides anecdotal and quantitative information on reported incidents.

Of note in this age of electronic media is the expanded use of the World Wide Web as a distribution tool for safety information. Many readers may have seen the various Coast Guard web pages. Lessons-learned are posted there periodically . In addition, the INTERNET surfer may link to other sites for additional marine



This schematic shows a conceptual design of a process for the national lessons-learned system.

safety information. Samples of some of these sites are included in this edition of the *Proceedings.*

A National Lessons-Learned System Considered

Safety lessons can be derived from many sources. Casualty statistics are a source of trend information and also indicate probabilities and risks. Research and studies yield valuable lessons that too often have limited circulation. Casualty investigations such as those conducted by the Coast Guard and the NTSB are typically the most visible sources of lessons-learned. This variety of sources point to the potential utility of a system or network of systems to improve access to all available information.

Perhaps the most useful sources of information upon which to build risk aversion and prevention programs are marine incidents—i.e. casualties and near-casualties. The benefit of these incidents lies in the fact that they are "system" failures. In the case of near-casualties, the system failures were detected, and the casualty was avoided. Careful analysis of known failures and interventions should provide lessons about fixing problems and, in turn, reduce the probability of system failures.

The terms near-casualty and near-miss means those events or circumstances that, if allowed to progress without interruption and without "last-minute" intervention or just plain luck, would have resulted in an accident (unintended event) or a mishap. The value of these near-casualties is that there are exponentially more of these than there are casualties. In other words, if we could create a system to analyze these non-casualties and apply the lessons they tell us, we could prevent casualties. Our prevention programs would not be predicated a history of tragedy. This is an enticing vision, but how do we create such a system?

A View Of A Marine Incident Reporting Systems

A **useful** incident reporting system must serve the safety goals of the users. Therefore, the first step for the marine community is to reach consensus on what the system is to accomplish. Some have expressed interest in an anecdotal system centered on high quality root cause analysis of system failures. Safety managers would develop intervention strategies from the pertinent cases to improve their own processes and procedures. Others have indicated a desire for a quantitative system—one that yields trends and probabilities of failures from which risks can be more accurately determined. Management and safety staffs would then be able to focus attention and resources more effectively on the most threatening issues.

The next step is to consider system controls. While wide participation in any system is crucial to its success, the potential disincentives are strong. A near-miss implies someone failed to do their job adequately. Many would be disinclined to admit failure to their employer. Similarly, participants may feel vulnerable to enforcement actions by the government or to litigation from third parties. Some have expressed concern that increased incident reports can be used by insurance companies to elevate premiums. To defuse these concerns, many have recommended that a national system should not be managed by the government and that incident reports be neutralized to protect companies and individuals from adverse actions. The aviation system (ASRS) preserves the anonymity of the reporting source through a process called "de-identification."

In an open system the quality and accuracy of reports may vary widely. The varying abilities of reporters in assessing the incident, defining the issues and expressing them correctly will introduce uncertainty and potential inaccuracies into the database. In some cases, a skewed report may be introduced to "protect" someone or, conversely, to "point the finger." Also, an incident may receive multiple and conflicting reports. Quality controls in the form of will explained reporting standards and report screening should be implemented in a national system.

If the system is to provide statistically significant information, greater care must be taken to assure the data elements are adequately defined. This is important not only for those entering information into the system but also for those extracting data. As the data is retrieved and manipulated, analysts will need a well-documented data dictionary to assure consistency in interpretation of the results.

The need for a set of controls to give shape to the national system and to assure a reasonable level of accuracy indicates the need for a national coordination mechanism. The coordination body should include all segments of the marine transportation industry and appropriate government agencies. The various Coast Guard advisory committees may be the natural nucleus from which to create a control group.

THE NEXT STEP

Clearly, with the increasing desire of many in the marine safety community to use incident data in casualty prevention programs, the time is ripe for an improved system to collect and disseminate lessons-learned. Government has an important role to play, but not in its capacity as an enforcement or regulatory entity. Rather, it should provide the forums for the industry and the public to address the fundamental issues and to develop a consensus approach to designing and implementing a national system. This issue of *Proceedings* should serve as the springboard for the next step. I invite you, the readers, to take that step. Send your comments to the editor of the *Proceedings*. Tell what you think about a national lessons-learned program; how it should work, who should control it and any other pertinent thoughts. All comments will be forwarded to the correct office or individual.

- **Coast Guard/American Waterway Operators (AWO) Safety Partnership** received the award for innovative, non-regulatory approaches to marine safety. The Partnership established a Quality Action Team consisting of government and industry representatives to examine the causes of crew fatalities in the inland towing industry. The team developed the "Stay Alert for the Edge" (S.A.F.E. Decks) campaign to improve awareness of fall overboard risks and to emphasize best practices and behaviors which will reduce those risks.

- **Marine Safety Office Portland, ME** formed a team to investigate ways to reduce loss of life and property on fishing vessels. They subsequently designed a vessel damage control simulator. Through simulation, users practice responding to shipboard flooding and other emergencies. The simulator employs pumps and tools to control flooding in a safe but realistic environment. Over 4,700 New England commercial fishing vessel operators and crew members have been trained thus far and are enthusiastically endorsing this live saving tool.

- **Marine Safety Office Morgan City, LA** formed a customer focus group to identify challenges to transiting the Berwick Bay area and reduce accident rates for tug and barge traffic in that area. The group identified 19 risk factors and implemented changes to overcome those. The changes have helped to decrease the rate of towing vessel accidents by 75% in the last three years.

- **Marine Safety Office Savannah, GA** initiated a natural work group, partnering with the Ports Authority, shipping lines, agents, National Cargo Bureau and others to develop a more efficient system for identifying containers and cargo requiring inspection. The old process involved driving to the port and randomly picking containers. The new system provides Coast Guard access to the Ports Authority computerized database allowing targeting/holding of containers based on content and shipper's history of compliance. This saved Coast Guard 10-20 man-hours/week and saved the customers time assisting in the identification and tracking containers for inspection.

- **Marine Safety Office Jacksonville, FL** created a "self-inspection" program for merchant vessels. Historically, Coast Guard inspectors conducted annual inspections of all aspects of these vessels, typically taking days to complete and with little involvement of the management or crew of the vessel. The streamlined process relies on self inspection by the crew and signed affidavits of compliance. Coast Guard inspectors then spot check high risk areas for verification. This program has saved over 150 marine inspection hours on low risk U.S. flagged container ships, allowing those hours to be redirected to high risk foreign vessels, while also placing responsibility for safety back on the vessel management, crew and operating companies.

- **The Coast Guard Regulatory Reinvention Team** is an interdisciplinary team which streamlined maritime regulations by eliminating 381 pages of obsolete regulatory text from Federal Regulations and reinventing another 1,976 pages. This effort removed unnecessary economic disparities between domestic and international shipping, potentially enabling U.S. shipping to better compete on a global scale.

- **Training Center Cape May** negotiated a mutually beneficial agreement with the Philadelphia Veterans Affairs Medical Center to provide various services to active duty members, saving driving time (2-5 hours) to a Military Treatment Facility (MTF) and cost savings for using a local civilian provider. This agreement resulted in the opening of the several new clinics at Cape May staffed with VA and TRACEN personnel. They include an Optometry clinic in November 1995, an orthopedic clinic in Jan 1996 and a women's clinic in May 1996. The anticipated savings expected are approximately $1,000,000 in 1996. This includes the decreased cost of the VA compared to MTF charges and civilian source fees as well as the decreased active duty travel times and associated loss from work as a result of that travel.

The Hammer Award represents a departure from yesterday's government with its $400 hammers. Fittingly, the award consists of a framed $6 hammer, a ribbon, and a note from Vice President Gore. About 600 awards have been presented to teams comprised of federal, state and local employees and citizens who are working to build a better government. Past recipients include:

- **The Coast Guard Vessel Inspection Team** and the St. Lawrence Seaway Development Corporation entered into an agreement in 1992 to "reinvent" the traditional inspection process by allowing Corporation and Coast Guard personnel to jointly conduct an abbreviated version of the Coast Guard's Port State Control Inspections and Ballast Exchange Screenings at the US Snell Lock in Massena, NY. (Awarded Oct. 1996)

- **Industrial Support Activity**, Support Center New York, initiated a P-250 pump re-manufacturing program which reduced management and overhead costs and improved delivery time to Coast Guard vessels. "New" pumps are made ready for issue before they're needed, and shipped immediately upon request. It used to take three-to-six months for a pump to be repaired. Now, next day delivery is not uncommon. Costs decreased significantly by about $500 to $1,000 per pump repair. Centralized analysis of the failed pumps has resulted in valuable lessons learned being incorporated into new operating procedures with each pump delivered. Additionally, Industrial Support Activity worked closely with the manufacturer, recommending improvements to their technical manuals and pump operating procedures for future field changes. (Awarded May 1996)

- **The First District Marine Safety Division** instituted a proactive **Fishing Vessel Safety Program** and developed a close partnership with industry. The program resulted in improved safety for fishing vessels (10 percent reduction in deaths and 43 percent reduction in injuries in the First District) while increasing efficiencies of CG efforts (shortened boardings at sea resulting in fewer personnel hours.) Specific initiatives included: voluntary dockside examinations; fishing vessel safety training incorporated into District Boarding Officer School curriculum; computer tracking system instituted for fishing vessel casualties, death, and injuries-analysts look for patterns to define key problem areas to help reduce casualties and minimize injuries; developed newsletter for fishing industry; and hosted seminars on safety related topics with industry. (Awarded May 1996)

- **Marine Safety Office Boston's** Vessel Documentation Office used technology and reengineering work processes to provide more timely, more effective service to the public. The group reengineered the 20,000 vessel file system from six separate systems to a single system key-indexed to the vessels' official number. All incoming work is entered into a database management program which tracks cycle time and maintains workload status. The time of locating files was reduced from about 50 minutes to less than five minutes. The occurrence of lost/misplaced files disappeared. The time for processing abstracts of title went from three-to-four weeks to three days. Previously, customers communicated strictly via mail or with the department head. Telephones were installed at employees desks and specialists were empowered to interact with customers directly. Customers now receive immediate attention on the phone or "over-the-counter." Correspondence has been reduced by more than 30 percent. Empowering employees improved morale and resulted in a 50 percent reduction in absenteeism. (Awarded May 1996)

- **The Coast Guard Notice of Violation Team** instituted a new civil penalty ticketing program for oil pollution cases and prevention cases. The ticketing program provides the recipient the opportunity for early resolution of the cases and saves the government time and money. Previously, all pollution cases were forwarded to a civil penalty hearing officer for consideration. In some cases it would take over a year from the time of the incident to first notification by the hearing officer that a case was being considered against the suspect. The new program was designed to allow recipients a choice of paying the penalty within 30 days (closing the case) or waiting for the case to move through the chain of review to a civil penalty hearing officer. During pilot testing customers overwhelmingly supported the new program by paying 88% of tickets issued. (Awarded July 1995)

- A partnership between the active duty and reserve at **Group San Diego** cut unnecessary spending and increased efficiency. The active duty absorbed administrative support for the reserve unit and extended its hours to include evenings and weekends. Reserves now focus on operational training rather than administrative tasks. This integration of functions enabled the Group to eliminate 15 percent of its billets and improve training efficiency at the same time. (Awarded Sept.1994)

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A "Special Thanks" to Elizabeth Neely, Baldrige National Quality Program, former member of the Commandant's Quality Staff, for helping to compile the information.

Safety Brokering:

Seven Lessons Learned for Maritime Safety

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Introduction

The world in which we live is increasingly complex, increasingly turbulent and continually changing. These characteristics are quite evident in safety-critical large scale systems, such as maritime systems, where a "silent ballet" (Grabowski, 1995) of complex interactions between many individuals and organizations distributed over a port or waterway is executed with precision on a daily basis, with no obvious choreographer in sight.

In the U.S. maritime system over the past several years, change has been continual, and the ground rules under which organizations and individuals in the system have been operating have changed substantially.

This combination of a complex, turbulent safety-critical system, which exists in an environment in which significant changes in standards and expectations have occurred, provides a number of opportunities. There are substantial management challenges for operators, managers, and regulators seeking to enhance competitive and safety performance in the system. At the same time, there are also significant operating pressures and challenges for individuals and organizations who are required to perform safety-critical complex tasks in a system where the requirements and expectations are changing. Finally, there are research challenges for observers and practitioners who are interested in enhancing human and organizational performance in complex large scale systems.

We consider some of these challenges. We focus particularly on how and why the U.S. maritime system works as it does, and consider how best to leverage lessons learned so as to enhance safety performance in the system. In this article, we consider the idea of safety brokering: borrowing lessons learned from safety critical large scale systems, both maritime and non-maritime. We begin first with an exploration of the concept of safety brokering and then consider seven lessons learned from within and without the maritime system.

Brokering Safety

Brokering is a time-honored profession in which an individual or organization acts as an intermediary for others in negotiating transactions for them. Maritime brokers date back to at least as early as the fifteenth century, when reference is found in English and European documents to the activities of marine insurance brokers. In the United States, while the clipper ship era was at its height, a few imaginative individuals established themselves as experienced intermediaries between merchants, shipowners, and underwriters, knowing market conditions and acting as the distributing medium between them. Nowadays, brokers are found in a variety of financial, psychological, social, technological, and commercial settings. In each of these settings, the principle of brokering is similar: an individual or organization acts as an intermediary between parties, and leverages knowledge and experience — of markets, activities, practices, or standards — in order to provide a value-added service to the parties.

Safety brokering is a less well known practice in which ideas about safety and performance enhancement in one domain can be used to solve problems in another. Much work in the high reliability organizations (Roberts, 1993; Roberts, Stout and Halpern, 1994), normal accidents (Perrow, 1984), technological safety (Sagan, 1993; Tenner, 1996; Vaughan, 1996), and human and organizational error (Reason, 1991; Grabowski and Roberts, 1996) fields provides examples of efforts to leverage knowledge and experience between like and unlike safety-critical large scale systems.

Much attention has been given to this concept of late, and there have been a variety of conferences, workshops, and colloquia given over the past several years that have focused on safety challenges in complex, safety-critical large scale systems. For instance, this spring, the National Transportation Safety Board, in conjunction with the American Petroleum Institute, hosted a seminar and workshop focused specifically on enhancing maritime human and organizational performance. Similar conferences and workshops have been hosted by the Society for Naval Architects and Marine Engineers (SNAME), the Human Factors Society, the Academy of Management, the Institute of Electrical and Electronic Engineers (IEEE), and other professional and trade organizations. The Coast Guard, under RADM Card's leadership, has developed and nurtured a ubiquitous human factors program called Prevention Through People. The Coast Guard also sponsors a human factors research program which links customer and user needs, Coast Guard mission and program requirements and research challenges.

The National Research Council's Marine Board, in a series of reports dating back twenty years, has examined the application of lessons learned, best practices, and knowledge across a variety of safety-critical domains (Maritime Transportation Research Board, 1976; 1981; National Research Council, 1994, 1996a, 1996b, 1997). Currently, the Marine Board is preparing a report of lessons learned and best practices in human and organizational performance which specifically examine work, projects, findings, and understandings from other domains that can be applied with good results to maritime systems (National Research Council, forthcoming).

Applying lessons learned from one domain to another domain is a tricky business, however. Making analogies between seemingly similar systems — between air traffic control and vessel traffic systems, for instance — is not always as straightforward as it seems. Knowing which lessons and knowledge from other systems will work in the system under study, and which will not, requires identifying key similarities in each system, and in safety-critical large scale systems, *understanding the impact of those similarities on safety performance in the system*. Simply identifying similarities between systems, thus, is not enough: the key to understanding whether lessons learned and best practices will work in similar large scale safety critical systems lies in understanding the safety performance impact of those variables identified as similarly safety-critical in the systems.

In this article, we consider lessons learned which can help enhance maritime safety, brokering knowledge and experience garnered from within and without the maritime world.

Lessons Learned

It is Difficult to Understand Safety Performance without Good Data

It is well known that it is difficult to develop quantitative foundations for organizations and systems without data that indicate what performance in the system or organizations has been. Leveraging knowledge and experience in systems hampered by inaccurate and unavailable data is similarly difficult. In general, maritime safety trends are derived from analyses of casualty data, infrequent major safety studies, and economic forecasts (National Research Council, 1983; 1994). However, maritime safety performance is not routinely monitored through systematic analysis of safety data, nor are the data adequate for this purpose. Further, analysis using historical casualty records is not timely enough for near-term adjustment of safety programs, and available casualty data do not provide the resource necessary to assess trends related to construction, outfitting, manning, technical systems, and maintenance, or to fully develop an understanding of all safety needs (National Research Council, 1994). The first lesson learned from within the maritime community is that quantitative (and qualitative) evaluation of safety performance is important; a codicil to this lesson is the understanding that in maritime systems, such evaluations are difficult to perform because of the inadequacy of the existing data sources.

User and Stakeholder Involvement is Critical in Enhancing Safety Performance

Change in most systems is a slow process; this is particularly true in large-scale, safety-critical systems such as maritime systems where enhancing safety performance requires change. One of the keys to successfully effecting change in a system lies in engaging members of the system — owners, operators, customers, clients, users, regulators and interested stakeholders — in a dialogue about the change. Such a dialogue can provide useful input to the decision making processes, can provide opportunities for system members to air their points of view and concerns and for members of the system and interested stakeholders to grow in their understanding of the multiplicity of concerns which must be addressed in any effort to induce change in a large scale system. Such a forum could also provide an opportunity for members of the community to begin to develop an understanding of others' concerns and interests, and the requisite trust (see below) so important to the effective functioning of a large scale system.

Near Miss, Unusual Incident Data and Expert Opinion Can Provide Important Insights

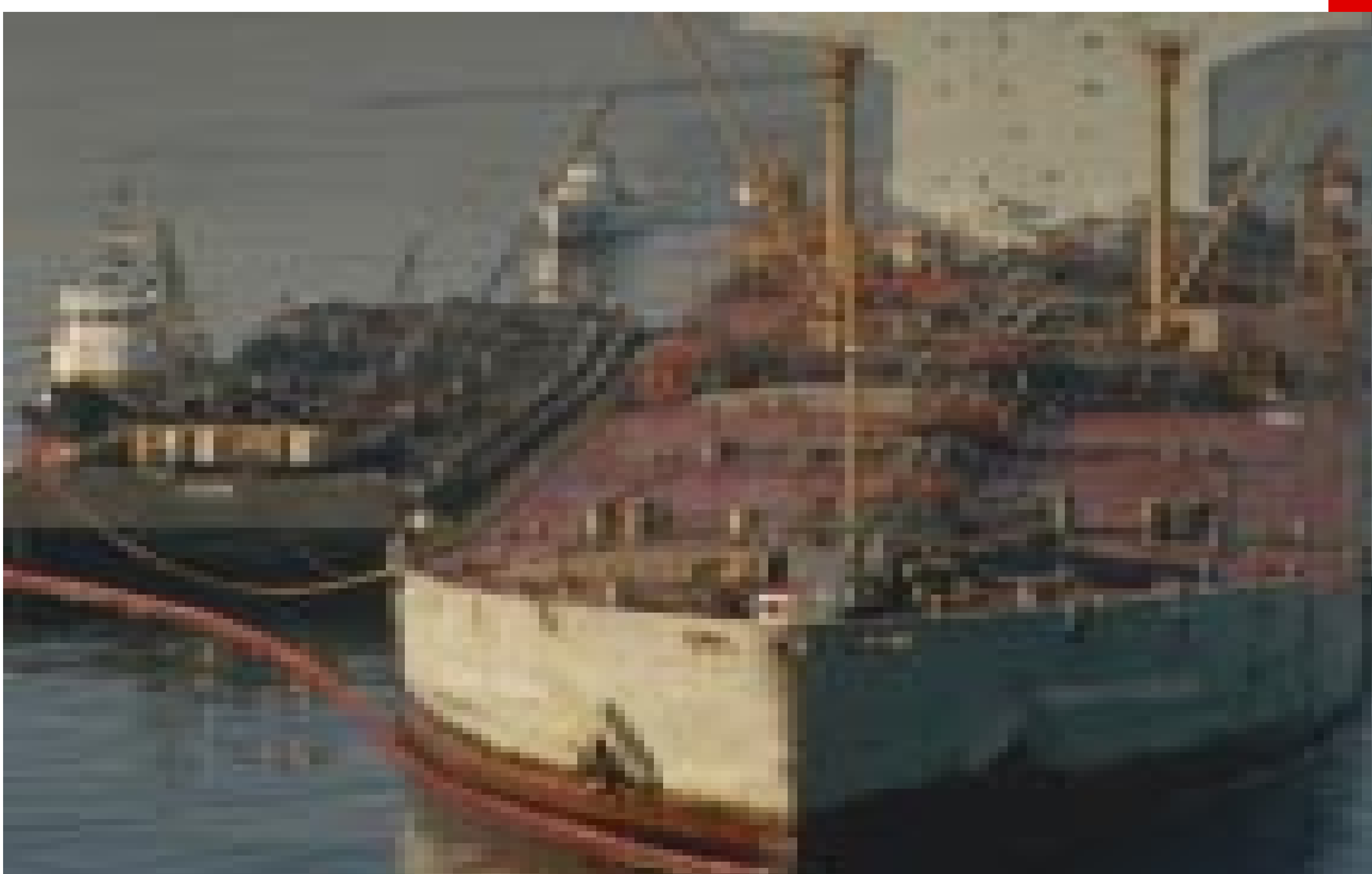
In systems which are characterized by data difficulties, such as maritime systems, efforts can be made to supplement the available quantitative data with additional sources of information, which can provide important input in assessing safety performance. "Near miss" or unusual incident data, in combination with, or in addition to, expert opinion can provide important insights in maritime systems. Even though the actual numbers of unusual incidents or near misses can be challenging to determine, gathering and analyzing this data is almost always an enlightening process.

Such data and expert opinion can fill important holes left by available quantitative data, and provide meaning to safety data trends or puzzling statistical observations. Moreover, near miss and unusual incident data can provide glimmers of problems which have not yet come to fruition — latent failures (Reason, 1991) or problems that might be nipped in the bud given careful attention to the warning information. Drawing correct inferences from near miss and unusual incident data, however, is challenging: NASA had years of test data regarding the performance of the shuttle O rings before the *Challenger* incident took place, yet engineers spent much time in post-mortems after tests "explaining away" the puzzling test data

(Vaughan, 1996). Thus, applying and understanding the messages and lessons being signaled by near miss and unusual incident data can be as challenging as gathering the data itself.

Every Port has a Signature

Every port or waterway has characteristics that differentiate it from other ports: this is one of the hallmarks of maritime systems, and one of the great challenges in conducting safety and risk analyses in port and waterway systems. Thus, analysis of available data, examination of the different types of unusual incidents, near misses or unreported incidents, and discussion of those incidents with domain experts, can provide clues as to the "signature" of the port — the safety variables that define performance. In a port such as New Orleans, the signature of the port has to do with combinations of river stage, visibility conditions and the physical location along the Mississippi River (i.e., river mile) (Harrald, Mazzuchi, and Grabowski, 1995). In a port such as Valdez, the signature of the port has to do with the presence of ice in shipping lanes, wind, and weather conditions (Harrald, Mazzuchi, Grabowski, Saebo, and Hutton, 1996). In each case, however, reliance solely on available safety data would not have provided the clues necessary to determine the port's signature: expert opinion from domain experts who live and work on the water, coupled with an examination of unusual incident data, were critical to determining the port's signature. Thus, the last point (near miss, unusual incident data and expert opinion can provide important insights) and this point are intertwined: determining a port's signature requires use of available quantitative data as well as domain-relevant qualitative data, including expert opinion.



Trust is the Lubricant that Makes the System Work

Much has been made of the importance of trust in large scale sociotechnical systems, and in maritime systems, in particular. Indeed, trust has been referred to as the "glue" that holds the system together, which enables the "silent ballet" to occur time and again on a daily basis (Grabowski, 1995). A core principle of trust is the optimistic anticipated behavior of other parties. Moreover, the anticipated behavior of the parties is a shared expectation of both parties. To the extent that one partner conforms to the expectations, other partners are encouraged to continue the association. Thus, there is a reciprocal relationship between continuity and trust: as trust reinforces the prospect of continuity in a relationship, a commitment to extend an interorganizational relationship into the future encourages trust (Hart and Saunders, 1997).

In maritime systems, these expectations are an essential component of what makes the system work. Shipping company owners and operators have expectations of safe navigational transits effected by ship's pilots, who count on the Coast Guard to articulate and enforce port state control regulations so as to ensure the safety of the ships entering U.S. waters. Coast Guard captains of the port similarly trust the pilots, as the eyes and ears of the maritime world, to provide feedback, where necessary, of actual conditions encountered aboard vessels entering port. Shipboard personnel and ship's pilots expect that VTS watchstanders will demonstrate competence, discretion and knowledge of how the port operates as waterway and traffic information is provided. Shoreside managers similarly have explicit and implicit expectations of shipboard personnel who are entrusted with expensive and potentially dangerous resources. These examples are oversimplifications, of course, but illustrate the web of relationships which are but part of how the maritime system operates.

In other large scale systems, some form of trust is also present — in large scale command and control networks, in air traffic control, in virtual organizations which encompass surgeons, hospitals, pharmacists and health maintenance organizations. However, in maritime systems, particularly in the U.S., trust is essential. Trust is implied in all the working relationships which exist in ports and waterways, and is the lubricant that keeps that system from breaking down. Absent of this trust, the complex, distributed large scale system would not function, and the safety-critical aspects of the system would be overwhelming. Trust is a double-edged sword, however, as is known from the criticisms which arise following oil spills: the public has high expectations of safety performance in the system. When those expectations are not met, and the public trust breached, the outcry is significant. Thus, managing expectations in a system based on trust is a difficult and potentially disastrous, enterprise.

"Drop Your Tools": Change is Inevitable

Change in systems and organizations is important and on-going and the topic of much continuing discussion. Organizational change is an ongoing improvisation by individuals and organizations trying to make sense of and act coherently in the world. Resistance to change, however, can have disastrous consequences. The failure of 27 wildland firefighters to follow orders to drop their heavy tools so they could move faster and outrun an exploding fire, which led to their death within sight of safe areas (Weick, 1996), is one such example. This reluctance to accept oncoming change, or to "drop one's tools," can be dangerous:

The reluctance to drop one's tools when threat intensifies is not just a problem for firefighters. Navy seamen sometimes refuse orders to remove their heavy steel-toed shoes when they are forced to abandon a sinking ship, and they drown or punch holes in liferafts as a result. Fighter pilots in a disabled aircraft sometimes refuse orders to eject, preferring instead the "cocoon of oxygen" still present in the cockpit. Karl Wallenda, the world-renowned high-wire artist, fell to his death still clutching his balance pole, when his hands could have grabbed the wire below him.

Dropping one's tools is a proxy for unlearning, for adaptation, for flexibility, in *short, for many of the dramas that engage organizational scholars. It is the very unwillingness of people to drop their tools that turns some of these dramas into tragedies (Weick, 1996, pp. 301-302).*

As practitioners and scholars interested in enhancing safety in maritime systems, we must be committed to unlearning, to adaptation and to flexibility. Because of the complexity, turbulence, and prevalence of change in the maritime system, we run a great risk. If we don't drop our tools, we, too, may be overcome in the firestorm that follows. The safety impact of the necessity of change in maritime systems demands a commitment to embracing change which can be at once challenging and life-saving.

The Importance of Storytelling

The final lesson learned for maritime systems has to do with a great tradition in maritime systems. Chroniclers of the maritime world have long observed the history of storytelling in the maritime domain. Indeed, most newcomers' introduction to the maritime tradition comes in the form of narrative: stories which relate an individual's experiences in the domain, an organization's history chronicled over time, or practices and their associated tales which comprise the oral history of the maritime world.

These stories play important roles in collaborative learning in the maritime domain. Collaborative processes are important in large scale systems, and in the maritime world in particular, because in complex systems no one person embodies the breadth and depth of organizational knowledge necessary to comprehend complex organizational problems, and because codified, abstract knowledge is seldom sufficient to deal with actual problems in the system. Orr (1990) and Brown and Duguid (1991) describe similar examples of machine repair technicians, whose knowledge comes not from what is taught in the classroom, but rather from informal story-swapping among technicians and users about their experiences in particular work environments.

As noted earlier, the key to successful safety brokering lies in being able to identify not only analogies between similar large scale safety critical systems, but in being able to identify analogies in the safety-performance impact of those similarities. For instance, in some large scale systems, storytelling becomes the means by which an oral tradition of best practices and lessons learned is passed from one generation to another. This is certainly true aboard nuclear powered aircraft carriers, submarines, fighter aircraft, tanks and howitzers. This is also the case aboard merchant vessels and throughout the maritime system.

Why is storytelling so important in these similar large scale systems? First, storytelling is the means by which both communities initiate members into a complex, changing system. Second, storytelling is also a low technology mechanism that can always be counted on to be available, in hazardous conditions, as long as two people with differing levels of experience in the domain are found in the same location. Third, storytelling provides an opportunity for members of both communities to bond and form alliances, which is critical for successful execution of the tasks members must perform. In order to succeed, members of both systems must insure that the stories are understood, that new members are able to act on those lessons, and that there is little ambiguity about what is expected of members when critical actions and reactions are required. Thus, the bonds and alliances formed with the transmission of the stories are critical for successful performance in both systems. The analogies in these two systems work, therefore, because the safety impact of storytelling in both systems is similar—not just the task of storytelling, but what the task means in terms of safety performance in the system.

Conclusion

This article suggests that lessons learned and best practices can be borrowed to good effect — from within and without the maritime community when there are similarities between two systems and when the safety impact of the similarities are understood and able to be leveraged. This framework provides a way to move forward in enhancing safety performance in maritime systems, by leveraging lessons learned and best practices which enhance safety performance.

Note: For references, please contact the author.

The Benefits of Using

Root Cause Analysis Techniques

to Improve Procedures and Avoid Future Incidents

By James P. Sweeney, Vice President Operations, Morania Oil Tanker Corp.

Every thing is normal. The captain and crew are experienced and have performed the maneuver many times. The equipment goes in and out of this terminal regularly. There are defined procedures to be followed. Sounds like the beginning of another routine docking maneuver. Unfortunately things do not happen as normal. The unexpected does occur and now there is an incident. Degree of damage, resulting consequences, what could have happened, become the focus in everyone’s mind. Yes, these questions will be answered, but most importantly, an analysis of why the event occurred and what can be done to prevent the event from occurring in the future become the real priority. What lessons can be learned, how does the company alter the way it conducts business, and how does the message get to the fleet?

Over the past six years, Morania Oil Tanker Corp. and Penn Maritime, Inc., have utilized a five step process to completely alter the manner and methods that they employed to do business. This five step process in summary is as follows:

1. Analyze the present Morania and Penn
2. Increase environmental awareness and improve required skills (Prevention through People)
3. Review equipment standards, procedures, and response capability
4. Implement an OPA ‘90 Construction Program
5. Strive to achieve the highest level of operator certification (Responsible Carrier, ISM)

Morania Oil Tanker Corp. and Penn Maritime, Inc., started as companies focused on servicing their customers. Today this focus, incorporates the protection of the environment, the preservation of the customers’ good name, and the development of the highest quality standard of operation. Part of the development of the highest quality standard of operation includes the utilization of root cause analysis techniques to investigate the factors that lead to accidents and injuries.

Root cause has been defined as the “most basic reason for an undesirable condition or problem which, if eliminated or corrected, would have prevented it from existing or occurring.” Root cause analysis is the easiest and most consistent way to understand what occurred that was not expected, planned for, or out of the normal course of business. Yes, there are many methods that can be employed that are accepted techniques that result in finding the root cause of an occurrence, but some techniques work better than others, especially when a thorough analysis is required to be documented and shared with not only employees but customers.

The less structured root cause analysis techniques include intuition, networking and experience. These techniques may have the advantage of a short turn around, ability to detect low level signals and the formation of abstract conclusions. But they also come with the disadvantages of subjectivity, difficulty in technique training, require the familiarity with the process, and incur the potential for a higher probability of failure. The techniques may be utilized in occasions where the obvious lack of procedures or known failures are present and corrections can be implemented immediately.

Each structured technique on the other hand

NATIONAL DEBATE

Although the company and employees are still gaining experience in the proper utilization of root cause analysis as a tool to improve the way we do business, the best example of the employment of the technique discussed above that can be shared is our first formal exposure to a joint company and customer tree diagram root cause analysis. This will illustrate the changes in procedures that can develop and the methods that can be employed to communicate the lessons learned.

Without using specific vessel or terminal names, in mid June of 1995 at about 1030, one of our tugs in the notch of a light 400' double bottomed oil barge started a docking maneuver at a terminal located in the lower kills of New York Harbor. The barge had an allision with the loading arm at the barge berth. The tug was held in place in the notch by 2" wire push cables running from the stern of the tug to the stern of the barge on both sides. At the time of the incident the wind was out of the NE, and the tide was ebbing. Low water should have been at about 1135. When the allision occurred, the bow rake of the barge was moving to port, overhanging the dock. There was no damage done to the barge. Prior to the allision, the port push cable, which ran from the stern of the tug to the stern bitt on the barge, got hung up on the north dolphin. The captain, when realizing the push cable was caught on the dolphin fenders, attempted to twist the unit to free the wire from the dolphin. This maneuver was only partially successful in that the vessel continued to swing to port due to the initial inertia created when caught, the wind out of the NE, and the twin screw twisting maneuver employed, before the wire came free and allowed the barge to back. Once backing, the tug used the fenders on the dolphin to fend off and counteract the force of the wind and ebb tide. The unit was then given orders to hang up and await further orders.

Subsequent investigation included crew and terminal statements, employment background and training, vessel and dock facility descriptions, drug and alcohol tests, analysis of weather and tide conditions, analysis of methods to enter the berth area, review of loading and berth orders, assist tug policy review, and a senior captain analysis of the event. These resulted in a perceived root cause, a contributory cause list, and the development of a policy to prevent such an occurrence from happening in the future. In addition, an advisory to all captains describing the incident and additional precautions that should be taken was sent from our manager of safety and training.

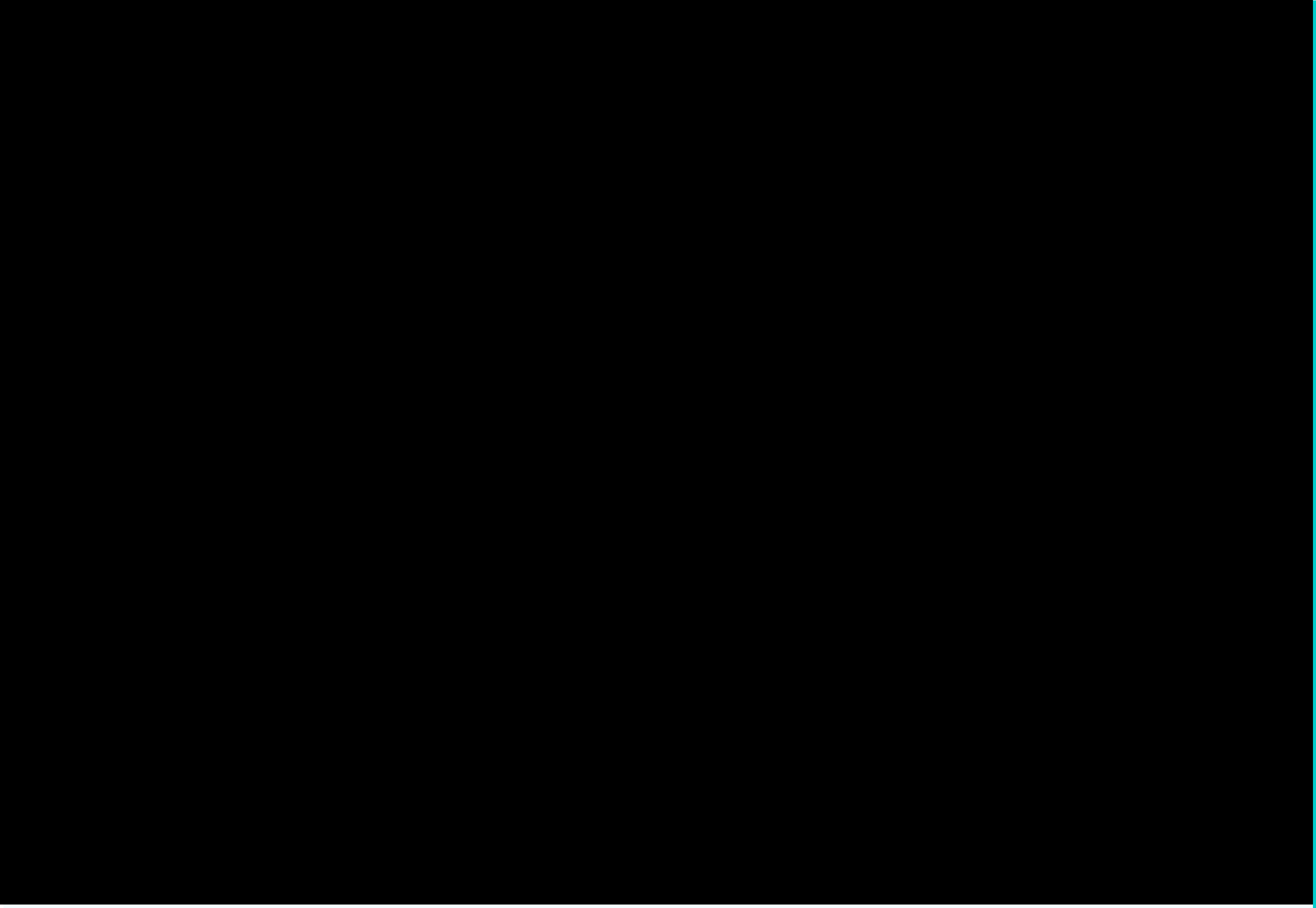
Having completed what we believed to be a thorough investigation, we next met with our customer to share our findings. This meeting and review of the incident resulted in an agreement to pool our resources and hold a formal meeting with representatives from both companies, to develop and display a tree diagram of the factors involved in the incident. Besides myself, from our company we utilized our fleet managers, our manager of safety and training, and three tug captains (which brought over 100 years of tugboat experience to the meeting). Our customer, which had extensive formal training in tree diagram analysis, contributed a manager of environmental safety and quality control, a refinery operations manager, a supply coordinator, and marine terminal advisor.

The advantages of the structured approach are repeatability, or the following of step by step procedures, the overall documentation produced is better, and there is considerable literature available about most of the formal techniques

In a no-holds-barred, five hour session, every detail of the event was reviewed, discussed, and analyzed. Eight levels of factors were employed in developing a tree diagram of the factors that may have influenced the event. Although the resulting root cause conclusions were similar to the first analysis, they became more focused. The benefits of using the formal tree diagram were truly appreciated. The experience of having not only office personnel, but vessel captains, involved in the process, was a valuable demonstration of the benefits that can be obtained in formalized tree analysis that leads to developing procedures that affect the manner in which we conduct our daily operation.

The tree analysis showed that by establishing clear procedures for how this tug should be made up to the barge when approaching this facility, the potential for a repeat of the event would be eliminated. This conclusion was reached after reviewing the unique relationship of the push cables as they led from the stern of the tug to the stern of the barge and the location of fendering on the dolphin that had to be utilized in this maneuver.

The company goal is to continue to improve the way we do business. Customer satisfaction and the elimination of all incidents that can be detrimental to their expectations are a priority as we go forward.



Vessel Traffic Service A Valuable Learning Tool

By Captain Ed Page
Commanding Officer of Coast Guard Marine Safety Office/Group Los Angeles-Long Beach

Professional athletes have for years reviewed movies of their games to see where they need to improve. The team shares lessons learned so they don't make the same mistakes. Their coaches demand continuous improvement and top performance... after all the stakes are high!

Of course the stakes athletes are playing are not as high as those a supertanker captain faces when he navigates his vessel, laden with several million barrels of oil, into a busy port complex. If he makes a mistake the impact can be billions of dollars, the environment damaged for years and thousands of lives negatively impacted. Perhaps the tanker captain can learn from athletes the value of critical self assessment by reviewing tapes of him navigating his vessel into port so he can improve his maritime skills! Obviously, all mariners could benefit from reviewing playbacks of their more problematic voyages into port.

We don't need to have a collision or grounding to be motivated to improve one's seamanship skills; it's too late then! Close calls can be equally effective in teaching valuable lessons. That's the philosophy advocated at the Coast Guard and Marine Exchange jointly operated Vessel Traffic Information Service (VTISY) at Los Angeles-Long Beach. The VTIS is equipped with a computer system that records the processed radar images of vessel transits which can be replayed at different scales and speeds. The system's records of "Vessel Incidents" provides the Captain of the Port and the maritime community an opportunity to review these incidents to identify problem areas and share lessons learned with the objective of preventing maritime casualties in this very active port area. With over 5,500 deep draft vessels calling on the ports of LA-LB annually, conducting over $160 billion of trade the "stakes" are high!

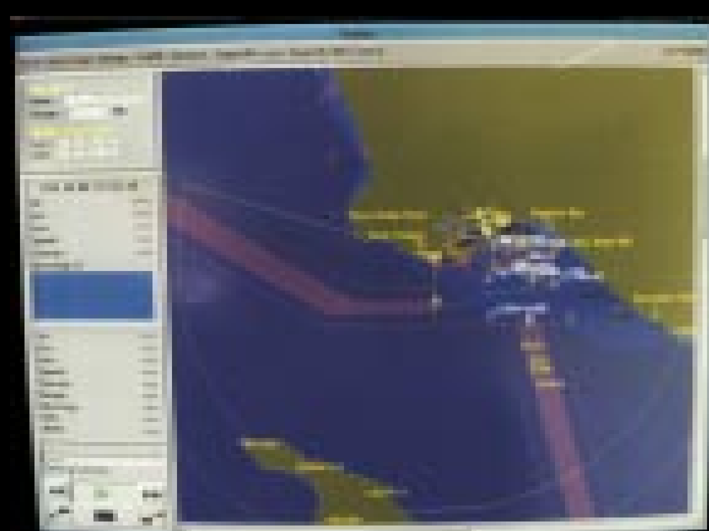
The Los Angeles-Long Beach VTIS is unique as its the only government/industry partnership Vessel Traffic Service. It's not a Coast Guard VTS, its the maritime community's VTS funded through user fees. There's both a Coast Guard and Marine Exchange employee on watch at all times, assisting the safe transit of vessels from 25 miles out to sea to the ports' breakwater. They assist over 30,000 vessel transits annually and, on occasion, observe some fairly serious mistakes. They take advantage of these "incidents" to educate mariners and help prevent them from making the same mistakes again. As 80% of marine casualties are attributable to personnel errors, we need to take advantage of new tools that allow us to continually train mariners to ensure they can safely operate vessels.

In Los Angeles-Long Beach this is how the process works;

- When the VTIS watchstanders observe a "Vessel incident" such as a close quarters situation, Rules of the Road infraction, speeding, etc., the details of the incident are immediately transmitted over computer to the Marine Safety Office staff (Captain of the Port, Chief of Port Operations and Command Duty Officer) and to the Executive Director of the Marine Exchange, in this case a civilian master manner.

- The Executive Director of the Marine Exchange contacts the agent and or vessel operator and notifies them of the incident and recommends the master visit the VTIS to review it on the playback computer. Oftentimes mariners feel more comfortable meeting with the Executive Director of the Marine Exchange/VTIS than with Coast Guard officials. Whatever works! The goal here is education not intimidation.

- The Captain of the Port also sends out a "Letter of Concern" to the operator explaining the details of the incident, strongly urging the "lessons learned" are shared with their entire fleet and arranging for the master and key bridge personnel to visit the VTIS to review the tapes of the "incident" and see how the VTIS operates. There's been 100% compliance.



• When the mariner and oftentimes the bridge management team visit the VTIS and review the playback of the "incident" they suddenly develop a better appreciation of the "big picture" and where they "dropped the ball". They are essentially retrained right then and there.

Does it work? One master conned his vessel in fog through congested waters confidently broadcasting to the other vessels that he was closing in on to "Comply with the Rules of the Road". What he didn't pick up on was that the "General Prudential" rule applied as the presence of several vessels presented a situation not specifically addressed by the Rules of the Road. He was not the "stand on" vessel as he thought.

Confusion ensued and a close quarters situation developed. He received a strong recommendation to come up to the VTIS. After meeting with the Captain of the Port and the Executive Director of the Marine Exchange/VTIS and reviewing the tapes of his earlier transit his demeanor changed ... "I see now" he said in a heavy accent. He humbly apologized and made arrangements to have his navigating officers visit the VTIS. He also developed a first hand appreciation for how a VTS can assist mariners in safely navigating in congested waters. This visit and playback of his transit provided an excellent lesson to this very seasoned mariner who became a little too confident over the years.

Altogether, the playback of incidents has proven to be an excellent training tool that is well received by the maritime community as a way of improving safety. And, for this port region, it's a critical element of "Prevention Through People", essentially providing timely retraining of mariners who made errors.

Captain Page, a 1972 graduate of the Coast Guard Academy, has been the Captain of the Port of Los Angeles-Long Beach since 1994. He works closely with Captain Manny Aschemeyer, a 1961 California Maritime Academy graduate and master mariner, who is the Executive Director of the Los Angeles Beach Marine Exchange and VTIS. Together, Captain Page and Captain Aschemeyer brought this unique VTIS on line in March 1994.

Prevention Through Pictures • Prevention Through Pictures • Prevention Through Pictures

Photos Show it All ...

Can you find the Bell?

When was it noted?

- **A. After paint was dry?**
- **B. During required drills?**
- **C. After the fire?**

Answer: C

When was it corrected?

- **A. Not yet**
- **B. Painting after fire**
- **C. Upon arrival of first lawyer**

Answer: C

Smoke ... ?

- **A. Rises?**
- **B. Settles?**

Answer: A

New fire safety amendement will require low level lighting to point to the exit.

Where should this lighting be installed?

- **A. Ceiling level**
- **B. Deck level**

Answer: B

Prevention Through People

By Kriste Hall

What does "Lessons Learned" mean? It means learning by that most memorable and painful of teachers, experience. Why should we share our "Lessons Learned"? The main reason is so that a painful or costly lesson only needs to be learned once first hand. Now, in a competitive environment, some people see sharing information as a bad thing and believe, "I paid to learn it. He should too." But the result of not sharing a lesson could affect each of us in greater insurance or workman's compensation costs, increased pollution, and other shared hazards. Prevention Through People (PTP) promotes the sharing of Lessons Learned and other information in accord with the established principles "Honor the Mariner," and "Share Commitment." This is also in line with the PTP goals of Know More & Cooperate More.

Sharing information and learning from those around us provides many benefits. Under the Cooperate More goal, we encourage the circulation of success stories, forging of partnerships, identifying the opportunities for improvement to be addressed and changing the culture from reactive to preventive. Our common bond of providing a safe and cost-effective marine environment joins us all together.

A lesson learned tale does not have to be big, complicated, or expensive to be worth sharing. In fact, as shown below, some of the most effective improvements require only communicating a problem to raise awareness. Some examples of Lessons Learned follow.

Getting the Message Out

Marine Safety Office (MSO) Portland, Maine, had a formidable task of letting the commercial fishing industry of Maine and New Hampshire know that some new survival craft regulations were taking effect. The Coast Guard kept running into problems doing this until they talked to the National Weather Service (NWS). The NWS agreed to transmit the advisory broadcast about the rule change in conjunction with their marine weather broadcasts. MSO Portland decided to approach the NWS because monitoring marine weather broadcasts is something done routinely by all mariners. The advisory broadcast was an unqualified success.

An Ounce of Prevention...

The port of Jacksonville, Florida, had several "loss of power" casualties in a short span of time. MSO Jacksonville decided to take a look at the situation and found that each casualty appeared to be rooted in a failure of the starting air system distribution and regulation valves of vessels with diesel direct power plants. In many of the cases, the valves wouldn't operate properly because of impurities in the starting air system. The MSO issued a marine safety information bulletin (5-96) and a MSO Jacksonville policy letter (1-96) to the local industry on the evaluation/ inspection of starting air systems. Since these items were distributed, there have been no new incidents in MSO Jacksonville's area of responsibility.

Who's There?

The Vessel Traffic Service (VTS) on the St. Marys River (Michigan) has always tried to let each vessel know who is around them on the river. They received a suggestion from a local master that has made this task much easier. Now when the VTS watchstander responds to a vessel call-in he/she repeats the vessel's name, direction and location. In this way, everyone on the St. Marys River who is monitoring the VTS channel can be aware of their companions on the river with every call-in. Not only does this provide a simple, inexpensive improvement, but it also shows the value of working together and listening to the ideas of others.

In each of these examples described here, and others which have taken place around the country, there is one overarching theme, we can work together to ensure that ours is the world's safest, most effective and economically effective maritime community. By working together toward common goals we can make a difference. That is what PTP is about.

What *Really* Happened?

By John S. Gelland
Personnel Safety Head, SeaRiver Maritime

The ship was in the shipyard when fire broke out in the tank undergoing hotwork repair. A splinter of hot metal or a spark had escaped the hotwork enclosure and ignited a sheen of crude oil which was floating on top of water that covered a portion of the tank bottom directly underneath where the burning was being performed. Two shipyard workers were present, the boilermaker/welder and a fire watch. Both workers were experienced personnel. The fire watch had a fire hose charged with water ready for immediate use. The fire caused damage to bulkhead coatings and some structural damage.

The barge tankerman was lowering a hose boom into its cradle when his hand slipped from the winch handle. The handle spun around and struck the back of the tankerman's left hand breaking a bone. The tankerman was wearing work gloves, using both hands on the winch handle and was standing so that he faced the side of the winch with his feet comfortably positioned. The man was familiar with the operation of the boom winch; furthermore, boom and winch operations had been the topic of the vessel's safety meeting, which had been conducted three days prior to the incident.

These two incidents seem to be pretty straightforward; so, what's to learn? As you will read later, the incident investigations and subsequent root cause analyses which were conducted in response to both of these events yielded a number of lessons learned and opportunities to improve the safety management system. While the payoff is in the findings, it is in the investigative and analytical process where the real learning occurs. Let's explore that process.

The primary purpose of an incident investigation is to prevent similar occurrences and improve the safety, reliability and effectiveness of operations. Rarely do single triggers cause an incident; most often, multiple, interrelated causal factors can be identified as having contributed to some degree. For the investigator, the intent is not to place blame; but rather, to focus on uncovering the critical factors in the chain of events leading up to the incident which may have either contributed to, or failed to prevent the undesired outcome.

Effective incident and "near-miss" reporting, investigation, analysis, and follow-up are necessary to achieve improvement in safety and environmental performance. These tools provide the means to determine the correctable root causes so that proper action can be taken to prevent recurrence. "Near-miss" incidents must be included in this system because they have the ***potential*** to inflict injury, property damage or customer complaints if their causes are not corrected. The hazardous action or condition that produces a "near-miss" one time may result in a serious injury, equipment or environmental casualty the next. Ask yourself, would you even consider getting onboard a plane if you didn't believe the airline company thoroughly investigated potential errors or failures prior to certifying the aircraft and its crew?

To borrow a concept from statistical process control, both "near-misses" and actual incidents can be viewed as "non-conformities" in the safety assurance system. Since actual incidents occur only infrequently, the power of the analysis is limited by having few events to study. By including "near-misses" in the analytical mix, the information base is greatly increased and we can better identify and learn about the factors which contribute to the causation of incidents. Since our company initiated a root cause analysis process in 1994, almost 60% of the incidents we have analyzed have been "near-misses".

With the United States' adoption of the International Safety Management (ISM) Code, passenger ships, tankers, gas carriers, bulk carriers and mobile offshore units will have to demonstrate compliance with its provisions by June 1, 1998. Section 9, of the Code, requires that companies establish "procedures ensuring that non-conformities, accidents and hazardous situations are reported to the Company, investigated and analyzed with the objective of improving safety and pollution prevention." In addition, companies

What *Really* Happened?

"should establish procedures for the implementation of corrective action."

What Are The Basics?

In seeking some further definition, ISO 9002 offers the following steps for seeking corrective action and prevention of non-conformities, whether they relate to accidents, equipment failure, process discrepancies or customer complaints:

· Perform an investigation to determine the root cause(s) of the non-conformity;

· Record the results of the investigation;

· Determine the corrective action needed to eliminate the cause of the non-conformity;

· Follow up to ensure the corrective action is implemented and effective.

ISO 9002 also states, "Often the root cause of a non-conformity is not obvious, thus requiring careful analysis of all related processes, operations and quality records."

Many investigations, often performed by those directly involved in, or responsible for the incident, simply do not look deeply enough into the underlying factors which may have contributed to the occurrence of that incident. An effective root cause analysis process assesses equipment, human performance and management system issues (like standards, procedures, training, supervision and administrative controls) identified during the investigation. Identifying root causes leads to the development of corrective actions for the identifiable problems which cause, or significantly contribute to incidents.

What Is A "Root Cause"?

According to one company which has developed

Key Steps in the Incident Investigation Process:

1. Report the incident
2. Plan the investigation (a step often overlooked)
3. Gather the facts/evidence
4. Determine the sequence of events
5. Identify causal factors (factors that, if they had been different, would have prevented/ significantly mitigated the incident)
6. Identify root causes (using a systematic, documented process)
7. Develop corrective actions
8. Communicate the facts of the incident, lessons learned and corrective action
9. Steward the status and verify the effectiveness of the corrective actions

a technique for performing root cause analysis, a root cause is, "The most **basic** cause(s) that can **reasonably** be identified and that management has control to **fix**". There are a number of methods employed throughout industry in attempting to identify root causes. Some ask "5 Why's", others employ structured risk or fault trees in attempting to probe more deeply into the underlying factors which may have contributed to an undesired event. Some of the processes are more robust than others and lead the investigator to consider a broader range of issues before completing his or her inquiry.

A systematic, well documented root cause analysis process should encourage investigators to look beyond the most obvious causal factors, or the ones the investigator(s) understand the best, and think about problems and their solutions differently. The process should help by more comprehensively and accurately identifying the equipment, human performance and management system deficiencies associated with the event. From this analysis the investigator needs to determine whether the problem was unique to the single event or is of a more generic, system-wide nature. By using a multi-disciplinary team to perform the root cause analysis resources are available to ensure appropriate corrective actions are identified. For example, our Company's shoreside root cause analysis committee is comprised of representatives from the Personnel and Operations Safety Groups, the Law Department, Operations, vessel personnel (when needed for further information/clarification), and technical expert resources as warranted.

What Are The Benefits?

Experience has shown that incidents are often more complex than they first appear. The systematic analytical approach which is currently employed demands an in-depth examination of the incidents investigated. Often multiple root causes are revealed to be associated with a single incident. It has been our experience that the process helps to identify correctable factors that may have been overlooked in our previous incident investigation process. The technique has taught us much about the broad range of factors which can be associated with incident occurrence.

Since we added root cause analysis to our incident investigation system a number of system improvements have been noted. The first is the improved quality of the Marine Casualty Summaries (MCSs) and "lessons learned" that we share with our fleet. The improved MCSs are a more helpful tool for fleet employees to use when leading reviews, discussions and performing follow-up during vessel safety meetings. In the process of examining the events leading up to an incident we learn more about the manner in which tasks are performed and how to improve the safety, effectiveness and efficiency of our operations.

Another benefit is a perceived change in the "safety culture". Since root cause analysis is a non-blame process, the current approach is viewed by employees as a genuine desire to learn what correctable factors were involved with any given incident and an attempt to prevent recurrences. In fact, the literature reports that in only a minority of cases is employee error the sole root cause. Learning what those other contributing factors may be is a key to developing sustained and continuous improvements to safety performance.

What *Really* Happened?

Tank Fire

The Marine Chemist issued the Hot Work Certificate even though he had "concern" about the oil on the surface of the water. The Marine Chemist was unable to describe the scope of work to be performed, the flashpoint of the crude oil, description of the hot work enclosure, number of blowers, dates and times he was in the tank to inspect. This was referred to the Marine Chemist Qualification Board.

There were no dry chemical or carbon dioxide extinguishers in the tank, water was used to try to extinguish the fire (the Material Safety Data Sheet clearly stated that water spray or fog "may not extinguish the fire"), in fact, the water spread the fire over a larger surface, the fire watch was not provided instructions for the preferred means to extinguish the fire, and the fire watch had not been recently trained. Company guidelines have since been changed to remind shipyard personnel that Material Safety Data Sheets must be reviewed prior to the commencement of work, that fire hoses and appropriate portable fire extinguishers are required to be present when hot work is performed, and fire watch training records are verified prior to the vessel's entry in the yard.

Some General Lessons Learned

Clarify, check for accuracy and completeness, and ensure work is performed according to procedures, standards or administrative controls.

Examples:

- Provide clear directions when issuing instructions.

- Require the use of work permits for higher risk jobs (e.g., hot work, tank entry, working aloft, electrical work, lock out/tag out, etc.).

- Perform regular internal and external audits/ assessments/evaluations of vessel operations and safety.

- Have up-to-date prints/drawings of vessel critical systems.

- Perform timely PM, ensure appropriate systems/ equipment are included in the PM system

Conduct Job Hazard Analyses (JHAs), provide job-specific training and supervision.

Examples:

- Ensure JHAs are conducted and personnel involved in performing the job participate, including third-parties.

- Ensure that necessary and important steps are reviewed and addressed by the JHA.

- Encourage questions if portions of a JHA are not clear, or a step seems to have been missed.

- If multiple instructions are provided, or if the task has multiple steps, provide a check-off list to make certain all steps have been completed and in the proper sequence.

- Provide adequate pre-job briefings, including sufficient information so that job participants understand the "big picture" and have enough information to properly perform their jobs.

Look for less obvious contributing factors.

Example: An employee is walking on a catwalk, not paying attention to where he or she is walking, and steps in a hole in the grating. Ask questions like the following:

- Why was there a hole in the grating? How long had it been there?

- What steps, if any, were taken to notify others of its presence?

- Were the "warnings" adequate?

- Why was the condition not corrected?

- What factors may have distracted the employee? Why was he or she not watching?

Referring back to the incidents at the beginning of the article, at first glance it may appear that no further inquiry is necessary. In the past, such consequences may have been attributed to worker inattention or carelessness. As a matter of fact, by employing a systematic incident investigation and root cause analysis process much more can be learned about the factors which can prevent similar incidents from occurring in the future. Following is a summary of some of the key root cause findings.

While uncomfortable with the presence of oil in the tank, vessel personnel relied on the Marine Chemist's Certificate and allowed the work to progress. Expectations for communicating, responding to and following up on concerns which may effect the safety of the crew or vessel were reinforced and standards for cleanliness for in-tank work were clarified. Management of change standards were also clarified pertaining to last minute changes and/or additions to the repair specifications.

Winch Accident

There was no mechanism found on the winch to stop the boom from free falling if the handle was accidentally released; the winch handle could not be secured or pinned to the shaft on the winch to prevent it from slipping off; the winch handle was 14" long and when in the 12 o'clock position it was at the employee's eye height (an ergonomically undesirable position). The winch has been re-engineered and a winch wheel has replaced the handle.

The employee lowered the boom by "letting it ride" on the brake; an attachment to the JHA created for this task stated the "hand brake is only used in an emergency, and is not to be used as a method for lowering the boom", the JHA manual on the boat did not have the attachment with the warning. The cargo boom winch operating procedures did not elaborate on the use of the winch dog for safety. The JHA and procedures have been modified.

Conclusion:

In SeaRiver, we have found that a systematic, comprehensive investigation and analytical system is a key factor in recognizing true opportunities for improvement in safety, efficiency and organizational effectiveness. The opportunity to learn from "non-conformities" is directly tied to a commitment to seek out the underlying factors which contribute to undesired events and to find out what really happened. The overarching "lesson" that we have learned is that incidents and their causal factors are often more complex than first perceived.

Can the Commercial Fishing Industry Benefit From Sharing Lessons Learned?

A smoke generator adds element of realism to fire drill.

Survival-at-sea exercises prepare mariners for real-life emergencies.

By Leslie J. Hughes

A recent fire aboard a floating processor moored in a remote area of Alaska, with a crew of more than 130, dramatically illustrates how vessel owners and crews can benefit from sharing information learned from emergency situations. The lessons learned from the following account should have universal appeal for any crew relying on Self-Contained Breathing Apparatus (SCBAs) for fighting a fire onboard their ship.

At 9:35pm the fire alarm system detected a fire in the freezer hold of a 260-ft fish processing vessel. The vessel's fire team mustered quickly, donned fire suits and SCBAs and responded to the fire zone with hoses and extinguishers, just as they had been instructed in their training and as they had practiced in their drills. Since the vessel was dockside at the time, crew members not needed for emergency response were evacuated to a shoreside facility.

The fire was soon arrested, but the fire teams noticed that the air in their SCBAs did not last long because of the physical exertion required and the excitement of fighting a real fire. The smoke was heavy throughout the vessel, requiring the fire teams to climb several flights of stairs between the muster area and the fire zone. As soon as the fire team started making good progress in knocking down the fire, the low-air alarms started ringing, forcing them to leave the fire for a fresh cylinder of air. At least one estimate was that a 30-minute cylinder was good for only 15 minutes in this emergency situation.

Fortunately, since the vessel was dockside, the local fire department responded to the fire alarm as well, bringing along a cylinder recharging compressor. Two neighboring processing companies also responded with additional cylinders of air for the firefighters. Less than 90 minutes was required to put the fire out completely. However, if this vessel had been at sea, there is some reason to doubt whether the onboard supply of SCBA cylinders would have been adequate for fighting this fire, in light of not having a means of recharging the cylinders.

Lesson 1: A working fire detection system allowed for early response while the fire was still manageable.

Lesson 2: The previous NPFVOA firefighting training of the crew allowed for an organized, rapid response to the fire with proper equipment.

Lesson 3: The frequent fire drills enabled the crew to conduct a quick, calm and safe evacuation.

Lesson 4: Although this vessel carried air substantially in excess of what is required by the Coast Guard, the crew learned that there can never be too much breathing air aboard the vessel. The managers and crew are in the process of evaluating the best method of increasing air supply to be carried, whether it will be a recharging compressor or a supply of large air cylinders, or a combination thereof.

No maritime sector has to look far to find incidents which could have easily resulted in more serious consequences, had it not been for the responses of a well trained crew on a well maintained vessel. Examples such as the one aboard this processor can be strong reminders to all vessels to re-assess the firefighting equipment they carry. Sharing "lessons learned" among fleets can often help prevent catastrophes aboard other vessels.

Crews tend to identify with incidents aboard vessels similar to their own. For the commercial fishing industry, sharing lessons learned is significantly more challenging than for other industry groups due to the diversity of vessel configurations and gear/equipment carried, and crew sizes, as well as areas and modes of operation throughout the country. Communicating lessons learned is further complicated by the lack of an industry-wide means to disseminate this kind of information. However, the Coast Guard's emphasis on ways to improve how we learn from accidents clearly personifies the Protection Through People concepts of identifying better information and procedures for defining and controlling safety problems.

Ms. Hughes is the executive director for the North Pacific Fishing Vessel Owner's (NPFVOA) Vessel Safety Program - a non-profit organization of approximately 200 vessel owners and 150 associate members. This organization is totally dedicated to safety education and training of commercial fishermen and other mariners. The program was developed in cooperation with the United States Coast Guard in 1985 as the model safety program for fishermen in the country. Photographs courtesy of NPFVOA.

Fishing Vessel Stability:

By Lieutenant Thomas C. Miller

On August 9, 1968, the U S. Coast Guard, at the urging of the Intergovernmental Maritime Consultative Organization (IMCO), issued a stability booklet entitled “Tips for Fishermen.” This booklet provided advice to commercial fishermen on how to maintain proper vessel stability. It depicted the effects that failing to maintain watertight integrity, adding free surface, allowing ice build-up, and failing to be a prudent operator had on a vessel’s stability. This initiative addressed stability issues which were prevalent within the industry at that time. In August 1996, nearly 30 years later, the commercial fishing occupation remains one of the most dangerous, and stability related loss is one of the primary hazards. A collective group of naval architects, fishing vessel owners/operators, and other commercial fishing industry representatives continue to fight the problem of fishermen and fishing vessels lost at sea due to stability related casualties. This problem is the very same evil that was being battled nearly 30 years ago.

In looking back through the hundreds of pages of stability related studies, fishing vessel stability regulations, stability booklets, and examples of how the stability issue had been addressed around the world, one can not help but wonder, what have the Coast Guard and maritime community missed, what else should we be doing, and why is this still an issue nearly 30 years later? We’ve cycled through presenting righting energy curves, simplified stability tests and booklets, definitions of metacentric height and free surface, and examples of non-linear hull response dynamics in a random sea spectrum. We’ve developed interagency fishing vessel subcommittees and fishing vessel safety programs aimed at improving the safety record of the industry with respect to stability related loss. What else needs to be done for the commercial fishing industry to understand that vessel stability must be a high priority in their everyday fishing operations?

While pondering this question, I wondered what it was that drove this industry to push the limits of the safety and stability envelope, and apparently fail to heed any Coast Guard or industry advice. It was not until I accompanied a Coast Guard boarding team on the inspection of a fishing vessel whose voyage had been terminated due to unsafe vessel conditions that I realized the answer to this question. Although this vessel had all the required survival equipment, it became frighteningly obvious, from the cracked framing, the compromised bulkheads, the deteriorated planking, the poor mechanical condition, and the attitude of the owner/operator, that this commercial fisherman was in grave danger. He would have continued to push the limits of safety and stability in order to provide for the needs of his family not realizing or acknowledging the seriousness of these conditions. If the Coast Guard had not intervened and terminated this voyage, it probably would have ended in vessel loss, and possibly death of the owner/operator.

Although this case may not be representative of the entire commercial fishing industry, with respect to vessel maintenance, it does paint a very clear picture of the motivation behind commercial fishermen and their decision making process. When working in an industry gravely affected by diminishing resources, fishermen are driven to stay that extra day in less than desirable conditions or to make one more haul back when holds are already pressed up. This economic situation and work ethic are not atypical within any industry.

Safety Improvement Reporting System

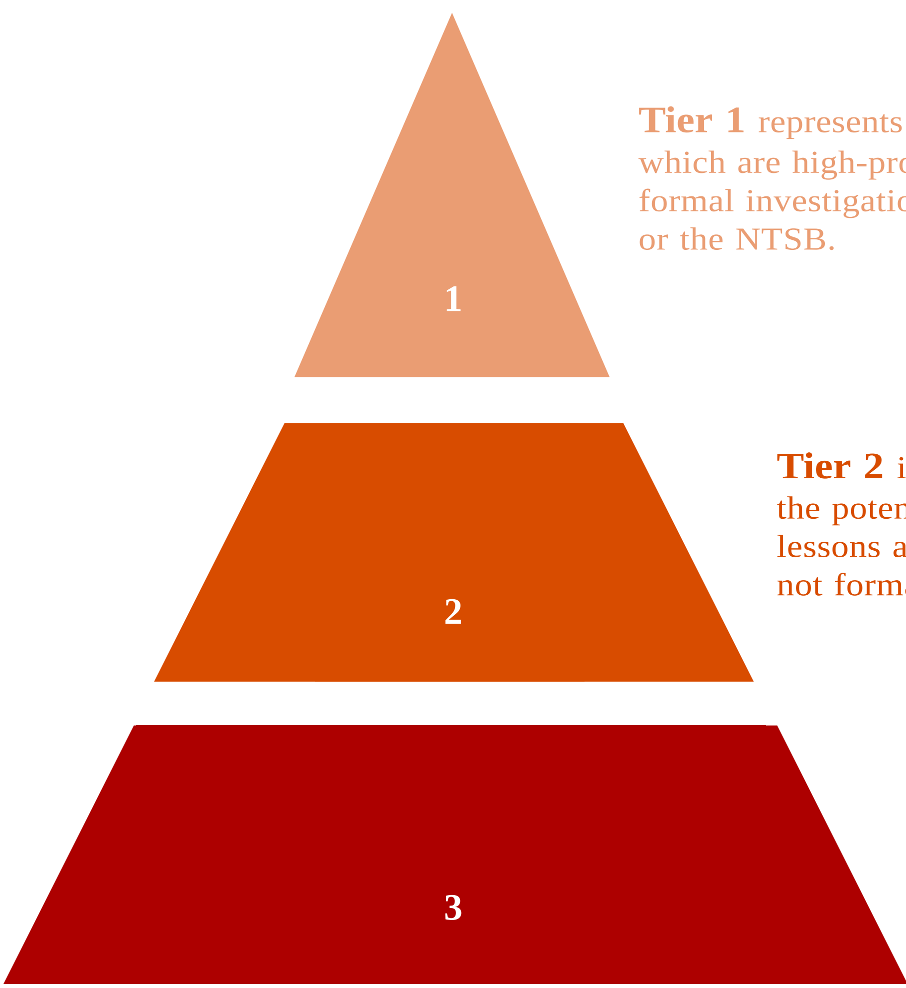
By Calvin Bancroft, PTP Subcommittee Chair

As part of its on-going Prevention-Through-People (PTP) implementation, the Chemical Transportation Advisory Committee, CTAC, conducted an assessment of the human and organizational error in the chemical transportation industry. Using a systems approach to safety analysis, the subcommittee applied PTP principles (Proceedings July/September 1996, p. 61) to develop approaches to minimizing accidents and injuries. The subcommittee quickly recognized the need to improve the Coast Guard's casualty report form (CG-2692) to include causal factors which may link specific human errors to accidents.

What is SIRS

An accurate database is the cornerstone of a meaningful, systematic approach to understanding the role of human errors in marine accidents and incidents. The CG-2692 should be redesigned to facilitate consistent causal analysis and reporting. To that end, the subcommittee proposes the Safety Improvement Reporting System (SIRS) which envisions a new multi-tiered approach to incident investigations.

Tier 1 represents those casualties which are high-profile and result in formal investigations by the USCG or the NTSB. Tiers 2 and 3 involve investigations conducted by companies and/or the Coast Guard using an improved version of CG-2692 to capture critical causal data. Investigations of casualties and incidents occurring at the Tier 2 level normally require Coast Guard investigation. Under SIRS these investigations could be conducted by companies instead of the Coast Guard if the company was classified as a "model" company. Model companies would confirm their intention to investigate using their own root cause analysis mechanisms. These cases would be designated by "de-identification" numbers for later submission (60-90 days) into a "blind" database in order to maintain anonymity and immunity.



Tier 1 represents those casualties which are high-profile and result in formal investigations by the USCG or the NTSB.

Tier 2 includes casualties that have the potential to yield important safety lessons and which require thorough, but not formal, investigations.

Tier 3 includes the bulk of marine casualties and incidents including near misses for which reports with causal analysis conclusions should be submitted.

Comparison of Near Miss Reporting Schemes:

Name	Agency	Who Reports?	Forms?	Report Criteria	Confidentiality?	Immunity?	Report Analysis	Database Output
A.S.R.S.	NASA	Anyone in aircraft operations	Yes	Any compromise of aviation safety	Yes. ID is deleted	Yes	Yes, by a staff of aviation specialists	* Alerting Messages - distributed immediately upon request of a hazardous situation. * Call back - monthly safety magazine * Directline - special publication to commercial operators. Highlights reports analysts deem significant. * Database Search Requests - will search for pertinent data for government, industry and academics. * Operational Support - supports NASA and FAA during rule-making and accident investigation * Topical Research - Conducts studies with application toward real-life operational applications.
Securities	Canadian T.S.B.	Any individual having an interest in marine safety. (Other branches cover rail & air)	Yes	* Unsafe conditions * Inadequate regulatoy provision * Unsafe procedures and practices	Yes. Will Release ID with authorization	Yes	Yes. By TSB	* When a safety issue is identified, TSB makes a formal recommendation to the appropriate regulatory agency for corrective action. * A Safety Letter may be sent to a specific company is the safety issue is not industry wide. * Summary of safety lessons published in Reflexions, the TSB Safety Digest * Database supports TSB studies and analyses. * Database is shared with other agencies and countries. * Annual statistical evaluation * Annual report to Canadian Parliament
Near Miss	Maritrans	Anyone in inland vessel operations	Yes	All incidents	Yes. Optional	Yes	Yes	* After investigation, supervisors discuss report with those involved, as an educational tool, not a disciplinary action * A fleet-wide letter is sent describing incident * Report is sent to P & I Club
M.A.R.S.	Nautical Institute	Anyone in vessel operations	No	Any incident involving marine safety	Yes. If desired by reporter.	Yes	Yes. One man	* Published in monthly journal - Seaways * Institute is occasionally asked to prepare reports
None	M.A.I.B, UK	"Ship", usually Master	Yes	* Hazardous incident (to things) * Dangerous occurrence (to person)	Yes	No	Yes. One man	* Report may provide grounds for a formal investigation. * Statistics compiled in Annual Report - for sale to public * Summary of Investigations published three times a year * If situation warrants, an "M" notice is sent to Marine Safety Agency alerting them to a potential hazard.

The model companies concept is included as a motivating factor or incentive for industry participation. For model companies, the CG-2692 should indicate the company's commitment to conduct root cause analysis and to submit the results to the central database. Coast Guard would not board vessels to investigate if such a commitment was made. This approach is similar to the streamlined inspection process under development by the Coast Guard. The approach would benefit the Coast Guard as well because local MSO resources would not be required.

Tier 3 investigations would be conducted using the improved CG-2692 to lead companies and masters through root cause analysis and key data documentation. The report would be expanded to include near-miss incident analysis. The informational issues developed in the "foundation" of the pyramid could be transmitted directly or indirectly to the designated database. This voluntary system is similar to the systems established in Canada called SECURITAS and the Aviation Safety Reporting System (ASRS) established in 1975 under a Memorandum of Agreement between Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA). In the ASRS system, FAA provides most of the program funding and NASA administers the program through a contractor arrangement. A comparison of various existing near-miss reporting schemes is provided above.

Benefits of SIRS

The integration of a sound root cause analysis program in concert with a near-miss/accident reporting scheme (SIRS) would:

(1) Identify opportunities to enhance safety in the Chemical Transportation and Marine systems;

(2) Promote the sharing of "lessons-learned" through direct and indirect feedback to the industry via technical reports, safety bulletins and alert messages;

(3) Remedy reported hazards;

(4) Enhance the understanding of chemical transportation issues or indicate operational safety problem areas for research;

(5) Improve casualty report accuracy by relieving the adversarial barriers of the mandatory reporting process;

(6) Shift ownership of the process to industry and increase buy-in;

(7) Expand understanding of root causes by focusing on a large pool of incidents verses accidents;

(8) Allow us to better target the safety measures necessary for prevention; and

(9) Through a better understanding of how accidents develop, interrupt the incident chain process and control the situation.

How should SIRS be managed?

The subcommittee believes the SIRS information should be submitted to a third party advocacy database; such as, the U.S. Maritime Administration (MARAD) or National Oceanic and Atmospheric Administration (NOAA), that does not have a regulatory mandate. The system should:

(1) be confidential and accessible by anyone in the transportation system;

(2) be an interactive analytical system for routine & special studies to strengthen the foundation of information relating to the human element; and

(3) include responsive communication mechanism for lessons learned.

The SIRS Procedures

The Coast Guard should revise it's CG-2692 to facilitate the collection of key root cause information. Since consistent reporting relies on common understanding of principles and methods of root cause analysis, Coast Guard should develop a NVIC to assist the industry in understanding and applying the principles. Also, the NVIC should explain the SIRS system, the nature of the voluntary and confidential reports and the various ways the database can be used. Most importantly, the procedures must eliminate the disincentives for reporting. Industry and mariners must be able to report anonymously on accidents and incidents. If the system is to succeed, they should enjoy immunity, at least with respect to the SIRS information submitted, from administrative or civil penalty action by the Coast Guard.

Conclusion

The subcommittee is convinced that an improved marine casualty reporting system that includes incidents as well as accidents will provide enhance understanding of human and organizational causes of casualties. This expanded information pool would assist safety managers to direct their training and resources in ways that will interrupt the causal chain, prevent casualties and save lives.

The Need For, and Analysis of Data to Address Human Factors Issues

To err is human, to forgive, divine

- Alexander Pope, "An essay on Criticism"

By Alexander C. Landsburg

Humans make errors and machines malfunction. The risk of something going wrong is everywhere in our daily lives, often with potentially severe consequences. Fortunately, errors or incidents are generally prevented by some compensating mechanism of a human or mechanical nature. In those cases where the many compensating mechanisms fail, there is an accident.

Accident:

An unintentional or unexpected happening that is undesirable or unfortunate, especially one resulting in injury, damage, harm, or loss" *(Random House College Dictionary, 1984).*

When an accident occurs, who's to blame?

The immediate answer to that question, in our society, focuses on the person in charge. We blame individuals for failure. Perhaps this tendency is based on the knowledge that, in general, 80% of accidents are attributable to operator error. However, given the fact that we know humans make mistakes, can we blame them for accidents that occur when they do in fact err?

Situations are too complex today for continued adherence to simplistic thinking that dictates that human error occurs in a vacuum or that all contributing factors are the responsibility of the individual. Individual feelings of infallibility and a reliance upon previous successes coupled with industrial competitiveness, threat of possible economic failure, and a focus on short-term benefits can contribute to system failure with catastrophic outcomes. It is, therefore, appropriate that the notion of blame be reconceptualized from an individual punitive perspective to a systems failure perspective.

Reasons/Needs for Analysis

All of us are responsible for safety. The Maritime Administration (MARAD), though not a regulatory body as the U.S. Coast Guard (USCG), is charged with ensuring that ships and a work force sufficient for supporting national economic, emergency, and wartime maritime transport needs be maintained. MARAD's interest is in supporting national goals of commerce by keeping the U.S. merchant marine a healthy, efficient, and safe enterprise. Safety and human factors are critical elements in meeting these goals.

Accentuating concern for safety and human factors issues was a result of the revolution on ship manning beginning in the 1980's. To remain competitive with low wages available through third world crews, many shipping companies radically reduced the numbers of personnel aboard ships through the use of automation. Low wage countries followed suit in order to keep their relative standing in this highly competitive game. A positive result of these developments is that our ships and systems have improved in reliability and simplicity of operation. Ramifications of this automation have required that all ship personnel be fully functional, physically fit, knowledge and ability capable, and highly attentive, since they must work long hours per day with no cover over an extended period.

With competitively higher stakes it is clearly no longer sufficient to discover that an accident is attributable to a human factor, rather, the nature of the human factor must be clearly identified and understood if reoccurrences are to be avoided.

Analyzing Human Factors Causes Using CASMAIN

One of the major problems in understanding human factors as causative agents is a lack of useful data. Marine accident data (USCG and elsewhere) has long indicated a high preponderance of human factors causes. However, using investigation data to study possible improvements has been difficult. In the late 1980's MARAD teamed with USCG to develop a system to focus investigative data collection toward gathering more useful human factors information (Dynamics Research Corp., 1989). The resulting study theorized an investigative philosophy and developed a taxonomy with about 60 categories of human factors origins that could be used during an investigation to better indicate root and underlying problems. Further research resulted in changing the investigative and data base approach. The resulting "MINMOD" system at USCG is now attempting to provide better indicators of human causal factors.

The historical USCG CASMAIN collection of accident data (some 3,500 investigations/reports per year) over an 11 year time frame represents a valuable historical data set. In a desire to look further into human factors causes, a copy of the CASMAIN data was transferred from the USCG workstation to MARAD and turned into a dBase III Plus file format that could be used on a standard PC compatible computer. Some cleaning of the records was accomplished where anomalies were discovered. Then an analysis exploring the human factors indicators was performed. The work was the basis for a masters thesis developed by an Eisenhower Research Fellow at MARAD (Nagendran, 1994).

The data showed that much can be learned through trend analysis. Many data elements in CASMAIN are capable of showing frequency of interesting properties such as when, where, how, and why most accidents occur; what ship types are involved with which major type of accident; whether weather, visibility, or darkness is a key causal element; and what trades or sectors of the industry are most at risk?

The data base also includes cost data which is valuable for analyzing economic impacts. There are well known limitations with all of the data, of course. The costs reported, for instance, are property estimates basically at the time of entry rather than actual costs. Many similar shortcomings of the data can be identified particularly where data elements are not used on a regular basis for reporting or analysis.

The main focus in this investigation, however, was to see what information could be gleaned about primary and contributing causes where human factors were involved. While not generally recognized, the data base has separate data elements to allow noting the primary cause and contributing causes for each casualty. Up to 7 causes or contributing causes can be entered from the investigation although this was not always done (Of the 42,367 accidents, 14,948 had a personal causal factor as the primary cause. There were an additional 5,005 accidents where human factors were involved as a contributing factor). Often in studies based upon the data, only the first cause (presumably the primary root cause identified by the investigator) is used in determining frequencies.

In examining the human factors data for ships 1,000 GRT and over, 44 different "Personal Causal Factors" were found in the entries. The frequencies of these causes were determined and the factors grouped under 7 categories that were considered best related to the variety of human factors characteristics. All of the factors were included in the analysis. The results thus include data where the personal causal factor was either a primary or a contributing factor. The results are shown in the table below.

The results shown here are interesting. The grouping into categories is subjective and one is unsure how the actual investigator would have described or classified the item if the categories used here had been known and understood. Many items could have been placed into different categories. Perhaps the information gleaned is most

PERSONAL CAUSAL FACTORS	Probability[1]
OPERATOR ERROR	**21.67**
Operator error	21.67
CALCULATED RISK	**15.93**
Failed to ascertain position	7.51
Failed to proceed at safe speed	2.46
Calculated risk	1.71
Failed to establish passing agreement	0.91
Failed to yield right of way	0.85
Failed to keep right of channel	0.83
Failed to use charts and publications	0.56
Improper/missing whistle signals	0.56
Failed to stop	0.28
Open flame	0.16
Smoking	0.10
EQUIPMENT DESIGN	**10.19**
Improper maintenance	4.97
Improper safety precautions	2.94
Preventive maintenance not done	1.43
Relied on floating aids to navigation	0.36
Improper/faulty lights/shapes	0.26
Bypassed available safety devices	0.24
JOB DESIGN	**23.44**
Failed to account for currents/weather	10.91
Failed to keep proper lookout	2.34
Failed to account for tided/river signals	1.97
Improper mooring/towing	1.65
Improper casualty control procedures	1.21
Failed to use radiotelphone	1.01

useful in helping to begin to identify what kind of data should be gathered in the future and how better to collect it in a way that is useful for prevention rather than just recording history.

Conclusions

Risk is everywhere. We can and must do a better job than waiting for an accident to happen in order to define safety needs. We must search out precursors to accidents, particularly human factors, and fully understand their origin and how to remedy problems.

One of the key problems with accident investigations is that the investigator needs to have a good understanding of human factors considerations in order to ask the right questions. Also the data needs to be entered consistently into the data base which means that different investigators must come up with the same causal trail and terminology. It comes down to a good bit of training/education, a consistently gathered set of data, an understandable taxonomy through which to classify data (ICAO, 1993, has some excellent airlines-based models to work from), and perhaps, most importantly, a keen sense of how the data will be used later to glean knowledge. Many of these elements are missing in current systems which are burdened with a great number of investigations, lack of consistent treatment, lack of requisite human factors background because of training and short job duration, and outputs from the system not receiving much visibility or attention from others.

Accident investigation data does provide useful information particularly on an individual case basis. Precursor or incident reporting, however, has the potential to provide much more useful data - anticipatory data - that can serve to better guide accident prevention.

The reality is that for every accident there are probably 100 or more incidents where, but for some compensating mechanism, there would have been an accident. Knowing how safe we are depends upon gathering much more data and measuring the right variables. Waiting for an accident to happen is not good enough.

The “Prevention Through People” program is the right basis under which to develop a “problem” reporting system to begin gathering precursor data. The people directly involved with the transportation system have the best potential to identify problems before they become accidents. If a safety culture can be created where everyone is on the same team and blame or retribution from errors is removed, accurate data can be gathered, leading to better understanding and correction of problems in the system before accidents occur.

PERSONAL CAUSAL FACTORS	Probability[1]
Failed to use available navigation equipment	0.85
Improper loading	0.68
Inadequate supervision	0.66
Improper securing/rigging	0.58
Used defective equipment	0.54
Design criteria exceeded	0.44
Service conditions exceeded	0.32
Improper cargo stowage	0.30
KNOWLEDGE/ABILITY	**4.61**
Failed to comply with rules, regulations, and procedures	2.84
Lack of knowledge	1.00
Lack of experience	0.60
Lack of training	0.18
NOT FIT FOR DUTY/IMPAIRED	**24.06**
Error in judgment	17.82
Carelessness	3.04
Inattention to duty	2.90
Fatigue	0.16
Intoxication (alcohol/drugs)	0.08
Stress	0.04
Psychological impairment	0.02
PHYSICAL CAPABILITY	**0.10**
Physical impairment	0.10

[1]Probability of the particular factor occurrence if an accident had a primary or a contributory human factor cause.

Note: For a list of references, please contact the author.

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Accident:

The Marine Safety Reporting System

By Vincent Cantwell
The Human Factors Group

Introduction:

The Marine Safety Reporting System, MSRS, was initiated in November, 1995. First introduced at the NASA-NTSB Symposium, the system functions as an anonymous data collection tool. Modeled after the NASA-FAA Aviation Reporting System, ASRS, the MSRS is designed to give mariners and members of industry the opportunity to report on working conditions, operational environments, policies and incident or near miss occurrences that would otherwise not be reported through standard means. The MSRS utilizes pre-printed forms that are distributed to the public that may be filed with or without contact information in as great detail as the reporter desires.

The purpose of this review is to explain the system generally, report significant findings, as well as discuss lessons learned through managing the system and interfacing with various legislative, regulatory and members of the industry. In the interest of brevity, this will be accomplished in interview question/answer format.

What is the purpose of the MSRS?

Data collection through anonymous survey of mariners, terminal personnel, recreational boaters and other industry members.

What is the scope of the MSRS?

Human performance and safety related incidents of any kind, including near misses.

What are the inputs to the system?

Anecdotal and objective data collected directly from reporters.

What is the intended use of the data?

- To enhance or augment other data collection efforts, achieve or discover magnitude and percentage of unreported and non-reportable safety related incidents occurring in the marine operational environment

- To enhance our understanding of the scope, magnitude and pervasiveness of problems, risks or threats common to the maritime environment.

What are the envisioned outputs?

- Data collection and exchange with industry, legislators, insurers and regulators.

- Qualification and quantification of the nature and severity of problems reported in comparison to problems presently identified, regulated or perceived.

- Propose hardware and software solutions to identified issues.

- Develop training solutions to identified problems where appropriate.

- Compare, correlate, validate findings of system and other data collection efforts.

What method is utilized?

Preprinted forms distributed to public without cost.

How are forms distributed?

Through designated distribution points such as:

- New York Nautical, New York, NY
- Baker Lyman, Metarie, LA
- Baker Lyman, Houston, TX
- MM&P Maritime Institute, Linthicum, MD
- MEBA Calhoon Engineering School, St. Michaels, MD
- SMART Forum, Seattle, WA
- Various Conferences since 1995
- By request from the HFG

What is the cost to the Industry?

The MSRS is sponsored by the Human Factors Group (HFG). Distributors donate space and some administrative efforts in the interest of goodwill and improving the safety of the marine environment.

Are there any costs to the user?

Yes, the time required to file form and first class postage (32 cents).

Describe the process by which data is processed

- Produce forms, distribute, advertise system.
- Receive forms back via standard mail.
- Assign random MSRS Case number, date stamp and record.
- Review data. If contact information is provided, detach and return to sender.
- Record data only. Remove specific reference to persons, corporations, vessels....
- Shred form once data is entered.
- Collate and analyze data periodically.
- Report findings via presentations and articles.
- Share data when appropriate.

How do you determine that the information is accurate?

With any anonymous system, data is subject to intentional falsification or misrepresentation. Certain statistical techniques can be used however to analyze the variance of data from itself for example, thereby reducing the significance of these potential reports. The reports received to date have all appeared to be authentic and sincere.

What problems that have been observed with the system or concept?

There has been a marked resistance to the system, particularly to identity disclosure. This is believed attributable to the pervasive distrust that most industry participants maintain regarding the domestic legal and regulatory communities.

Many would-be reporters are concerned that information will someday be used against them by the USCG, competition or by other interests in the industry including, environmentalists, owners and other organizations that have actively campaigned to discredit the industry or modily present organizational and rate structures.[1]

Fear of litigation, reprisal or embarrassment has discouraged certain important segments of the industry from formally or anecdotally admitting that problems may in fact exist with the industry at all.

Other segments of the industry in certain areas of the country have elected to develop and maintain control of their "own" systems, even when specialized and specific systems were offered to them without cost.

Hesitance to admit that problems exist, coupled with the willingness of some to implement any number of dissimilar systems results in the exclusion of important data not necessarily available to Port State Control. Further, data collected will be difficult to validate between systems for reasons not limited to geographic specific operational differences alone.

Some also feel that the vocabulary and attentional requirements of the form itself are inappropriate to a large segment of the maritime population. We have reviewed the form carefully and agree, though there is some debate as to what level of reading comprehension is appropriate to the entire industry.

What solutions do you propose to these problems?

Given the issues of liability and exposure that at least in the United States are here to stay, immediate solutions are limited. The objective of the MSRS is to work within the existing operational, legal and regulatory structure however possible. Certain changes would enhance participation and the quality of the data collected, which must remain the focus of any system however implemented.

Optimally, we would like to see legislation enacted such as would allow the MSRS to offer similar incentives and be structured like the ASRS including the extension of limited liability or immunity to reporters for a specific type or magnitude of incident. This limited protection might include exoneration from criminal prosecution and/or limitation of fines levied.

Determining what type of incidents or the magnitude that would qualify for such relief is complex, however. State and federal regulations regarding pollution and waterway safety often parallel or coexist with each other. The structure and presence of these regulations may make relief or limitation of personal liability only partially possible. Were such relief possible however, it is unlikely that a "free-for-all" would result, as some have suggested.

Mariners by definition, remain accountable to the USCG as per the terms and conditions inferred through issuance of the Merchant Mariners Document. Withstanding that pollution and serious marine incidents are already required to be reported via CG Forms 2692 A and B, DOT form 5800.1, and are routinely investigated by the Marine Inspection Office, the NTSB and sometimes the insurer independently there is little likelihood that purposeful wrong-doing will go unpunished were some degree of immunity granted. Nevertheless, the highest quality data and greatest benefit to the industry would be realized through the implementation of a system modeled after the ASRS.

Alternately, the MSRS might accomplish similar results as a vehicle through which the incident reporting and data analysis requirements specified by the SOLAS Chapter 9, the International Safety Management Code - Safety Management System, may be satisfied. Essentially, the MSRS could be utilized by companies to track internal safety issues and incidents via specially designed tools designed to facilitate incident reporting, safety meetings and similar, as would be provided by the HFG.

These would be processed and analyzed at a central location. A confidential report would then be generated and returned to the subscriber company for review at periodic intervals. The general data acquired would simply be added to the MSRS database, which as mentioned before, has all corporate, personal or vessel identity removed prior to entry. In this manner, corporations would receive the benefit of meeting these requirements in the most economical, scientific and accurate manner possible. The industry would benefit from the lessons learned as they do now, however, the intrinsic value of such a unified and broad data base cannot be understated.

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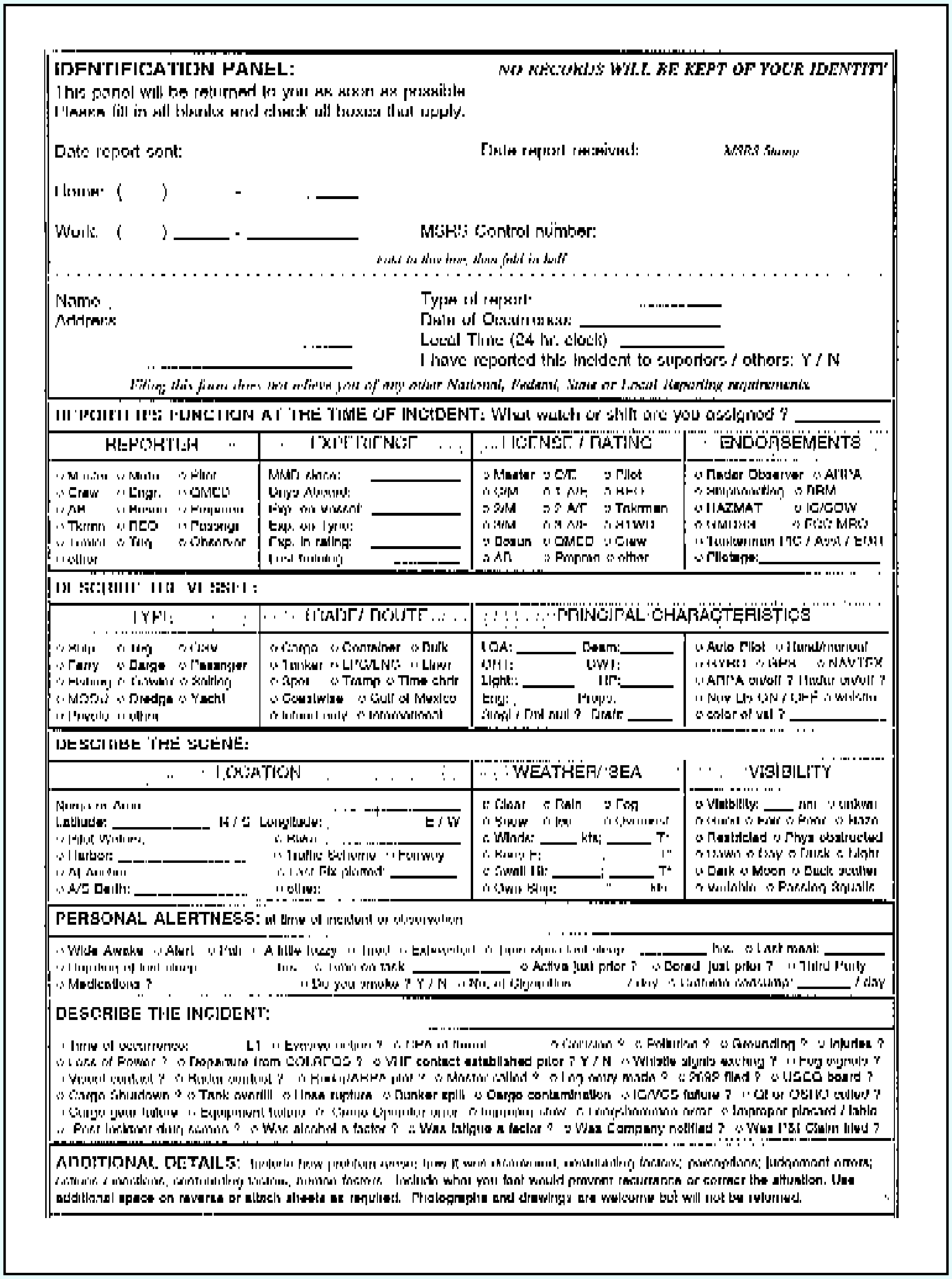
[1] For example, one international organization has consistently attempted to discredit marine pilots, at times utilizing "data" however collected and media sensationalism.


IDENTIFICATION PANEL: *NO RECORDS WILL BE KEPT OF YOUR IDENTITY*

This panel will be returned to you as soon as possible
Please fill in all blanks and check all boxes that apply.

Date report sent: Date report received: *MSRS Stamp*

Home: ( ) -

Work: ( ) ______ - __________ MSRS Control number:

Fold to this line, then fold in half

Name Type of report:
Address Date of Occurrence: __________
Local Time (24 hr. clock) __________
I have reported this incident to superiors / others: Y / N

Filing this form does not relieve you of any other National, Federal, State or Local Reporting requirements.

REPORTER'S FUNCTION AT THE TIME OF INCIDENT: What watch or shift are you assigned ? ________

REPORTER	EXPERIENCE	LICENSE / RATING	ENDORSEMENTS
○ Crew ○ Engr. ○ QMED ○ AB ○ Tkmn ○ RED ○ Passngr ○ Trng ○ Observer ○ other	MMD since: ______ Days Aboard: Exp. on vessel: ______ Exp. on type: Exp. in rating: ______	○ Master ○ C/E ○ Pilot ○ 2/M ○ 2 A/E ○ Tnkmn ○ Bosun ○ QMED ○ Crew ○ AB ○ other	○ Radar Observer ○ ARPA ○ BRM ○ HAZMAT ○ IC/GOW ○ Pilotage: ______

DESCRIBE THE VESSEL:

TYPE	TRADE / ROUTE	PRINCIPAL CHARACTERISTICS	
○ Ferry ○ Barge ○ Passenger ○ Sailing ○ MODU ○ Dredge ○ Yacht ○ other	○ Cargo ○ Container ○ Bulk ○ Tanker ○ LPG/LNG ○ Liner ○ Spot ○ Tramp ○ Time chtr ○ Coastwise ○ Gulf of Mexico ○ International	LOA: ______ Beam: ______ DWT: Light: ______ HP: ______ Props. Draft ______	○ Auto Pilot ○ NAVTEX ○ ARPA on/off ? Radar on/off ? ○ color of vsl ? ______

DESCRIBE THE SCENE:

LOCATION	WEATHER / SEA	VISIBILITY
Latitude: ______ N / S Longitude: ______ E / W ○ Harbor: ______ ○ Traffic Scheme ○ Fairway ○ A/S Berth: ______ ○ other:	○ Clear ○ Rain ○ Fog ○ Snow ○ Winds: ______ kts; ______ T° ○ Swell Ht: ______; ______ T° ○ Own Shps	○ Visibility: ____ nm ○ Haze ○ Restricted ○ Phys obstructed ○ Night ○ Dark ○ Moon ○ Back scatter ○ Passing Squalls

PERSONAL ALERTNESS: at time of incident or observation

○ Wide Awake ○ Alert ○ A little fuzzy ○ Tired ○ Exhausted ______ hrs. ○ Last meal: ______
○ Active just prior ? ○ Bored just prior ? ○ Third Party
○ Medications ? ○ Do you smoke ? Y / N ______ / day

DESCRIBE THE INCIDENT:

○ Collision ? ○ Pollution ? ○ Grounding ? ○ Injuries ?
○ Loss of Power ? ○ Departure from COLREGS ? ○ VHF contact established prior ? Y / N ○ Whistle signals exchng ? ○ Fog signals ?
○ Master called ? ○ Log entry made ? ○ USCG board ?
○ Cargo Shutdown ? ○ Tank overfill ○ Hose rupture ○ Bunker spill ○ Cargo contamination ○ IG/VCS failure ?
○ Cargo gear failure ○ Equipment failure ○ Improper placard / lable
○ Was alcohol a factor ? ○ Was fatigue a factor ? ○ Was Company notified ? ○ Was P&I Claim filed ?

ADDITIONAL DETAILS: Include what you feel would prevent recurrance or correct the situation. Use additional space on reverse or attach sheets as required. Photographs and drawings are welcome but will not be returned.

The sponsors of the MSRS have formally requested an opinion from the Commandant regarding the suitability and feasibility of utilizing the MSRS to meet SOLAS Chapter 9 requirements, but have not to date received a determination.

Finally, the MSRS can continue as it is, though if any other system is ever formally adopted by the United States or some large segment of the industry, it is likely that the MSRS will be abandoned in the interest of supporting one unified comprehensive system — which is what the MSRS intended to achieve all along.

We have recently considered removing contact information completely from our present form though — in hopes that the complete absence of identification might encourage further use. The vocabulary and reading comprehension levels of the form may also be revised to accommodate a larger population, as may a Spanish and Philippine version.

We have also considered sponsoring the return postage fees which we opted not to pre-pay at the advice of survey and psychology professionals consulted. The present form requires the reporter to provide their own 32 cent stamp, which some felt would discourage insincere reporting despite the insignificant expense. This benefit has to be weighted against the nuisance value that the added step in filing the report may represent to otherwise would-be reporters, however, were postage free. In an ideal system, the forms and postage should be free of charge to the user.

In fact, one suggestion we considered was to “pay” reporters for report use, perhaps via reduction of USCG transaction fees. In other words, reporters would achieve dollar credits toward their next document transaction for some minimum to maximum number of reports filed with disclosure.

In this event, return contact strips complete with case numbers could be presented at the REC window for credit without disclosure or specific reference to the event reported. There are some validation and document control issues to work out with such a credit program, but such a concept would likely encourage the greatest participation and simultaneously serve to increase mariner awareness regarding the role and importance of safety related data. REC’s incidentally would be excellent distribution points for the forms utilized by any system, credits granted or not.

What has the data collected said about the industry to date?

As mentioned before, participation has been poor so sample sizes are still small, but at least three distinct issues seem to pervade the industry. They are in order:

1) Work-rest schedules or the lack there of contribute to dangerous levels of fatigue that impair performance, particularly during arrival, cargo and departure watches. Some feel this is a side effect of the reduced manning levels that have been approved by Flag State, despite that administrative and technological burdens have dramatically increased over the last decade or more. Many reporters feel that they are continually being asked to do less with more and that the industry is strained to keep pace with normal operations. Emergency operations and non-routine circumstances have been reported to increase the physiologic and psychological burden on crews to potentially dangerous levels. Present regulations, including OPA '90 and the revisions to STCW '95, do not provide sufficient guidance regarding crew management and are not realistic to all segments of the industry, particular coastwise and inland operations.

2) Present safety, pollution and operational regulations do not match the perceived needs of the operational environment. Mariners report abbreviating or ignoring regulations in the interest of efficiency or perceived corporate pressure to do so.

3) Communication difficulties often contribute to unsafe conditions, particularly in pilot waters. The scope of English comprehension among culturally diverse crews appears limited to standard communications and conditions only. Non-standard or emergency situations have been reported to require a standard of communication and comprehension not possessed by many ratings.

What should the role of a safety reporting system be?

The primary role of any system should be to collect data that would otherwise not be reported and analyze it accordingly. The second and third objective should be to report the results to the community as a whole, and to compare results to other data however achieved.

Achieving these objectives can be accomplished in more than one way. One way is to set up a very specific system designed to collect a very specific type and range of data. Such a system over time might help pinpoint exactly "what" the perceived problems are and assist in discriminating between the issues resident in differing operational environments.

A more general system would be cheaper to manage but yield less specific data. Data so achieved would essentially serve to highlight areas that need further study or survey, which could be selected on the basis of their merits and cost-benefit to the industry overall.

The present structure of the MSRS falls somewhere between the two in so much as reporters are afforded the opportunity to provide more specific anecdotal information in addition to the standard information presently requested. As mentioned before, the highest quality data and understanding of the situation would be achieved through a system such as the ASRS wherein call-back interviews could be conducted.

Should we bother; are we really going to learn anything we don't already know?

The short answer is yes, I believe we should bother and that there is much to be learned. Why we should bother is another issue, however.

There are many competing and compelling reasons why we should collect data about ourselves. These range from the scientific to issues of corporate and social responsibility. Primarily we feel that it is healthy and wise for the industry overall to have some mechanism other than post accident in nature, by which to measure its relative health. It is also good business. Demming was well known for his taunt which can be paraphrased to say "don't just tell me about it ... show me the data."

While it is no secret to anyone that the industry has room for improvement there are many conflicting opinions as to what constitutes necessary, realistic or reasonable change. Both as regulators and as operators, we need to collect data to decide what is "broken and needs fixing" as compared to what isn't or just does not merit repairing at this time. Further, we need to collect data to help measure the effectiveness of changes once implemented, like the ISM Code for example. Accident data alone does not provide sufficient measure of the safety of a given system or the likelihood of an incident recurring.

To paraphrase John Lauber "Just because you haven't had an accident, doesn't mean its safe." We owe it to ourselves as participants in the industry and stakeholders in the environment to take whatever reasonable measures will serve to help us understand and define the early warning indicators that precede an incident. Data collection is integral to helping us achieve that level of understanding.

3 Casualties, 3 Lessons Learned

By Donald J. Sheetz
Vice President Vanuatu Maritime Services Limited and
Deputy Commissioner of Maritime Affairs, Republic of Vanuatu

"Can't see the forest for the trees." That phrase continues to haunt me every time I initiate an accident investigation. Sometimes we are focused on identifying the proximate cause of a casualty that we overlook the root cause. We tend to look at things from a very narrow point of view, not holistically. We "focus" our attention as if through a microscope; we rarely step back to view the entire problem.

I warn my investigators to try to avoid this – sometimes being on the spot they can't, and I have to look at things more generally, more globally, more holistically. I try to see the forest, rather than the individual trees. Three casualties come immediately to mind.

1

An acetylene cylinder explosion on the fishing vessel OLYMPIA resulted in a fire and rapid sinking. Briefly, an acetylene cylinder fire was noted in the workshop area long after working hour. A fire party mustered, attempted to cool the cylinder, but the fusible metal pressure relief plug popped releasing burning acetylene gas. The fire quickly spread, overcoming the best efforts of the crew, forcing them to abandon ship and watch it sink some 50 minutes later.

One would immediately jump to the conclusion that it was due to human error – someone had been doing hot work, a spark flew and caught the cylinder on fire. Well, they would be wrong: no hot work had been done in the 6 hours before the fire. No one had ever even used the cylinder or been near it.

The cylinder gave way, most likely from a corrosion hole which allowed the acetylene/acetone content to leak, causing internal heating, and ultimately spontaneous combustion.

During the extended investigation we learned that when acetylene bottles are handled, great care should be taken not to cause sideshell damage. With a small indentation or fracture there could be a leaking of both the acetylene gas and the acetone medium within the cylinder. This would self ignite when escaping through a small ragged aperture. This is not, unfortunately an unusual occurrence.

This caused us to research the international regulations on the carriage of dangerous goods as ship stores: there are none. Proposals to IMO on establishing regulations for such dangerous goods were not accepted. We did the only thing possible and produced an extensive Safety Bulletin calling attention to this problem and gave it wide distribution.

2

The second incident involves attitudinal problems aboard a vessel and within a company. To protect the innocent, let's call the vessel the CORPORAL TAYLOR:

In the early morning, fire broke out in the engine room. A fire party was organized, donned breathing apparatus and attempted to extinguish a fire adjacent to the fuel oil heater. Several attempts were made during the next two hours to extinguish the fire first with portable extinguishers, then with a fire hose, before the decision was made to flood the engine room with CO_2. The vessel had to call on shoreside assistance to complete the extinguishment of the fire and had to be towed to the closest port. The proximate cause was determined to be a tiny hole in the fuel oil heater which allowed an oily mist to hit hot surfaces and ignite.

Continued next page

But the investigation and complete inspection of the vessel after the fire found not only failure of equipment and procedures but also questionable competency of certain officers and crew members; inadequacy in training, drills and on board instructions; and lack of management commitment. If taken in their totality, it is a wonder that the vessel survived.

The following partial list describes the conditions found:

- failure of the fuel oil heater
- failure to use the engineer's alarm
- failure to muster the crew at the assigned mustering areas
- failure of the fuel oil heater isolating switch
- failure of the backup electrical system
- failure of an emergency trip wire for the mail engine fuel supply
- failure of the breathing apparatus
- failure to start the emergency fire pump in a reasonable period of time (estimates of attempts varied from 5 to 10 minutes)
- failure to store solvents in the paint locker
- failure to detect hot spots and secondary fires
- failure of the CO2 system to extinguish the fire
- failure of the "not under command" lights
- failure of the emergency fire pump to provide full pressure
- failure of the crew to properly launch the lifeboat subsequent to the fire
- condemnation of 50 percent of the fire hoses

3

Case three involves a classic collision situation: when departing from Tauranga, New Zealand, the WASHINGTON collided with the HAN TAO HE just after the WASHINGTON dropped the pilots outbound. Both vessels were found at fault, but clearly the HAN TAO HE was the give-way vessel. In the investigation that followed, several things were determined to have contributed to the incident.

The Bridge Team Management on the WASHINGTON was deficient: there was little input to the master from the junior officers, and even if there had been, the authoritarian style of the master limited its value.

There were misunderstandings / miscommunications / misrepresentations in the sharing of information between the pilots and the master/watch officers.

Sleep deprivation/fatigue played a significant part: the master and deck officers were not properly rested. Lack of rest allowed for complacency, errors in judgment, faulty assumptions, confusion, and delayed reaction time. Coupled with an already poor Bridge Team Management structure, this provided a climate ripe for small errors to escalate rapidly into big errors, including the failure to carefully and effectively monitor the HAN TAO HE's relative position by visual and radar bearing, and take the appropriate and timely action; and the failure to attract attention or sound the appropriate sound signals.

As an aside, it was interesting to overlay "The Nine Switches of Human Alertness" (see Captain Jerry Aspland's article in the May-June 1995 issue of "Proceedings of the Marine Safety Council") on the deck officers of the WASHINGTON. It was determined that 7 of the 9 switches were in the "off" position at the time of the incident.

And, lastly, owner involvement in a safety management system was non-existent at the time: it permitted a lack of a safety culture to exist on the vessel.

So there you have it: Three forests; three casualties; three lessons learned!

Rule 18

Who Must Keep Out of the Way?

By CDR Ann Sanborn, U.S.M.S.
Assistant Professor, U.S.M.M.A.
Master Mariner Attorney Member NAVSAC

Summary

Rule 18 of the Inland and International Rules of the Road, which defines the responsibilities between vessels, does not assign primary responsibility to keep out of the way in situations involving a vessel not under command and a vessel restricted in ability to maneuver. Instead, both vessels are bound by Rule 2, which mandates that no vessel, owner, master or crew is exonerated from the consequences of any neglect of any precaution which may be required by the ordinary practice of seaman, or by the special circumstances of the case. In addition, Rule 2 requires mariners to operate their vessels with due regard for navigation hazards, risk of collision and any special circumstance including the limitations of their vessel.

Background

The Navigation Safety Advisory Council (NAVSAC) was asked to advise the USCG as to the correct interpretation of Rule 18 of both the Inland and International Rules. NAVSAC is a 21-member panel of maritime experts selected to advise the Department of Transportation on matters relating to the prevention of collisions, rammings and groundings.

The question to NAVSAC came from the protest of a USCG license examination question. The license question was intended to test the examinee's knowledge of Inland and International Rule relevant part: (See 'Rule 18' at right)

The protested license question stated:

"BOTH INTERNATIONAL & INLAND" Which statement is true according to the Rules?

A. A fishing vessel has the right of way over a vessel constrained by her draft.

B. A vessel not under command shall avoid impeding the safe passage of a vessel constrained by her draft.

C. A vessel engaged in fishing shall, so far as possible, keep out of the way of a vessel restricted in her ability to maneuver.

D. A vessel restricted in her ability to maneuver shall keep out of the way of a vessel not under command.

Answer A is incorrect because the term "right of way" is no longer used in the current Inland and International Rules, and also vessels constrained by their draft are not included in the Inland Rules of the Road. Answer B is incorrect because vessels constrained by their draft are not part of the Inland Rules, and the question concerns both Inland and International Rules. Answer C is a correct statement of Rule 18 (c) (ii) and is the answer to the license examination question.

The protest concerned Answer D, which states: “A vessel restricted in her ability to maneuver shall keep out of the way of a vessel not under command.” The conclusion of NAVSAC was that Answer D was also incorrect, because Rule 18 does not specifically assign the duty to keep out of the way to a vessel restricted in ability to maneuver. NAVSAC looked not only at the wording of Rule 18 and case law but also the legislative history of the Inland Rules. A factor that influenced NAVSAC’s conclusion was that there was no indication in the legislative history that Congress intended otherwise.

This conclusion was reached after a long and thoughtful discussion by NAVSAC with the final vote 16 in favor, 1 opposed and 1 abstention. It was also decided that Rule 18 has been subject to misinterpretation regarding the responsibilities between vessels not under command and those restricted in ability to maneuver and that an interpretive ruling was needed to clarify this issue.

Closing Comments

When a situation arises that was not anticipated by the Rules of the Road, Rule 2, the Special Circumstance Rule, governs the situation. If risk of collision develops between a vessel riot under command and a vessel restricted in ability to maneuver, both vessels are bound by Rule 2 to act prudently and take the necessary actions to avoid collision. It may be that in the case of a vessel totally disabled and incapable of maneuvering that the only action they can take is to give timely warning of the vessel’s plight. This would include the use of the statutorily required sound, light and shape signals, and also other appropriate means of communication, such as a timely warning on the VHF.

The Rules require all vessels to exercise great care in determining if risk of collision exists, and to take early and positive action to avoid collision. Given their limited mobility vessels not under command and restricted in their ability to maneuver must act prudently and exercise increased vigilance to comply with the Rules of the Road.

Note: For references, please contact the author.

Rule 18

Responsibilities Between Vessels

Except where Rules 9 [Narrow Channels], 10 [Traffic Separation Schemes] and 13 [Overtaking] otherwise require:

(a) A power-driven vessel underway shall keep out of the way of

(i) a vessel not under command;

(ii) a vessel restricted in her ability to maneuver;

(iii) a vessel engaged in fishing;

(iv) a sailing vessel

(b) A sailing vessel underway shall keep out of the way of:

(i) a vessel not under command;

(ii) a vessel restricted in her ability to maneuver; and

(iii) a vessel engaged in fishing.

(c) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:

(i) a vessel not under command; and

(ii) a vessel restricted in her ability to maneuver.

International Rules

(d) (i) Any vessel other than a vessel not under command or a vessel restricted in her ability to maneuver shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draft, exhibiting the signals in Rule 28. [notations added]

Lessons Learned in the Inland Towing Industry

Coast Guard / American Waterways Operators Partnership:

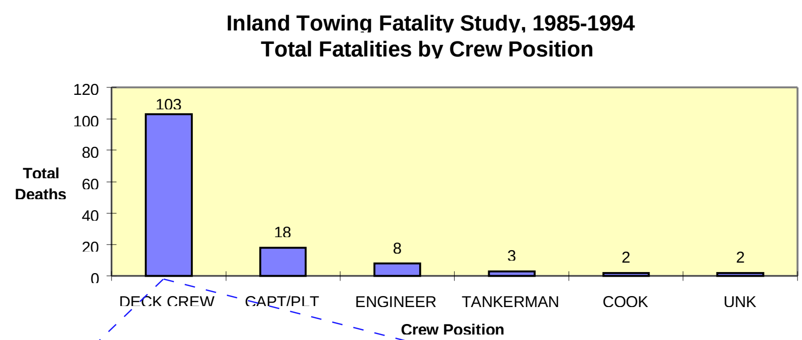
The American Waterways Operators (AWO) and the U. S. Coast Guard established a joint Quality Action Team (QAT) in November 1995 to study the causes and determine the rate of crew fatalities in the inland marine towing industry. The study focused on the 10-year period from January 1, 1985 to December 31, 1994, and was limited to on-the-job fatalities of crew members on vessels operating on the Western Rivers and the Gulf Intracoastal Waterway. The study excluded fatalities resulting from natural causes, suicide or homicide. Data came from the U. S. Coast Guard Marine Safety Management System database at USCG Headquarters and the 1994 Mercer Management Consulting Report to the AWO on casualties in the U. S. towing industry.

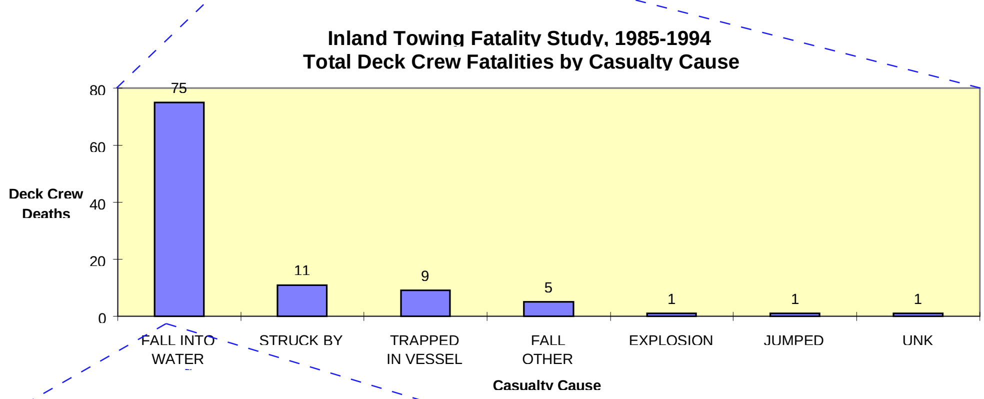
The study determined that the inland towing industry, as defined, experienced an annualized average rate of 68 deaths per 100,000 employees over the 10-year period of study. Falls overboard accounted for the vast majority of fatalities, and the greatest number of deaths from falls overboard occurred among young, inexperienced deck crew while handling lines, moving on deck and conducting maintenance activities, as noted in the table and graphs which follow. Case analysis showed that among the root causes occurring most frequently were poor work practices, poor situational awareness, and unnecessary risk-taking. These findings suggest immediate and substantial improvement in crew safety could be realized by focusing preventive measures on the human performance aspects of these tasks. The QAT recommended numerous ways to reduce the risk of falling overboard through better training, improved workplace practices, enhanced supervision, and refined measurement of crew safety performance to determine future trends and risks. As part of the implementation program, the Coast Guard and the AWO have developed the "S.A.F.E.* Decks" campaign, which seeks to raise industry awareness of the hazards of falling overboard through a non-regulatory safety enhancement effort. (The S.A.F.E. Decks brochure is reproduced on the following page.) * *Stay Alert For the Edge*

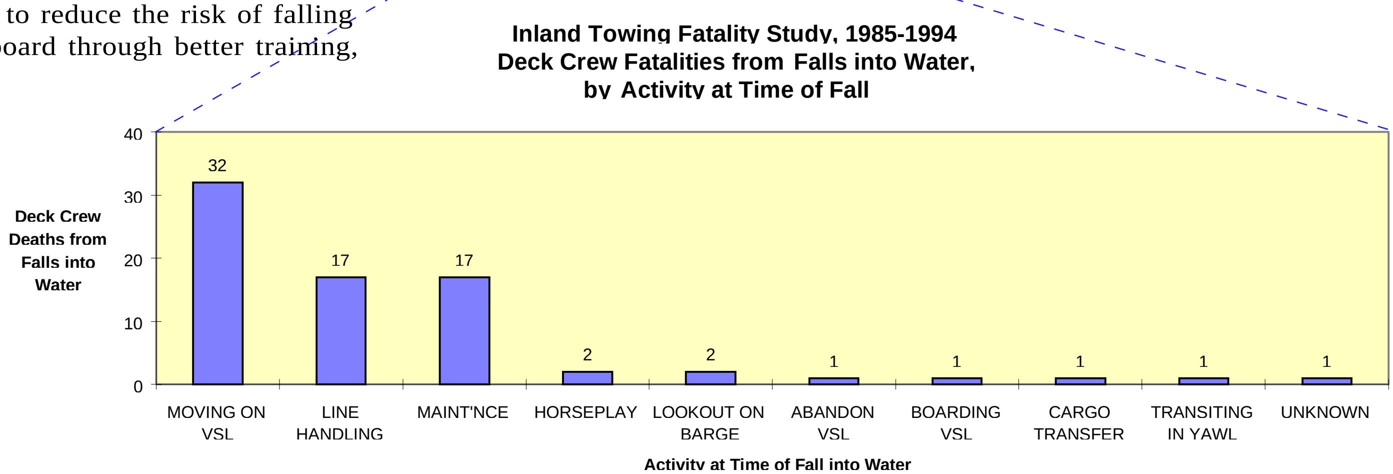
Inland Towing Industry Crew Fatalities -- Position & Cause

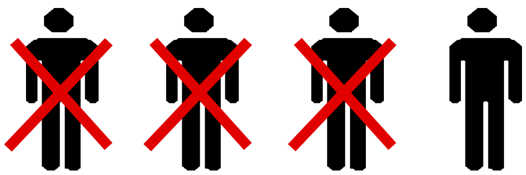
TOTAL FATALITIES 1985-1994	Crew Position						
Cause	DECK CREW	CAPT/PLT	ENGINEER	TANKERMAN	COOK	UNKNOWN	**Total**
FALL INTO WATER	75	11	7	2	1	0	96
STRUCK BY	11	1	0	0	0	0	12
TRAPPED IN VESSEL	9	1	1	0	0	0	11
FALL, OTHER	5	0	0	0	0	0	5
JUMPED	1	3	0	0	1	0	5
UNKNOWN	1	1	0	1	0	2	5
ASPHYXIATION	0	1	0	0	0	0	1
EXPLOSION	1	0	0	0	0	0	1
Grand Total	103	18	8	3	2	2	136

Source: USCG Marine Safety Management System database, USCG Headquarters (G-MOA-2)





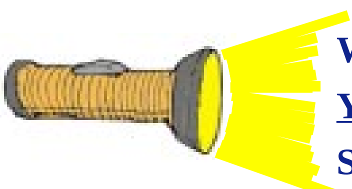




* 3 of every 4 deaths in the inland towing industry are deckhands.
* 1 of every 2 deckhand deaths are from falls overboard.
* Don't get crossed out!

MAKE SAFETY YOUR HABIT

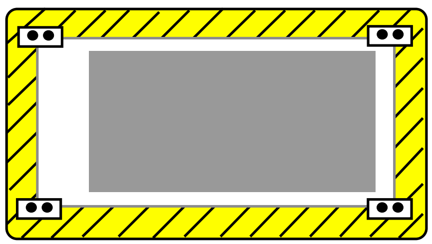
* Avoid working with your back to the water.
* Wear proper clothing and footwear.
* Use the buddy system.
* Tell others where you are.
* Use a flashlight at night.
* Avoid tripping hazards. Step around or over them.



WHERE'S <u>YOUR NEXT</u> STEP?

* The AWO/USCG Quality Partnership has found that FALLS OVERBOARD from barges and towboats account for the majority of crew deaths during the last 10 years.
* Our S.A.F.E. DECKS campaign is part of a larger effort to raise safety awareness in the barge and towing industry.

Keep a safety margin while you're bargin'



Stay Alert For the Edge

AWO/USCG - A Quality Partnership

For further information or to share your lessons learned:

American Waterways Operators
1600 Wilson Blvd., Suite 1000
Arlington, VA 22209
(703) 841-9300

Commandant (G-MOA)
2100 Second Street, SW
Washington, DC 20593-0001
(202) 267-1430

U.S. Coast Guard web site:
http://www.dot.gov/dotinfo/uscg/hq/g-m/moa/mao1a.htm

Developed under Contract DTCG23-95-D-HMS026

S.A.F.E. DECKS

MAN OVERBOARD!

Don't let this be you!

Stay
Alert
For the
Edge

Prevention Through People

Work on the dry side

Watch the "bump"

Wear your work vest

Keep decks clear

Make a work plan

Don't jump between barges

Mark tripping hazards

Use your radio

Don't walk the notch

WALKING THE DECKS

INSPECTING VOIDS

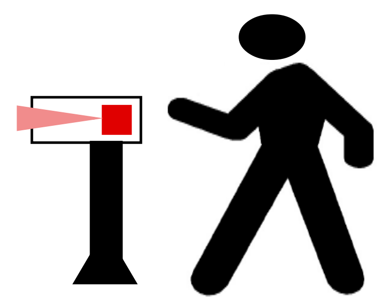
S.A.F.E. DECKS

HANDLING LINES

BOARDING THE TOW

Safety is a full time job.
Don't let the "Rush to Finish"
be <u>YOUR</u> "Finish."

CHECKING NAVIGATION LIGHTS



Stay Alert For the Edge

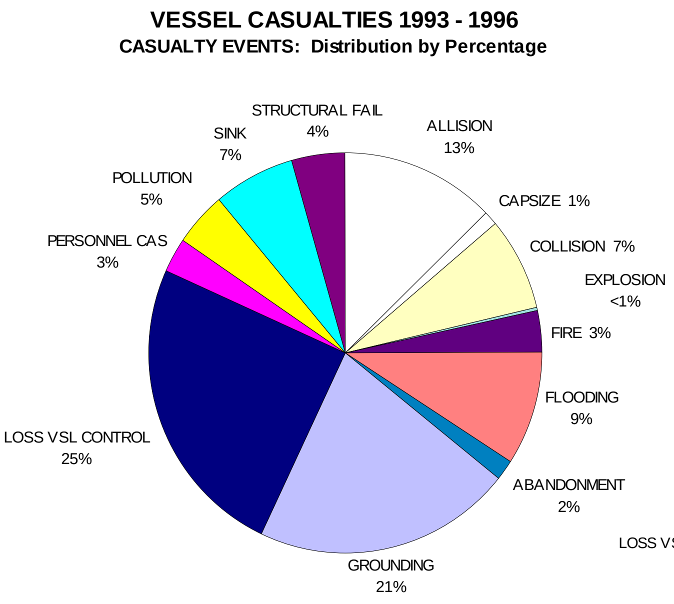
Statistical Overview

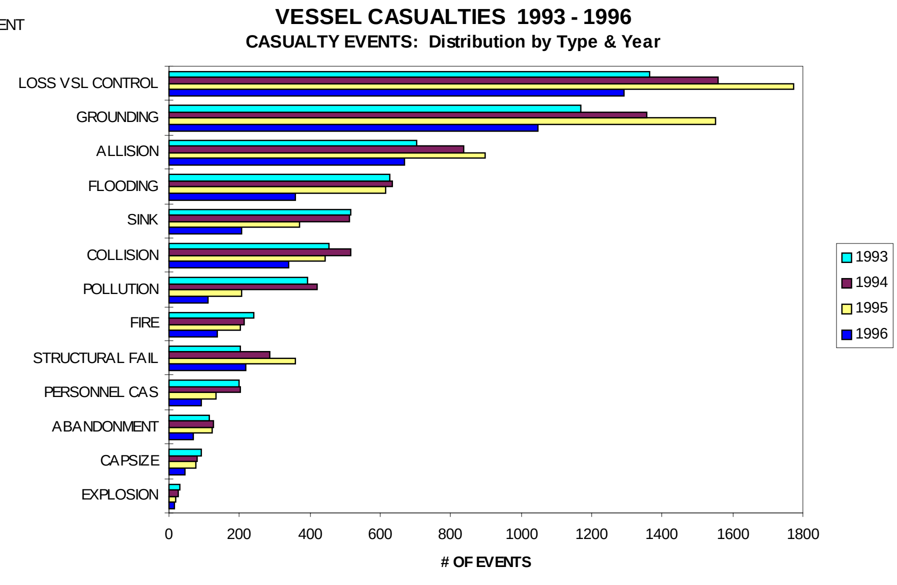
The following statistics provide a national overview of casualty data with respect to vessels, personnel and pollution during calendar years 1993 to 1996, inclusive. These are derived from casualty incidents reported to and investigated by the Coast Guard. Only completed investigations are counted—ongoing, open cases are not included. Some categories may show a drop in numbers for 1996, since there were a number of investigations from 1996 still open as of 31 December 1996, the closing date of the data extract. Data on vessel casualties represent casualties on U.S. flag vessels as well as foreign flag vessels (as long as the casualty occurred in U.S. jurisdiction). All data have been compiled by the Coast Guard Headquarters Office of Investigations and Analysis (G-MOA) and are derived from the U.S. Coast Guard Marine Safety Management System database at Coast Guard Headquarters, Washington, DC, extract dated 31 December 1996.

It is important to note that these statistics are primarily numerator data. Changes within categories from year to year do not necessarily imply trends or rates within the category. However, these statistics do help us to learn lessons by indicating areas for further study and analysis.

VESSEL CASUALTIES

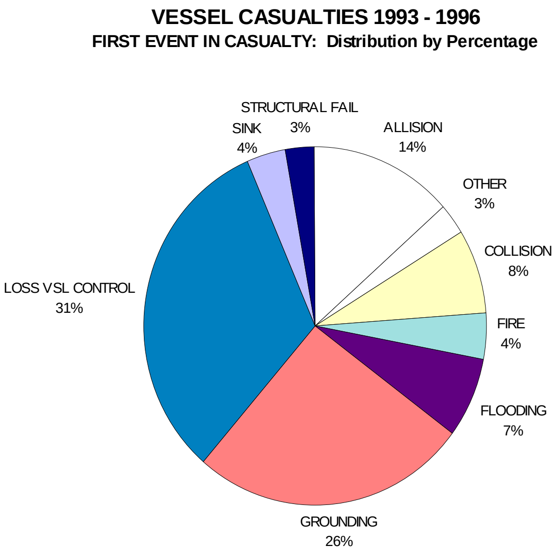
The following pie and bar charts depict the distribution, by percentage, and by type and number, of vessel casualty events from 1993 to 1996 inclusive. Since any one casualty may have multiple events (a vessel can lose steering, have an allision and then run aground), the data in these charts should not be confused with numbers of casualty cases. The categories “POLLUTION” and “PERSONNEL CAS” in the charts refer only to those pollution or personnel casualties which directly resulted from a vessel casualty. “LOSS VSL CONTROL” includes loss of steering and loss of propulsion.

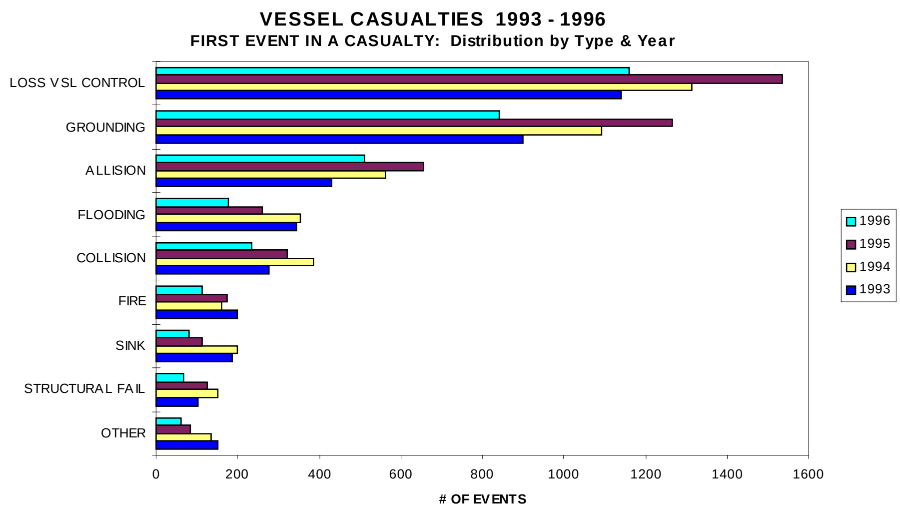


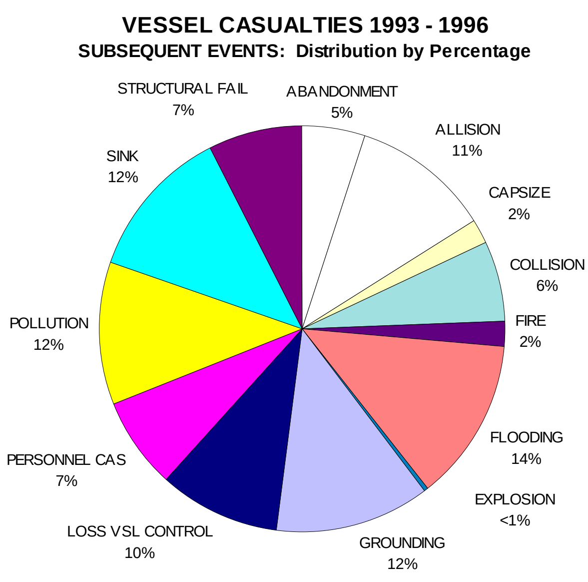


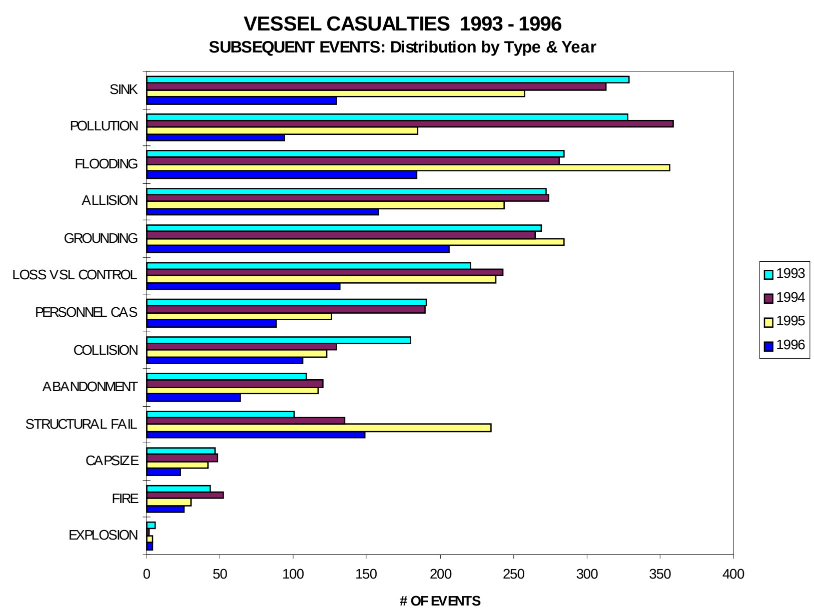
A common focus when studying vessel casualties for lessons learned is the precipitating, or first event in a casualty. By identifying the most prominent first events in casualties and focusing prevention efforts on them, subsequent events may be avoided.

The next charts isolate first events from subsequent events. As might be expected, LOSS OF VESSEL CONTROL, ALLISIONS and COLLISIONS are the most common first events. These typically precede other incidents such as groundings, sinkings and pollution. The category “OTHER” in the charts of first events incorporates Pollution, Capsize, Personnel Casualty, Abandonment and Explosion.



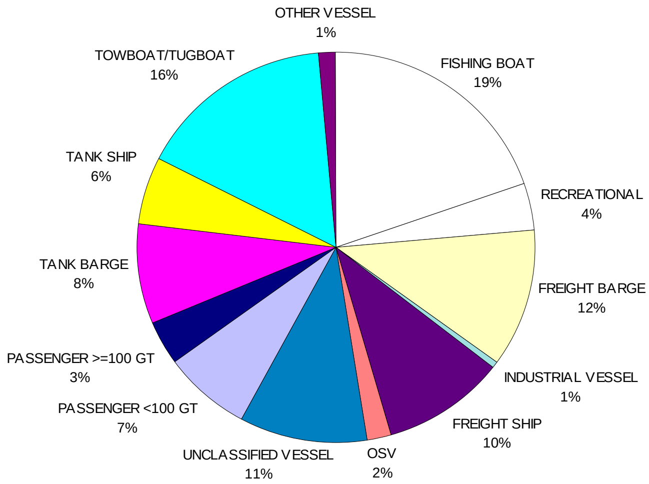




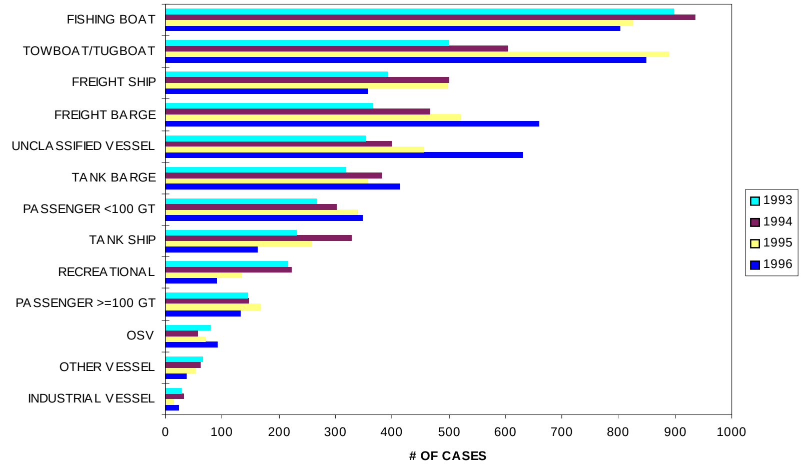


The following charts represent the distribution, by percentage and number, of vessel casualties by service of vessel. Some services have been grouped together to simplify the graph. “TANK BARGES” includes chemical and oil carrying barges. “UNCLASSIFIED VESSEL” includes all vessels which did not have a service listed or where service was listed as “Commercial” in the database. “FREIGHT SHIP” includes roll-on/roll-off vessels, container vessels and dry bulk ships. Mobile offshore drilling units, oil recovery vessels, passenger barges, unclassified passenger vessels, public vessels, research and school ships accounted for less than 1% of all vessel casualties, and were grouped together in the category called “OTHER VESSEL”.

VESSEL CASUALTY CASES 1993 - 1996
VESSEL SERVICE: Distribution by Percentage

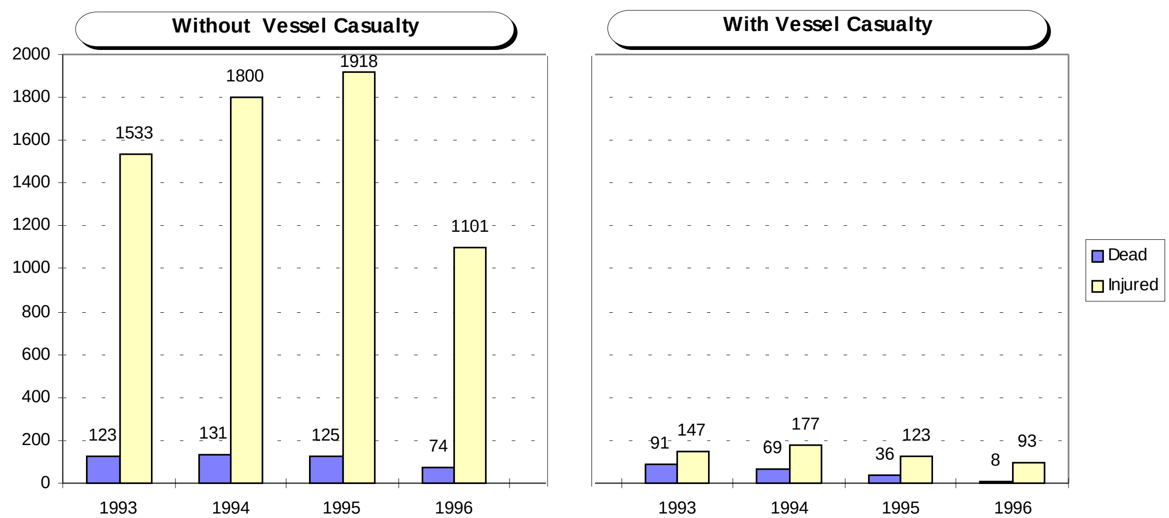


VESSEL CASUALTY CASES 1993 - 1996
VESSEL SERVICE: Distribution by Type & Year



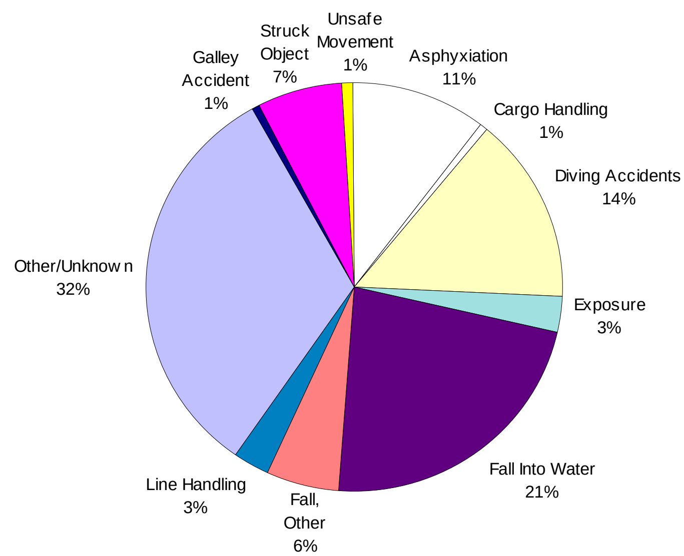
The charts below report personnel casualties in two major categories: those which resulted from a vessel casualty and those that did not. These are further divided into "DEAD" or "INJURED." (The category "DEAD" includes persons reported missing and presumed dead.)

PERSONNEL CASUALTIES -- NATIONAL TOTALS 1993 - 1996



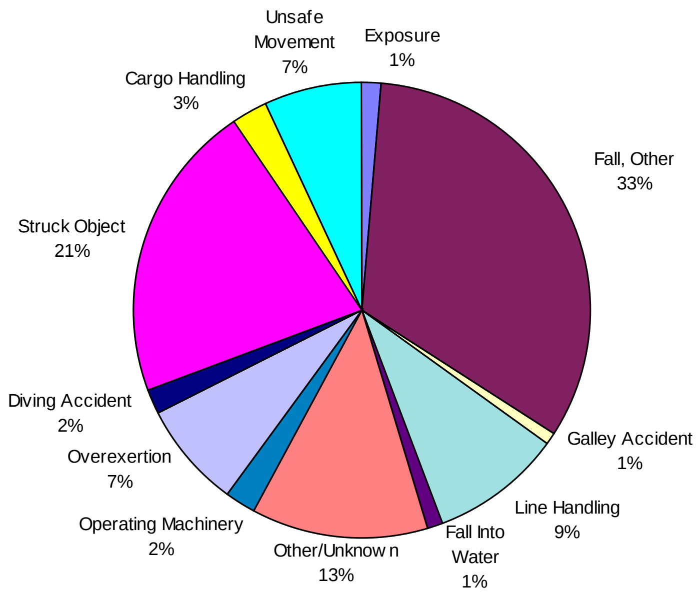
The next two pie charts depict the accident type which resulted in either death or injury. The charts show total personnel casualties regardless of whether or not they resulted from a vessel casualty. In cases in which the accident type accounted for less than 1% of the total, it was grouped within another category as follows: "FALL, OTHER" includes Falls Into Tank/Hold; Falls, Other Level; Falls, Same Level; and Falls, Not Classified. "LINE HANDLING" includes the accident type "Caught in Lines;" and "STRUCK OBJECT" includes "Bumped Fixed Object." Nearly all of the deaths reported as "DIVING ACCIDENTS" were suffered by recreational divers.

PERSONNEL DEATHS 1993 - 1996
ACCIDENT TYPE: Distribution by Percentage



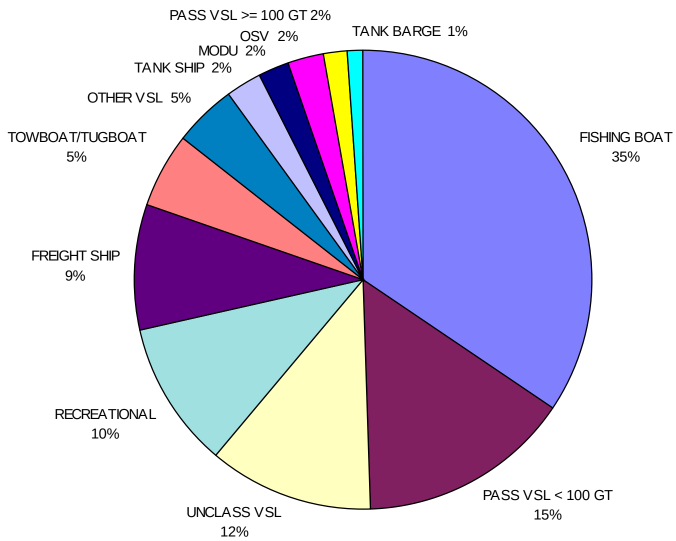
PERSONNEL INJURIES 1993 - 1996

ACCIDENT TYPE: Distribution by Percentage



The tables and graphs below present personnel deaths and injuries by vessel service and year of occurrence.

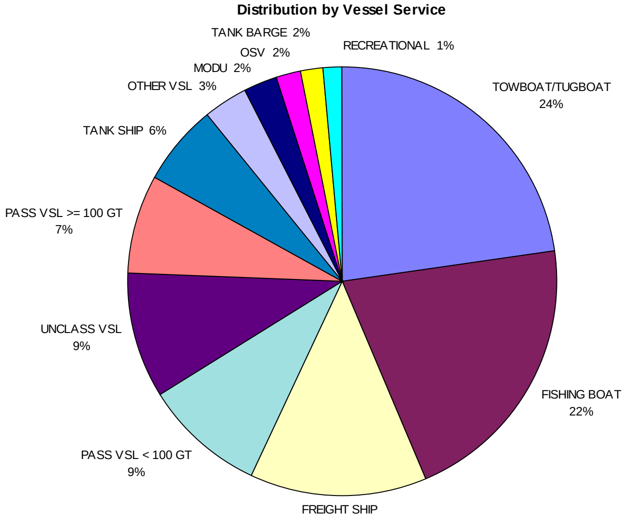
PERSONNEL DEATHS 1993-1996
Distribution by Vessel Service



Personnel Deaths: 1993-1996 National Totals

Vessel Service	1993	1994	1995	1996	Total
FISHING BOAT	89	63	47	27	**226**
PASS VSL < 100 GT	28	29	27	15	**99**
UNCLASS VSL	18	23	22	13	**76**
RECREATIONAL	23	21	21	3	**68**
FREIGHT SHIP	21	16	13	8	**58**
TOWBOAT/TUGBOAT	15	7	8	5	**35**
OTHER VSL	7	11	9	3	**30**
TANK SHIP	1	10	4	1	**16**
MODU	2	7	4	2	**15**
OSV	5	4	3	3	**15**
PASS VSL >= 100 GT	2	8	1	0	**11**
TANK BARGE	3	1	2	2	**8**
TOTAL	**214**	**200**	**161**	**82**	**657**

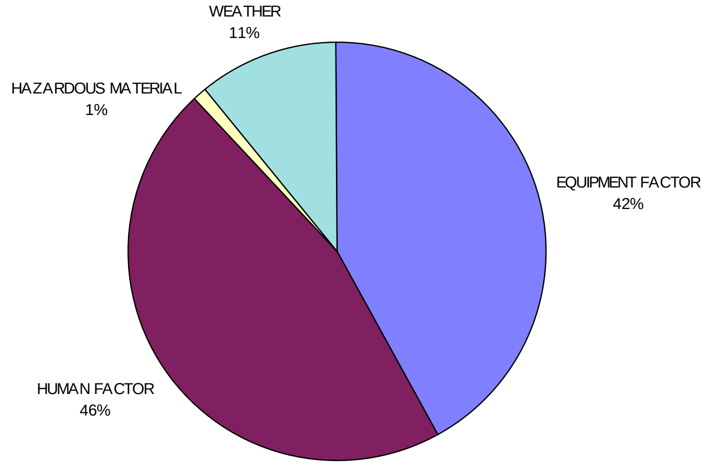
PERSONNEL INJURIES 1993-1996
Distribution by Vessel Service



Personnel Injuries: 1993-1996 National Totals

Vessel Service	1993	1994	1995	1996	Total
TOWBOAT/TUGBOAT	260	500	555	261	**1576**
FISHING BOAT	414	421	354	232	**1421**
FREIGHT SHIP	287	244	245	143	**919**
PASS VSL < 100 GT	153	136	192	168	**649**
UNCLASS VSL	129	200	181	136	**646**
PASS VSL >= 100 GT	84	158	172	90	**504**
TANK SHIP	126	123	118	58	**425**
OTHER VSL	70	62	61	45	**238**
MODU	47	47	52	17	**163**
OSV	54	22	42	22	**140**
TANK BARGE	21	37	41	15	**114**
RECREATIONAL	35	27	28	7	**97**
TOTAL	**1680**	**1977**	**2041**	**1194**	**6892**

Every casualty event has one or more causal factors associated with it. A grounding may be caused by a combination of human error, adverse weather and equipment failure. The following graph is a distribution by percentage of the aggregate of all causal factors for every casualty event resulting from vessel, personnel and pollution casualties. There are only 4 factors from which the investigator may choose: "Human," "Equipment," "Weather" and "Hazardous Material." We suspect that the Human Factor is understated. In order to address this concern, the Coast Guard has been directing efforts toward increasing the ability of investigators to determine accurate causal factor information.



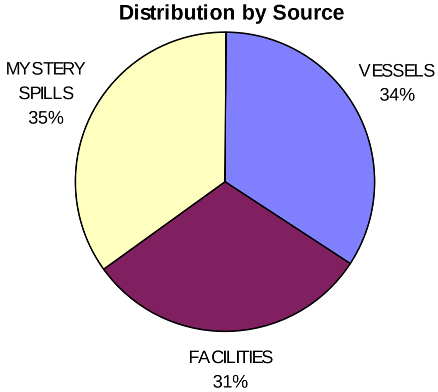
The following table and graphs present oil pollution spill data. They contain the number of spills and the quantity spilled throughout the United States. Facility is defined as anything that is not a vessel. In addition to traditional waterfront oil transfer facilities, this category includes shipyards, pipelines, marinas, aircraft, and bridges. Mystery spills are spills for which a source could not be identified.

VOLUME OF OIL SPILLED 1993 - 1996

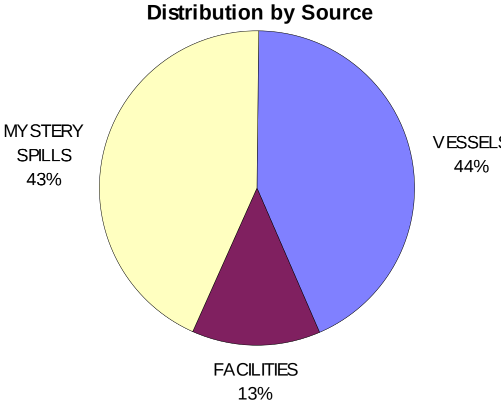
YEAR	1993		1994		1995		1996	
	# SPILLS	VOL SPILLED	# SPILLS	VOL SPILLED	# SPILLS	VOL SPILLED	# SPILLS	VOL SPILLED
VESSELS	3038	818,852	3378	1,235,833	3538	1,493,731	2380	614,886
FACILITIES	3000	429,853	2998	425,596	2827	254,815	2363	164,679
MYSTERY SPILLS	3481	555,806	3119	2,334,696	2884	77,970	2987	1,154,227

* VOLUME SPILLED IS IN GALLONS

NUMBER OF OIL SPILLS 1993 - 1996
Distribution by Source

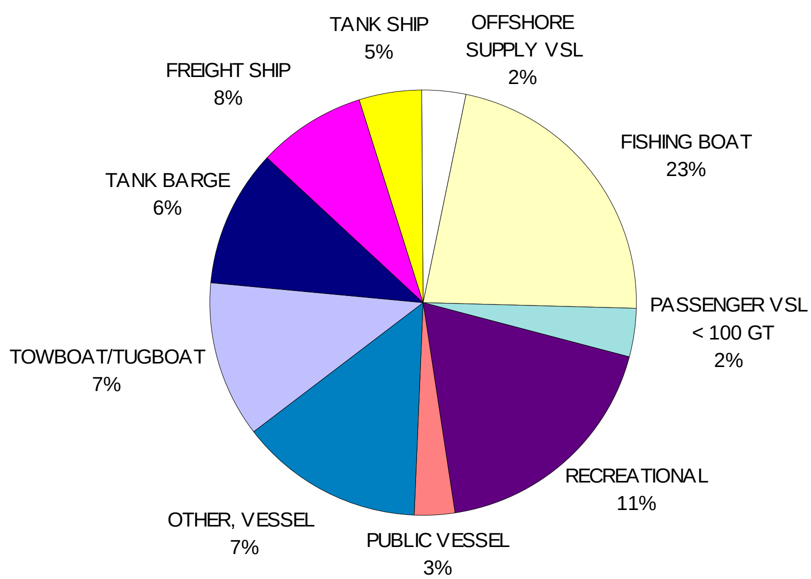


VOLUME OF OIL SPILLED 1993 - 1996
Distribution by Source



The graph below further breaks down spills by source. Excluded from these numbers are mystery spills and spills from facilities.

POLLUTION INCIDENTS FROM 1993 - 1996
DISTRIBUTION by PERCENTAGE from VESSELS
(excluding Facilities & Mystery spills)



DECK

Nautical Queries

1. The grab rail of a metal lifeboat is normally located _____ .
   A: along the turn of the bilge
   B: along each side of the keel
   C: near the top of the gunwale
   D: at the bow and at the stern

2. Your vessel is chartered under a time charter party. Under this type of charter party, your responsibility is ________ .
   A: solely to the charterer for all matters pertaining to cargo and ship administration
   B: solely to the cargo shippers and consignees
   C: solely to the owner, as under normal conditions
   D: to the owner for vessel administration and to the charterer for cargo operations and schedule

3. The most important reason for taking anti-seasickness pills as soon as possible after entering a life raft is to ______ .
   A: assist in sleeping
   B: reduce appetite by decreasing nausea
   C: prevent loss of body moisture by vomiting
   D: prevent impaired judgement due to motion-induced deliriousness

4. You are going ahead on twin engines with rudder amidships. Your starboard engine stalls. To continue on course, you should __________ .
   A: apply left rudder
   B: apply right rudder
   C: increase engine speed
   D: keep your rudder amidships

5. In a national emergency, when communicating via the Navy, messages are sent by precedence. A message designated ROUTINE will be delivered in
   A: 1 to 6 hours
   B: 3 hours to start of business the following day
   C: 30 minutes to 1 hour
   D: 10 minutes if possible

6. What is NOT a function of the scrubber of an inert gas system?
   A: Cool the inert gas
   B: Remove particulate matter like soot
   C: Maintain pressure in the tanks
   D: Remove chemical impurities

7. You are docking a vessel. Wind and current are most favorable when they are ______ .
   A: crossing your course in the same direction
   B: crossing your course in opposite directions
   C: parallel to the pier from ahead
   D: setting you on the pier

8. What is NOT a unit of a satellite navigation set aboard ship?
   A: Transmitter to trigger the satellite to broadcast
   B: Data processor to process signals from satellite
   C: Video display or printer to show generated data
   D: Antenna to receive satellite signals

9. When the declination of the Moon is 0º12.5' S, you can expect some tidal currents in Gulf Coast ports to ______ .
   A: exceed the predicted velocities
   B: become reversing currents
   C: have either a double ebb or a double flood
   D: become weak and variable

10. The use of pulse groups and extremely precise timing at each Loran-C station makes possible the use of _________ .
    A: high frequency pulses
    B: combinations of high and low frequency pulses
    C: the same frequency for all stations in a chain
    D: varied long and short pulses

Answers: 1-A 2-D 3-C 4-A 5-B 6-C 7-C 8-A 9-D 10-C

Nautical Queries

1. The part of the anchor windlass that engages the anchor chain for lifting is called the ___________ .
   - A: warping head
   - B: fairlead
   - C: wildcat
   - D: capstan

2. Ferrous metals are metals containing ______ .
   - A: no iron
   - B: a large percentage of copper
   - C: a large percentage of iron
   - D: a large percentage of aluminum

3. In a two-stroke/cycle, opposed piston, diesel engine, one crankshaft operates several crank angles in advance of the other crankshaft to ______ .
   - A: allow the exhaust ports to open and close before the inlet ports close
   - B: allow the scavenge ports to open and close simultaneously with the exhaust ports
   - C: prevent scavenge air pressure buildup in the cylinders
   - D: prevent the exhaust piston from reaching TDC and BDC before the intake piston

4.According to Coast Guard Regulations (33 CFR), a "suspension order" to suspend oil transfer operations can be withdrawn by the appropriate ____________ .
   - A: Captain of the port
   - B: Officer-in-charge, Marine Inspection
   - C: District commander
   - D: all of the above

5. Coast Guard Regulations require that prior to departure on a three-day voyage, the steering gear, whistle, and communications system between the bridge and engine room must be tested prior to departure no earlier than ______ .
   - A: 1 hour
   - B: 4 hours
   - C: 8 hours
   - D: 12 hours

6. Boiler refractories previously baked out and fired are more sensitive to ______ .
   - A: rapid cooling
   - B: sustained high furnace temperature
   - C: rapid heating
   - D: shock and vibration

7. Which of the listed classes of fire would apply to a main switchboard fire?
   - A: Class "A"
   - B: Class "B"
   - C: Class "C"
   - D: Class "D"

8. Each buoyant work vest on a MODU must be _____
   - A: Coast Guard approved
   - B: marked with the name of the unit
   - C: equipped with a waterlight
   - D: all of the above

9. Which of the listed procedures should be followed in preparing a main propulsion plant for getting underway?
   - A: Start the condensate and circulating pumps, check and start the lube oil system, engage the turning gear, then start the first-and second-stage air ejectors and the gland sealing.
   - B: Start the condensate and circulating pumps, check and start the lube oil system, start the air ejectors and the gland sealing system, then engage the turning gear.
   - C: Check and start the lube oil system, engage the turning gear, start the condensate and circulating pumps, start the gland sealing system and second stage air ejector.
   - D: Check and start the lube oil system, start the second-stage air ejector and the gland sealing system, start the condensate and circulating pumps.

10. Inefficient operation or a faulty condition of turbine components will be indicated by an abnormal variation of which condition?
   - A: Speed
   - B: Lube oil pressure
   - C: Lubricating oil temperature
   - D: All the above conditions are individually correct.

Answers:
1-C 2-C 3-A 4-D 5-D 6-A 7-C 8-A 9-C 10-D

Focus on IMO

Editor's Note: *From time to time, I receive requests to print information on the International Maritime Organization. The following section is a combination of many different requests for information. Included in this IMO section is Basic Facts; Frequently Asked Questions; and an article on Mandatory Fire Tests.*

Basic Facts About IMO

Foundation and Purpose

The Convention establishing the International Maritime Organization (IMO) was adopted on 6 March 1948 by the United Nations Maritime Conference.

The name of the Organization was changed to the International Maritime Organization in accordance with an amendment to the Convention which entered into force on 22 May 1982.

The purposes of the Organization are to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships. The Organization is also empowered to deal with administrative and legal matters related to these purposes.

The Organization has approximately 155 Member States and two Associate Members.

Structure

The Organization consists of an Assembly, a Council and four main Committees: the Maritime Safety Committee; Marine Environment Protection Committee; Legal Committee, and Technical Cooperation Committee. There is also a Facilitation Committee and a number of Sub-Committees of the main technical committees.

The **Assembly** is the highest Governing Body of the Organization. It consists of all Member States, and it meets once every two years in regular sessions; but may also meet in extraordinary session if necessary. The Assembly is responsible for approving the work program, voting the budget and determining the financial arrangements of the Organization. The Assembly also elects the Council.

The **Council** is composed of 32 Member States elected by the Assembly for two-year terms beginning after each regular session of the Assembly.

The Council is the Executive Organ of IMO and is responsible, under the Assembly, for supervising the work of the Organization. Between sessions of the Assembly, the Council performs all the functions of the Assembly, except the function of making recommendations to Governments on maritime safety and pollution prevention which is reserved for the Assembly. Other functions of the Council are to:

(a) coordinate the activities of the organs of the Organization;

(b) consider the draft work program and budget estimates of the Organization and submit them to the Assembly;

(c) receive reports and proposals of the Committees and other organs and submit them to the Assembly and Member States,with comments and recommendations as appropriate;

(d) appoint the Secretary-General, subject to the approval of the Assembly;

(e) enter into agreements or arrangements concerning the relationship of the Organization with other organizations, subject to approval by the Assembly.

The **Maritime Safety Committee** (MSC) is the highest technical body of the Organization. It consists of all Member States. The functions of the Maritime Safety Committee are to consider any matter within the scope of the Organization concerned with aids to navigation, construction and equipment of vessels, manning from a safety standpoint, rules for the prevention of collisions, handling of dangerous cargoes, maritime safety procedures and requirements, hydrographic information, logbooks and navigational records, marine casualty investigation, salvage and rescue, and any other matters directly affecting maritime safety.

The Committee is also required to provide machinery for performing any duties assigned to it by the IMO Convention or any duty within its scope of work which may be assigned to it by or under any international instrument and accepted by the

Organization. It also has the responsibility for considering and submitting recommendations and guidelines on safety for possible adoption by the Assembly.

The MSC operates with the assistance of nine sub-committees. These are:

1. Bulk Liquids and Gases (BLG)

2. Carriage of Dangerous Goods, Solid Cargoes and Containers (DSC)

aspects are concerned.

The **Technical Cooperation Committee** is required to consider any matter within the scope of the Organization concerned with the implementation of technical cooperation projects for which the Organization acts as the executing or co-operating agency and any other matters related to the Organization's activities in the technical cooperation field.

The Technical Cooperation Committee consists of all Member States of IMO.

The **Facilitation Committee** is a subsidiary body of the Council. It deals with IMO's work in eliminating unnecessary formalities and "red tape" in international shipping. Participation in the Facilitation Committee is open to all Member States of IMO.

The **Secretariat of IMO** consists of the Secretary-General and nearly 300 personnel based at the headquarters of the Organization.

Contributions to the **IMO budget** are based on a formula which is different from that used in other United Nations agencies. The amount paid by each Member State depends primarily on the tonnage of its merchant fleet. The top-ten contributors for 1996 were:

1. Panama
2. Liberia
3. Japan
4. Greece
5. Cyprus
6. United States
7. Bahamas
8. Norway
9. Russian Federation
10. China

Other entities associated with IMO and the **Integrated Technical Co-operation Programme**; the **World Maritime University**; and the **IMO International Maritime Law Institute**.

IMO Facts

What does IMO do?

When IMO first began operations its chief concern was to develop international treaties and other legislation concerning safety and marine pollution prevention. By the late 1970s, however, this work had been largely completed. After that IMO concentrated on keeping legislation up to date and ensuring that it is ratified by as many countries as possible. This has been so successful that many Conventions now apply to more than 98% of world merchant shipping tonnage. Currently the emphasis is on trying to ensure that these Conventions and other treaties are properly implemented by the countries that have accepted them.

Why do we need an international organization to look after shipping?

Because shipping is an international industry. If each nation developed its own safety legislation the result would be a maze of differing, often conflicting national laws. One nation, for example, might insist on lifeboats being made of steel and another of glass-reinforced plastic. Some nations might insist on very high safety standards while others might be more lax, acting as havens for sub-standard shipping.

How does IMO implement legislation?

It doesn't. IMO was established to *adopt* legislation. Governments are responsible for *implementing* it. When a government accepts an IMO Convention it agrees to make it part of its own national law and to enforce it just like any other law. The problem is that some countries lack the expertise, experience and resources necessary to do this properly. Others perhaps put enforcement fairly low down their list of priorities. With 154 governments as Members, IMO has plenty of teeth - the trouble is that some of them don't bite.

The result is that serious casualty rates - probably the best way of seeing how effective governments are at implementing legislation - vary enormously from flag to flag. The worst fleets have casualty rates that are a hundred times worse than those of the best. IMO is concerned about this problem and in recent years has set up a special Sub-Committee on Flag State Implementation to improve the performance of governments.

Another way of raising standards is through port State control. The most important IMO Conventions contain provisions for governments to inspect foreign ships that visit their ports to ensure that they meet IMO standards. If they do not they can be detained until repairs are carried out. Experience has shown that this works best if countries join together to form regional port State control organizations. IMO has encouraged this process, and agreements have been signed covering Europe and the north Atlantic; Asia and the Pacific; Latin America; and the Wider Caribbean.

IMO also has an extensive technical cooperation program which concentrates on improving the ability of developing countries to help themselves. It concentrates on developing human resources through maritime training and similar activities.

What about pollution?

In 1954 a treaty was adopted dealing with oil pollution from ships. IMO took over responsibility for this treaty in 1959, but it was not until 1967, when the tanker *Torrey Canyon* ran aground off the coast of the United Kingdom and spilled more than 120,000 tons of oil into the sea, that the shipping world realized just how serious the pollution threat was. Until then many people had believed that the seas were big enough to cope with any pollution caused by human activity.

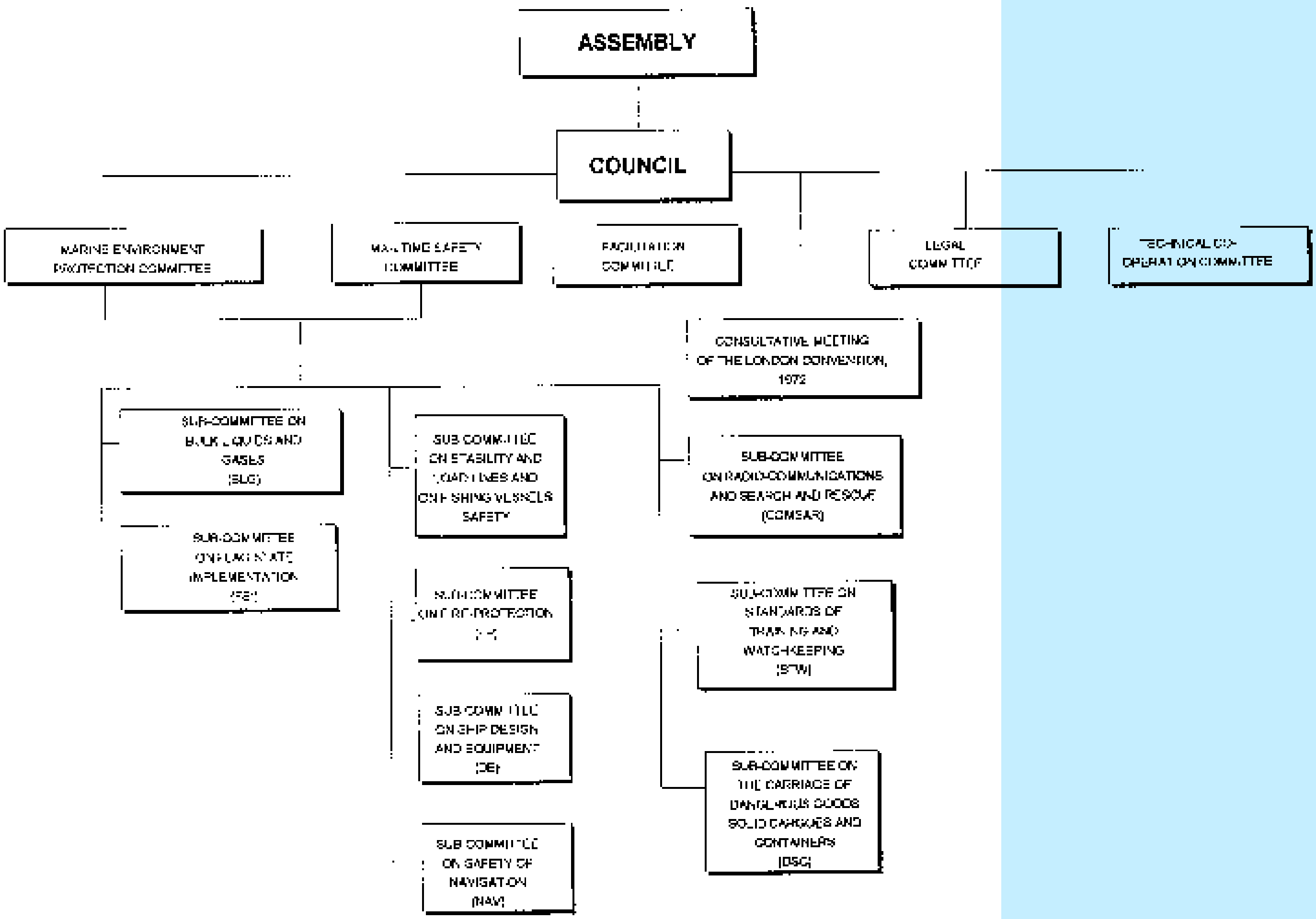
Since then IMO has developed numerous measures to combat marine pollution - including that caused by the dumping into the seas of wastes generated by land-based activities. Thanks in part to these measures, oil pollution from ships was cut by about 60% during the 1980s, according to figures compiled by the National Academy of Sciences of the United States.

Doesn't IMO always aim for the lowest common denominator?

IMO usually tries to act on a consensus basis. This is because it is important that measures adopted by the Organization, which can have a major impact on shipping, achieve as much support as possible. A treaty that was supported by only 51% of the IMO membership, for example, would be opposed by nearly half the shipping world. Not only would they not ratify the treaty concerned but they might go off and adopt an alternative treaty of their own, thereby dividing the maritime community.

But this does not mean that the measures themselves are of a low standard. Governments that did not want high standards would not bother to join

INTERNATIONAL MARITIME ORGANIZATION
Structure of IMO Bodies



IMO. The governments that do join IMO do so because they support the Organization's aims. Experience has shown that the treaties adopted by IMO represent an extremely high standard, and their acceptability can be shown by the fact that many of them are now almost universal in their coverage. Some have been accepted by more than 130 countries and cover all but a fraction of the world merchant fleet.

How much does IMO cost?

IMO is a bargain. It is one of the smallest agencies in the United Nations system, both in terms of staff numbers (just 300 permanent staff) and budget. The total budget for the 1996-1997 biennium is £36,612,000 (about US$56.3 million). This is less than half what it would cost to buy a medium-sized oil tanker and represents only a fraction of the cost of the damage caused by an oil spill, for example (the *Exxon Valdez* spill in Alaska in 1989 has so far cost more than US$5 *billion).* If IMO is responsible for preventing just one oil tanker accident a year then it more than covers its cost. And IMO has helped to cut tanker accidents dramatically during the past 15 years or so. The IMO budget is unique for another reason. Costs are shared between the 154 Member States primarily in proportion to the size of each one's fleet of merchant ships. The biggest fleets in the world pay the biggest share of IMO's budget.

Panama's share of the assessment for 1996 comes to 12.46% and Liberia's to 10.81%, Japan pays 5.75%. The United States, which pays by far the highest contribution to the budgets of other UN agencies, pays only 4.4% of IMO's budget while the host country, the United Kingdom, pays 2.58%.

IMO used to be called "the rich man's club". Has it changed at all?

When IMO began operations in 1959 shipping was still dominated by a relatively small number of countries, nearly all of them located in the northern hemisphere. IMO tended to reflect this. But as the balance of power in the shipping industry began to change so did IMO.

The Maritime Safety Committee, the senior technical body, was thrown open to all Member States (previously it had consisted only of 16 Members, elected by the governing Assembly). The Council, which acts as governing body in between the two-yearly meetings of the Assembly, was increased in size from 18 to 24 Member States, then to 32 and will shortly be increased still further to 40. This was done partly to take into account the growing membership of IMO, but also to ensure that the views of developing countries were properly represented. The biggest increase in Council membership has been to the section which takes geographical representation into account.

In 1979 IMO became the first UN agency to make its Technical Cooperation Committee a permanent institution - an indication of the importance the Organization attaches to this subject.

Shouldn't IMO have some sort of police function?

It is sometimes said that IMO should have some sort of authority to enforce its regulations. This seems to imply the creation of a team of inspectors and a fleet of patrol boats crewed by officials with the right to board any ships they suspected of contravening IMO regulations. In practice, the creation of such a force would be enormously costly. It would mean recruiting hundreds, probably thousands, of people - and politically impossible: most governments would never agree to allow ships flying their flag to be boarded in international waters, and any attempt to introduce a system of penalties and punishments would be even more unacceptable.

The IMO police force would duplicate the work being done already by individual governments, and there is no guarantee that it would make a significant impact on safety and pollution, certainly in relation to the cost involved.

IMO has, however, been given the authority to vet the training, examination and certification procedures of Contracting Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). This was one of the most important changes made in the 1995 amendments to the Convention. Governments will have to provide relevant information to IMO's Maritime Safety Committee, which will judge whether or not the country concerned meets the requirements of the Convention.

Why is IMO so slow?

The main purpose of IMO is to adopt international treaties which are intended to apply to as many ships as possible. Unanimity of this kind inevitably takes time - it depends on the speed with which governments act, as well as IMO - and it can only be achieved at all by ensuring that the regulations adopted are very widely acceptable; this can take time.

But when speed is necessary IMO can act very rapidly indeed. Following the *Estonia* disaster of September 1994, in which a passenger ro-ro ferry sank with the loss of more than 900 lives, the Secretary-General of IMO, Mr. William A. O'Neil, called for a complete review of ro-ro safety to be carried out by a special panel of experts.

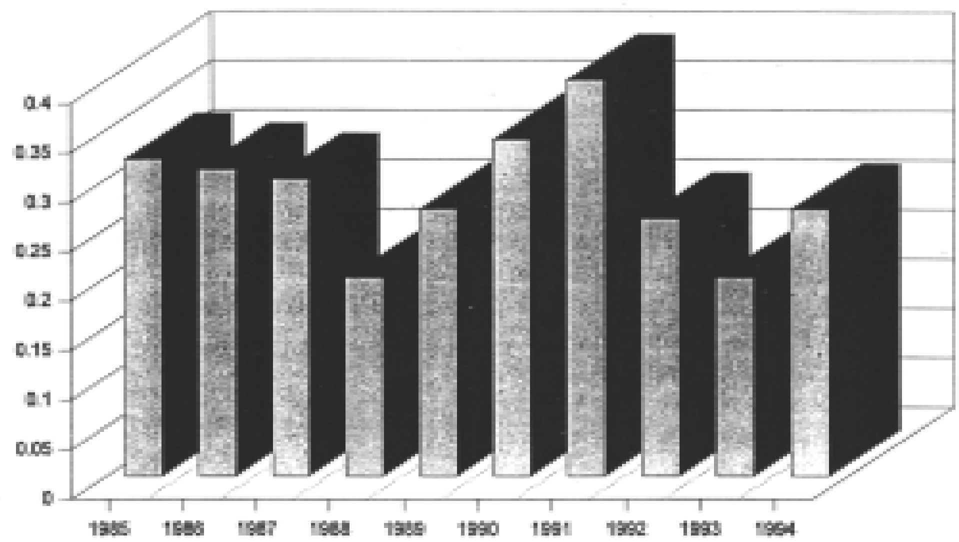
The panel's report was considered by the Maritime Safety Committee in May 1995 and amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974 were adopted in November. Special requirements concerning the crews of ro-ro passenger ships were included in amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 that were adopted in July 1995. All of this was done before the final report into the disaster had been issued.

Another example is provided by the 1995 amendments to the STCW Convention as a whole. Although IMO agreed some years ago to amend the Convention, the timetable originally envisaged would have meant that this would not have taken place before 1998 and the amendments themselves would not have entered into force until the next century. In May 1993 the Secretary-General urged the Maritime Safety Committee that this process be accelerated by using special consultants. The Committee agreed, and the amendment procedure - which amounted to a complete re-writing of the Convention - was completed by July 1995. As a result the amendments were entered into force in February 1997 -more than a year before the amendment conference would have been held under the original timetable.

IMO has improved its procedures over the years to ensure that changes can be introduced more quickly. One of the most successful of these has been the process known as "tacit acceptance", which has been included in most technical conventions adopted by IMO since the early 1970s.

World Loss Ratio, 1985-1994

% of world merchant fleet



Although the average loss ratio has been under 0.30% during the period, it has fluctuated from 0.20 to 0.40, making it difficult to distinguish any particular trend.

The normal procedure for adopting amendments to an international treaty is by means of “explicit acceptance”. This means that the amendments enter into force so many months after being accepted by a specified number of Parties to the original Convention. The number can be as high as two thirds, and if the parent Convention has been accepted by a large number of countries it could mean 80 or more of them having to ratify the amendment before it becomes international law. Experience has shown that this can take decades to achieve - by which time the amendment itself is likely to be out of date.

The tacit acceptance procedure means that amendments - which are nearly always adopted unanimously - enter into force on a set date unless they are specifically rejected by a specified number of countries. Because of the care taken at IMO conferences to achieve unanimity, very few rejections have ever been received and the entry-into-force period has been steadily reduced. In exceptional cases amendments can enter into force as little as a year after being adopted. Apart from the speed, tacit acceptance also means that everyone involved knows exactly when an amendment will enter into force. Under the old system you never knew until the final acceptance was actually deposited with IMO.

Have shipping safety and the marine environment improved because of IMO?

Although “yes” can be said to this question with some confidence, it is difficult to compare shipping today with that of thirty or forty years ago because of the great changes that have taken place in the industry during that period. In the 1950s shipping was dominated by a handful of traditional maritime countries. They built the ships, operated them, manned them and provided the goods that were carried on them. Today most ships fly the flags of developing countries, their crews come from all over the world. Doubts have been expressed about the ability of some of these countries to maintain and operate ships to the high standards laid down in IMO regulations. Ships themselves have changed dramatically in size, speed and design and in addition economic factors mean that the average life of ships today is much higher than it used to be.

Despite these changes, safety standards around the world are generally good and have improved considerably since the late 1970s, when IMO treaties began to enter into force and the number of acceptances rose to record levels. Statistics do not always tell the whole story. In the early 1980s, for example, a study carried out in the United Kingdom showed that the number of collisions between ships was much the same as it had been ten years before, indicating that the introduction of traffic separation schemes and other measures had not had much impact. But closer examination showed that the number of collisions had fallen dramatically in areas where IMO-approved schemes had been adopted - but had risen by the same number in areas where nothing had been done.

Generally speaking, the rate of serious casualties has not greatly changed during the past ten years or so. But in view of the changes taking place in shipping - notably the steady aging of the world fleet over the past fifteen years or so - this is an indication that IMO measures are having an impact.

As far as pollution is concerned, the indications are that there has been a remarkable improvement in the amount of pollution caused by ships during the past two decades. This is partly due to the tightening of controls through IMO Conventions such as the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) and partly to the introduction of better methods of controlling the disposal of wastes. According to a study carried out by the United States National Academy of Sciences, oil pollution from ships fell by about 60% during the 1980s while the number of oil spills has also been greatly reduced.

All of this is encouraging. But IMO is aware that a great deal more needs to be done to improve safety and prevent pollution. It is now concentrating not on developing new treaties (there are enough of those already) but on making sure that governments and the shipping industry implement the ones that exist more effectively -and on reducing the number of accidents at sea which are caused by human error. Since some estimates say that mistakes make up around 80% of the total, the scope for improvement is enormous.

Who represents the U.S. at IMO meetings?

The State Department has overall responsibility for U.S. participation in international organizations. The State Department has delegated the responsibility of the U.S. "representative" at IMO meetings to the Coast Guard.

Are the representatives from the U.S. all Coast Guard personnel? Do they have specific experience and knowledge about the subjects discussed?

Other members of U.S. delegations include Coast Guard personnel, representatives of the private sector who have special expertise related to the topics under discussion, and sometimes representatives from other federal agencies, if appropriate.

Are non-Coast Guard persons, i.e. merchant marine officers, asked for advice on the Coast Guard discussions at IMO? Do any merchant mariners actually attend the IMO meetings as Coast Guard advisors?

Any interested parties are welcome to participate in the development of U.S. positions at IMO. There are public meetings held at Coast Guard HQ before and after each IMO meeting for the purpose of reporting to the public, and receiving public input. These meetings are announced in the Federal Register by the State Department, and the announcements are also included in the Marine Safety Newsletter. The Coast Guard has a point of contact for each IMO Committee and Subcommittee, who keeps a mailing list of persons who want to be more actively involved in the development of U.S. positions. Merchant mariners have been included in past delegations in a variety of capacities.

Is the U.S. State Department actually involved in IMO activities?

Sometimes a State Department representative will be on a U.S. delegation when there are issues of particular to the State Department.

Can or does the U.S. representative make permanent decisions at the various IMO conferences? Are the CG decisions later reviewed by someone out of the Coast Guard?

The U.S. representative speaks for the Untied States at IMO meetings. However, all IMO meetings are conducted according to a published agenda. Members submit formal position papers on the various agenda items. One of the functions of the public meetings at CGHQ mentioned above, is to review and refine U.S. positions, and to discuss significant positions taken by other countries. The U.S. representative goes into each meeting with well-defined U.S. positions to present and defend. In addition, the U.S. representative is given specific instructions by the State Department on sensitive international issues that might arise, and how to handle those situations. The U.S. representative is not normally required to make spur-of-the-moment decisions on important matters.

Over the years. what weight is given to U.S. comments at IMO meetings?

The U.S. is always well-prepared for IMO meetings, from both a technical and political standpoint, making sure U.S. positions are logical and well-supported. The U.S. represents positions vigorously and thoroughly. Marine trade with the U.S. is very important for many countries in the world. For these reasons, U.S. positions are generally given great weight. U.S. advice and counsel is often sought in the corridors at IMO, outside of the formal meeting setting.

Who are the representatives for NGO's? What status do NGO's have?

There are numerous Non-governmental organizations (NGO's)that have observer status at

IMO. NGO's enable different - and highly expert - points of view to be expressed during meetings and discussions. They include representatives of industry, technical and professional bodies and environmental groups. Non-governmental organizations in consultative status with IMO are:

- Advisory Committee on Protection of the Sea (ACOPS)
- Association of West European Shipbuilders (AWES)
- Baltic and International Maritime Council (BIMCO)
- International Association of Producers of Insurance and Reinsurance (BI PAR)
- European Council of Chemical Manufacturers' Federations (CEFIC)
- International Radio-Maritime Committee (CIRM)
- Oil Industry International Exploration and Production Forum (E and P FORUM)
- Association of European Manufacturers of Internal Combustion Engines (EUROMOT)
- Friends of the Earth International (FOEI)
- Greenpeace International
- Hazardous Materials Advisory Council (HMAC)
- International Association of Classification Societies (IACS)
- International Association of Drilling Contractors (IADC)
- International Association of Institutes of Navigation (lAIN)
- International Association of Lighthouse Authorities (IALA)
- International Association of Ports and Harbors (IAPH)
- International Bar Association (IBA)
- International Chamber of Commerce (ICC)
- International Council of Cruise Lines (ICCL)
- International Confederation of Free Trade Unions (ICFTU)
- International Transport Workers' Federation (ITF)
- International Cargo Handling Co-ordination Association (ICHCA)
- International Council of Marine Industry Associations (ICOMIA)
- International Chamber of Shipping (ICS)
- International Electrotechnical Commission (IEC)
- International Federation of Shipmasters' Associations (IFSMA)
- Institute of International Container Lessors (IICL)
- Instituto Iberoamerico de Derecho Maritimo (IIDM)
- International Law Association (ILA)
- International Life-saving Appliance Manufacturers' Association (lLAMA)
- International Life-boat Federation (ILF)
- International Maritime Committee (IMC/CMI)
- The Institute of Marine Engineers (IME)
- International Maritime Lecturers Association (IMLA)
- International Maritime Pilots Association (IMPA)
- International Marine Transit Association (IMTA)
- International Association of Dry Cargo Shipowners (INTERCARGO)
- International Association of Independent Tanker Owners (INTERTANKO)
- International Ocean Institute (IOI)
- International Petroleum Industry Environmental (IPIECA)
- International Road Transport Union (IRU)
- International Shipping Federation Ltd. (ISF)
- International Ship Managers' Association (ISMA)
- International Organization for Standardization (ISO)
- International Ship Suppliers Association (ISSA)
- International Salvage Union (ISU)
- International Tanker Owners' Pollution Federation Ltd. (ITOPF)
- International Union for Conservation of Nature and Natural Resources (IUCN)
- International Union of Marine Insurance (IUMI)
- Latin American Shipowners' Association (LASA)
- Oil Companies International Marine Forum (OCIMF)
- Permanent International Association of Navigation Congresses (PIANC)
- International Group of Protection and Indemnity Associations (PANDI)
- Society of International Gas Tanker and Terminal Operators Ltd. (SIGTTO)
- World Wide Fund for Nature Conservation Policy Division (WWF)

Note: Please contact Proceedings magazine for a list of non-governmental organizations and their addresses.

Where can more information on IMO be found?

More information can be found on the Internet on the IMO home page.

What is the world wide web address for IMO?

The URL is http://www.imo.org

The IMO Mandatory

What Does it Mean to

Vessels with a Safety of Life at Sea (SOLAS) certificate are required to comply with certain minimum fire safety criteria for materials of construction. These criteria are usually determined through fire testing. The recommended fire tests are described by International Maritime Organization (IMO) Resolutions. Most Administrations use these tests for qualifying marine materials although some Administrations including the United States have relied primarily on domestic test standards.

In July of 1995, the IMO's Subcommittee on Fire Protection (FP Subcommittee) met in London with the intent of formulating a mandatory Fire Test Procedures Code (FTP Code). The FP Subcommittee formed an intersessional correspondence group to develop the draft text for approval at the September 1996 meeting of the FP Subcommittee (FP 41). This draft FTP Code is expected to be approved at FP 41 and is intended to take effect in 1998.

Background

The IMO has over the years developed or adopted a comprehensive set of fire test procedures which are used to verify the performance of materials and construction arrangements on board merchant vessels requiring a SOLAS certificate. These test procedures are currently recommended practices and are not required as the sole means of proving compliance with the SOLAS Convention. Any Administration (flag state) has the authority to use other test procedures if the Administration is satisfied that such test procedures prove the performance of the product as required by the SOLAS Convention.

This process has created inconsistency among various Flag States. Administrations use different test procedures and it becomes difficult to compare the relative performance of various products. This situation is analogous to individual states within this country applying different building and fire codes.

The problem is evident when a Port State inspects a foreign vessel and questions a specific product or arrangement for compliance with the SOLAS Convention. An Administration may not agree with the test procedure used to prove compliance. This problem is most noticeable during the initial construction stage or major overhaul when materials are most closely scrutinized by the Flag State, Port State and Class Society. As a result, the FP Subcommittee has committed itself to standardizing the test procedures by making the IMO fire test procedures mandatory. Thus any vessel with a SOLAS certificate would have products and arrangements complying with the same fire test procedures.

Implementation

The FTP Code is intended to apply the IMO fire test procedures consistently to SOLAS certificated vessels. The development and implementation of the FTP Code will be accomplished in three steps as follows:

Step #1
The Correspondence Group on Interpretations has rewritten the applicable text of SOLAS so that where the text once referenced the "recommended" IMO test procedure by resolution number, the text will now reference the "Mandatory" Fire Test Procedures Code.

Step #2
A correspondence group has been formed to draft the FTP Code. This Code consists of a collection of the IMO Resolutions describing the IMO fire test Procedures and a general section which will discuss procedural details and the applicability of the FTP Code.

Step #3
The FTP Code and the amended text of SOLAS referencing the FTP Code should be

limitations) has the final say as to what tests or documentation are required to prove compliance with SOLAS. However, when the mandatory FTP Code is adopted by IMO, and the requirements are placed in force, the test procedures used to show compliance with SOLAS will not be optional. The Flag State and the U.S. Coast Guard will only approve materials and construction procedures in accordance with the IMO FTP Code.

This development at IMO will not affect shipbuilders and suppliers of U.S. certificated vessels that do not require a SOLAS certificate. These domestic vessels will continue to apply the existing Subchapters under 46 CFR including Subchapter C, D, H, I, K, T, and U. However, Coast Guard policy is adjusting to give domestic shipbuilders more options under 46 CFR to use the international procedures as an alternative to the current domestic procedures so that the U.S. marine infrastructure can adapt to the international requirements while maintaining the capability to build and compete domestically.

The U.S. Coast Guard has begun a process by which approvals under 46 CFR will include a statement indicating compliance with the requirements of SOLAS, when appropriate. This was an important first step because currently U.S. approvals do not indicate such compliance and thus these approvals do not ensure acceptance by other Administrations.

Even if the Coast Guard explicitly states such approval for products tested to domestic standards, the ultimate decision rests with the Flag State as to acceptance of such approvals. The only way to ensure that a product will be accepted by any Administration is to test the product using the current fire test procedures as recommended by SOLAS and incorporated into the FTP Code.

Conclusion

It is the choice of individual manufacturers in the U.S. marine industry to decide if international competitiveness is right for their business. If so, it is essential that these domestic manufacturers and shipyards become familiar with the international requirements and seek approvals according to the international fire test procedures.

SAFETY ALERT

Propeller Clearing Ports

In August of 1996 a commercial fishing vessel capsized while tending hagfish traps 13 nautical miles south east of Cape Elizabeth, Maine. The crew of the vessel first noticed the flooding condition while recovering fishing gear, but were unable to determine the source of the flooding. Within 10 minutes, the vessel had capsized, remaining on the surface partially submerged. The vessel's crew safely abandoned to a life raft.

Following salvage of the vessel, Coast Guard Investigators determined that the source of the flooding was from a Propeller Clearing Port, which had been installed over the vessel's propeller to allow the crew to clear away line and fishing gear which may have become fouled in the vessel's propeller.

In this incident, the vessel's master had removed the propeller clearing port hatch the day prior to the accident to clear line that had become fouled in the propeller. Coast Guard investigators believe that this hatch was not properly secured in place, and came loose under pressure the following day.

The Coast Guard believes that propeller clearing ports are becoming more popular on vessels constructed to tend stationary fishing gear. Stationary fishing gear includes traps used to catch lobster and hagfish, as well as other types of fishing equipment, such as gillnets and longlines. The lines and trapmarkers used to mark and recover stationary fishing gear creates a higher risk of fouled propellers, which can easily disable a vessel, than with other types of fishing equipment.

Because the hatches of propeller clearing ports are placed above waterline, some vessel operators may underestimate the risk of flooding associated with these devices. Clearing ports are placed in the same plane as the propeller, in order to provide access to clear away line and debris. In this location side wash from the vessel's propeller will place considerable pressure on the clearing port hatch cover while the vessel is maneuvered. In the event the hatch cover becomes loose, the vessel may experience flooding rates in excess of approximately 1000 gallons per minute.

The Coast Guard advises fisherman considering installation of propeller clearing ports to design the ports with the access hatch on the vessel's main deck. On vessels with access hatches placed below the main deck, means to prevent the hatch from unintentional opening, such as double nuts, safety wiring of bolts, etc. should be utilized. The Coast Guard strongly advises against the installation of clearing ports below the main deck in hulls not fitted with watertight bulkheads.

For further information on this Safety Alert contact:

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