THE ROLE AND IMPORTANCE OF SAFETY IN MARITIME TRANSPORTATION

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ABSTRACT

Today, safety is a very important factor that affects all elements of maritime industry. However, safety management and its implementation in the maritime industry are more important than ever. International legislation and regulations in shipping were rather scarce at the time of the Titanic tragedy. Present-day maritime industry has a number of codes, conventions and guidelines that set the boundaries of safety and efficiency in shipping. The development of maritime industry has resulted in the great development of technology, design, size, propulsion and safety of ships. Consequently, the development of new technologies in the maritime industry has brought changes in the education systems over the last few decades. After the Second World War the maritime education system has been evolving proportionally to the demands of the industry. Despite great breakthroughs in technology and safety at the workplace, the marine industry is still a relatively dangerous place to work. This paper presents the flow and the analysis of the development of technologies that have been major milestones in shipping with regard to their contribution to maritime safety. The paper also discusses important factors that adversely affect the safety of navigation today and points out the dangers affecting the future of maritime safety, with the aim of minimising the dangers, i.e. material and human losses, and maximising the environment preservation.

KEY WORDS

maritime safety, development of ships, professional training, international regulations and standards, competent authorities for safety.

1. INTRODUCTION

Maritime safety is one of the imperatives of the maritime industry. Sea accidents occur under a set of circumstances in an area where each of the factors affecting these circumstances may, at a moment of time, alter its initial state and turn into another state that can be more or less predictable. A danger is a state of imminent distress, whereas a risk is a danger that can be predicted, but only to a certain extent. It should be borne in mind that the risk always implies the probability that an undesirable event may occur and that the only thing a man can do is to assess it. Risks in maritime shipping are mostly related to accidents at sea that can be, according to their causes, be divided as follows [4]:

- accidents caused by unintentional human error,
- accidents caused intentionally by man,
- accidents due to technical failures,
- accidents due to poor weather (wind, waves, lightning, etc.)

In the context of safety of traffic in maritime shipping, it may be assumed that a system or its sub-system is likely to function properly within the set limits. Hence the goal is to reduce or to eliminate the causes of adverse events that threaten the safety of navigation with the purpose of achieving absolute reliability in maritime transportation. In a wider sense, the safety of maritime transportation may be defined as a set of measures that are taken to protect human life, but also as a set of measures that are taken to protect material and non-material assets that are directly or indirectly related to maritime transportation. There are a large number of factors affecting the safety at sea, including shippers, ports and port authorities, coastal countries, international community, etc.

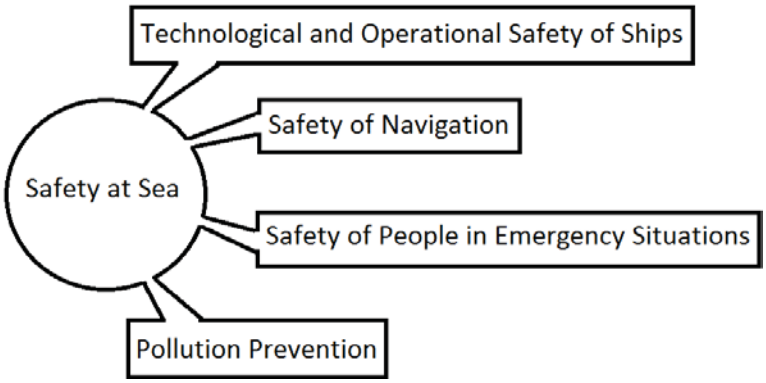


Figure 1. Safety at sea
Source: Kopacz; 2001; 201 [4].

In a narrower sense, the safety of maritime transportation implies the measures aiming at performing the carriage of cargo by sea without harmful effects on human life, cargo, vessel and environment. In order to obtain an adequate level of safety, a system of safety has to exist at the international level which will be capable of bringing adequate necessary measures and which will monitor the implementation of these measures by means of various instruments and through various institutions. The maritime system of safety at sea can be divided into the following components [4]:

- institutions bringing legal regulations (international conferences, International Maritime Organization and its institutions, etc.),
- institutions in charge of the implementation and monitoring of security measures and standards,
- international maritime conventions and other legal instruments related to safety at sea, and
- users at sea.

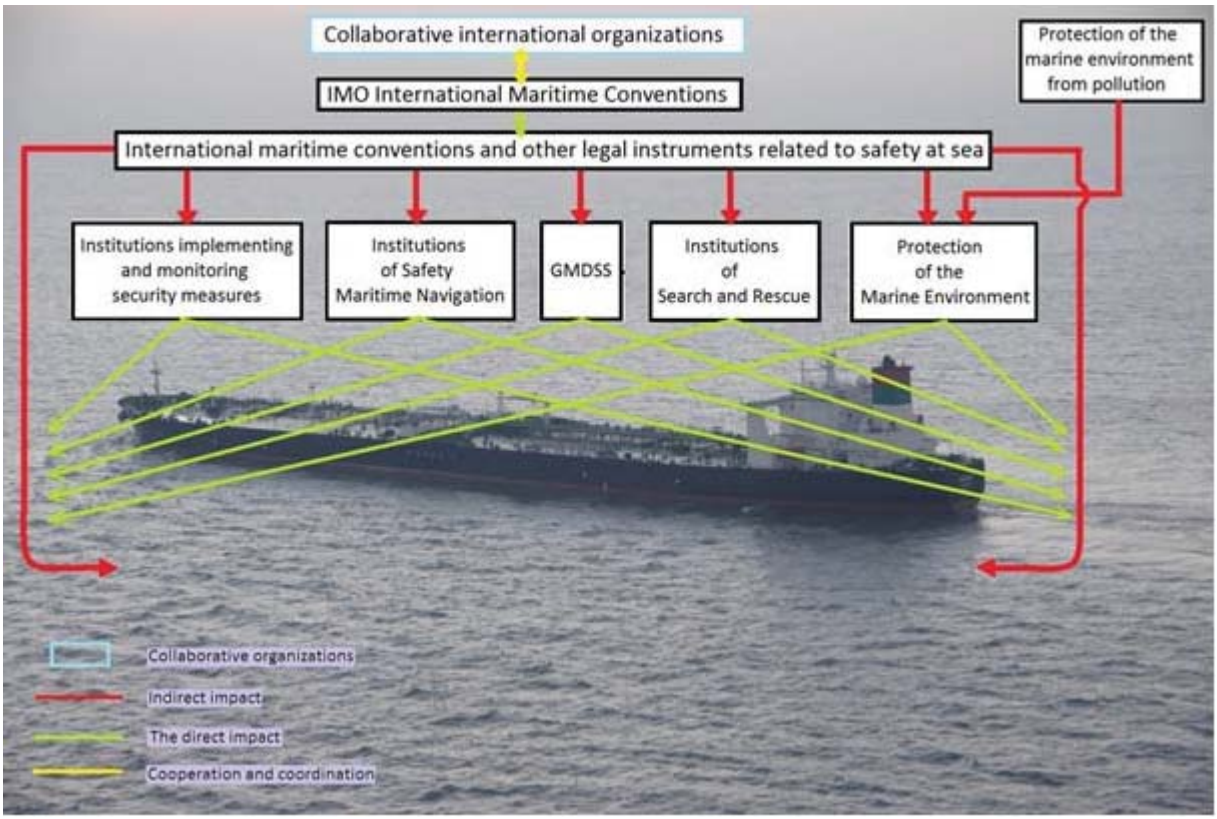


Figure 2. The system of maritime safety
Source: Kopacz et al.; 2004; 24 [3]

2. ANALYSIS OF SAFETY FROM THE STANDPOINT OF TECHNOLOGICAL DEVELOPMENT OF MARITIME INDUSTRY

Since the 1970s, world seaborne trade has been growing due to the market globalisation (Figure 3). Generally speaking, from the ancient times up to present days, the transportation of goods by sea has remained one of the cheapest ways of shipping and the world seaborne trade has been growing steadily, particularly after the World War II. The number and size of merchant ships have increased due to major technological breakthroughs, yet maritime industry has remained a dangerous workplace. Today's world fleet consists of more than 100,000 vessels with the total tonnage of almost 1 billion GT. [8]

Since the 1912 RMS Titanic disaster that claimed 1513 lives [9], there have been many changes with regard to safety of navigation in terms of regulations and technology. The new technologies that have considerably affected the safety in maritime industry include the introduction of gyro-compass, RADAR, followed by ARPA RADAR for improved safety in maritime traffic, mandatory use of electronic charts (ECDIS) since 2012, Global Positioning System (GPS), Automatic Identification System (AIS) for identifying and locating vessels, vessel traffic service (VTS) for traffic control and monitoring, etc. However, it should be underlined that some research results show that the dependence on certain technologies may lead to accidents.

Over the years, the progress in design and construction of ships has resulted in the improved safety at sea. The progress has been achieved not only in design, but also in the strength and the size of the vessels which have become increasingly larger

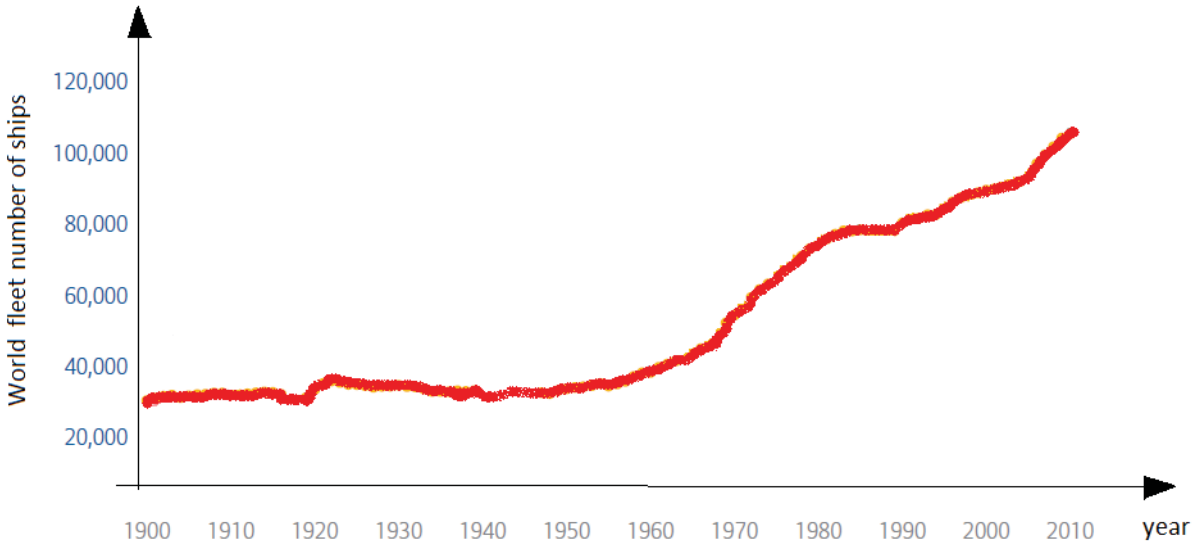


Figure 3. Each year the world fleet size is increased by a number of ships
Source: Lloyd's Register Fairplay, World Fleet Statistics 1900-2010

(Figure 4). The construction techniques have progressed to such an extent that they have very little in common with the techniques used in the times when the Titanic was built. That vessel, which represented a high-tech marvel of shipbuilding technology at her time, appears rather small when compared to modern container ships, VLCCs and FPSO (floating production, storage and offloading) units (Figure 4). In early 20th century Europe was the centre of shipbuilding, the vessels were designed by small teams and constructed in relatively small shipyards. Today, just a hundred years later, the situation is entirely different.

The centres of ship design and construction have moved to the countries in the Far East (China, South Korea and Japan). Forty years ago (in 1979) the world market share in shipbuilding between Japan and Europe was 1:1, whereas by 2012 this ratio dramatically changed: China 45%, South Korea 29%, Japan 18%, the EU 1%, the rest of the world 7% [10].

Computer-supported modelling has replaced difficult and time-consuming calculations of ship's stability, structure and hydrodynamics. In addition to hull design, there have been other technological changes in the past hundred years, e.g. regarding the bridge arrangement and appliances.

At the time of the Titanic the navigation bridge featured few navigational appliances. The standard equipment used to include Nautical Almanac, sextant, chronometer and magnetic compass. On the other hand, modern bridges are equipped with computers and high-tech appliances such as autopilot, VHF radio, depth finder, Automatic Identification System (AIS), ARPA Radar, Global Positioning System (GPS), Electronic Chart Display and Information System (ECDIS) etc., and the magnetic compass has been superseded by gyro-compass. These appliances have ensured a safer and easier navigation.

Furthermore, major breakthroughs in weather forecasting have also improved the safety at sea. Monitoring weather conditions and selecting optimal routes with regard to fuel consumption, vessel's characteristics and reduction of voyage time have become standard procedures. The purpose of selecting the optimal route using modern technologies, including meteorological service, is not to avoid poor weather but to find the balance between the length of the journey and fuel consumption, with due attention paid to safety of the crew, passengers, cargo and the ship when meeting bad weather.

During all these years the maritime industry has attempted to enhance safety implementation and control. However, despite all efforts, the recent disaster of the cruiser Costa Concordia has proved that, in modern times, the safety at sea is the result of a set of initiatives, research, regulations and innovations.

Maritime shipping has become considerably safer over the past decades and navigation appears to be safer than ever, but further development of technologies will bring new challenges that the shipping industry will have to deal with and that will require solutions for future problems.

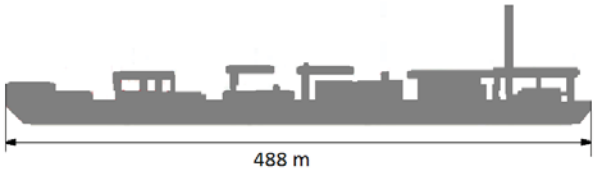
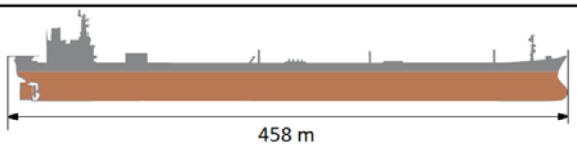
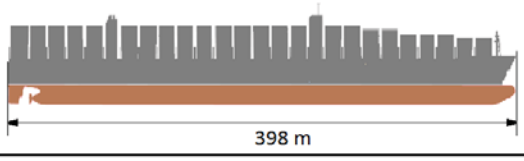
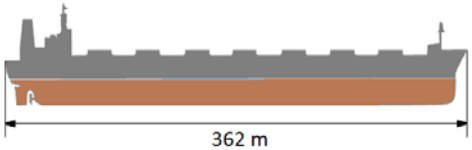
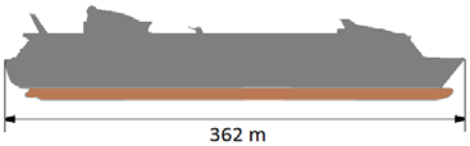
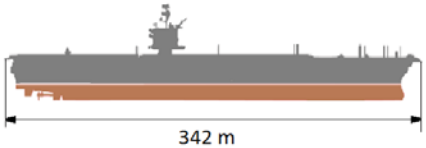
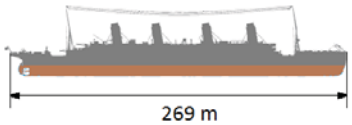
SHIP SIZE COMPARSION	NAME	TYPE	YEAR
	Prelude	FLNG	2017
	Knock Newis	Oil Tanker	1979
	Mærsk Mc-Kinney Møller	Container Ship	2013
	Valemax	Bulk Carrier	2011
	Alure Of The Seas	Cruise Ship	2009
	USS Enterprise	Aircraft Carrier	1961
	Titanic	Ocean Liner	1912

Figure 4. Size of modern ships compared with the size of the Titanic, the vessel that was the most advanced shipbuilding achievement of her era
Source: author

3. ANALYSIS OF SAFETY FROM THE STANDPOINT OF MARITIME LEGISLATION

The technological development of the maritime industry has increased the need for new conventions and guidelines that would define new boundaries of safety and efficiency. Safety and security management and implementation are very important aspects of modern shipping. The Port State Control (PSC), established on the basis of STCW convention in 1978, has greatly contributed to the safety and security in maritime shipping. The PSC is entitled to check any vessel at any port and prevent a vessel's departure if she does not meet safety requirements. The PSC encourages vessels to respect international safety and security standards, to prevent environmental pollution, and to observe other operational regulations. The performed inspections of vessels are uniform in order to ensure equal standards of safety and avoid the obstruction of fair market competition. There are more and more inspections worldwide, in accordance with the increase in maritime traffic. Classification societies also contribute to the safety at sea through applying international standards in designing and construction of vessels. The states whose ensigns the vessels are flying are the ones observing the IMO regulations. However, the "flags of convenience" appeared in the 1950s and some of them have been criticised for being loose in observing regulations and control, by failing to ratify international standards in national parliaments or by failing to implement ratified laws and regulations.

Figure 5 shows the development of safety through the introduction and amendments of regulations over the years. It can be noticed that significant changes came into effect after the Titanic disaster in 1912 by adopting the SOLAS convention and its amendments.

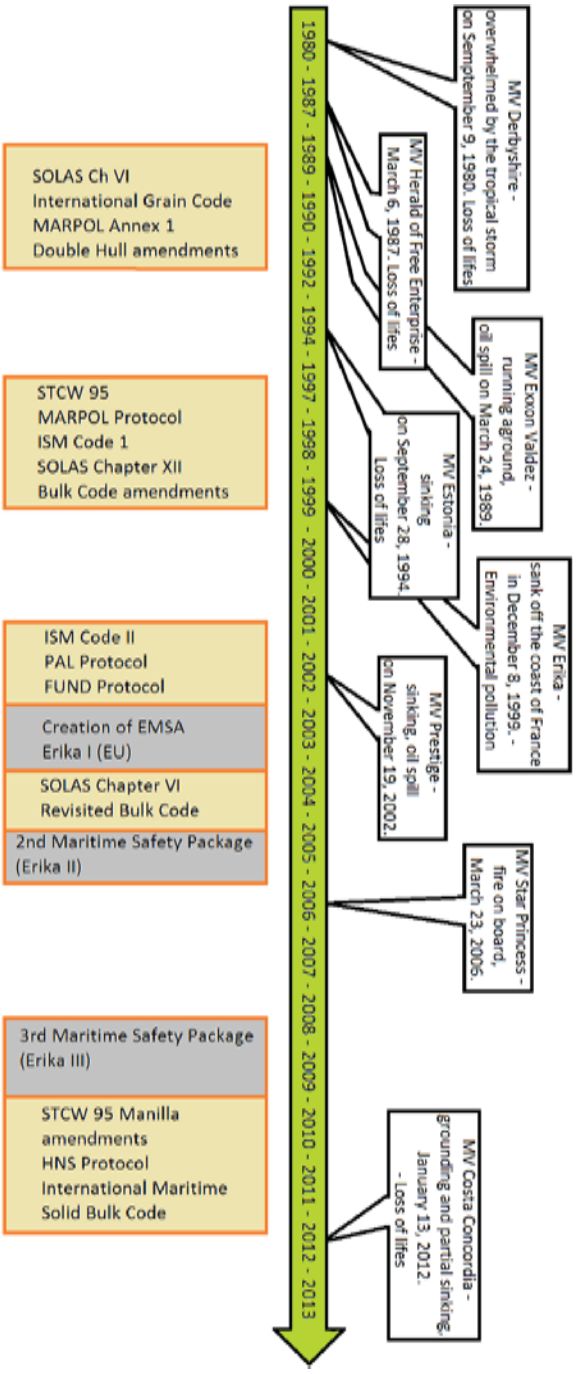


Figure 5. Time flow chart presenting the changes in safety regulations over the years
Source: 15 Years of Shipping Accidents: A review for WWF

Similar changes were introduced by the regulations governing the transport of dangerous cargo (tankers, bulk carriers, etc.), e.g. Bulk Code, amendments to MARPOL Annex I, and the US regulations such as the Oil Pollution Act 1990 (OPA '90). Sadly, some of the changes regarding the improved safety of navigation were introduced only as a response to maritime disasters that had already occurred. For instance, it was only after the calamitous fire on the cruise ship Star Princess in 2006 that fire regulations, i.e. amendments to SOLAS chapter II-2 and to the International Code for Fire Safety Systems (FSS Code) were adopted. In this context, it remains to be seen what safety regulation changes will take place, in the near future, following the disaster of the cruise ship Costa Concordia.

4. THE MOST COMMON CAUSES OF SHIP LOSSES IN MARITIME INDUSTRY

Despite the fact that maritime transport has been ranked as one of the safest means of transportation (e.g. compared to road traffic), seafaring remains a very dangerous profession. According to the data covering the period 1996-2005, there were 84 fatalities per 100,000 seafarers in Poland each year, 96 fatalities per 100,000 seafarers in Hong Kong, 90 fatalities per 100,000 seafarers in Denmark and 11 fatalities per 100,000 seafarers in the United Kingdom. When studying the data referring to the UK, it can be concluded that the safety at sea has improved over the last two decades: fatal accident rate per 100,000 seafarers per year amounted to 53 from 1976 to 1985, 39 from 1986 to 1995, and 11 fatalities from 1996 to 2005. [8]

When observing Table 1, it can be noted that, over the last several years, most of human lives have been lost onboard passenger / Ro-Ro ships and general cargo ships. In 2012 there were 610 persons reported killed or missing (lives lost) as a result of total losses during the year.
Human errors and fatigue figure prominently in these accidents. Most of the casualty situations are caused by [7]:

- sinking (49%)
- grounding / stranding (18%)
- fire / explosion (15%)
- engine failure / hull fracture (2%)

Figure 6 shows the world fleet total losses over the past 100 years. Although the data clearly indicate a downward trend in marine accidents, there is still a risk of collision, explosion and other events that can result in the loss of vessel. The losses are also affected by the type, age and sailing area of a vessel.
Sinking is the most common cause of ship losses, resulting in 50% of all ship losses per year. [8] The losses are also related to geographical areas where they took place, most frequently in the South China Sea and the Black Sea (Figure 7). Sinking is followed by grounding as the second most common cause of ship loss.

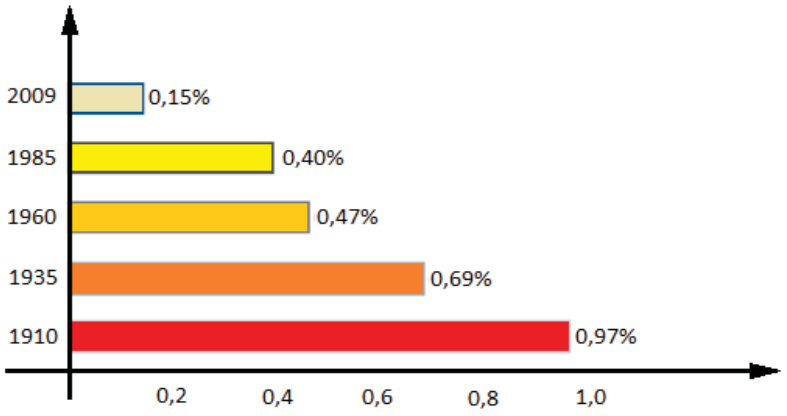


Figure 6. Total losses - % of the world fleet
Source: Calculated from Lloyd's Register World Casualty Statistics 1900-2010

Table 1: Lives lost (as a result of total losses) for the period 2007-2012

Ship Type	2007	2008	2009	2010	2011	2012
Anchor Handling Tug Supply	16					
Asphalt/Bitumen Tanker			3			
Bucket Dredger		3				
Bulk Carrier	39	15	55	48	39	8
Bunkering Tanker						
Cement Carrier	2		1			
Chemical Tanker	14				2	
Chemical/Products Tanker						17
Container Ship (Fully Cellular)			12			
Crane Ship						
Crude Oil Tanker					5	
Deck Cargo Ship	5	4				
Diving Support Vessel		1			13	
Factory Stern Trawler	11	5	2		1	
Fish Carrier						
Fishery Research Vessel						
Fishing Vessel	4	39	18	41	17	26
General Cargo Ship	199	156	327	144	72	86
Grab Dredger						
Heavy Load Carrier			1			
Hopper, Motor	1					
Landing Craft	1	1				
Livestock Carrier			43			
LPG Tanker		10				
Offshore Tug/Supply Ship				10		
Ore Carrier						
Passenger Ship	2		143		12	293
Passenger/Cruise	2					32
Passenger/Ro-Ro Ship (Vehicles)	22	831	62		3013	103
Passenger/Ro-Ro Ship (Vehicles)/Rail			5			8
Pipe Carrier						
Platform Supply Ship	1					
Products Tanker		1				10
Pusher Tug	3		5		5	
Refrigerated Cargo Ship				2		2
Research Survey Vessel	2				7	
Ro-Ro Cargo Ship	10	7	1			2
Standby Safety Vessel						1
Stern Trawler	10	27	9	6	28	9
Tanker (unspecified)	1	14	3			
Trailing Suction Hopper Dredger						
Trawler	4	4	3	1		
Tug	7	1	1	1		2
Vegetable Oil Tanker	7					
Vehicles Carrier						11
Grand Total	**363**	**1,119**	**694**	**253**	**3,214**	**610**

Source: IHS Fairplay - World casualty statistics 2012

Figure 7. Total losses by region from 26 November 2011 to 25 November 2012
Source: Lloyd's List Intelligence Casualty Statistics. Analysis: AGCS.

When studying the statistical data (Table 2) by the type of the vessel, it can be noticed that cargo ships and fishing vessels have most losses (48%). Among large merchant ships, bulk carriers have more losses than tankers, container ships and cruisers – around 7%, although they make only 20% of the world merchant fleet. It can be also noted that vessels conveying liquid cargo and containerised cargo have a lower loss rate.

Table 2. Ship losses by type (2001–2012)

Period	Barge	Bulk	Cargo	Chemical/Product	Container	Dredger	Fishery	LPG/LNG	Other	Passanger	Ro Ro	Supply/Offshore	Tanker	Tug	Unknown	
2001-2002	4	9	70	6	1	4	43	2	13	11	5	1	2	6		177
2002-2003	3	11	68	9	1	1	31		9	14	7		4	8	3	169
2003-2004	2	6	65	9	1	4	30		4	10	9	3	3	9	1	156
2004-2005	5	8	58	7	2	3	38	2	3	13	7	3		5		154
2005-2006	7	8	56	10	5	2	23		2	12	10	3	2	8	1	149
2006-2007	5	10	76	5	3	4	34		7	7	5	5	1	9	1	172
2007-2008	4	8	55	9	1	3	36	1	4	5	8	1	3	9	1	148
2008-2009		12	49	8	5	1	30		6	5	5	3	2	5		131
2009-2010	1	10	57	4	4	1	20		3	2	1	1	3	3		110
2010-2011		12	35	4	2	2	17	1	2	8	2	2	1	3		91
2011-2012		7	51	7	4	1	12	1	6	3	4	2	2	6		106
Total	31	101	640	78	29	26	314	7	59	90	63	24	23	71	7	1563

Source: Lloyd's List Intelligence Casualty Statistics. Analysis: AGCS

Table 3. Causes of loss statistics (2001–2012)

Period	Collision	Contact	Foundered	Fire / Explosion	Hull Damage	Missing / overdue	Machinery damage / failure	Piracy	Wrecked / stranded (aground)	Miscellaneous	Total
2001-2002	20	2	51	35	24		15		22	8	177
2002-2003	21	1	59	22	12		13		34	7	169
2003-2004	13	3	72	21	7	1	9	1	28	1	156
2004-2005	24	4	62	18	7	3	10	1	23	2	154
2005-2006	25	4	61	18	5	1	7		26	2	149
2006-2007	16	2	68	15	11	1	17	1	39	2	172
2007-2008	11	1	74	17	3		8		33	1	148
2008-2009	13		62	14	8		7	1	24	2	131
2009-2010	10	1	58	12	3	1	3	2	18	2	110
2010-2011	3		50	6	3		5		24		91
2011-2012	6	2	52	11	5		6		23	1	28
Total	162	20	669	189	88	7	100	6	294	28	1563

Source: Lloyd's List Intelligence Casualty Statistics. Analysis: AGCS

According to the type of accident, most of the vessels were lost over the last decade due to sinking and grounding. Many researches and studies have proven that the highest risks include collision, sinking and hull fracture [11]. Fire / explosion also represents a considerable risk onboard ships, threatening general safety and resulting in human casualties and material losses. Fire remains a major threat particularly onboard Ro-Ro vessels and large cruise ships.

5. MAJOR FACTORS AFFECTING THE SAFETY OF MODERN NAVIGATION

5.1. Professional competence

Due to the progress in technology, vessels have become increasingly larger over the past 100 years. Modern ships (VLCC tankers, large cruisers and container ships) feature cutting edge design and represent a challenge to insurance instruments because of their added value. Large passenger ships intended for cruising are designed and built with special attention paid to the safety of passengers. Their design represents additional challenge in the areas of safety, security and risk management, particularly with regard to evacuation and rescue operations at remote locations. Because of high costs of maintenance, insurance, and additional professional training, many shippers seek cheaper workforce in the developing countries where standards of living are lower. This trend challenges the safety of modern maritime shipping because some of these countries do not have sufficiently developed infrastructure that would meet the requirements of professional education and training, and ensure future competence of the seafaring personnel.

Despite IMO regulations and guidelines for introducing international standards in professional education of seafarers, education policies and grading standards are not consistent across the world, which may lead to differences in professional competency. It is clear that some

countries fail to fully implement IMO educational and training standards. Varying standards and policies on professional education, as well as different methods of training and assessing the seafarers' proficiency and competence, result in an internationally inconsistent system of certification where a certificate issued by one flag state does not have the same value as the certificate issued by another flag state. [2]
Such differences in standards result in differences in seafarers' skills and competency, which may have adverse consequences and lead to jeopardised safety at sea.

5.2. Insufficient manning

Insufficient manning is another frequent safety problem in modern maritime industry. In spite of advanced technologies, insufficient number of crew members dealing with a growing scope of tasks and duties may result in risk and danger induced by human factor (fatigue being the most common), especially in important operations lasting 24 hours or more. A tired or exhausted worker is less productive and is more prone to accidents and injuries. Fatigue is a common problem partly due to maritime legislative which in most segments appeases the shippers allowing them to use minimum crew onboard ships. Such practice should be changed and the excessive scope of work per person should be reduced in order to reduce various elements (e.g. fatigue, sleep deprivation) that may lead to dangers caused by human factor.

5.3. Piracy

Piracy remains one of the major issues affecting the safety in maritime shipping. Pirate activities have been particularly prominent in the region of the Gulf of Aden. Maritime industry has been insufficiently successful in fighting the piracy and is still seeking ways and methods to eliminate it completely. Statistics show that the situation has changed recently (Figure 8) but it still remains a serious threat to safety of navigation. The problem is most prominent in the West Indian Ocean region and the Gulf of Aden, mainly due to low standard of living and failure to restore effective governance in Somalia. According to 2011 statistical data provided by ICC International Maritime Bureau (IMB), 28 ships were hijacked by pirates off the Somali coast and fifteen people were killed in those attacks. [12]
Another problem lies in the fact that pirates operate across vast ocean areas which are difficult to monitor and control efficiently, particularly in view of the limited assets that are allocated for fighting piracy. IMO has been encouraging national governments to provide military aid to achieve greater safety at sea.
Given the fact that the piracy-related costs amounted to almost 7 billion US dollars in 2011 [8], it should be noted that it is very important to raise global public awareness of the dangers and risks of piracy in maritime affairs and to encourage the governments to respond more resourcefully to the situation.
Figure 9 shows the areas of pirate attacks reported to IMB Piracy Reporting Centre during 2014. It can be noticed that frequent pirate attacks threatening the safety at sea were reported along eastern and western coasts of Africa and in the region of Indonesia (in the area of the Malacca and Singapore Straits).

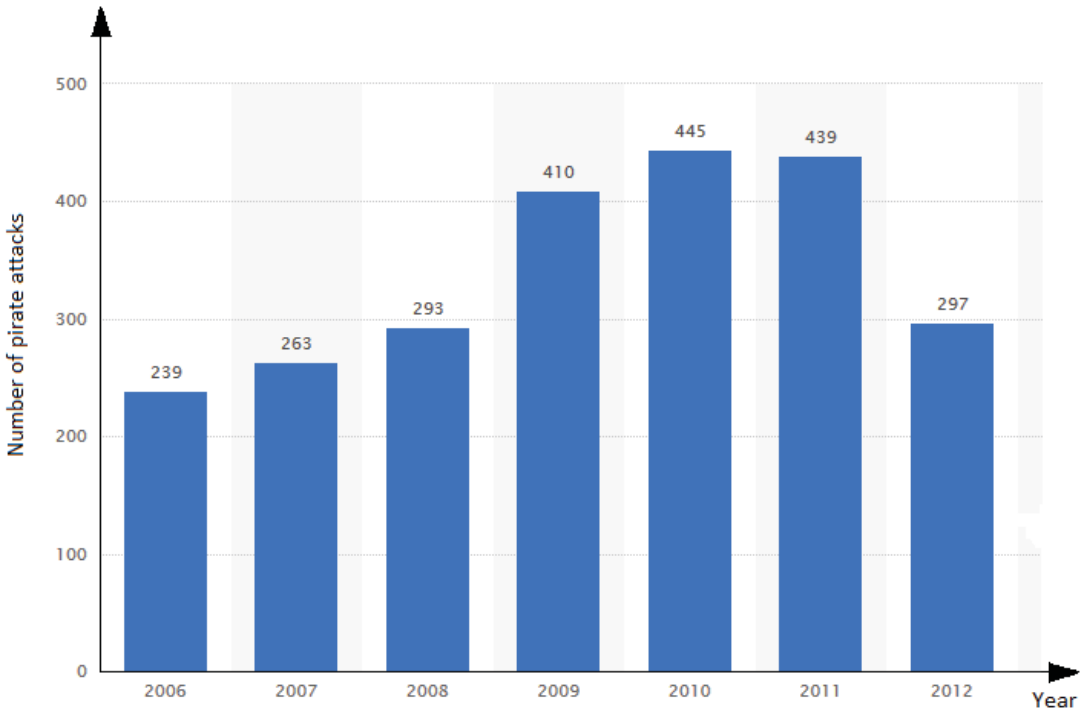


Figure 8. Number of pirate attacks against ships worldwide from 2006 to 2012

Source: http://www.statista.com/statistics/266292/number-of-pirate-attacks-worldwide-since-2006/

Figure 9. IMB Piracy and Armed Robbery Map 2014

Source: http://www.icc-ccs.org/piracy-reporting-centre/live-piracy-map

5.4. Language barrier

The language barrier represents a serious safety issue onboard ships. Since the dawn of times, people have tried to communicate with each other and to develop languages as the means of communication. This inherent human need resulted in thousands of languages, which naturally resulted in efforts to find common languages that would enhance communication among various populations who do not share a common language. In modern times, English language has become a *lingua franca*, i.e. the bridge or unifying language, in global economy and international maritime affairs. Language barriers have always affected the safety onboard ships with multi-national crew. As most of modern large vessels carry multi-national crews, English language has become, in most cases, the principal means of communication. However, problems often arise in communication during routine operations or even in emergencies when people react impulsively while they are supposed to respond effectively. It sometimes occurs that crew members under pressure start panicking and using their national languages. Language barriers onboard ships are not only about understanding orders but are involving other important issues such as social and cross-cultural aspects. Language as a means of communication is not the only factor that can cause misunderstanding and other problems that jeopardise the safety of the ship – the safety can be at risk due to conflicts arising from different social, cultural, even religious backgrounds. After adopting the criteria regarding the ships flying the flags of convenience, multi-language crews have become common, and so have the problems related to

onboard communication and cross-cultural behaviour of the crew members. Tragic examples include the disasters of the Ro-Ro ships Scandinavian Star and Estonia, and the tanker Sea Empress, where huge loss of lives or environmental disaster took place due to misunderstanding, unfamiliarity with the language, or errors in communication among the crew. [14]

As multi-national crews are here to stay onboard vessels, it is strongly recommended that they adopt English language as their bridge language, a lingua franca, and that the satisfactory proficiency in English is achieved by every crew member in order to improve onboard safety and avoid accidents and tragedies. Finally, English language is the language of the maritime industry and is widely used and applied by maritime shipping community.

6. FUTURE CHALLENGES TO THE SAFETY IN MARITIME INDUSTRY

The development of technologies has been followed by new problems and challenges that the maritime industry has to face. The distressing fact is that the important changes related to the improved safety at sea were introduced only as a response to maritime disasters that either claimed many human lives or caused extensive and long-lasting environmental damage. Such situations should be avoided by proactive analyses of potential threats and challenges in maritime navigation and, based on the obtained results and conclusions, by designing measures for improved safety of seaborne transport without harmful effects on people, cargo, ship and environment.

A serious problem threatening the safety in the field of maritime industry lies in the sluggish and complicated maritime legal regulations that tend to appease the shippers. For example, flags of convenience allow shippers to place economic criteria above safety criteria. This is directly related to the issue of additional costs associated with supplementary education and training of the workforce, which encourages most of the shippers to recruit cheaper labour from the developing countries. Many of these countries do not have sufficiently developed educational infrastructure to ensure the implementation of IMO standards and to meet international requirements regarding the levels of proficiency and competence of seafarers. Despite the efforts of the IMO and the international maritime community, the educational policies, grading standards and certificate-awarding criteria are not consistent in all countries. Some of the drawbacks of this inconsistency and recruitment of cheaper workforce are related to the insufficient proficiency in foreign language skills, in particular English language, which in crisis situations may put the safety of navigation at risk. The problem of multi-national manning does not only involve language barriers but also social and cross-cultural hurdles.

Piracy represents another serious threat to safety at sea. The efforts that have been made by the IMO and national governments are insufficient because statistical data show (Figure 8) that no major progress has been made in dealing with this issue over the past several years. Therefore it can be expected that piracy will remain one of the major threats to the safety of navigation and will likely continue to result in further loss of human lives, ships and cargo. It is undisputable that maritime shipping and the safety in maritime shipping have greatly benefited from the development of technologies but, given the above discussed problems, maritime industry has to put more effort into the enhancement of risk management and into minimising the above mentioned threats, dangers and risks.

7. CONCLUSIONS

It is certain that safety represents a crucial factor that affects all components of the maritime industry and that the safety of modern maritime shipping is the result of a set of initiatives, research, regulations and innovations. Despite great breakthroughs in technology and safety at the workplace, the marine industry is still a relatively dangerous place to work. It is true that the progress in construction, design, electronic appliances and helpful navigational devices fitted onto the bridge has resulted in the increased safety at sea. However, other safety issues have emerged, such as piracy or legislative regulations that allow shippers to reduce operation costs at

the expense of safety. Furthermore, insufficient manning leads to increased scope of work and, subsequently, fatigue and sleep deprivation of seafarers who are, consequently, less productive and more prone to accidents and injuries. Another issue arising from cutting operational costs is connected with hiring cheaper workforce from the countries which are unable to implement the adopted international standards in the professional education and training of seafarers. Global public awareness should be raised, the above discussed factors that jeopardise the safety of modern navigation should be analysed and adequate measures should be taken across the maritime community in order to minimise the factors that put the safety of maritime shipping and safety of navigation at risk.

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