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16. Abstract <p>The present study developed casualty investigation procedures that focused on communications problems. These procedures were applied by U.S. Coast Guard (USCG) Investigating Officers in their investigation of 589 marine casualties over a seven-month period. Analysis of the resulting casualty reports determined that communications is a prevalent causal factor in marine casualties, being a factor in 18 percent of critical vessel casualties, 28 percent of critical personnel injuries, and contributing to 19 percent of critical marine casualties overall. The investigations procedures also identified characteristics and causes of communications problems. The single largest problem involved mariners who did not communicate when appropriate. Two types of faulty assumptions were usually the cause of this: they either misinterpreted the situation and did not perceive a threat, or they incorrectly assumed that others were aware of the problem and would take care of it. Training in developing team situation awareness is suggested to combat the first problem. Better crew resource management, specifically empowering crewmembers to speak up when a threat is perceived, would correct the second problem and potentially reduce communications-related casualties by 29 percent.</p>					
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## EXECUTIVE SUMMARY

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It is estimated that human error contributes to between 75 and 96 percent of marine casualties (U.S. Coast Guard, 1995A). In order to identify strategies to reduce the likelihood of casualties resulting from human error, we must first gain a better understanding of the nature and causes of these casualties. The U.S. Coast Guard (USCG) has historically investigated marine casualties for cause; however, procedures for investigating, reporting, and analyzing *human factors* causes is a more recent initiative. A recent study demonstrated the value of developing and implementing investigation and reporting procedures that focused on a single human factors topic (fatigue) for use by USCG investigators (McCallum, Raby, & Rothblum, 1996). The present study was conducted to investigate the suitability of this focused approach for investigating the role of inadequate communications in marine casualties. In addressing this goal, two study objectives were identified:

- Develop a method for the focused investigation and reporting of communications problems in marine casualties.
- Identify the characteristics and underlying causes of communications problems.

The topic of communications was selected based on an earlier study which showed it was an important contributor to marine casualties. Communications investigation and reporting procedures were developed, and USCG Investigating Officers (IOs) received initial training in the investigation and reporting procedures during August and October 1997. A total of 29 IOs from four Marine Safety Offices (MSOs) supported this study by investigating and reporting on 589 marine casualties during the seven-month period from September 1, 1997, through March 31, 1998. A final assessment of the investigation and reporting procedures was conducted with IOs from each participating MSO in May 1998.

The procedures for investigating communications-related casualties were based on a model of communications processes, problem areas, and contributing factors. The model divides communications into four processes (*Prepare and Send Message, Message Transmission, Receive and Interpret Message, and Act on Message*) and four corresponding communications problem areas. Sixteen individual communications problems were defined within these four problem areas. The model further identifies seven general contributing factor areas that can cause or contribute to a communications problem (*Knowledge or Experience, Procedures, Performance, Assumptions, Environment, Communication Equipment, and Management and Government Regulations*). Thirty-four individual contributing factors were defined within these seven areas.

The procedures for investigating and reporting communications problems in marine casualties included a general casualty screening form and separate forms for reporting on the nature of communications problems in each of five operational areas: vessel-vessel, bridge-pilot, vessel-shore authority, crew-crew, and vessel-shore worker. The procedures consisted of a progressive, three-step series of casualty review and screening: (1) casualty criticality screening (a screening method already used by MSOs to determine which casualties warrant a full investigation); (2) human factors contribution screening (to determine which of the critical casualties appear to have a direct human factors cause); and (3) communications operational area identification, investigation, and reporting. Feedback from IOs indicated that the procedures were useable and facilitated more accurate characterization of communications problems.

Overall, communications problems were associated with 18 percent of all critical vessel casualties and 28 percent of all critical personnel injuries (19 percent of critical casualties overall). The communications screening procedure was found to be quick and easy to use and effective: among the 50 critical casualties identified through the screening procedure as having a potential for communications, 38 cases (76 percent) were found to have a contributing communications problem.

The analysis of communications problems revealed striking similarities among the vessel and personnel injury cases. Among both types of casualties, the most prevalent communications process problem was *Prepare and Send Message*; problems in this area contributed to 87% of the communications-related casualties. This problem area was most frequently cited in crew-crew, vessel-vessel, and pilot-bridge communications. A failure to initiate needed communications was identified as the most common specific problem, and contributed to 68% of the communications-related casualties. Several contributing factors were cited as leading to problems in preparing and sending messages, with incorrect assumptions regarding the need to communicate as the most prevalent general factor among both critical vessel and critical personnel injury casualties. In this subset, the most frequently cited incorrect assumption was that there was no need to communicate. An incorrect interpretation of the situation and the incorrect assumption that someone else recognized the danger and would take action were two other frequent causes for not initiating communications.

A meta-analysis of the reasons behind these failures to communicate led to the conclusion that in almost all these situations, at least one mariner did not recognize that a dangerous situation was unfolding that required him to take action (communicate with others). Methods for improving crew situation awareness would help eliminate this problem. A second discovery was that in almost half of the “did not communicate” casualties, there was a different crew member who *did* recognize the threat, but who still

*did not speak up*, generally because he thought (incorrectly) someone else was also aware of the problem. Training and implementation of crew resource management is highly recommended as a way to instill a responsible and participatory attitude among crewmembers and to empower them to speak up whenever a potential threat is perceived.

The set of communications screening procedures could be adopted as a tool for identification of cases that are likely to involve communications problems. The set of follow-up questions that is included in each communications operational area reporting form could be used by IOs in identifying specific communications problems and underlying causal factors. The revised and streamlined set of investigation procedures is provided in Appendix D. In addition, along with the present findings, the communications process model and contributing factors developed as part of this study could be incorporated into the Coast Guard's Investigating Officer course.

The current study identified the most prevalent communications problems and contributing factors in critical vessel casualties and personnel injuries. These findings can help in establishing a framework for ameliorative actions by industry. Specifically, the single most pervasive problem found was that of mariners who did not communicate important information. It would appear that actions to improve crew situation awareness and to facilitate the sharing of information are sorely needed. As a first step in making industry aware of these problems, the findings from this project were presented at the Maritime Human Factors Conference in March, 2000.