MBNA Publishing House Constanta 2021

Proceedings of the International Scientific Conference SEA-CONF

SEA-CONF PAPER • OPEN ACCESS

Considerations for risk mitigation in the international carriage of goods by sea

To cite this article: O. Ștefanov and G M. Apetroaei, Proceedings of the International Scientific Conference SEA-CONF 2021, pg. 384-391.

Available online at www.anmb.ro

ISSN: 2457-144X; ISSN-L: 2457-144X

doi: 10.21279/2457-144X-21-046

Considerations for risk mitigation in the international carriage of goods by sea

O. Ștefanov[1], GM. Apetroaei[2]

[1]Lecturer, PhD Student, Eng., "Mircea cel Bătrân" Naval Academy, Constanta, Romania

[2] Senior Lecturer, PhD, Master mariner, Apetroaei Gabriel Marius

1. Introduction

Risk has been defined in the literature as the probable level of loss of life, number of injured, damage to property and economic activities by a certain natural phenomenon or group of phenomena in a certain place and in a certain period.

The risk management process includes risk identification, risk analysis and risk response. The analysis of the negative events such as naval accidents and accidents created the premise that in the managerial practice two defining structural elements are distinguished: risk and uncertainty.

When a decision is taken in risky conditions, it involves an awareness of the risk taken, namely the knowledge of the probability of occurrence of the risk. If the decision is made in conditions of uncertainty, the risks are not known, although they are assumed.

So the risk is an uncertain event, but possible, its origin being in uncertainty. It can be said that risk is a common denominator for all economic, social and political activities as it occurs in the relationships between individuals or in the relationships between them and the environment. So risk involves the idea of potential loss (of any kind), loss caused by the evolution of certain factors (risk factors) in the opposite direction to expectations.

As the risk can be quantified by probability laws, and the uncertainty does not, the two are combined in different proportions, in reality the uncertainty being inherent to all phenomena, it cannot be eliminated. In many situations, when talking about risk, there is a tendency to confuse the terms risk and uncertainty. Both terms would denote the human inability to predict the future evolution of events [1].

2. Theoretical aspects

Interpretation of reasoning on risk theory acceptance of Skjong and Ronold (Skjong, R. and Ronold, K., ``Social Indicators of Risk Acceptance'' OMAE 1998 Norvey), Quality-of-Life Index was defined by the formula :

$$I_{CV=} \gamma^{W} * \varepsilon^{1-W}$$

Icv= quality of life index
γ = gross domestic product per person per year
ε = life expectancy (years)
w = part of life carried out in economic activity (in countries developed w = 1/8)

The ICPD (Default Cost of Preventing a Death) principle, as a criterion for reducing the risk, will implement the safety measures, as long as the change at *Icv* level is positive. [2]

Equation established:

It is assumed that the prevention of a death will save on average $\Delta \varepsilon = \varepsilon/2$, which is half of life expectancy.

The biggest change in the domestic product, $\left|\Delta\gamma\right|_{max}$, was obtained by intertwining this expression for $\Delta\varepsilon$ in the equation presented.

The fact can be interpreted as the optimal acceptable cost per year of lives saved. *,,The implicit optimum acceptable cost of preventing a death``* - CIPDop, can be calculated according to the equation:

where:

CIPDop (optimal CIDP) value , years saved by preventing a death

γ = gross domestic product per person/year

ε = life expectancy (years)

w = part of life in economic activity (in developed countries w = 1/8)

Based on the established criterion, the proposed/suggested safety (risk control) measures must be implemented as long as the estimated CIDP does not exceed the ICPDop.

In 2016, the value of CIPDop for developed countries was about 4 million pounds. The value of CIPDop varies over time [3].

The official safety assessment in the ship's design and operation can provide incentives with high potential.

Their application can lead to improved performance of the current fleet, be able to measure performance changes and ensure that new naval design plans are valid, ensure that experience in the field is used in the current fleet and that any lessons learned from an accident are harnessed to new ships. Another consequence may be the provision of a mechanism for predicting and controlling the most possible scenarios that can generate accidents.

3. Results and discussions

Safety assessment is a new approach to maritime safety that involves the use of risk techniques and cost-benefit assessment to serve the decision-making process.

Work protection projects apply to a particular type of ship, but the official safety assessment is intended to be applied to safety problems common to a type of ship (such as a high-speed passenger ship) or to a particular type of hazard (such as fire). Basic, the philosophy of official safety assessment is the same as that of a labor protection project.

Many shipowners began to develop their own strategies. The major difference between such specific applications and the generic application through regulators is that while specific features for a particular type of ship cannot be taken into account for a generic application, the common factors and elements that influence the risk and its reduction can be identified and reflected in a regulatory application for all ships of the same category.

This results in a more rational and transparent regulatory regime. The use of the official safety assessment by a shipowner, individually, on the one hand, and by the regulatory authority on the other, shall be as consistent as possible.

It has been noted that many leading classification societies are making arrangements to adopt this type of assessment. It is concluded that this framework of work can facilitate the assessment of maritime safety.

Taking into account the specificity of this scientific approach, the enumeration and classification of risks in the field of naval transport involves certain difficulties due to the large number of factors and causes

that directly condition this type of activity. In terms of their nature and even of transport insurance, risks can be grouped into maritime, special and excluded risks.

Maritime risks are those possible but uncertain events which may occur during transport and which may cause total or partial loss or damage to the goods transported and/or to the means of transport and/or to any pecuniary interest connected with the transport shipment.

Situations or events which endanger the ship, cargo or any pecuniary interest in connection with the sea consigning are determined, inter alia, by natural phenomena (recorded except in cases of force majeure - Act of God).

Special risks include risks due to the nature of the goods being transported as well as those due to special causes such as war, strikes, embargoes, etc. Among the special risks, proper, which appear as a result of some physics-chemical properties of the goods, we mention leakage (leaking), rusting (rusting), spreading (spillage), breaking (breaking, smashing), sweatage (sweatage), heating, alteration (deterioration), etc., and among the risks assimilated to the above we mention war risk (war risk) and strike risk.

Excluded risks are those risks for which the insurer bears no liability in the event that they arise in the course of a transport operation insured. This category includes risks due to the own vice of goods, the application of customs duties on goods on their arrival at the port of destination, seizure, confiscation and other measures applied for clandestine, prohibited or smuggling trade, etc [1].

The types of risks (incidents and accidents) in respect of cruise ships can be classified as:

- ✓ disasters (attacks of sinking, grounding, overthrow, collision, allision, terrorist and pirate, pollution, accidents and crimes carried out on land or on board a ship)
- ✓ Mechanical (fire, propulsion problems, loss of power) - often leads to cruise cancellations.
- ✓ Outbreaks of disease (Norovirus / Gastro, Flu, Legionellosis) - can lead to changes in the itinerary.
- ✓ deaths (jumps overboard / missing passengers and crew members, drowning in ship pools, critical trauma, murder, suicide, myocardial infarction / heart attack)
- ✓ trauma (rape, aggression, battery, fractures by accidental fall / slip)
- ✓ crimes (bomb threats, robbery, drug trafficking and possession, arrests for warrants issued by competent authorities, theft, acts of vandalism and indecent exposure to intoxication) • related to weather conditions (fog, gusts, storms, hurricanes) - usually leads to route changes and delays in the ports of destination.

Practice and historical experience in any field show us that the process of making a good decision includes:

- ✓ identifying a wide range of potential options (a favorable framework for initiating new approaches in the field);
- ✓ realistic assessment of the advantages and disadvantages associated with each option;
- ✓ adequate levels of data entry and review;
- ✓ correct and timely decision making methods;
- ✓ effective communication and implementation of decisions taken.

At this moment, we are not mistaken if we state that, regardless of the field of activity analyzed, the issue of risk is topical. The problem of a potential risk is always associated with consequences, which cannot always be foreseen or anticipated.

Directing the discussion to the economic sector one of the most important standards that the experience of large companies recommends is the standard on risk management. From this point of view, each organizational entity has the obligation to systematically analyze the risks related to the activities carried out, to elaborate appropriate plans in order to limit the possible consequences of these risks and to appoint those responsible for the implementation of those plans.

In these conditions, this practice has "migrated" from the states with tradition to the vast majority of countries and the governments of the Member States of the European Union have integrated risk management in the managerial reforms undertaken in recent years.

The benefits of preventing a death are difficult to quantify. It is stated that such a quantification is impossible because it involves associating a value with people's lives. Such an economic criterion has great value in risk analysis, and non-use may even be unproductive in relation to safety, because the benefits of preventing a death can be an important impetus in the implementation of measures to reduce costly risks.

Table 1: Number of Marine Accidents by Year as of August 31, 2021 [4]

Year	Collision	Contact	Grounding	Sinking	Flooding	Capsizing	Fire	Explosion	Vessel missing	Facility damage	Fatality/ Injury	Others
2021	111	48	100	2	22	51	11	3	1	15	67	1
2020	190	94	156	13	16	50	29	2	0	19	133	1
2019	218	98	200	11	25	66	31	1	0	40	145	2
2018	243	86	172	21	26	52	24	2	0	24	180	0
2017	200	96	181	14	22	55	27	3	0	23	143	0
2016	217	94	163	5	19	46	26	3	0	21	144	0
2015	244	102	202	5	12	56	38	3	0	20	122	1
2014	265	116	213	7	11	61	35	1	0	37	150	3
2013	264	145	210	10	25	49	33	2	0	38	163	2
2012	246	132	264	5	21	55	44	2	0	34	155	0
2011	282	145	264	12	18	56	32	1	0	23	142	1
2010	356	180	369	15	18	50	35	2	0	26	146	0
2009	325	174	431	16	19	58	42	3	0	38	217	2
2008	181	101	255	12	4	28	15	3	0	30	61	0
2007	0	1	2	0	0	0	0	0	0	0	0	0

In order to better understand how important a good assessment of the risks of naval accidents is, we can see the evolution of the number of their occurrence each year in the statistics above.

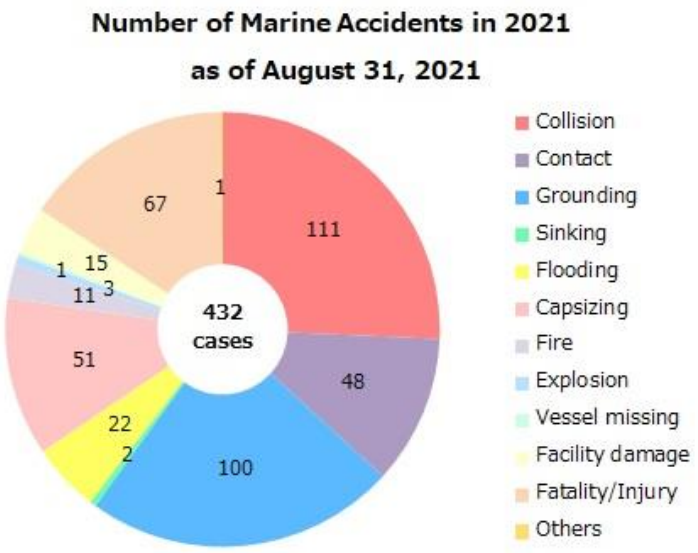

Fig. 1[4]

In view of those observed in the above statistics, special attention is paid by the maritime industry to the development of safety on board ships regardless of the type of ship or craft, because depending on the specifics of the activities carried out.

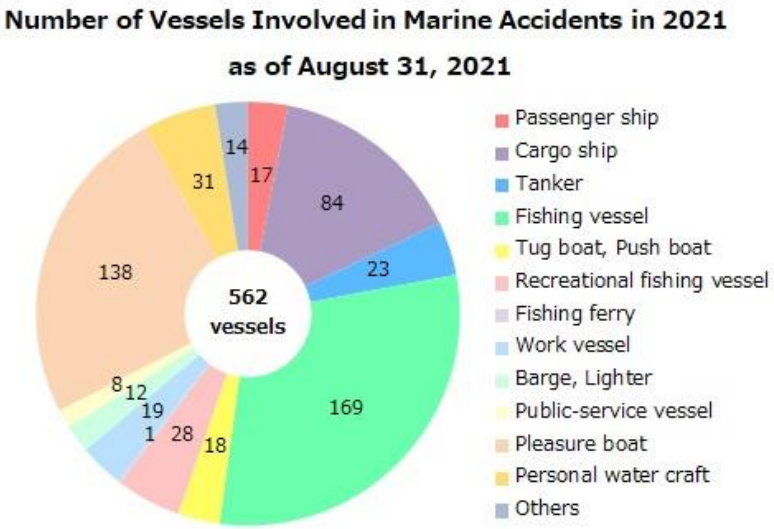

Fig. 2 [4]

It goes without saying that working at sea is dangerous. To reduce the risk of accidents, ships and workers alike will always be able to navigate.

If a ship loses its propulsion power, there is a risk of a collision with other ships or a failure on land. There are many causes of maritime accidents. Some of them are unavoidable, such as extreme weather conditions. Others are caused in part or in whole by the negligence of crew members, the so-called ``human factor``.

A large part of maritime accidents can be directly attributed to human error. Sea conditions can be severe. To reduce the risk of maritime accidents, crew members must be well trained and alert to dangerous situations. Unfortunately, there are many factors at sea that can contribute to accidents with disastrous consequences.

The risk of maritime accidents due to human error is imminent at the occurrence of certain causes such as: extended work schedule, lack of sleep that leads to fatigue, lack of training and professional experience, extended time at sea, long voyages, conflicting interpersonal relationships on board the ship, inappropriate behavior, including drug and alcohol abuse, poor decision-making in extreme situations and / or negligence, pressure from shipowners or charters and the stress of professional tasks.

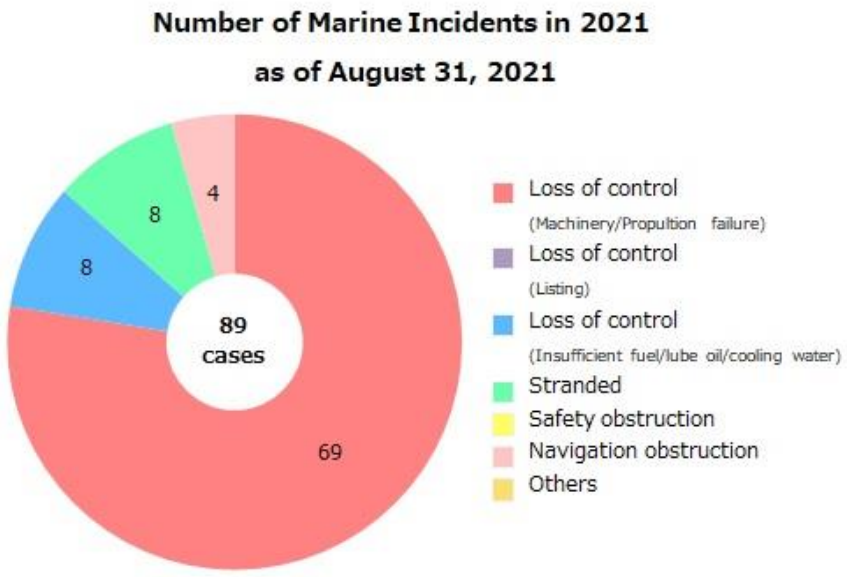

Fig. 3 [4]

Around 80 to 85% of accidents at sea are due to human factors. Following the analyses carried out by the International Maritime Organization (I.M.O.) such errors are due to:

- ✓ lack of adaptation to the marching conditions (40% of accidents occur in the first 10-12 hours after departure). In the first 3 to 4 days or 7 to 8 days the level of accidents increases.
- ✓ Prejudice of the lack of danger in known areas. (10% of accidents).
- ✓ Lack of attention, due to the first two, stress and overwork.
- ✓ High level of accepted risk
- ✓ Abusive use of the radar navigation in areas of entry, exit, canals, straits.
- ✓ "Lonely navigation" - on the way back (to home) especially if the trip was difficult = low vigilance.

Objective risk factors (hydrometeor conditions, technical failures, wrong maneuvers of other ships).

A major concern of interest of the players on the profile market is to find the best solutions from an engineering point of view to combine attractive factors, such as the shape of the hull and interior spaces, with the safety factor and the economic factor, efficient constructive achievements and with a pleasant design at the lowest possible financial costs.

An example of this is the shape of the hull and the propulsion means for RoPax ferries that develop a cruising speed of up to 30 knots, provided by the International Journal of Automatic & Computing (2012) which notice the shape of the ship's hull and the type of displacement as the best a choice made by the Ficantieri-Italy shipyards, a harmonious combination of naval architecture, economic efficiency and increased safety of passengers and crew on board these international ferries [5].

The owners of these types of ships and the classification societies in the field can maintain and even increase safety by introducing increasingly stringent criteria to be met by the operators of these ships. The objective of most studies in the field of naval safety and security carried out by classification societies is to identify and assess step by step the risks of naval disasters or accidents on board ships, the relationship between triggering events and the consequences of these naval tragedies.

Only in this way can subsequent recommendations be made to all the factors involved in this field regarding the identification of the deficiencies found, the consequences produced by their development and the methods to prevent their occurrence.

Conclusions

Despite the evolution of obvious contemporary technologies and the constant evolution of rules in the field of safety and security of maritime navigation, the real risk of human error and failure to apply adequate management in critical situations are causes that still intertwine for maritime disasters with difficult consequences provided.

It has been shown that certain improvements need to be made in the internal rules and policies of companies regarding the manner in which shipowners respond to crisis situations, such as the immediate and unequivocal announcement of the authorities responsible for providing assistance and saving lives. in the event of an emergency, encouraging the application of the effective alarm measure and the immediate evacuation of persons on board in such a situation of imminent danger, permanent consultation of the master with the command and encourage them to adopt a proactive attitude of support towards the command of the ship but also the much more cohesive collaboration between the masters and the representatives of the responsible companies on safety and security issues on board ships, they through their active attitude can influence decisive c applicants in making extreme but effective decisions to rescue those on board ships and its ship or equipment.

Certain rules of application in the field of equipment operation or ship hull design may or may not be up-to-date, so it has been called for the creation of much better performing electrical networks by passenger ship manufacturers and designers, as in the event of a shipwreck. powering the ship's vital equipment to continue to operate at a high level to maintain the ship's vitality.

Changes are also needed in the design of the accommodation of vital equipment of the ship so that the occurrence of major damage to the hull of the ship does not lead to the immediate and irreparable removal from use of vital equipment, such as emergency generators, propulsion system ship's electrical panels and related circuits, ship's rudder or seawater drainage pumps flooding spaces inside the ship.

It was concluded that water infiltration sensors should also be placed inside the ship's airtight compartments to immediately warn of the occurrence of such damage to the ship.

The most common methods used in risk analyzes and the search for methods to reduce the risks of maritime accidents, take into account calculation schemes that are built in relation to a created state of failure as ship accident, damage to vital equipment of a ship or loss of life.

References

[1] - Nicolae, F., ,,*Risk management in the naval industry*``, IMNP Master Course, adl anmb platform, "Mircea cel Bătrân" Naval Academy, Constanța, 2014

[2] – ,,Risk Analyses Developed Model`` PhD. Candidate Georgiana Cristina NUKINA , 2012

[3] - Skjong, R.and Ronold, K., ,,*Social Indicators of Risk Acceptance*``.OMAE 98, Det Norske Verita, Hovik, Norway, 1998

[4] - https://www.mlit.go.jp/jtsb/statistics_mar.html, website accessed in 2021

[5] -P. Antao and C. Guedes Soares -,,Fault-tree Models of Accident Scenarios of RoPax Vessels ", 2006