Expansion of the Reporting System Paradigm to the United States Maritime Industry

by Jeffrey A. Bixler

This paper focuses on the creation of a U.S. maritime reporting system designed to alert the industry of safety incidents and prevent accidents. A brief history of aviation safety reporting will be provided, followed by an analysis of eight recent U.S. maritime accidents that reveal a gap in maritime safety information sharing. This paper will also describe the United Kingdom's maritime reporting system and the previous work completed on a U.S. maritime reporting system. This paper concludes with the impact of terrorism on maritime security and how previous work in aviation security reporting could be incorporated into a maritime reporting system.

INTRODUCTION

The United States has remained an aviation leader since the Wright Brothers' humble beginnings in 1903. However, the same is not true for the U.S. maritime industry. The industrial prosperity that followed World War II did not include the commercial maritime community, and although U.S. Naval Forces maintained supremacy, the nation's merchant marine fleet declined. The disparity between aviation and maritime transportation modes is also reflected in the area of safety. While the United States is a world leader in techniques and tools to improve aviation safety, it has not adapted these capabilities to the maritime industry.

This paper focuses on the need to create a U.S. maritime reporting system designed to alert the industry to safety incidents, the precursors to accidents. This paper will provide a brief history of aviation safety reporting, followed by an analysis of eight U.S. maritime accidents that demonstrate the need for a reporting system that can identify maritime hazards and prevent similar accidents. This paper will also describe the United Kingdom's maritime reporting system and the previous work completed in developing a prototype U.S. maritime reporting system. This paper concludes with the effects of the 2001 terrorist attacks on maritime security and how previous work in aviation security reporting could be applied to a maritime reporting system.

HISTORY OF U.S. AVIATION SAFETY REPORTING

To best apply the proven techniques and concepts of aviation safety to the maritime industry, it is important to understand the history of aviation safety reporting. In aviation, technological improvements reduced the accident rate by reducing mechanical failure. As a result, human error has become the leading cause of aviation accidents, and prevention methods focus their attention on near-miss incidents to better understand and reduce human error. The aviation reporting program that has served as a model for other systems arose from a National Transportation Safety Board (NTSB) recommendation made in a 1974 airline accident investigation. The NTSB found that while one airline was aware of a significant safety hazard and distributed a company-wide alert concerning the near-miss incident, no system existed to share information throughout the industry. Less than two months after the first airline experienced the near-miss incident, a second airline experienced the same event and a fatal accident occurred. Consequently, a joint program by the Federal Aviation Administration (FAA) and National Aeronautics and Space Administration (NASA), called the Aviation Safety Reporting System (ASRS), was created to fill this information gap. Since 1976, it has

been providing human factors researchers with valuable aviation incident (near-miss) information (NASA Aviation Safety Reporting System 2008a).

An equally positive outcome of ASRS has been the expansion of reporting programs and concepts to include additional disciplines and domains. During an interview with the NASA ASRS Director, Linda Connell, on December 10, 2008, Ms. Connell stated that other professional fields such as medicine, security and emergency response, along with highway, rail and maritime transportation modes, had consulted NASA about developing reporting systems. While the shift from mechanical error to human error accidents has also occurred in the maritime industry, there is currently no U.S. Government directed program to collect individual reporter information and disseminate it to the maritime industry.

RECENT U.S. MARITIME ACCIDENTS

A review of U.S. maritime accidents reveals an information sharing gap, further revealing that a maritime safety reporting system would help to prevent repeat accidents. The NTSB investigated all eight of the U.S. maritime accidents described in this paper, with seven of them occurring in the previous six years. The first four accidents describe two very common types of marine accidents involving shipboard fires and stability problems. The goal of any safety reporting system is to learn from near-miss incidents in order to prevent similar accidents.

Engine Fire on Small Passenger Vessel *Express Shuttle II*

A shipboard fire occurred in 2004 on board the *Express Shuttle II*, a small passenger vessel operating on the Pithlachascotee River near Port Richey, Florida. The vessel was being used to transport 78 passengers to an offshore casino boat in the Gulf of Mexico, but only three crew members were on board when the fire occurred. None of the crew was seriously injured, but the outcome could have been very different with a full compliment of passengers due to the severe fire that caused $700,000 in damages. The NTSB concluded that the fire's initial fuel source was a fractured diesel fuel line running to the starboard engine's number five cylinder. The board also concluded that the fracture resulted from metal fatigue caused by excessive vibration, because the line was not properly secured (National Transportation Safety Board 2006b, ii). The severity of the fire prevented identification of the ignition source, but investigators reasoned that when the fuel contacted nearby hot engine components, a fire erupted. One of the most prevalent indications of an impending problem to everyone involved with the *Express Shuttle II* should have been the excessive number of replacement fuel lines required. The vessel had replaced 13 fuel lines on the starboard engine on 11 different dates over a 10-month period. A warning in the engine manufacturer's service manual specifically addressed the risk of fire from vibrating fuel lines. The root cause of the accident was improper preventive maintenance that should have identified both the incorrect fuel line fastening and the excessive replacement rate (National Transportation Safety Board 2006b, 41).

Engine Fire on Small Passenger Vessel *Massachusetts*

The second accident occurred two years later, in 2006, and also involved a fire that was caused from incorrect maintenance practices on an engine fuel line. The commuter ferry *Massachusetts* was underway in Boston Harbor carrying 69 passengers and crew when fire broke out in the engine room. The crew did an outstanding job of containing the fire, contacting local emergency responders and evacuating all passengers to a nearby ferry vessel. As a result of their actions, no one was injured, and the damage was limited to the *Massachusetts'* engine room at an estimated cost of $800,000 (National Transportation Safety Board 2007a, 2).

On the day of the fire, the *Massachusetts* had made three uneventful ferry runs during the morning and then traveled to a marine repair facility because of three mechanical problems. One

of these problems involved a faulty fuel injector, and while servicing the injector, the mechanic removed and replaced the fuel supply line of the number three cylinder. However, the mechanic did not calibrate or measure the amount of torque used in tightening the fuel line, even though he understood the importance of proper fastening. After repairs, the ferry began its afternoon passenger schedule and fire broke out in the engine room (National Transportation Safety Board 2007a, 22).

Investigators examining the wreckage concluded that the fuel line attached to the fuel injector of the number three cylinder had disconnected, allowing fuel to spray onto nearby hot engine components and ignite. The NTSB investigation of the *Express Shuttle II* and the *Massachusetts* noted deficiencies with the fire detection and extinguishing systems on both vessels. These two very similar accidents occurred two years apart but shared common human factors maintenance issues that involved improper practices and procedures on a specific engine component. Previously reported near-miss incidents could have allowed a reporting system to alert the maritime community (specifically maintenance personnel) of these hazards, possibly eliminating both accidents. In addition, the identification of inadequate fire fighting systems on both vessels might aid in identifying similar deficiencies on other vessels.

Capsizing of Small Passenger Vessel *Lady D*

The next two accidents involve stability issues, which caused both vessels to capsize and resulted in numerous fatalities. The first accident occurred in March 2004 and involved the small passenger vessel *Lady D*, a pontoon water taxi, which was carrying 25 passengers and crew from Fort McHenry to Fells Point, Maryland. The vessel encountered heavy weather, began to roll in the waves and eventually capsized, drowning five and injuring 16. The United States Coast Guard (USCG) and NTSB determined that a faulty classification of the *Lady D* had allowed the vessel to be certified for more passengers than its stability permitted. Specifically, the *Lady D* had been certified under sister ship requirements used for four other vessels of similar dimensions, but different hull and superstructure designs. In addition, a passenger weight of 140 pounds was used as the standard for the original stability calculations, but did not accurately reflect the actual 168-pound average weight of the passengers on board the accident vessel (National Transportation Safety Board 2006a, ii).

Capsizing of Small Passenger Vessel *Ethan Allen*

A similar fatal accident occurred a year and half later in October 2005 on Lake George, New York. A public vessel named the *Ethan Allen*, carrying a state certificate of inspection, encountered waves from the wakes of nearby vessels and capsized. Twenty passengers died and nine were injured due to the insufficient stability of the vessel. The vessel had originally been certified by the USCG to carry 48 passengers and two crewmembers, but the vessel had been sold and subsequent modifications completed under New York state regulations. As in the previous incident, the *Ethan Allen* had used the sister ship certification process, even though the subsequent modifications differed from the original design (National Transportation Safety Board 2006c, ii).

Post accident stability tests indicated that the canopy and window modifications made to the *Ethan Allen* should have voided its sister ship certification and required new stability calculations that would have reduced its passenger capacity from 48 to 14. A maritime reporting system may have generated earlier warnings about the hazards associated with the sister ship certification process. As in the case of the *Lady D*, the average passenger weight on board the *Ethan Allen* the day of the accident was 178 pounds, versus the 140-pound historical standard used to calculate stability (National Transportation Safety Board 2006c, 34). Inaccurate weight and balance issues have also been an increasing problem for airline safety, as identified by ASRS. The current average passenger weight exceeds the 170 pounds used to calculate performance and stability. Recognizing cross-modal transportation safety issues, such as inaccurate maritime and aviation passenger weights, would be an additional benefit of an overarching transportation safety reporting system.

Heeling Incident on the Cruise Ship *Crown Princess*

The following four accidents feature distinct occurrences that possibly could have been eliminated had similar incidents been used to alert and educate the maritime industry. During a July 2006 transit, the cruise ship *Crown Princess* heeled over 24°, causing 298 passenger injuries but no structural damage. The event occurred when the second officer became concerned about the ship's integrated navigation system and tried to counteract the system's rudder inputs by switching from automatic to manual steering control (National Transportation Safety Board 2008, iv).

Subsequent investigation revealed that the ship's navigational autopilot performed as designed, but insufficient crew knowledge about the advanced system allowed a dangerous situation to develop. When the second officer interceded, his inappropriate actions caused several rudder reversals, which resulted in the vessel heeling over and tossing passengers and cargo about the cruise ship. The NTSB recommended additional crew training on the integrated navigation system and promotion of industry-wide reporting for other heeling incidents in order to gather information (National Transportation Safety Board 2008, 43).

A review of the ship's recorded engineering data and performance indicated a fully operational autopilot system. Therefore, the key to understanding why the accident occurred required an examination into how the second officer interacted with the ship's internal navigation system. While mechanical and electronic recorders tell *what* happened, an incident reporting system provides the *why*. Incident information is invaluable in educating others to identify and respond properly during similar situations. As the human-computer interface in both aircraft and vessels increases in complexity, it becomes even more important to understand human perceptions in the occurrence of near-miss incidents. Using this knowledge, appropriate actions can be devised and applied to clarify and correct operational human-computer interface issues before an accident occurs.

Boiler Explosion on *SS Norway*

A fatal accident occurred in the port of Miami in May 2003, when a boiler exploded on the SS *Norway*, killing eight and seriously injuring 10 of the ship's crew. An hour after docking, a boiler in the aft boiler room exploded and sent 20 tons of water at 582°F expanding 1,200 times into a powerful wall of steam. The force of the explosion broke through a number of bulkheads and decks into the crew berthing areas and fatally injured several crew members. The NTSB concluded that faulty inspection procedures and boiler maintenance led to the explosion. In particular, improper water chemistry, boiler usage and cycle procedures caused the explosion (National Transportation Safety Board 2007c, 2-8). As in the previous accident, awareness and education are essential to preventing similar accidents. In the case of the SS *Norway*, education concerning water chemistry and usage rotations discovered by other maritime companies could have educated this ship's crew and possibly prevented the accident.

Pipeline Explosion Involving the Towing Vessel *Miss Megan*

A recent accident from 2006 might also have been averted by a reporting system that educated mariners on proper safety procedures. The *Miss Megan* was pushing two barges in the West Cote Blanche Bay oil field in Louisiana when the barge *Athena 106* had its aft 5-ton spud (mooring pylon) accidently release into the water. The pylon struck an underwater gas pipeline that exploded resulting in the death of six workers and approximately $1.5 million in damages (National Transportation Safety Board 2007b, 4).

The accident occurred because the barge and tug crews failed to follow all available safety precautions by not ensuring that the pylon winch brake was set or that the pylon holding pins had been secured during transit. Finding number eight of the NTSB report called for improved communication between the Coast Guard, the Occupational Safety and Health Administration

(OSHA) and the maritime industry (National Transportation Safety Board 2007b, 42). Providing feedback and improving communication in the aviation industry was the original purpose of ASRS, and a maritime reporting system would likewise serve as a valuable communication conduit for the maritime industry.

Bridge Collision with Towboat *MAUVILLA*

One of the deadliest U.S. maritime and rail accidents occurred in September 1993, when the tugboat *MAUVILLA,* pushing barges in Big Bayou, near Mobile, Alabama, struck and displaced a railroad bridge in dense fog. The resulting damage caused Amtrak's Sunset Limited, traveling from Miami to Los Angeles, to derail, killing 47 and injuring 103 passengers and crew. The resulting NTSB investigation recommended that there be a system used to evaluate and report on bridges with similar risks (National Transportation Safety Board 1994). A maritime reporting system may have identified both the bridge at risk and the lack of navigational markings and radar reflectors encountered by the disoriented tugboat captain. An overarching cross-modal transportation incident reporting system would have the ability to identify hazards impacting multiple transportation modes prior to an accident.

As mentioned, the United States is a forerunner in the development and utilization of aviation safety tools but has not fully realized their relevance in the maritime industry. ASRS has inspired the development of similar aviation reporting programs in the 12 countries that form the International Confidential Aviation Safety Systems (ICASS) group. One of the earliest members of ICASS was the United Kingdom, which instituted an aviation reporting system based on ASRS in 1982 and also realized its applications to the maritime industry (NASA Aviation Safety Reporting System 2008b).

U.K.'S MARITIME REPORTING SYSTEM

In 2003, the U.K. created a maritime reporting system called the Confidential Hazardous Incident Reporting Program (CHIRP). Some of the maritime reports CHIRP has received identify similar issues described in the previous maritime accidents. Reported information is distributed through CHIRP's *MARITIME FEEDBACK* newsletter in order to inform and educate the U.K.'s maritime community and prevent future accidents. As many British officers serve on non-U.K. flagships, and non-British seafarers serve on ships managed by British companies, CHIRP has become known internationally. Examples of topics typically covered in *FEEDBACK* include ineffective operating procedures, navigational issues and mechanical failures (Confidential Hazardous Incident Reporting Program 2008b).

CHIRP is managed as a charitable organization by an independent board of trustees, who help to ensure its autonomy through independent organization and financing. The program is funded by the U.K.'s Department of Transport (Confidential Hazardous Incident Reporting Program 2008b). Submissions to CHIRP are de-identified, and, with the consent of the reporter, are sent to organizations capable of addressing the reported situation or incident. Typically, anonymous reports are not acted upon unless the submitted information can be verified. Both the U.K.'s aviation and maritime reporting programs are designed to be complementary to other governmental and organizational reporting systems (Confidential Hazardous Incident Reporting Program 2008a).

A list of written questions was submitted to the Director of Maritime CHIRP, Mr. Chris Rowsell, whose response was received on December 19, 2008, and was used in the following paragraphs. CHIRP offers mariners several reporting methods that include written reports, faxes, emails, telephone messaging and website submissions. The two most common submission methods used by mariners at sea are the CHIRP website or e-mail, and during five and a half years of operations, the maritime reporting system has received approximately 525 report submissions. Although CHIRP was designed for use by U.K. mariners, the program accepts reports from non-U.K. mariners, and if possible will present safety concerns to the owner or, where relevant, the insurer or the Flag

State. CHIRP has a robust and well-proven protocol for protecting the identity of its reporters, and these methods are strictly adhered to when coordinating reporter consent and follow up action. Incident information is disseminated to the relevant agency for information/action after removing identifying reporter information, and after a report is closed, CHIRP expunges the reporter's contact information.

Issues regarding reporter legal protections do not typically arise because CHIRP reports usually reference near-misses, which are unlikely to result in legal action since injury or damage did not occur. Accidents on U.K.-flag vessels and on ships in U.K. waters must be reported to the Marine Accident Investigation Branch (MAIB). The reports of the MAIB are inadmissible in judicial proceedings used to attribute or apportion liability or blame. If CHIRP receives a report of an accident that should have been reported to the MAIB, CHIRP advises the reporter accordingly. In the U.K., Certificates of Competency for mariners are issued by the Maritime and Coastguard Agency (MCA), an agency that encourages near-miss reporting and provides non-financial support to CHIRP. (The MCA's Chief Executive is an ex-officio trustee of CHIRP and a member of the CHIRP Maritime Advisory Board). The nature of the hazardous incidents and near-misses being reported to CHIRP are not generally such that, if reported to the MCA, they would lead to revocation or suspension of a mariner's certificate. Furthermore, CHIRP coordinates with each reporter about how the report is processed, so the possibility of self-incrimination is very low. In response to questions involving maritime security, Mr. Rowsell responded that CHIRP is not designed, nor does it actively seek security information. During the previous two years, CHIRP has dealt with only one report that described an alleged port security breach. Concerning the use of information received by CHIRP, Mr. Rowsell provided the following response:

a) For resolution of a specific safety issue with the employer. CHIRP uses the report to follow up with the employer or authorities, being careful not to disclose the identity of the reporter explicitly or implicitly.

b) For follow-up of a hazardous incident involving a third party, typically a near-collision between two vessels. CHIRP typically provides the third party with a summary of the report, without identifying the reporter, and encourages the third party to investigate and to provide feedback.

c) To share concerns and lessons learned with the wider maritime community. CHIRP publishes a quarterly newsletter, *Feedback*, summarizing reports and commenting on them. Approximately 140,000 copies of this newsletter are distributed to the commercial shipping, leisure and fishing sectors of the maritime community and it is also published on the CHIRP website.

CHIRP's primary means for promulgating the lessons learned is the quarterly newsletter described above. In addition, the CHIRP Maritime Director promotes the program through conference and seminar presentations and with regular visits to shipping companies, harbor masters, yacht clubs and other maritime industries. CHIRP is well represented in the maritime community, and its Maritime Advisory Board meets quarterly and includes senior representatives from 18 different maritime organizations. CHIRP monitors developments at the International Maritime Organization and International Labor Organization and conducts outreach efforts with international shipping companies, maritime organizations and international oil companies.

U.S. PROTOTYPE MARITIME SAFETY REPORTING SYSTEM

The U.S. attempted to develop a maritime reporting program called the International Maritime Information Safety System (IMISS), but challenges detailed in the following paragraphs prevented implementation. A 1998 press release from the USCG and the U.S. Maritime Administration (MARAD) stated that a memorandum of agreement had been signed between the two agencies "to work together with industry to develop and implement a practical, voluntary, confidential national

maritime safety incident reporting system. The system would allow both agencies to receive, analyze, and disseminate information about unsafe occurrences" (United States Coast Guard 1998).

The USCG realized that near-miss incidents are an under-used source of human factors information and can be used proactively to prevent accidents, instead of reacting to the aftermath (United States Coast Guard 1998). The goals for the reporting program listed by the two agencies were "to reduce the frequency of marine casualties, the extent of injuries and property damage including environmental damage, and to create a safer and more efficient shipping transportation system and mariner work environment" (United States Coast Guard 1998). IMISS was also to "collect information on near-miss incidents, potential hazards, safety 'best practices,' and 'lessons learned' reported by members of the maritime industry" (United States Coast Guard Research & Development Center 1999). The two agencies invited industry participation in a working group that was created to design and develop the reporting system, because both agencies realized the necessity of industry participation and support in order to develop effective data collection, analysis and dissemination methods (United States Coast Guard 1998).

IMISS Report Form Development

Two of the working group's members included NASA's ASRS at Ames Research Center and the Coast Guard Research and Development Center. Collaboration between the two agencies developed a reporting form for prototype testing. The report form was developed for mariners, dockworkers, shipyard personnel, recreational boaters and others to report maritime incidents, hazards and near-misses. The prototype system was evaluated to determine additional changes that would be required in an operational reporting system (United States Coast Guard Research & Development Center 1999).

The prototype used 87 mariners to test the IMISS report form for a simulated marine incident. The 87 who participated with the report form prototype were commercial mariners currently enrolled at one of three maritime training institutes. This group of reporters included 24 licensed deck personnel, 21 unlicensed deck personnel, 24 licensed engine personnel and 18 unlicensed engine personnel. Overall, these mariners were highly experienced, with 57 of the 87 reporters (66%) having 10 or more years of experience as commercial mariners. Approximately half of these mariners read a fictitious incident scenario and then completed a report, while the other half made up an incident and described it on the IMISS Report Form (United States Coast Guard Research & Development Center 1999).

The report forms were then reviewed and coded by two groups of analysts, human factors analysts and marine analysts. The analysts completed a report comment form for each report that evaluated how thoroughly and accurately each mariner reporter described the incident. At the conclusion of the evaluation, each analyst completed a survey that provided an overall assessment of the usability and validity of the report form and database. Each marine analyst reviewed and coded a subset of the reports, consulting with other analysts only as needed. Marine analysts also participated in regular conference calls with the human factors analysts to review major events and causes identified in the reports (United States Coast Guard Research & Development Center 1999).

Challenges to IMISS

A telephone interview was conducted concerning IMISS with USCG Captain Scott Ferguson, currently the District 7 Prevention Chief on December 16, 2008. He had previously served as the USCG Marine Safety Program Analyst for IMISS from 1997 to 2000 and was able to provide insight into the many challenges described in the following paragraphs.

One obstacle for IMISS users involved the submission of reports from mariners underway or located in international ports. Unlike mariners, the majority of aviation pilots using ASRS are able to ensure their privacy by mailing reports or sending reports through secure electronic transmission,

without expending significant effort. Mariners face unique challenges by being isolated and away from the average amenities and services available to other transportation industry workers. Originally, IMISS had planned to use paper reporting forms submitted through the mail, but Captain Ferguson indicated that electronic reporting methods would have been adopted when secure transmission protocols permitted.

In addition, the maritime industry's workforce is even more diverse than that in aviation. Education levels range from professionally educated mariners to illiterate deck hands and cabin stewards, as well as the multi-national crews used by many companies, resulting in a mixture of cultures and languages. All of these challenges needed to be met with the development of a suitable reporting form and delivery protocol. When asked about the wide diversity of mariners using a single applicable reporting form, Captain Ferguson stated that the form's simplicity worked, because the reviewing expert analysts had the ability to contact a reporter for amplifying information.

The greatest challenge to any voluntary reporting system is the ability to protect the reporter's identity and encourage the open and continued flow of information. For the U.S. maritime industry, this difficulty is amplified by the limited number of U.S. vessels that typically operate in distinct geographic areas or on specific routes. This paradigm is contrary to aviation, where thousands of similar aircraft operate universally around the world, thereby helping to ensure the anonymity of aviation reporters. This challenge also requires regulating and enforcement agencies to have an enlightened attitude concerning the protection of reporter confidentiality and a desire to nurture a positive rapport between the industry, reporters and government.

Captain Ferguson stated that IMISS did not receive this type of positive response during its development from the Department of Justice (DOJ). The Transportation Department, under which the Coast Guard served until 2003, required several executive departments to agree to the IMISS program provisions. The DOJ was the only agency that did not agree to reporter confidentiality and transactional immunity (non-punitive action) for reported incidents. The DOJ found it unreasonable to provide protection from civil fines and certificate action for inadvertent incidents. Understanding the important concepts surrounding transactional immunity can be difficult for an enforcement agency to embrace, but it is essential if improvement is to be made in discovering and reducing inadvertent human errors. It may be erroneous and shortsighted to believe that inadvertent human error can be legislated, regulated or forced into compliance through civil or criminal judicial action.

Due to DOJ objections, the development of IMISS stalled and the Coast Guard eventually withdrew funding, even though the Department of Defense endorsed IMISS and hoped to use it for its civilian reserve maritime fleet. Captain Ferguson stated there had been strong industry and international support for U.S. development of the reporting system, and efforts had even begun to incorporate confidential reporting systems such as IMISS into the International Maritime Organization (IMO). He stated that a number of prominent U.S. maritime companies planned to use IMISS to establish internal company safety reporting systems. Captain Ferguson stated that maritime companies with superior safety programs understood the importance and value of learning from occurrences outside their company fleets.

A written interview was conducted with Mr. Alex Landsburg, the former MARAD representative to IMISS, on December 23, 2008. He is currently a senior advisory staff member for Computer Sciences Corporation. Independent from Captain Ferguson, Mr. Landsburg expressed a similar viewpoint regarding the necessity for IMISS and the culpability of the DOJ in its failure. He indicated that many preeminent maritime companies remain strongly supportive of developing a safety reporting system, even without the protection of transactional immunity.

Mr. Landsburg described MARAD's current efforts to develop the Ship Operations Cooperative Program, an IMISS type system for its members. He also recognized the strong NTSB support for the near-miss reporting concept and its applications in other transportation domains, such as a newly implemented reporting system at the Federal Railroad Administration (FRA). Although numerous significant challenges confronted IMISS, it is unfortunate that the program was not allowed to develop and prove its value in improving maritime safety.

TRANSPORTATION SECURITY REPORTING

The consequences of the terrorist attacks in 2001 have also required security to be included in any discussion of transportation safety. The requirements of the Maritime Transportation Security Act (MTSA) have increased the importance of information flow throughout the maritime sector. While IMISS had been developed before 2001, Captain Ferguson felt that security would be a logical extension for IMISS and that such a venue for generalized threat identification would be extremely valuable.

This author was part of a NASA team at ASRS that developed and implemented the Security Incident Reporting System (SIRS) for use in the aviation sector. SIRS was designed specifically to target security and provide a reporting avenue for security incidents and issues that were being reported through the ASRS. In addition, it was designed primarily for the thousands of new Transportation Security Administration (TSA) employees, who instantly became the first line of defense in commercial aviation. A prototype of SIRS was put in place at three large northern California airports and was gaining momentum until NASA redirected funding for all of the agency's aviation security work toward space exploration. The concept of adding security reporting to IMISS was discussed during the creation of SIRS, and members of the SIRS working group believed that maintaining a single reporting system for both safety and security would be very effective.

Security would be a logical addition to IMISS and would enhance the value of the program by adding additional capabilities. Protocols for the handling of maritime security sensitive information (SSI) would need to be developed, as was done for the aviation sector. The role of IMISS would remain a complementary system, and its purpose would be to identify general security hazards and trends, rather than time-critical threats. IMISS would serve as a relief valve for those individuals reluctant to use other reporting channels. Like safety, the reported security incident information could be assessed for threats and used as appropriate for education throughout the maritime industry. In addition, the interdependence of cargo transportation modes would increase the effectiveness of a security incident reporting system that operated across the boundaries of rail, maritime, aviation and highway.

CONCLUSIONS

The effort and support for the prevention of accidents and improvement of security is especially prominent in critical outcome environments, where even a minor mistake can have tragic results. The losses of life and substantial injury that may result from inadvertent accidents or deliberate actions are especially tragic if it is later discovered that the event could have been prevented. In large, complex and dynamic environments like transportation, nuclear power, medicine and security, even a minor error or system flaw can lead to catastrophe. Every opportunity to discover and learn from previous incidents must be encouraged and maximized. In order to enhance safety and improve security throughout the U.S., it is paramount that the nation develops capabilities to study the synergistic relationships between transportation modes in order to effectively apply the lessons learned from near-miss incidents. In order to protect our nation's valuable, but vulnerable maritime infrastructure, now is the time for the U.S. to develop and incorporate a reporting system for the commercial maritime industry.

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