Assessing the Impact of Management and Organizational Factors on the Risk of Tanker Grounding

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ABSTRACT

Management and organizational factors have contributed, directly or indirectly, to many tanker accidents. These factors are frequently not considered in human reliability analysis, probabilistic risk assessment or accident investigations. In order to identify effective and efficient measures to prevent accidents, a systematic approach including all important root causes and variables must be utilized. The objective of this paper is to present a probabilistic risk model for tanker grounding which includes management and organizational factors and their relationship to human error. Work on this model continues the development of an earlier model which applied risk assessment methodologies from the nuclear power industry to quantify the impact of human error on the probability of tanker grounding. This approach is extended to consider the effect of management and organizational factors on human performance shaping factors, and ultimately on human error. This effect is examined and quantified using expert opinion and the Analytical Hierarchy Process (AHP). Management and organizational factors found to have the greatest impact on the probability of grounding are identified and compared to factors emphasized by the International Safety Management (ISM) Code.

KEY WORDS: Grounding, risk, human error, International Safety Management (ISM) Code, Analytical Hierarchy Process (AHP)

INTRODUCTION

A number of highly visible oil spills have increased the public’s awareness of the dangers involved in transporting oil at sea. As a result, the marine industry has come under increased pressure to reduce the risk of such accidents. Traditionally, design deficiencies and individual error have received the most attention when assessing tanker risk and investigating tanker accidents. More recently the importance of management and organizational factors (MOFs) in ship operations has been realized (Boniface and Bea, 1996a & b; Moore and Bea, 1995).

Human error has a substantial impact on the reliability of complex systems, and it may occur in any phase of design, construction or operation. Due to the large number of accidents caused by human error, success in reducing tanker risk depends directly on measures to improve human performance (NRC, 1994). MOFs greatly influence both physical and human elements involved in the design and operation of a ship. The ability of ship systems to perform in a satisfactory manner depends on proper design, maintenance, and operation, all of which are directly affected by management. Similarly, crew performance is greatly affected by policies, procedures, and decisions made by management.

The International Safety Management (ISM) Code recognizes the importance of MOFs to ship safety and environmental protection. In order to meet the requirements of the ISM Code, a ship operator is required to identify factors that involve the most risk, and to develop preventive or corrective measures for these factors. This paper analyzes a generic and simplified series of processes and tasks for tanker route planning and piloting in a notional waterway. By applying this framework and methodology to the processes and routes for a specific tanker or fleet of tankers, a ship operator may identify critical MOFs contributing to tanker risk in their ships.

INTERNATIONAL SAFETY MANAGEMENT (ISM) CODE

The ISM Code is the international standard for the safe management and operation of ships (IMO, 1994). It requires companies to provide for safe practices in ship operation, and insure a safe working environment. They must identify, evaluate, and establish safeguards against all identified risks. They must continuously improve the safety management skills of personnel ashore and onboard their ships, including preparation for emergencies related both to safety and environmental protection. Here, “companies” means ship owners or any other organization or person who assumes responsibility for operation of the ship from the ship owner. The ISM Code mandates that ship owners and operators have a safety management system (SMS) which ensures that both safety and pollution prevention are central in operations. The code introduces the concept of self-regulation including the requirement for internal audits and management reviews.