Log M-384

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C. 20594

Safety Recommendation

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In Reply Refer To: M-93-17 through -26

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On August 7, 1992, the United Kingdom passenger vessel RMS (Royal Mail Ship) QUEEN ELIZABETH 2 (QE2) was outbound in Vineyard Sound, Massachusetts, when the vessel grounded about 2 1/2 miles south of Cuttyhunk Island. No injuries or deaths resulted from this accident. However, damage was significant; temporary and permanent repairs cost about $13.2 million. In addition, the total revenue lost for the period before the vessel returned to service on October 2, 1992, was estimated at $50 million.[1]

As a result of its investigation of this accident, the Safety Board is making recommendations to the U.S. Coast Guard concerning establishing standards, curricula, and requirements for bridge resource management training; disseminating maneuvering and vessel squat information; providing guidelines to Coast Guard boarding officers on informing marine employers of toxicological testing responsibilities; conducting safety orientation briefings for passengers boarding vessels at intermediate ports; and improving safety measures for disabled passengers.

Four of the recommendations being made as a result of this investigation concern bridge resource management training. Bridge resource management (BRM) provides a management

[1]For more detailed information, read Marine Accident Report--*Grounding of the United Kingdom Passenger Vessel RMS QUEEN ELIZABETH 2 Near Cuttyhunk Island, Vineyard Sound, Massachusetts, August 7, 1992* (NTSB/MAR-93/01).

model that addresses the operational problems stemming from inadequate communication between the pilot, master, and other members of a bridge watch collectively forming the bridge team. BRM applies to this accident in that all members of the QE2's bridge team should have been more communicative and aware of the vessel's status, performance, and general situation so that they could have contributed to operational decisionmaking. Also, BRM would have enabled the QE2's bridge team to react more effectively to emergency situations than the traditional bridge operation. The activities of the QE2's pilot and bridge team were examined within the context of bridge resource management and found lacking in several instances.

The Safety Board investigation determined that neither the pilot nor the master of the QE2 were aware of all the factors and conditions that significantly affected the vessel when the pilot decided to alter the course from the original trackline. This deficiency relates to the classic definition of situational awareness, a basic requirement for effective bridge resource management. One major clue to the loss of situational awareness is a deviation from a planned or anticipated maneuver. The Safety Board believes that the pilot's decision to change course at the "NA" buoy should have alerted the master to his lack of full understanding of the pilot's intentions. The consequence of the course change was a decision to return to the base course without completely assessing the reasons for the course change or the implications of the proximity of the vessel to an area having reduced bottom clearances.

The Safety Board also believes that a critical need existed for improved communication between the pilot, the master, and the other crewmembers on the bridge. The master had apparently made incorrect assumptions about the pilot's intentions, and the pilot saw no need to inform the master about what he actually planned to do. Although the pilot expressed full confidence in the ability of the officers on the bridge to perform navigational tasks and was aware that the second officer was monitoring the ship's progress and reporting that information to the master, the pilot still opted to pilot by his own methods rather than following the courses plotted by the navigator. The master stated that he assumed that the pilot was going to follow the reverse of the inbound course. Thus, the navigation of the vessel as understood by the pilot was not communicated to the master or the bridge watch.

Evidence from the investigation indicates that the master did not fully understand how the pilot had planned to get to his debarkation point or that the pilot planned a course change at the "NA" buoy. The Safety Board believes that had adequate communication been established between the master and pilot, the master would have told the pilot of his preference to remain on a course that passed Brown's Ledge to the south. Moreover, the pilot probably would have explained his intention to stay north of the shoals near Brown's Ledge, and he and the ship's officers would have discussed the implications for safety in returning or not returning to the base course. Had the pilot and the ship's officers discussed the ship's course either immediately following the turn at the "NA" buoy or during a predeparture pilot/master conference, the factors increasing the risk of striking bottom would have become apparent.

The Safety Board is also concerned about the pilot's reluctance to integrate the trained bridge personnel directly into his voyage planning. He clearly had confidence in the ability of

the bridge officers and assumed that they would detect any serious miscalculations. However, by failing to familiarize bridge personnel with his overall plan before its execution, the pilot prevented them from effectively monitoring or verifying his decisions. The advantages of integrating these bridge resources into his navigational procedures are apparent, and the pilot would probably have done so if he had been familiar with BRM concepts.

Conclusions from this and previous accidents investigated by the Safety Board show that training is needed to broaden the scope and depth of communication among the bridge team and between pilots and bridge watch officers to improve the crew's collective operational performance. The Board believes that the International Maritime Organization (IMO) and the Coast Guard should develop standards and curricula for bridge resource management training and that such training should be required for masters, deck officers, and pilots. The Safety Board concludes that the use of effective bridge resource management techniques by navigation watches will greatly increase the safety of navigation and believes that pilots and ship's officers should undergo such training.

Another area of concern explored in this accident investigation concerns the provision of squat and maneuvering information on board ships and also the dissemination of information to mariners on the effects of vessel squat.

Since 1968, the international maritime community has expended considerable resources and effort at IMO to address the problems created by vessels with poor maneuvering characteristics and the consequent dangers posed to life, property, and the marine environment. This sustained effort culminated in the development of IMO Resolution A.601(15), "Provision and Display of Maneuvering Information on Board Ships" (the Resolution). The Safety Board considers the development of the Resolution to be a noteworthy achievement in the ongoing effort to educate operators of all types of vessels regarding the maneuvering and squat characteristics of their vessels. The urgent need for such information to help prevent accidents has been highlighted again in the squat-related grounding of the QE2.

IMO resolutions are recommendations that are intended to be widely used throughout the maritime community to gain experience in their practical application. Despite the fact that the Resolution A.601(15) was adopted by international consensus in 1987 to further the IMO's declared objectives of improving the safety of ships and waterways, the Safety Board is concerned that the Resolution is not being implemented. Therefore, the maritime community has not gained the necessary experience in the practical application of the Resolution, a situation that appears likely to continue in the foreseeable future. The Safety Board believes that the Resolution has not been effective because it remains only a recommendation and is not enforceable by national regulations or through the SOLAS Convention. The grounding of the QE2 should heighten the awareness of the maritime community and its safety regulators concerning the relevance of Resolution A.601(15) and the importance of implementing it.

The Safety Board believes that implementation of the Resolution will not overly burden the marine industry. The Resolution calls for squat only to be estimated; this can be

accomplished by using the empirical formulas and experimental data developed by researchers over the past 20 to 30 years. Most of this information is readily available in the public domain and can be easily utilized by naval architects. Most of the other information required by the IMO Resolution pertains to ship maneuvering characteristics that are routinely obtained during shipyard delivery trials conducted for new or modified vessels. The safety benefits of implementing the Resolution would far outweigh the minimal effort involved in adding the squat information to the maneuverability information already available. In addition, the Safety Board believes that the Coast Guard should amend the Navigation Safety Regulations to require that information on squat characteristics be included with the maneuvering information now required by 33 CFR 164.35(g).

The Safety Board found that delays in the collection of toxicological samples after this accident were significant. The Coast Guard boarding officer from the Marine Safety Detachment, Cape Cod, did not begin to arrange for the collection of toxicological samples from the bridge watch until approximately 13 hours after the grounding, when the pilot mentioned to him that someone from the Newport Alliance for Business Health would be coming out to the ship to collect samples from the pilot. At that point, the boarding officer contacted Marine Safety Office, Providence, for advice on collecting samples from the master and bridge watch of the QE2.

Marine postaccident drug testing problems have existed because operational safety issues are attended to first, as they should be. Nonetheless, boarding officers should have a plan for informing marine employers of their responsibility to test crewmembers and for assisting marine employers in carrying out toxicological testing, if necessary. Although drug testing may not be of immediate concern, it should not be treated as an afterthought. Toxicological samples must be obtained in any and all cases in which crew performance may be questioned and must be collected as soon after the accident as is practical.

The Safety Board concludes that the Coast Guard boarding officer on the QE2 knew that toxicological testing was required, but lacked field or operational guidelines to inform the vessel owner of the responsibility to test crewmembers and to assist the marine employer, as necessary, in accomplishing toxicological sampling and testing.

During its investigation of this accident, the Safety Board also found deficiencies in shipboard emergency preparedness. For instance, the passengers who boarded the QE2 at Halifax did not have the advantage of participating in a lifeboat drill that those passengers who boarded the vessel at the commencement of the cruise in New York had. The Halifax passengers' emergency briefing consisted of being made aware of the emergency instructions posted in their accommodations by their room stewards. Because an emergency can occur at any time after the voyage commences, passengers boarding a vessel at intermediate ports should also receive comprehensive safety and emergency instructions by qualified vessel personnel. This lack of instruction in emergency procedures could have serious consequences if an emergency evacuation were to occur, especially late at night. The Safety Board concludes that

the passengers who boarded the QE2 at Halifax should have been given a comprehensive briefing or an emergency drill.

Additionally, although the difficulties experienced by disabled passengers were not a major problem in this accident, they illustrate the need for additional precautions to prepare disabled passengers for emergencies. For instance, one hearing-impaired passenger responding to the Safety Board's survey complained that she could not hear the public address system. When she attempted to gain information from the television in her room, she found that it was not equipped with closed caption. However, according to Cunard, the QE2 could have provided closed-caption programming through the ship's television system.

Hearing-impaired passengers should not be excluded from obtaining vital safety or emergency information. More than 28 million Americans have a hearing loss and 80 percent of those affected have permanent, irreversible hearing damage. In addition, more than one-third of the U.S. population has a significant hearing impairment by age 65, according to statistics compiled by the National Institute on Deafness and Other Communication Disorders. The population of older, potentially hearing-impaired passengers could be sizable. A statistician from the Cruise Line International Association stated that over a 5-year period, on average, 36 percent of the passengers traveling on cruise vessels were at least 60 years old. The Safety Board believes that hearing-impaired and other disabled passengers should have a means of obtaining emergency information to prevent the possibility of not being notified of a vessel emergency such as fire, sinking, or evacuation. In light of the potential problems revealed by this investigation, the Safety Board concludes that disabled passengers who travel by ship require additional safety precautions to advise and prepare them to act in an emergency.

Therefore, the National Transportation Safety Board recommends that the U.S. Coast Guard:

> Establish standards and curricula for bridge resource management training for Federal pilots licensed by the U.S. Coast Guard. (Class II, Priority Action) (M-93-17)
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> Propose to the International Maritime Organization that standards and curricula be developed for bridge resource management training for the masters, deck officers, and pilots of ocean-going ships. (Class II, Priority Action) (M-93-18)
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> Propose to the International Maritime Organization that the masters, deck officers, and pilots of ocean-going ships be required to successfully complete initial and recurrent training in bridge resource management. (Class II, Priority Action) (M-93-19)
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> Require that all applicants for an original or the renewal of a Federal pilot and deck officer license for vessels of more than

1,600 gross tons successfully complete a course in bridge resource management. (Class II, Priority Action) (M-93-20)

Propose that the International Maritime Organization incorporate IMO Resolution A.601(15), "Provision and Display of Maneuvering Information on Board Ships," into the SOLAS Convention. (Class II, Priority Action) (M-93-21)

Amend the Navigation Safety Regulations (33 CFR 164.35(g)) to require that squat characteristics be included with the maneuvering information on vessels, as recommended by IMO Resolution A.601(15), for deep-draft, high-speed vessels over 1,600 gross tons. (Class II, Priority Action) (M-93-22)

Widely publicize the particulars of this accident concerning the large squat for ships operating at high speeds in shallow waters. (Class II, Priority Action) (M-93-23)

Provide guidelines to boarding officers investigating marine accidents about informing marine employers of their responsibility to conduct toxicological testing and on providing assistance when necessary (such as providing sampling kits and making arrangements for testing with local approved laboratories). (Class II, Priority Action) (M-93-24)

Propose to the International Maritime Organization a requirement that all passengers boarding vessels at intermediate ports during a voyage receive comprehensive safety and emergency instructions by qualified crewmembers soon after boarding. (Class II, Priority Action) (M-93-25)

Propose to the International Maritime Organization that appropriate safety standards be developed to ensure the safety of disabled people aboard passenger vessels during an emergency. (Class II, Priority Action) (M-93-26)

As a further result of its investigation, the National Transportation Safety Board reiterated the following safety recommendations to the U.S. Coast Guard:

M-91-6

Require bridge resource management training for all deck watch officers of U.S. flag vessels of more than 1,600 gross tons.

M-91-28

Amend 33 CFR 164.11(k) to require that masters and pilots discuss and agree beforehand to the essential features and relevant checkpoints of maneuvers they expect to undertake.

Also, the Safety Board issued Safety Recommendations M-93-27 to the Department of Transportation, M-93-28 and -29 to the National Oceanic and Atmospheric Administration, M-93-30 through -33 to Cunard Lines, Ltd., and M-93-34 to State pilot commissions. If you need additional information, you may call (202) 382-6850.

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.

By: Carl W. Vogt
Chairman