ANALYSIS OF NEW RISKS IN MARITIME TRANSPORT

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ABSTRACT

In this paper I briefly analyzed both the safety of ships at sea and the formal assessment of their safety. The current practices and the latest advances in the marine and offshore industry are discussed above all. The relationship between standard ship safety cases and the formal assessment of ship safety is described. I analyzed the risk factor study in the formal assessment of maritime safety.

Keywords: hazard, risk assessment procedures, risk reduction, human error, safety.

1. INTRODUCTION

The maritime industry faces new challenges due to the continuing increase in maritime shipping worldwide, according to Allianz Global Corporate & Specialty (AGCS), a shipping company specialized in shipping. Damages related to transport at sea decline despite the triple global fleet, while the increasing size of ships, "human error" and transport in the Arctic are among the new challenges.

2. NEW RISKS OF MARITIME TRANSPORT, 100 YEARS AFTER TITANIC

In these 100 years after the Titanic's sinking, the world's maritime merchant fleet has tripled to more than 100,000 vessels, although the rate of marine damage has fallen from a ship per 100 per year, in 1912, to a ship per 670 per year, in 2016.

The number of line passenger shows a significant increase in the recent period, and an average annual growth of 7.4% is projected for the period 2017-2020. It is estimated that in 2018 over 22 million passengers will be transported by cruise ships around the world (2011: 19.2 million).

The "black areas" of accidents include South China, Indo-China, Indonesia and the Philippines, with 17% of the total damage in 2005-2015. They are followed by the Eastern Mediterranean and the Black Sea (13%) and Japan, Korea and North China (12%). The waters of the British Isles also reveal a relatively high concentration of losses (8%).

The rising trend of building over-sized vessels and cost pressure pushing ship owners to hire crews from emerging countries, where training and assessment standards may be inconsistent, are some of the shipping issues, according to a report by AGCS, based on a research by the Seafarers' International Research Center (SIRC) at Cardiff University in the UK.

3. ANALYSIS OF SIGNIFICANT RISKS

Other significant risks are: the numerical reduction of crew members that may compromise the margin of safety and may promote the risk of "human error", the increase of bureaucracy on board, the continued threat of piracy in Somalia and other areas, the dismantling of ice blocks and possible complications of navigation and environment associated with it.

While the seas are now safer than ever, the industry needs to address these new risks proactively. For example, large ships pose challenges for insurers because of their size or value, while others are a concern because of their structural integrity. Since the size itself does not make these ships riskier, however, the increase of dimensions implies specific risks that need to be taken into account, such as cases of rescue and recovery and emergency maneuvers.

The largest modern container ships under construction are so large that beneath the deck is enough space for a basketball court, an American football stadium, and a hockey court with full stands. “Ships of this size raise questions about adequate coverage of losses in the event of an incident and also about potential structural limitations.”

The Costa Concordia cruise ship (a 300-meter (112-ton) package) with 4,229 passengers, including 3,200 passengers from 60 countries, failed on January 13, 2012 after it hit a cliff, about 300 meters from the shore, near the small island of Giglio, in the archipelago of the Tuscan region, in the Mediterranean Sea.

The nausea, considered one of the worst accidents in the history of the Italian navy, resulted in 32 deaths, and the bodies of two people have not yet been discovered.

The rock broke the plank 70 meters long, after which the ship was invaded to a good deal by water and sloped up to an angle of 65 degrees, making it unavailable. More than 4,200 people aboard were able to save themselves, but yet the accident ended with 15 deaths and 20 missing, as soon as it was discovered. Finally, the balance was 32 deaths. The wreck of the ship, left partially on the surface, was later transported to Genoa in July 2014 to be dismembered.

During the process, the authorities of Grosseto pointed out that the ship had dangerously approached the island of Giglio, hit a cliff, leaned and took a large amount of water on board. The ship's black boxes, which record crew members' conversations, indicate that the impact occurred at 21.45 (20.45 GMT) local time on January 13, 2012, but the commander did not immediately notify the closest port Captain.

An officer in charge of the vessel rejected the allegations that the ship would have deviated from its normal trajectory, but this was demonstrated during the trial, many witnesses saying that the ship sailed very close to the shore and, for that reason, hit a rock.

The master was also subjected to analyzes to see if he had taken drugs or other toxic substances on the night of the shipwreck, but all these analyzes were ultimately negative.

The trial also revealed that the Italian Coast Guard had asked the Captain of Costa Concordia in vain to return on board to coordinate the evacuation of passengers.

4. CONTRIBUTION OF HUMAN FACTORS ISSUES

“In any effort to identify hazards and assess their associated risks, there must be full consideration of the interface between the human operators and the systems they operate. Human Factors Engineering (HFE) issues can be integrated into the methods used to identify hazards, assess risks, and determine the reliability of safety measures. For instance, hazard identification guidewords have been developed to prompt a review team to consider human factor design issues like access, control interfaces, etc. An understanding of human psychology is essential in estimating the effectiveness of procedural controls and emergency response systems. Persons performing risk assessments need to be aware of the human factors impact, and training for such persons can improve their ability to spot the potential for human contributions to risk. Risk analysts can easily learn to spot the potential for human error any time human interaction is an explicit mode of risk control. However, it is equally important to recognize human contributions to risk when the human activity is implicit in the risk control measure. For example, a risk assessment of a boiler would soon identify “overpressure” as a hazard that can lead to risk of rupture and explosion. A checklist of common errors or an audit of the management system for operator training are examples of methods used to address the human error potential and ensure that is also controlled. The purpose of any tool would be to identify the potential for error and identify how the error is prevented.

- Does the operator know what the alarm means?
- Does he know how to shut down the boiler?
- What if the overpressure event is one of a series of events (e.g. what if the operator has five alarms sounding simultaneously)?
- Did the engineer properly size and specify the relief valve?
- Was it installed correctly?
- Has it been tested or maintained to ensure its function? A corollary to each of the above questions is required in the analysis” [1]: “How do you know?” The answer to that last question is most often found in the management system, thus “Human Factors” are the glue that ties risk assessment from a technology standpoint to risk assessment from an overall quality management standpoint.

5. RISK ASSESSMENT PROCEDURES

Chargers from offshore maritime activities can apply more protection and safety plans based on ground-based decision-making tools on judicious risk assessment and safety and security optimization. This approach can encourage marine safety analysts to develop and implement new safety assessment and decision-making strategies to address safety and security issues at sea. The relationship between such typical regulations for the issue in question can be seen in Figure 1 where the core of the problem is safety and the related regulations. Compliance with current regulations is ensured through a rigorous implementation of the integrated risk assessment plan, from feasibility studies and extending to a complete life cycle of an installation. This is done through stages of hazard identification for the lifecycle of an installation starting from the project stage to the discharge stage as well as by risk assessment methods as a matter of fact.

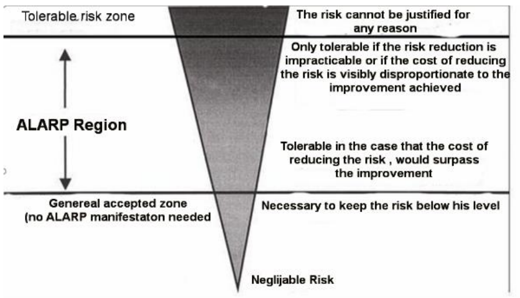


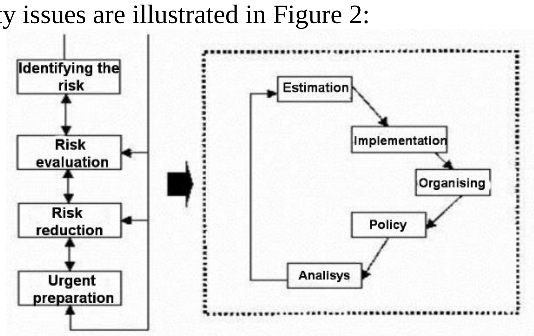
Fig.1 Working framework for decision-making on risk tolerance

In the case of a risk-based approach, priority is given to those hazards that cannot be anticipated or predicted by the progressive adoption of appropriate measures to prevent, detect, control and maintain control, as well as the integration of the response reaction in case of emergency.

The main feature of the new maritime safety regulations at sea is the absence of a prescriptive regime that defines the operator's specific duties, as well as the clear definition of the appropriate measures in this respect. The regulations stipulate a high level of safety as a central objective, but it neglects some aspects of the hazard situations that the operator has to deal with. This is an acknowledgment that the hazard situations that may occur in an installation are specific to the function served by it and its location conditions.

Industry guidelines have been established in the risk assessment project designed and introduced by the UK Maritime Operators Association (UKOOA). In general, this project could be successfully applied in a whole range of situations. Its purpose is to facilitate the implementation of important decisions during the design, exploitation and disposal of a marine installation. It especially provides a solid basis for assessing the various options that need to be considered in the feasibility stages and the selection of design criteria, in particular regarding "hazards caused by serious accidents" such as fires, explosions, impacts, loss of stability, and so on. It can also be combined with other formal auxiliary tools for making decisions such as Multi-Attribution Utility Analysis (AUMA), Analytical Hierarchy Process (PIA), or decision trees if a quantitative or more detailed analysis of different decisional alternatives is required.

It should be noted here that inaccuracies of information or contributing factors may occur in the decision-making process. This includes inaccuracies such as cost estimates, schedules, risks, benefits of protection, valuation of shareholder perceptions and views, etc. The five key elements related to concepts of protection and safety issues are illustrated in Figure 2:



A. Hazard identification

This stage is meant to identify all hazard situations with the potential to cause serious accidents.

B. Risk assessment

Once the hazards have been identified, the next step is to determine the risks that arise here. In general, hazards can be grouped into three risk areas known as intolerable, tolerable and negligible risk areas as shown in Figure 1.

C. Risk reduction

As a result of the risk assessment, it is necessary to reduce the risks resulting from extremely dangerous hazard situations that need to be addressed.

D. Emergency preparedness

The purpose of emergency preparation is to determine the most appropriate actions in case a hazard situation arises and its effects have to be minimized, including measures to evacuate the high risk location to a low-risk location.

6. THE PROTECTION AND SAFETY MANAGEMENT SYSTEM

The purpose of the protection and safety management system is to ensure that the organization achieves its proposed goals in a safe, efficient and environmentally friendly manner. One of the most important factors is explaining and understanding how the operator understands to adapt the management system to achieve the objectives in safe conditions. A work safety and security project is a written proposal drawn up for the commissioning of a seafront offshore installation. It is a stand-alone document that can be evaluated by itself without a correlation with other similar documents but which has reverberations in other studies and adjacent calculations. The amount of information contained in the document is at the discretion of the operator in agreement with the authority concerned.

In general, the following elements are common to many work protection projects:

1. A complete description of the installation
2. Details of the hazard situations created by the handling of the installations
3. Concrete demonstrations that the risks involved in these hazards have been properly identified and reduced to the minimum operability level (ALARP)
4. Description of the labor protection management system, including plans and procedures to be adopted for normal or emergency operations.
5. Relevant auxiliary references.

The following activities characterize the process of designing and setting up a work safety plan:

1. Establishment of acceptance criteria for safety, including the environment and loss of material goods.
2. Taking into consideration both internal and external hazards, using the formal and rigorous identification of hazards.
3. The estimation of frequency or probability of each hazard occurrence.
4. Analysis of the consequences of the occurrence of each type of hazard.
5. The assessing of risks and making a comparison with the criteria.
6. Demonstration of the minimum operability level (ALARP).
7. Identifying remedial measures for design, modification, or follow-up steps to reduce the frequency of occurrence and dissipate the consequences.
8. Preparation of a detailed description of the installation including information on the protection systems and the measures to be taken to control and manage the risks.
9. Preparing a description of labor safety management system and ensuring the implementation of appropriate procedures for each type of risk.

7. CONCLUSIONS

A marine offshore installation / ship is a complex and costly technical structure made up of many systems, and is typically unique in its design /respectively by operational characteristics (Wang and Ruxton (1997)).

Marine offshore installations / ships need to constantly adopt new approaches, new technology, new risky loads, etc., and each element brings with it a new form of risk.

Therefore, the safety assessment should cover all areas including those where it is difficult to apply traditional safety assessment techniques. Such safety assessment techniques are considered to be complete in many application areas. Depending on the level of uncertainty / availability of failure data, the right methods can be applied individually or combined to cope with the situation. All techniques of this kind can be integrated in a sense so as to formulate a general structure to facilitate risk assessment.

The lack of conclusive safety data and lack of confidence in safety assessments have been two major issues in engineering safety analysis. In order to solve this type of problem, it is necessary to develop new and flexible techniques to deal with uncertain issues and insecurity, and also to use decision-making techniques on a rational basis.

In the framework of the offshore safety assessment, a major problem was the high level of uncertainty of failure data, the issue being at the center of attention at the UKOOA support for decision-making on risk.

Different approaches require application in accordance with uncertainty levels. It is also required, in the case of thorough study, the application of computerized analysis. In recent years, advanced computer technology has been increasingly used to meet the requirements for control of situations, to reduce errors caused by the human factor and to give operators, at ship level, a superior working environment. This has resulted from the development of many computerized intensive systems. However, the use of software systems has introduced new types of failure that have created problems in developing critical security systems. In the official safety assessment of the ship, each critical (computerized) security system requires verification to establish the certainty that it is impossible or unlikely to lead to a catastrophic failure of the system and also to provide evidence both for the producer and for the evaluating authorities, demonstrating that the risk associated with the software is accepted within the globally accepted risk.

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