ΑΚΑΔΗΜΙΑ ΕΜΠΟΡΙΚΟΥ ΝΑΥΤΙΚΟΥ

Α.Ε.Ν ΜΑΚΕΔΟΝΙΑΣ

ΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ

ΕΠΙΒΛΕΠΟΥΣΑ ΚΑΘΗΓΗΤΡΙΑ: ΠΑΝΑΓΟΠΟΥΛΟΥ ΜΑΡΙΑ

ΘΕΜΑ: **ACCIDENTAL INCIDENTS AT SEA**

ΤΟΥ ΣΠΟΥΔΑΣΤΗ: ΠΑΝΑΓΙΩΤΟΥ ΚΩΝΣΤΑΝΤΙΝΟ

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Ο ΔΙΕΥΘΥΝΤΗΣ ΣΧΟΛΗΣ : ΤΣΟΥΛΗΣ ΝΙΚΟΛΑΟΣ
ΠΛΟΙΑΡΧΟΣ Α’

ABSTRACT

This dissertation paper deals with various maritime accidental incidents, case studies of them and analyzes the factors that may or may not have contributed for the incident to take place. In the first chapter definition are given for the reader to fully comprehend and absorb the paper's content. Next there is a historical view of accidents and legislation rules that prove to be the pillars of today's International Safety Management Code (ISM Code). Thereafter, the most dangerous but yet common accidents are studied including marine pollution, piracies, fires on board and singings and how they can threaten the ship's seaworthiness and the crewmembers wellbeing. The case studies have been conducted in regards to the media reports and inquiries that have been published until today.

Contents

Introduction

Since the earliest times, the sea has always been synonymous with insecurity for those who venture on to it. He who would wish to sail without danger must never have come on the main sea, as the proverb puts it. This endemic absence of safety probably explains why early maritime trade was mainly the preserve of adventurers. The sea was associated with the idea of chance or fate, a concept still to be found in expressions such as "perils of the sea". Seaborne transport developed in such a laissez-faire way that the many accidents of which bold navigators were victims were soon accepted as part of the natural course of things.

The history of navigation since ancient times shows that the needs of safety came only gradually to the fore, in the wake of accidents and disasters, bringing about huge changes in the individual and collective behavior of those engaged in maritime activities, who clung to ancient practices and habits.

Chapter 1: Definition of Incidents and Accidents

1.1 Incidents

The word incident is quite vague. It can refer to a humorous occurrence or a violent one, something that disturbed one's routine or something unusual that happened. In our case an incident is an unexpected and usually unpleasant occurrence that happens at sea, during a ships voyage as well as her stay in port. Common marine incidents include groundings, capsize, flooding, fires, collisions with other boats or buoys or jetties or pontoons, falls within a boat or overboard, piracy, pollution and generally whatever affects the wellbeing of the vessel ,her crew and the surrounding area. Incidents involving injuries to people must always be reported to the authorities even if the boat does not sustain any material damage. The information gathered from marine incident reports helps to develop safety standards, education programs and on-water compliance programs that benefit all waterways users. Reporting a marine incident may also help you if you decide to make insurance claims on any damage. Some insurance companies may require a marine incident report to validate claims.

1.2 Accidents

An accident is an undesirable incidental and unplanned event that could have been prevented had circumstances leading up to the accident been recognized, and acted upon, prior to its occurrence. A marine accident does not include a deliberate act or omission, with the intention to cause harm to the safety of a ship, an individual or the environment. Accidents may be classified (in order of severity) as follows:

- **Very serious marine accident** means a casualty to a ship which involves the total loss of the ship, loss of life or severe pollution (Casualty Investigation Code, 2008). These are accidental situations where either the safety measures have not been implemented properly or have failed, or as manifestations of a poor safety culture. All safety measures and regulations have been designed to ensure the safety at the sea at all levels. The notion of a “safety culture” normally refers to the principles underlying operations that govern the performance of daily work and decision making. .

- **Serious marine accident** means a casualty which does not qualify as a very serious casualty and which involves:

- a fire, explosion, grounding, contact, heavy weather damage, ice damage, hull cracking or suspected hull defect, etc., resulting in
- structural damage rendering the ship unseaworthy, such as penetration of the hull underwater immobilization of main engines, extensive accommodation damage.
- pollution (regardless of quantity)
- a breakdown necessitating towage or shore assistance. (UK MAIB- Marine Accident Investigation Branch, 2012)

- **Less serious accident** are casualties to ships which do not qualify as very serious and can easily pass unnoticed.

Chapter 2: Accidental incidents and prevention: Historical review

2.1 Insecurity at Sea in Ancient Times

It might be thought that there were relatively few risks at sea in olden times, when craft of modest size, and few in number, using sails or oars as their mode of propulsion, never ventured far from the coast. In fact, the period was one of persistent insecurity, making sea voyages extremely hazardous.

Until the end of the Roman Empire, seafarers were ill equipped to confront bad weather. Passengers and bulky cargoes were packed together on deck. Ships were loaded well beyond safety limits. Navigators knew little about winds. Derisory efforts were made to combat storms as the ship was bound round with ropes fore and aft, to prevent it splitting apart, and an anchor was dragged behind to slow down its progress.

Another method of dealing with imminent danger was to cast objects overboard such as the cargo, rigging and even victuals were jettisoned to lighten the vessel. The decision was taken by the captain, the ship's owner, or the most prominent or experienced passengers.

Ultimately, the safety of a voyage rested on the shoulders of a single man, the equivalent of the captain in ancient times. He bore technical responsibility for and the choice of the safest route and ports of call. However, his decisions were overridden by ship owners anxious to earn higher profits by sailing even in bad weather. Some ships took even greater risks than warships, and this explains the frequency with which shipwrecks occurred.

2.2 Incidents and prevention in the Middle Ages

Conditions of navigation underwent very little significant change throughout the middle ages. Ships stayed in port in winter. Until the end of the l8th century, the Levantines sailed only from 5 May to 26 October.

Advances in ship safety did occur in the Middle Ages, with the implementation of the first preventive rules on loading. According to commentators, these originated in the Lex Rhodia which is the ancient ancestor of Maritime Law. From the mid-13th century, the maritime authorities in large Mediterranean ports introduced very strict legislation on freeboard, in order to combat the abuses of unscrupulous ship owners and captains who overloaded their ships, at the risk of losing them, in order to earn more from the freight. The very first regulations appeared in Venice in 1255. They made it illegal to exceed the draught, marked on each ship by a cross. Similar provisions were to be found in Cagliari and Pisa at the same period, and also in Barcelona, in the decree issued by Iago de Aragon in 1258, and in the maritime statutes of Marseilles in 1284. The most elaborate regulations appeared in the 14th-century Genoese statutes.

In 1330, the maritime authorities in Genoa had already laid down not only very precise rules for calculating the maximum draught of certain ships, but also an inspection procedure and a whole range of penalties for anyone contravening the rules.

2.3 First Navigation Rules

The 19th century saw the first regulations on navigation at sea. Around 1840, with the earliest steamships, a number of nations became concerned about what steps could be taken to avoid collisions and shipwrecks. At the time, each of them acted separately. No ships carried navigation lights, except warships travelling in squadron by night. Whenever two vessels approached each other, it was customary to show one's presence by hoisting a flag or lighting a flare. British ships applied the signaling rules proposed by W.D, Evans, regarded as the father of present-day regulations.

The simplicity and effectiveness of British rules were appreciated by seamen in all countries, to such an extent that France, where maritime circles had long been calling for uniform legislation, signed an agreement in 1848 with Great Britain about the lighting of steamships. This was not exactly an international convention, but simply the acceptance of identical general rules in both countries. This first agreement met with resounding success, however, for its provisions were immediately copied and adopted by other leading maritime nations.

France and Britain subsequently signed other agreements, gradually setting up a proper maritime traffic policing force. An 1852 agreement covered signaling for sailing ships. In 1856, a series of rules on maritime signals established a communications guide containing 78,000 combinations of only eighteen flags. Another agreement in 1856 set standards for navigation in fog, and in 1862 the first joint rules for routes at sea were laid down. In 1884, the two countries signed a treaty on lighting of fishing boats and special signals to be assigned to telegraph cable-laying ships.

2.4 Navigation rules in the 20th century: The Internationalization of Regulations in the 20th Century

The quest for some uniformity of national rules and customs regarding safety at sea has intensified throughout the 20th century. But before going back over the main steps in this internationalization of maritime law, it is worth summarizing the causes of the trend.

Thus we have the followings:

- **Problem of the high seas:** The problem mainly involved the high seas, where the principle of freedom traditionally prevailed. It was very soon realized that it was in everyone's interest to agree on a minimum of rules to be respected, for both signals and traffic. These came to form the "common law of the sea'", covering rules for navigation, rescue and collisions.

- **Foreign ships in port:** In the early years of the century, every State laid down its own conditions for the control of ships in its ports.

- · **Regulation of competition:** Maritime trade has always been subject to fierce international competition. Repeated maritime disasters gradually convinced national legislators that economic rivalries, particularly as regard fleet operation, could endanger safety and bring this form of transport irretrievably into disrepute. It was realized that only an agreement among States, laying down minimum standards to be met by a particular ship performing a particular service, could offer a satisfactory long-term solution.

Chapter 3: Marine Pollution

Ships can pollute waterways and oceans in many ways. Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons found in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment. Oil spills are probably the most emotive of marine pollution events. Exhaust gases from ships are considered to be a significant source of air pollution, both for conventional pollutants and greenhouse gases. Cruise ships, large tankers, and bulk cargo carriers use a huge amount of ballast water, which is often taken on in the coastal waters in one region after ships discharge wastewater or unload cargo, and discharged at the next port of call, wherever more cargo is loaded. Ballast water discharge typically contains a variety of biological materials, including plants, animals, viruses, and bacteria. These materials often include non-native, nuisance, invasive, exotic species that can cause extensive ecological and economic damage to aquatic ecosystems along with serious human health problems.

3.1 Types and causes of pollution

<u>Pollution by oil</u>

Pollution by oil cargoes receive a lot of attention in the media but is actually a minor contributor to oil pollution worldwide. The most common type of pollution is caused by bunker heavy oil. Pollution by heavy oil is serious due to its chemical consistency and properties, thus having a more harmful impact on the maritime environment and making clean-up more difficult and expensive. Pollution by oil can occur:

- During bunkering operations
- During shipboard operations such as re- pumping and/or ballast measures
- Due to an accident such as collusion or grounding
- As a deliberate act of discharging oil into the sea, which constitutes a criminal act.

During bunkering operations, weather in port or alongside or at anchor, utmost care and attention is required by all crew members involved. The prevention of pollution by oil is covered by MARPOL 73/78 Annex I.

Pollution by noxious liquid substances

Pollution by chemicals is rare and occurs mainly during cargo operations, or as consequence of an accident such as collusion. However, the damage to the environment in such occasions may be catastrophic, depending of the nature of the chemicals escaping from the vessel, and the effects are immediate and long-lasting. The prevention of such pollution is covered by MARPOL 73/78 Annex II.

Pollution by harmful substances in packaged form

Pollution by dangerous goods occurs occasionally by accident when cargo is lost overboard and to lesser extent, during operations. The prevention of dangerous packaged goods pollution is covered by MARPOL 73/78 Annex III.

Pollution by sewage

More stringent regulations to prevent pollution by sewage and thus avoid detrimental effects on the marine environment and its flora and fauna have been required due to the increasing number of passengers carried by ship. MARPOL 73/78 Annex IV sets out regulations for the prevention of pollution by sewage from ships.

Pollution by garbage

Pollution by disposal of ship’s garbage is not only prohibited under MARPOL Annex V, but also constitutes a criminal offence similar to pollution by oil in most jurisdictions. Pollution by garbage is mainly caused by careless or international disposal overboard. It has various impacts on the environment. Garbage not only pollutes beaches and estuaries but also harms marine fauna. It can seriously disrupt factories which are located on waterways and use water for cooling purposes, by blocking their suction cages. In ports with garbage disposal facilities, garbage disposal should be carried out in accordance with the vessel’s Garbage Management Plan. Garbage includes ship’s domestic waste, wrappings from provisions and stores delivered on board, sweeping from the cargo holds.

Pollution by ballast water

Ballast water from vessels is one of the major sources of the global introduction and spread of harmful aquatic organisms and pathogens. On 1 December 1997, the IMO Assembly adopted Guidelines for the Control and Management of Ship’s Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens.

Certain port States have imposed significant control procedures, detentions and fines on vessels discharging ballast water in their jurisdictions.

Air pollution

Air pollution is caused by deficiencies in vessels' exhaust pipe filters when burning heavy fuel oil. Air pollution from exhaust gases contributes to global warming and can be reduced by achieving a more efficient combustion of fuel oils. Although less prevalent today, pollution of air by soot from the ship's funnel may still occur. In such instances, not only can soot particles be carried out from miles, but also clean-up is labour intensive and costly. Annex VI to MARPOL 73/78 sets out regulations for the prevention of air pollution. Also, there are EU directives on restrictions on the use of MDO (Marine Diesel Oil).

3.2 Dangerous goods

Dangerous goods or hazardous goods are solids, liquids, or gases that can harm people, other living organisms, property, or the environment. The IMDG Code or International Maritime Dangerous Goods Code is accepted as an international guideline to the safe transportation or shipment of dangerous goods or hazardous materials by water on vessel. IMDG Code is intended to protect crew members and to prevent marine pollution in the safe transportation of hazardous materials by vessel. It is recommended to governments for adoption or for use as the basis for national regulations. Dangerous goods are often indicated by diamond-shaped signage on the item, its container, or the building where it is stored. The color of each diamond indicates its hazard, e.g., flammable is indicated with red, because fire and heat are generally of red color, and explosive is indicated with orange, because mixing red (flammable) with yellow (oxidizing agent) creates orange. A nonflammable or nontoxic gas is indicated with green, because all compressed air vessels are this color in France after World War II, and France was where the diamond system of hazmat identification originated. Dangerous goods are divided into nine classes on the basis of the specific chemical characteristics producing the risk:

1. Explosives

2. Gasses

3. Flammable liquids

4. Flammable solids and other flammable substances

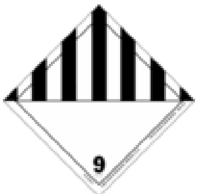
5. Oxidizing substances and organic peroxides

6. Toxic and infectious substances

7. Radioactive material

8. Corrosive substances

9. Miscellaneous dangerous substances and articles



3.3 Air Pollution

Ships pour out large quantities of pollutants into the air, principally in the form of Sulphur and nitrogen oxides and particulate matter. The emissions from ships engaged in international trade in the seas surrounding Europe - the Baltic, the North Sea, the north-eastern part of the Atlantic, the Mediterranean and the Black Sea - are estimated to amount to 1.6 million tonnes of Sulphur dioxide and 3 million tonnes of nitrogen oxides a year in 2015. In contrast to the progress in reducing emissions from land-based sources, shipping emissions of Sulphur and nitrogen oxides have steadily been increasing over the last thirty years. While recently introduced Sulphur standards at global and EU levels have halted this increasing trend for SO2-emissions (at least in the Sulphur Emission Control Areas - SECAs) in northern Europe and North America), NOx-emissions are expected to continue increasing. As a result, within ten years the NOx-emissions from international shipping around Europe is expected to equal or even surpass the total from all land-based sources in the 28 EU member states combined. Technical measures to cut air pollution from ships by 80 to 90% are easily implementable. The benefits would considerably outweigh the costs involved. These include the adoption of cleaner fuels, adding 'scrubbers' or other exhaust gas cleaning devices to ships and wider use of alternative sources of energy, including wind power and port-side electricity.

In 2008, the UN International Maritime Organization (IMO) revised its standards on the Sulphur content of marine fuels (contained in MARPOL Annex VI). In October 2012, the standards were officially transposed in Europe. Under the current EU regulations:

1. From 2015, ship sailing in the Sulphur Emission Control Areas (SECAs) cannot use fuel with more than 0,1% of Sulphur. European SECAs currently include the Baltic Sea, the North Sea and the English Channel;
2. Globally, ships will have to cut their fuel's Sulphur content to a maximum of 3.5% in 2012 and to 0.5% in 2020. While the latter limit will be subject to review in 2018 at the IMO, the EU decided to firmly stick to the implementation date of 2020;
3. In Europe only, passenger ships sailing outside SECA will have to respect a limit of 1,5% Sulphur fuels, which was set in 2005.
4. Different compliance methods are offered to ship owners. Instead of using marine diesel, shipping operators can choose to switch to LNG-fueled ships or to cut their Sulphur emissions by fitting engines with scrubbers or other exhaust gas cleaning technologies.

3.4 Exxon Valdez Oil Spill Incident

On March 24, 1989, the tanker Exxon Valdez grounded on Bligh Reef in Alaska's Prince William Sound, rupturing its hull and spilling nearly 11 million gallons of Prudhoe Bay crude oil into a remote, scenic, and biologically productive body of water. The very large spill size, the remote location, and the character of the oil all tested spill preparedness and response capabilities. Government and industry plans, individually and collectively, proved to be wholly insufficient to control an oil spill of the magnitude of the Exxon Valdez incident. Initial industry efforts to get equipment on scene were unreasonably slow, and once deployed the equipment could not cope with the spill. Moreover, the various contingency plans did not refer to each other or establish a workable response command hierarchy. This resulted in confusion and delayed the cleanup.

Picture 1: Exxon Valdez spilling oil into the sea

The governor of Alaska declared the situation an emergency and placed responsibility for the cleanup in the hands of the oil group Exxon. The company acknowledged its responsibilities and stated that it would take full charge of the organization of clean-up and cover the costs. Floating booms and skimmer barges were deployed. To prevent the whole cargo from spilling into the sea the oil from within the Exxon Valdez was rapidly transferred into the tanker Exxon Baton- Rouge. In two months 7,000 km^2 of drifting slicks polluted 800 km of coastline (1,700 km including all the inlets and islets). Tens of thousands of professionals and volunteers, with unprecedented means (1,400 vessels and 85 helicopters), were deployed to save seabirds and mammals and to clean-up the shoreline, beach by beach. The main response techniques used were manual and mechanical clean-up, pumping, washing (cold water low pressure washing and high pressure washing with hot water and detergents) and bioremediation.

The spill was the worst that had occurred up to that point in American history, damaging more than 1,300 miles of shoreline, disrupting the lives and livelihoods of people in the region and killing hundreds of thousands of birds and marine animals. The Exxon Valdez spill, though still one of the largest ever in the United States, has dropped from the top 50 internationally. It is widely considered the number one spill worldwide in terms of damage to the environment, however. The timing of the spill, the remote and spectacular location, the thousands of miles of rugged and wild shoreline, and the abundance of wildlife in the region combined to make it an environmental disaster well beyond the scope of other spills.

Chapter 4: Piracy

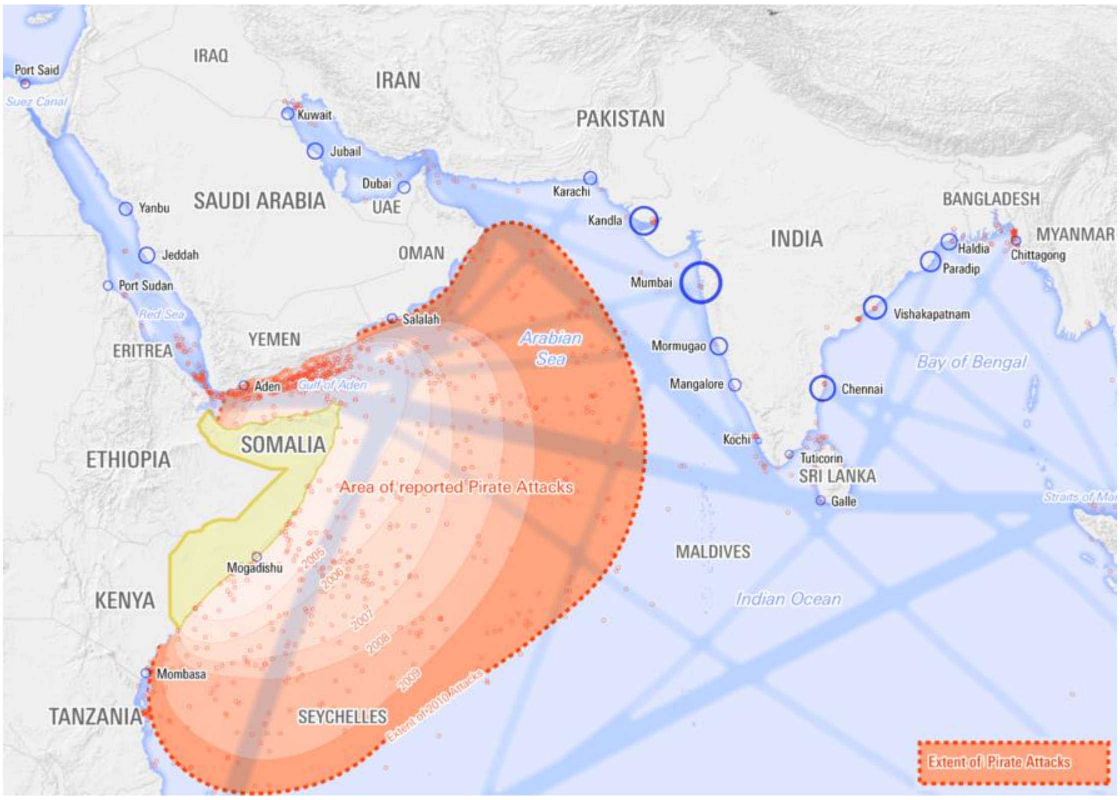
According to the IMO, "*Piracy is an act of boarding or an attempt to board a ship with the intent to commit theft of the intent or capability to use force in the furtherance of that act or the intent or capability to use force in the furtherance of that act*"(IMO,2005) . Piracy may appear in many forms like a quick theft attempt or may involve an organized crime syndicate that seeks to hijack ships and hold the crew as hostages. It is a worldwide problem with higher concentrations in Southeast Asia and the waters between Somalia and Yemen. We must also underline that the odds of a piracy attack are greater when a ship is in port, but ships that are underway are vulnerable too. Moreover piracy as a form of an incident may lead to further catastrophes. For example, if all the crew is being held as hostages and no one is in the bridge, the vessel might be vulnerable to a collision accident. Piracy actions may cause economic loss as many times a lot of money are paid to pirates, in ransom, from piracy acts.

4.1 The Problem

The issue of piracy against merchant vessels poses a significant threat to world shipping. In 2015, there were 439 pirate attacks and 45 merchant vessels hijacked worldwide. 237 of these attacks and 28 of these hijackings occurred in the Gulf of Aden, off the coast of Somalia, and in the wider Indian ocean. As of spring-2016 there have been more than 51 attacks off Somalia (121 worldwide), 11 hijackings off Somalia (13 worldwide), and over 158 hostages taken off Somalia. Currently, 12 ships and more than 170 seafarers are being held hostage by Somali pirates for ransom.

Although liner vessels, container ships and roll-on/roll-off vessels are generally considered to be at lower risk for hijackings because of their higher operating speeds and freeboard, liner vessels have been consistently targeted by Somali pirates. In 2014, 32 liner vessels were attacked and six were hijacked. In 2015, 65 liner vessels were attacked and one was hijacked. As of spring-2016, eight liner vessels have been attacked and one has been hijacked.

Somali pirates are now using hijacked merchant ships as mother ships to carry out attacks in the north Arabian Sea and near the coastline of India, more than 1500 nautical miles from Somalia. Pirates operate multiple, high-speed skiffs to approach and fire on the bridges of vessels with automatic weapons and rocket propelled grenades in an attempt to slow or stop the vessels so the pirates can get on board. Once a vessel has been hijacked, the pirates typically request a large ransom payment for the safe return of the crew, vessel and cargo.



Picture 2: Extent of Pirate Attacks 1

4.2 Finding Solutions

Successfully addressing this threat is a complex challenge for both governments and businesses. The World Shipping Council (WSC) and its member companies are working closely with the International Chamber of Shipping (ICS), other international maritime trade associations, the International Maritime Organization (IMO), and various governments to closely monitor the ongoing piracy crisis in the Indian Ocean and to reduce the risk that commercial vessels transiting the affected region will be attacked and successfully hijacked.

The WSC is playing an active role in the development and revision of the industry Best Management Practices (BMPs) for ships to prevent and respond to pirate attacks. Specifically, the BMPs call on vessels to communicate their intentions to transit the piracy high risk area to Naval Forces in the region and to employ vessel self-protection measures based on a vessel-specific risk assessment. The BMPs also provide ships with important steps to take if boarded by pirates.

To help address the piracy issue, the IMO Maritime Safety Committee, recently approved interim guidance to ship owners/operators for the use of private armed guards on ships operating in the high risk area, and draft interim recommendations to flag states on the use of private armed guards. In an effort to increase the governmental response to the Somali piracy crisis, the leading maritime shipping associations and the International Transport Workers' Federation (ITF) have initiated the "Save Our Seafarers" campaign, in which governments are asked to take the following steps to eradicate piracy at sea and ashore:

- Reduce the effectiveness of the easily identifiable pirate mother ships.
- Authorize naval forces to detain pirates and deliver them for prosecution and punishment.
- Fully criminalize all acts of piracy and the intent to commit piracy under national laws in accordance with their mandatory duty to cooperate to suppress piracy under international conventions.
- Increase naval assets available in the area.
- Provide greater protection and support for seafarers.
- Trace and criminalize the organizers and financiers behind the criminal networks.

4.3 The Maersk Alabama Incident

MV Maersk Alabama is a 17,375 DWT container ship owned by Maersk Line Limited and flying the USA flag. On April 7, 2009, the U.S. Maritime Administration, following NATO advisories, released a Somalia Gulf of Aden advisory to mariners recommending ships to stay at least 600 nautical miles off the coast of Somalia. On April 8, 2009, four Somali pirates boarded the Maersk Alabama when it was located 240 nautical miles southeast of the Somalia port city of Eyl. With a crew of 20, the ship was on route to Mombasa, Kenya. The ship was carrying 17,000 metric tons of cargo, of which 5,000 metric tons were relief supplies bound for Somalia, Uganda, and Kenya. According to Chief Engineer, the engineers sank the pirate speedboat shortly after the boarding by continuously swinging the rudder of the Maersk Alabama thus scuttling the smaller boat. As the pirates were boarding the ship, the crew members locked themselves in the engine room while the captain and two other crew members remained on the bridge. The engineers then took control of the ship from down below, rendering the bridge controls useless. The pirates were thus unable to control the ship. The crew later used "brute force" to overpower one of the pirates, who they managed to overpower and capture.

Frustrated, the rest of the pirates decided to leave the ship, and took the captain of the vessel with them to a lifeboat as their bargaining chip. The crew attempted to exchange the captured pirate, whom they had kept tied up for twelve hours, for the captain. The captured pirate was released but the pirates refused to release Phillips in exchange. Since the battery had died on the open-air boat, they left in the ship's covered lifeboat, taking Phillips with them. The lifeboat carried ten days of food rations, water and basic survival supplies. On April 8, the destroyer USS Bainbridge and the frigate USS Halliburton were dispatched to the Gulf of Aden in response to a hostage situation, and reached Maersk Alabama early on April 9. Maersk Alabama then departed from the area with an

Picture 3: Maersk Alabama lifeboat as seen from a scan eagle

armed escort, towards its original destination in Mombasa, Kenya, with the vessel's chief mate in charge. On Saturday, April 11, Maersk Alabama arrived in the port of Mombasa, Kenya, still under U.S. military escort, where the chief mate was relieved by a new captain, who had previously been captain of the Maersk Alabama until he was relieved eight days prior to the pirate attack. An 18-man marine security team was on board. The FBI secured the ship as a crime scene.

On April 9, a standoff began between the navy ship USS Bainbridge and the pirates in the Maersk Alabama's lifeboat, where they continued to hold Captain Phillips hostage. Three days later, on Sunday, April 12, Navy marksmen opened fire and killed the three pirates on the lifeboat, and the captain was rescued in good condition. The USS Bainbridge captain Commander, with prior authorization from U.S. President, ordered the action after determining that Phillips' life was in immediate danger, based on reports that a pirate was pointing an AK-47 assault rifle at his back. U.S. Navy SEAL snipers on USS Bainbridge's fantail opened fire, killing the three pirates with bullets to the head. A fourth pirate, aboard the USS Bainbridge and was treated for an injury sustained in the takeover of Maersk Alabama. He was taken into custody and later in court pleaded guilty to piracy charges and was sentenced to more than 33 years in prison.

Chapter 5: Fires on Board

5.1 The theory of Fire and Classification

Fire or combustion is the result of rapid oxidation and energy is given off in the form of heat and light. In order for any substance to oxides, its molecules must be well surrounded by oxygen molecules. Molecules of any solid or liquid are too tightly packed to be surrounded. Thus only vapor can burn. When a solid or liquid is gradually heated, its molecules move around rapidly and some molecules will break away from its surface and form vapor just above its surface. This vapor will mix with oxygen and start to burn. The burning vapor produces heat that release and ignites more vapor from the material concerned thus staring a chain reaction.

Elements required for a fire to start are:

1. Fuel which will vaporize and burn.
2. Heat to raise temperature of fuel vapor to ignition temperature.
3. Oxygen from air or form oxidizing agent to combine with fuel vapor.

Picture 4: Filre Triangle

If any element of this fire triangle is missing, a fire cannot start and if any element of this fire triangle is removed, a burning fire will die out.

In order to successfully put out a fire, you need to use the most suitable type of extinguishing agent—one that will do the job in the least amount of time, cause the least amount of damage and result in the least danger to crew members. The job of picking the proper agent has been made easier by the classification of fire types, or classes, lettered A through D. Within each class are all fires involving materials with similar burning properties and requiring similar extinguishing agents. However, most fuels are found in combinations, and electrical fires always involve some solid fuel. Thus, for firefighting purposes, there are actually seven possible fire classes. Knowledge of these classes is essential to firefighting, as well as knowing the burning characteristics of materials found aboard vessels.

Class A — Fires of common combustible solids such as wood, paper and plastic are best put out by water, a cooling agent. Foam and certain dry chemicals, which act mainly as smothering or chain-breaking agents, may also be used.

Class B — Fires caused by flammable liquids such as oil, grease, gas and other substances give off large amounts of flammable vapors and require smothering agents to do the job. Dry powder, foam and carbon dioxide (CO_2) may be used. However, if the fire is being supplied with fuel by an open valve or broken fuel line, you must first shut down the source of the fuel. This action alone may stop the fire or at least make it easier to put out. In a gas fire, it is important to shut down the source of the fuel. Attempting to put out the fire without shutting down the sources, creates an explosive hazard that is more dangerous than the fire itself. If may be necessary to put out a gas fire before shutting down the fuel supply in order to save a life or reach the supply valve, but these should be the only exceptions.

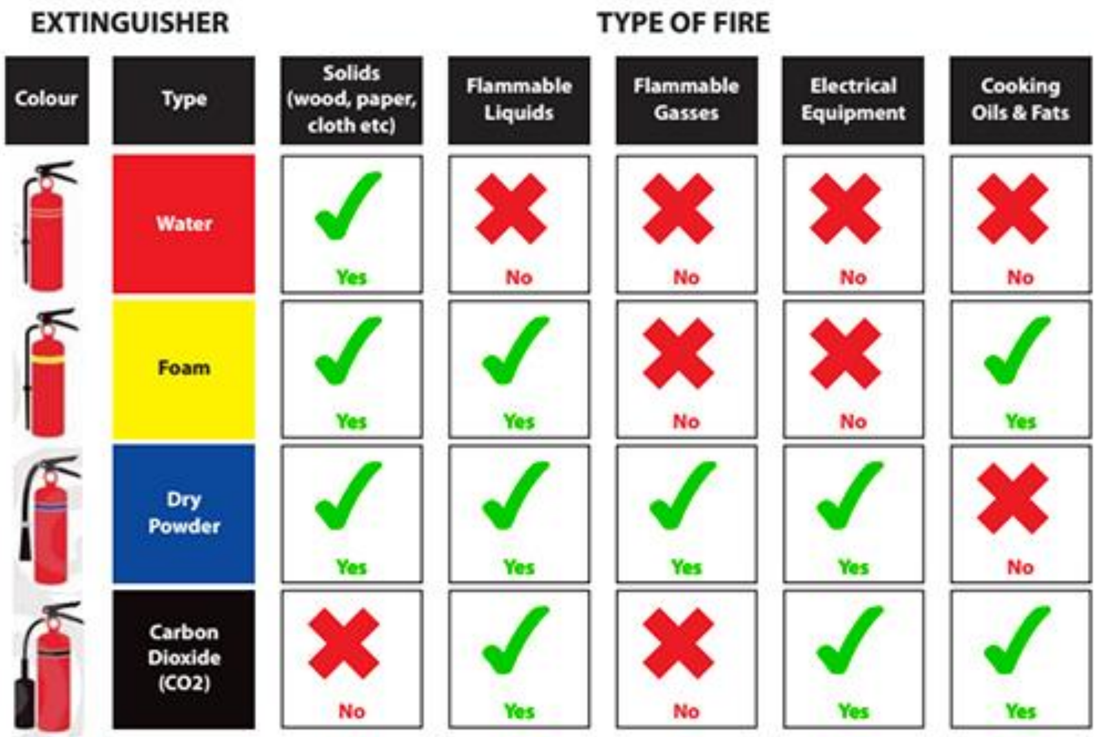
Combination Class A and B — Water fog and foam may be used to smother fires involving both solid fuels and flammable liquids or gases. These agents also have some cooling effect on the fire. In enclosed spaces, CO_2 may also be used. Caution: CO_2 robs the air of oxygen and can suffocate a person using CO_2 to put out the fire in enclosed spaces.

Class C — For fires involving energized electrical equipment, conductors or appliances, non-conducting extinguishing agents must be used such as CO_2, Halon and dry powder. Note that dry chemical may ruin electronic equipment. Always attempt to remove the source of electricity to remove the chance of shock and the source of the ignition.

Combination Class A and C — Since energized electrical equipment is involved in these fires, non-conducting agents must be used. CO_2, Halon, and dry powder are best. CO_2 reduces the oxygen supply, while the others break the chain reaction. It’s crucial to always try to de-energize the circuit.

Combination Class B and C — Again, a non-conducting agent is required. Fires involving flammable liquids or gases and electrical equipment may be extinguished with Halon or dry powder acting as a chain reaction breaker. In enclosed spaces, they may be extinguished with CO_2.

Class D — These fires may involve combustible metals such as potassium, sodium, and their alloys, and magnesium, zinc, zirconium, titanium and aluminum. They burn on the metal surface at very high temperature, often with a brilliant flame. Water should not be used on Class D fires. It may add to the intensity and cause the molten metal to splatter. This, in turn, can extend the fire and inflict serious burns on those nearby.



Picture 5: Suitable fire extinguishers for different classes

5.2 Common causes of Fires Onboard

If you ask someone unfamiliar with the world of shipping what the greatest fear of a sailor might be you will get an almost universal response of drowning. If you ask the sailor about his greatest fear directly the almost universal answer is fire. There is tons of gear to keep us from drowning but fire is a whole different issue. Fire practices are stressful events so the real thing is no fun at all. Fire Regulations on board ships began to change dramatically about one hundred years ago, shortly after the Titanic sank. Two international conventions set most of the rules for firefighting, equipment, and training. The first is Safety of Life at Sea (SOLAS) which finds its roots in the Titanic disaster. The other is the Convention on Standards for Training, Certification, and Watch Keeping (STCW) which first appeared in 1978 and had major amendments in 1984, 1995, and will have another soon with the full implementation of the Manila Amendments by 2017.

Careless smoking tops the list of causes of fire. Smoking is a strong habit and as such not only people tend to smoke without any regard to circumstances or location but also they hardly pay any heed to the safe disposal of lit cigarettes, cigars, pipe tobacco and matchsticks. Temperature of a burning cigarette is about 500 degrees Celsius. Thus glowing ashes and tobacco contain enough heat to start a fire in such materials as dunnage, paper, cardboard, cordage, linen and beddings. If a person is tried after a busy day and smoking in bed, a smoldering fire can result if the glowing tobacco touches the bedding, resulting smoke will most certainly cause drowsiness and possible suffocation or asphyxiation of this person before the fire is discovered. A person who has been drinking alcohol and smoking too, tends to be careless and has to be observed carefully by other crew members so that his careless actions do not jeopardize safety of crew and vessel. Smoking is therefore permitted on board a ship, only in designated smoking areas. These areas must be identified and clearly marked thus. In port, shore personnel boarding vessel for various works should be appraised of shipboard smoking regulations as well as locations of designated smoking areas on board. Safety matches and cigarette lighters must never be carried on person outside ship’s accommodation. Many terminals expressly forbid smoking or even carrying on person of matchboxes or cigarette lighters, around their premises.

All fires require air, fuel and heat to ignite and sustain their flames. Most ships have all three of these fire ingredients in their boiler rooms or other areas with heavy machinery. Boiler rooms are warm areas where fuel is present and gases are in pipes under high pressure. A leaky pipe or fuel reservoir and a discarded cigarette may be all a fire needs to ignite. Leaky high-pressure pipes, puddles of fuel or oil and exhaust gases all contribute to the risk of an onboard fire. Leaks may be caused by a breakdown in clamps or connections between pipes and gauges. These environmental factors, when mixed with human factors like negligence and laziness, create a ripe environment for fires. Some materials when damp or soaked with paints, oils of vegetable origin in particular can ignite without external application of heat. Auto ignition temperature of a material is the temperature at which a flammable material will ignite without initiation of a spark or flame. Spontaneous combustion is the process of gradual increase in temperature of a material as a result of oxidation, without drawing any heat from its surrounding. This process finally results in ignition of the material concerned. Lagging on steam pipes or cotton rags if soaked with oils and or paints and stocked in a warm area without ventilation is prone to spontaneous combustion. This oil begins to oxidize and produces heat in the process. This heat causes the remaining oil to oxidize faster and produce still more heat that will start building up around the rag. This in turn will ignite any other flammable substance resulting in a major fire. Petroleum liquids when heated sufficiently will ignite without the application of a naked flame. When fuel or lube oil under pressure sprays onto a hot surface, it will get hotter and will auto ignite as a result.

Electricity is a safe and convenient source of power if the equipment concerned is properly insulated and wired. If worn-out, misused or poorly wired electrical energy is converted into heat and the equipment concerned becomes a source of ignition and thus a fire hazard. Only approved electrical equipment for shipboard use that will stand the strenuous conditions at sea are installed and used on board a ship. Any electrical equipment onboard must be installed, maintained, tested and repaired in accordance with existing regulations and only by qualified personnel.

Other causes of onboard fires include oily rags and a type of heat-producing bacteria known as thermophilic bacteria. All ship machinery must be maintained, which often requires oil and other lubricants. However, the rags used to apply these lubricants are common fire starters, since oil is highly flammable and can actually self-ignite at high temperatures. Machinists must be diligent in their efforts to clean up after servicing equipment, and other crew members should pitch in and notify superiors when rags present a fire hazard. Thermophilic bacteria may cause trash can fires on board ships. This type of bacteria can build up in garbage cans where flammable waste, like oily rags, is mixed with biodegradable waste, like food. As these items break down, the bacteria makes enough heat to cause a fire if the waste is exposed to air, such as when someone opens the can to dispose of something.

5.3 Fire Incidents At Sea

5.3.1 Norman Atlantic

MS Norman Atlantic is a roll-on/roll-off passenger (ROPAX) ferry owned by the Italian ferry company Visemar di Navigazione. The ferry was chartered by ANEK Lines from December 2014. On 28 December 2014, Norman Atlantic caught fire in the Strait of Otranto, on a ferry run from Patra to Ancona. A fire broke out on the car deck just before 6:00 am local time, half an hour after leaving port of Igoumenitsa, Greece, an intermediate stop, when she was 44 nautical miles northwest of the island of Corfu, 33 nautical miles northwest of the island of Othonoi. At the time she was carrying 222 vehicles, 487 passengers, and 12 crew. The heat from the fire permeated the entire ship, even starting to melt people's shoes on the reception deck. The incident happened in Greek territorial waters but with night closing in, the ship started drifting towards Albania. There were gale-force winds and lashing rain.

Picture 6: Flaming Norman Atlantic

Passengers assert that the order to abandon ship was not given until four hours after the fire had started. Despite their cabins filling with smoke, no alarm had sounded. They also state that the crew of Norman Atlantic gave them little assistance. One group of 49 managed to escape in a lifeboat, but others were prevented from doing so as two of the four lifeboats were destroyed by the fire. The lifeboats had a capacity of 160 people each. Survivors described "scenes from hell" on board the burning ship, with the ship's crew overwhelmed by the crisis and jungle law prevailing rather than an orderly evacuation. Those in the lifeboat were rescued by the Singapore-registered container ship Spirit of Piraeus and landed at Bari, Italy.

Much has already been reported in the media with relation to factors and defects of the vessel that may have contributed to the maritime tragedy. These issues must be examined and researched carefully in the immediate future by technical and legal consultants of the victims, as they may play an important role in the determination of the extent and nature of the possible liability of the ship owners, the managers and those persons who are responsible for the safety of the ship and crew. Among the list of issues that must be examined are:

- the reported recent deficiencies that had been verified by the authorities concerning safety equipment and procedures
- the causes of the fire in the garage
- the reasons for the inability of the ship to respond to the fire by its own means and to restrict and shut it off effectively;
- the discrepancies in the coordination of passengers
- the fact that unlisted persons were onboard, possibly including undeclared stowaways in the garage.

5.3.2 MSC Flaminia

The accident occurred on 14th of July 2012 in the Atlantic Ocean. The German-flagged full container MSC Flaminia was en route back from the east coast of the United States to Europe. The ship sailed out of the port of Charleston on 8 July 2012.

There were 23 crew members and two passengers on board. In total the ship was carrying 2,876 containers of various sizes, from which 149 were full of dangerous goods. On 14 July 2012, a sample extraction smoke detection system alarm sounded on the bridge. The alarm indicated smoke in cargo hold 4. The lookout sent from the bridge to the cargo hold confirmed there was fire in the hatch. Following that, the officer on watch sounded the general alarm. After everybody was accounted for, closed-down state was established around cargo hold 4. CO2 was discharged into the affected cargo hold to fight the fire. The area around cargo hold 4 was to be cooled down later. A team of seven crew members was working in this area to make the necessary preparations when a heavy explosion occurred 2 hours later.

Picture 7: MSC Flaminia in flames

After the explosion followed a rapid outburst of the fire. All passengers and the crew were commanded to abandon the ship. The victims of this accident were 2 crew members who died. Some crew members were rescued and transferred on board DS Crown and the rest were taken to the MSC Stela.

Chapter 6: Human Injury and Fatalities on Merchant Vessels

6.1 Fatalities and Injuries

Merchant seafaring has long been one of the most hazardous occupations. It has also been associated with high risks of mortality from fires, groundings, explosions flooding and various other accidents that can occur on merchant vessels. Throughout almost all of the 20th century, there was a sharp reduction in the fatal accident rate among seafarers in the trade. This was linked to several factors, including improvements in ship design, safety equipment and rescue services, a reduction in hazardous working practices and an increase over time in passenger shipping with a reduction in higher risk cargo shipping.

Speaking at the opening of the first meeting in 2016, the Sub-Committee on Fire Protection, IMO Secretary said that the number of lives lost annually at sea had been over 1,000 for each of the past five years. In 2015 the IMO Secretariat counted 1051 lives lost, compared with 1095 in 2014, 1501 in 2013, 2395 in 2012 and 1942 in 2011. The 2015 figures, which include passengers, were broken down into approximately 100 in fishing, 400 in domestic operations and 500 in other categories, including international shipping, with the proportions remaining roughly the same over the five years.

The Secretary’s target is to reduce the annual number of lives lost at sea by half by 2018. The current level is over 1,000. We should aim at below 500 he said and continued “ You may say one life lost is too many, I would say, if one is too many, then 1,000 is astronomical and 500 is still too many.”

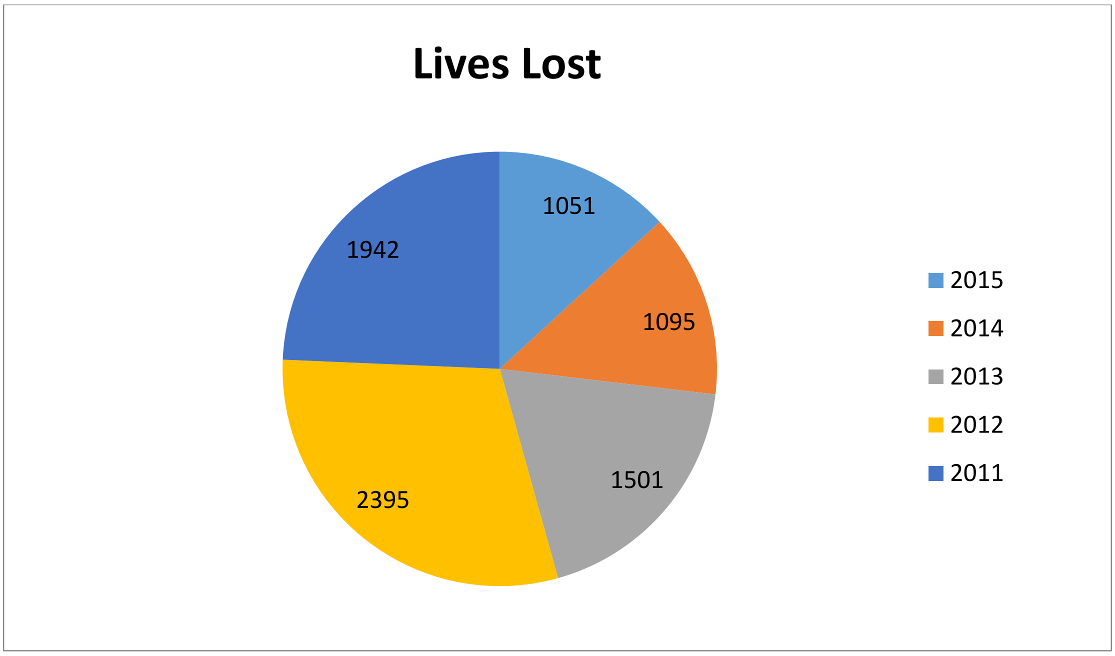


Chart 1: Lives Lost at sea in the year 2011 - 2015

Establishing accurate and comprehensive figures on the number of lives lost at sea has been notoriously difficult for a number of well-known reasons. Statistics usually include the deaths of passengers, leading to distortions when one incident may involve large loss of life. Much also depends on the degree of compliance by flag states with IMO requirements on reporting serious casualties which include those involving loss of life.

6.2 Human Factor and The Role Its Playing

Throughout the years in the shipping industry, we have seen improvements in hull design, stability systems, propulsion systems and navigational systems. Despite the fact that nowadays ship systems are technologically advanced and highly reliable, the maritime casualty rate is still high. Of course, no technological system is unmistakable, but the maritime system is a people's system, and human errors are primarily mover in casualty situations. So, the human factor has a fundamental importance in the rate that maritime accidents occur. Research and statistics show that human error is to blame in over 70% of marine accidents.

By “human error” we mean an incorrect decision, an improperly performed action, or an improper lack of action. The types of human errors that contribute to the occurrence of a maritime incident or accident are innumerable. In many cases an accident is caused by trips and falls, fire, pollution and collisions, low capability and reaction of the crew, lack of communication, lack of implementation of safety practices and regulations, inadequate training, failure in the rational judgment of the situation. Such incidents often result in crew injuries or fatalities, with the ship being consequently delayed or damaged. Some other forms by which the human factor is to blame for marine accidents are technical inability, carelessness in commanding, fatigue and lack of alertness, overworking, insufficient rest periods and so forth.

Usually, a marine casualty is occurred not only because of one reason or a single mistake, but by the confluence of a whole series or chain of errors. There are many cases were more than one human errors were made, each of which was a necessary condition that led to the casualty. This also means that many of the serious accidents reviewed might have been averted if some of the above deficiencies did not exist. Therefore, in order to achieve greater marine safety and fewer casualties, we must find ways to prevent some of the most usual errors or at least increase the probability that such errors are noticed and corrected in time. Below we are listing some of the most common factors that can affect the performance of a ship’s crew and therefore lead to an undesirable situation:

- The energy storage that each employee may have
- The fatigue of each working date in accordance to the free time he has for rest
- The satisfaction someone gets from his job
- The living conditions on board
- The differ demands of the job
- The qualifications and the knowledge of each seafarer
- The basic and continuous training
- The ability to communicate easily with his colleagues and to encourage the team work and the trustworthiness.

6.3 Various Onboard Accidents

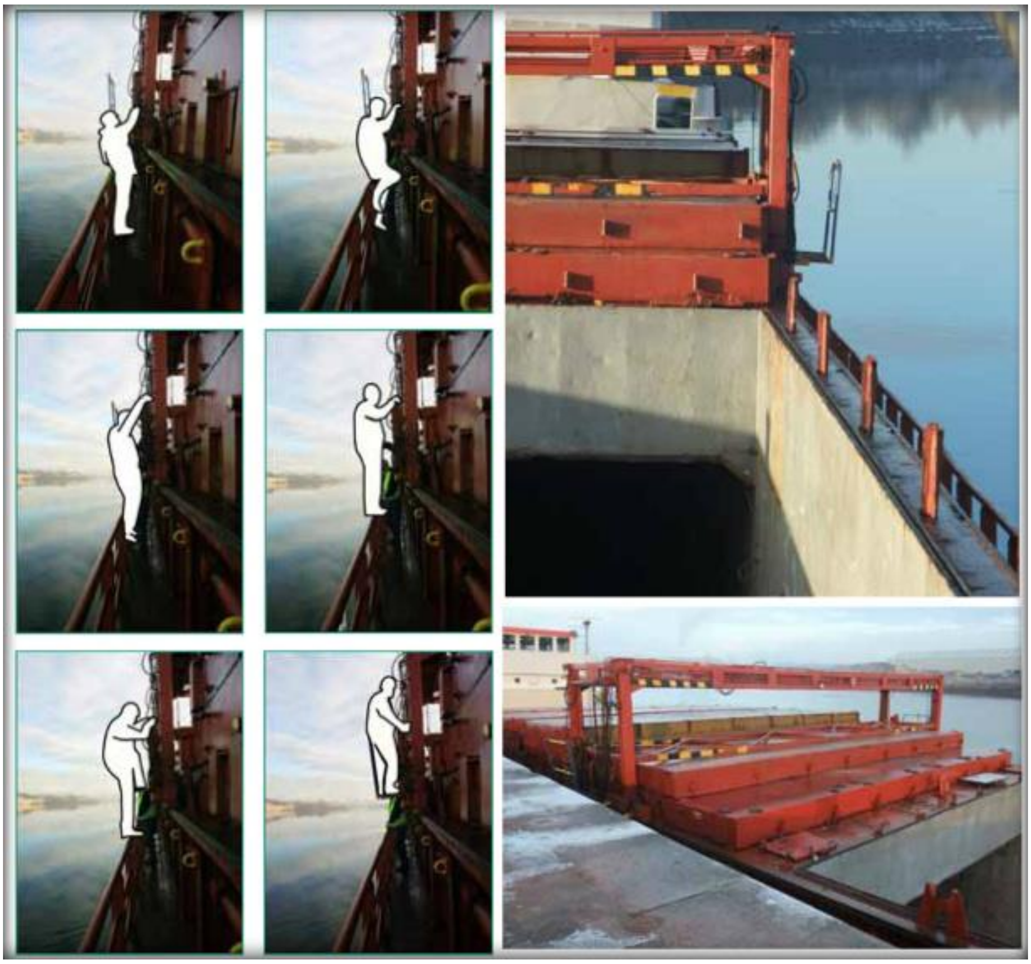
6.3.1 Death Due To Partially Open Hold

On 17 December 2011, an able bodied seaman (AB) fell approximately 25m into a partially open hold on the container vessel Tempanos while it was berthed in the port of Felixstowe. The AB died of multiple injuries. There were no witnesses to the accident, but the available evidence indicated that he probably slipped on a patch of ice while walking across a hatch cover that was partially covering an open hold. Considering the injuries he sustained and the position in which he was found, there is little doubt that the AB died from falling into the cargo hold. The last communication between him and the third officer was at 0642, when he reported that cargo work had commenced at bay 14. When the AB was called on the radio at around 0645, he did not answer. Therefore, it is likely that he fell between 0642 and 0645 even though his body was not discovered until 0704. Without any witnesses to the accident, it was not possible to establish what the AB was doing on the hatch cover immediately prior to the fall. Regarding the access to the hatch covers although guardrails and safety barriers where in place, it was reported to be common behavior of some container ship crew members to walk on the hatch covers of partially open holds. Even though it is considered less likely that the crewmember fell through an open safety barrier in the guardrails protecting the walkways between the holds on Tempanos, several barriers were found open immediately after the accident. This was a serious breach of the instructions in the vessel's safety management system, which required the barriers to be kept closed whenever the hatches from the adjacent cargo hold were removed.

Walking on the hatch covers while the holds are fully covered does not present an inordinate hazard. However, when one or more covers are removed, the same activity is potentially very hazardous. The risks of falling into an open hold, especially when the hatch covers could be slippery from ice or water, must be assessed by the ship's managers and practical control measures introduced to prevent accidents.

6.3.2 Crewman's Death After Falling Overboard

On 13 December 2010, an able seaman (AB) fell into the River Clyde from the St Vincent and the Grenadines registered cargo vessel Joanna, while the vessel was alongside in Glasgow, Scotland. He was recovered from the water about 25 minutes later, but could not be resuscitated. The investigation identified that the AB almost certainly fell while climbing up to the port side platform of the straddle lift used to move the vessel's cargo hatch covers. The crew usually accessed the platforms either by climbing up from the main deck or via the hatch covers. The figure to the left below shows the method usually adopted by the crew to reach the platform from the main deck. The crew climbed up the guardrails while facing the straddle lift and holding on to the hand/foot supports on the aft upright. When on the top guardrail, the crew would step across to the platform. To approach the platforms from the hatch covers, the crew either had to duck under the lift's main beam or swing outboard of the aft upright using the hand/foot supports provided.



The accident happened soon after the cargo operations were completed. The chief officer instructed the bosun and the deceased seafarer to close the hatches. The two ratings left the bosun’s store and went to the ladder providing access to the main deck on the starboard side. The bosun then went down the ladder and made his way along the starboard side of the main deck towards the straddle lift which was stowed amidships. It is assumed that the deceased also went down the ladder to make his way towards the port platform. Using the deck guardrail as a ladder, the bosun climbed onto the straddle lift platform and waited for the deceased seafarer to appear on the port side. Soon afterwards, the bosun called out to the deceased seafarer because he could not be seen on the port platform as expected. There was no response. The bosun immediately climbed on to the hatch covers and walked across to the port side. He saw the deceased seafarer face-down in the water between 1 and 2 meters from the vessel’s hull. The bosun ran to the master’s cabin, shouting to raise the alarm along the way.

Later on, the first of the emergency services had arrived on the quayside and the transfer basket was connected to the crane’s hook. The basket was lowered over the water. Inside the basket were a harbor pilot who had been attending an adjacent vessel, the crane foreman, and another port foreman. The deceased seafarer was pulled into the basket and was landed on the quay. He was then taken to hospital by ambulance but was declared deceased.

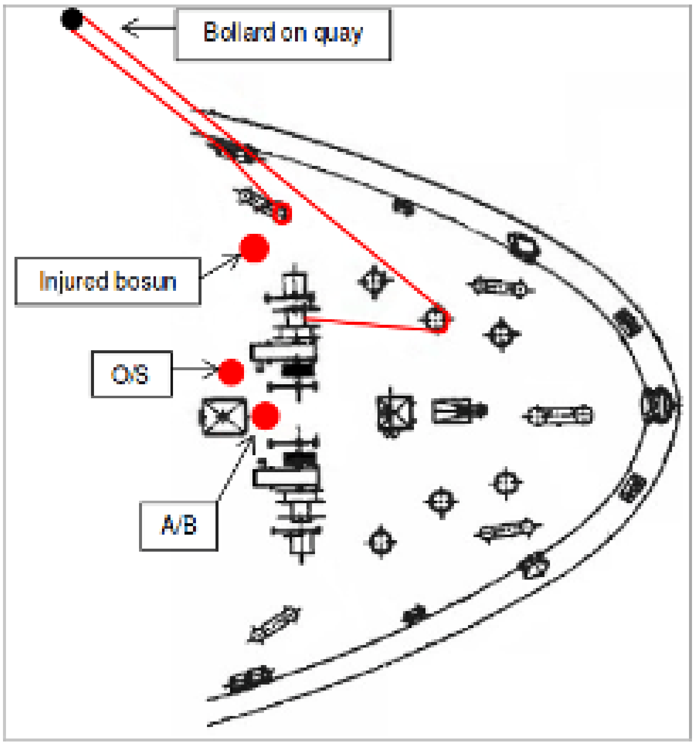
6.3.3 Snap Back Mooring Line Injuring Bosun

MV Pachuca, an Antigua & Barbuda flagged containership was engaged in regular trade between ports in Northern Europe and called at some six ports a week. The master and crew had been in Esbjerg several times before and were therefore familiar with the harbor area and mooring conditions. The port stay was planned to last a few hours. After discharging was complete at 0445, loading commenced and was completed at 0615. Shortly after the ship was ready for departure, the chief officer and the master were on the bridge and on the enclosed forecastle were the bosun, one ordinary seaman and one able seaman.

At 0620, the crew on deck started to single up to one forward spring line. There was a strong breeze from an easterly direction that made it difficult for the master to maneuver the ship from the berth. He turned the rudder hard to port and set the thrusters to push to starboard. He then gave the main engine a short forward order by setting the pitch propeller to 40%. His intention was to open the ship with the forward spring and get distance to the berth then he could use the propulsion to move the ship into the middle of the harbor basin.

As the distance to the berth increased the crew on the forecastle slackened the spring line to ease the tension on the rope. Within 10 to 15 seconds, the spring line was slacked until there was no mooring rope left on the winch drum. The clamp, to which the mooring line was fastened, broke and the line struck the bosun.

The master saw the mooring line part from the ship. He tried to contact the bosun, but there was no reply. He realized that something was wrong and prepared to bring the ship along-side again. The AB reported from the forecastle that the bosun was seriously injured, but was still breathing. At 0635 the ship was alongside and moored again and the bosun was evacuated by ladder from a firetruck and taken to hospital. No-one saw the bosun being hit but his approximate location is known:



Picture 8: Crew's position at the time of the accident

There are at least three possible reasons why the spring line was put on the bollard on the quay in a loop: Firstly, if the mooring line is a loop, then the crew on the ship does not depend on the shore side personnel to let the line go. Secondly, there is the perception that a loop constitutes a stronger mooring than when the line is fastened on the bollard by the eye of the rope. Thirdly, the shipboard main manual stated that the "Mooring ropes should never be left on the winch drums (in port) for the purpose of securing the vessel as they are not designed for same. Only mooring bitts should be used". It's important to note that no snap-back zones were marked on the foredeck.

6.3.4 Confined Space Incident

A serious confined space incident in which a crew member was injured was occurred on a Danish port. The incident happened during quarterly planned maintenance of the leakage detection system in the base of one of the legs of a semi-submersible accommodation unit alongside fixed production platform.

A crew member lifted the manhole cover to gain access to the tank to undertake planned maintenance. The crew member was working next to his supervisor who began to lower gas sampling equipment into the tank as part of normal pre-entry checks. Within a minute of the manhole cover being lifted, the gas sampling equipment (which was 3m down into the 6m height of the tank) gave an alarm, and the crew member lost consciousness. Subsequent gas sampling during the investigation was undertaken and recorded unexpectedly high levels of hydrogen. The presence of hydrogen can be explained by the electrolytic reaction between the sacrificial anodes and the steel within the ballast tank below the tank being worked upon. The crew member who lost consciousness recovered fully with no residual ill health effects.

The company involved made the following recommendations after the incident:

- Vent ballast tanks regularly in order to prevent hydrogen build-up
- Ensure appropriate steps are taken to purge gases from ballast tanks prior to tank opening

- Using appropriate equipment, conduct tests for the presence of hydrogen before tank entry
- Remain mindful of the potential for build-up of hydrogen in ballast tanks where sacrificial anodes are used
- Review gas sampling procedure

According to the Jones Act, injured seamen and officers can hold their employers responsible for their injuries if the employer's negligence had any role in the injury. Seamen and officers may collect compensation for medical expenses, lost wages, the value of room and board he or she would have received if still able to work at sea and pain and suffering that arises out of the injury.

To prove his or her case, a seaman's job duties must contribute to the ship's function in some way and his or her employer must be the ship's owner. If the injured party meets these criteria and can show the employer's negligence contributed to the injury, a judge may award compensation.

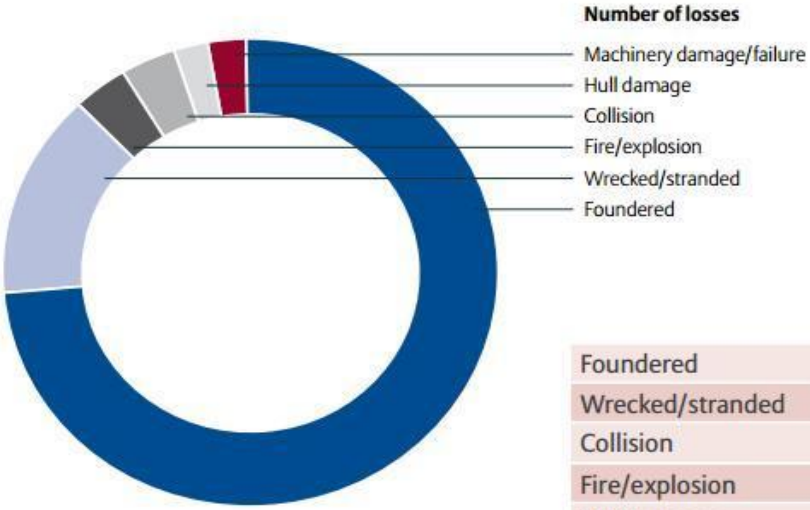
Chapter 7: Capsizing and Sinking

7.1 Definitions and Statics

One of the most common types of marine casualties is the sinking of a vessel. The sinking of a vessel is often caused by bad weather conditions. However the sinking can be also caused in many cases by a ship's cargo shift in a storm, fire, navigation errors, design and equipment failure and instability. Also there are several cases where a leak may develop somewhere in the vessel's structure and as a result the ship will capsize and eventually sink. Capsizing is normally catastrophic for larger ships, except if a vessel has enough flotation to prevent sinking so in that case it may recover on its own if the stability is such that it is not stable inverted. Among ship types, a roll-on-roll-off (RO-RO) ship is more prone to capsizing as it has large open car decks near the waterline. If the watertight car-deck doors fail through damage or mismanagement, water entering the car-deck is subject to the free surface effect and may cause a capsize. As a RORO ferry rolls, vehicles can break free and slide down if not firmly secured, adversely altering the ship's center of gravity, accelerating the roll, and possibly turning an otherwise recoverable roll into a capsize.

According to the Allianz Safety and Sipping Review 2016, losses declined 3% compared with the 88 losses 2014. The 2015 accident year represents a significant improvement on the 10-year loss average. Large shipping losses have declined by 45% over the past decade, driven by an increasingly robust safety environment and self-regulation. However, regional disparities remain. More than a quarter of all losses in 2015 occurred in the South China, Indochina, Indonesia and Philippines maritime region, which has been the top loss hotspot for the past decade. Losses are up year-on year and are double those of the next highest loss region which is the East Mediterranean and Black Sea.
36 Cargo and 16 fishing vessels accounted for over 60% of ships lost with cargo losses increasing for the first time in three years. Foundered (sunk/submerged) is the most common cause of loss, often driven by bad weather, accounting for almost 75% which is up 25% year-on-year.

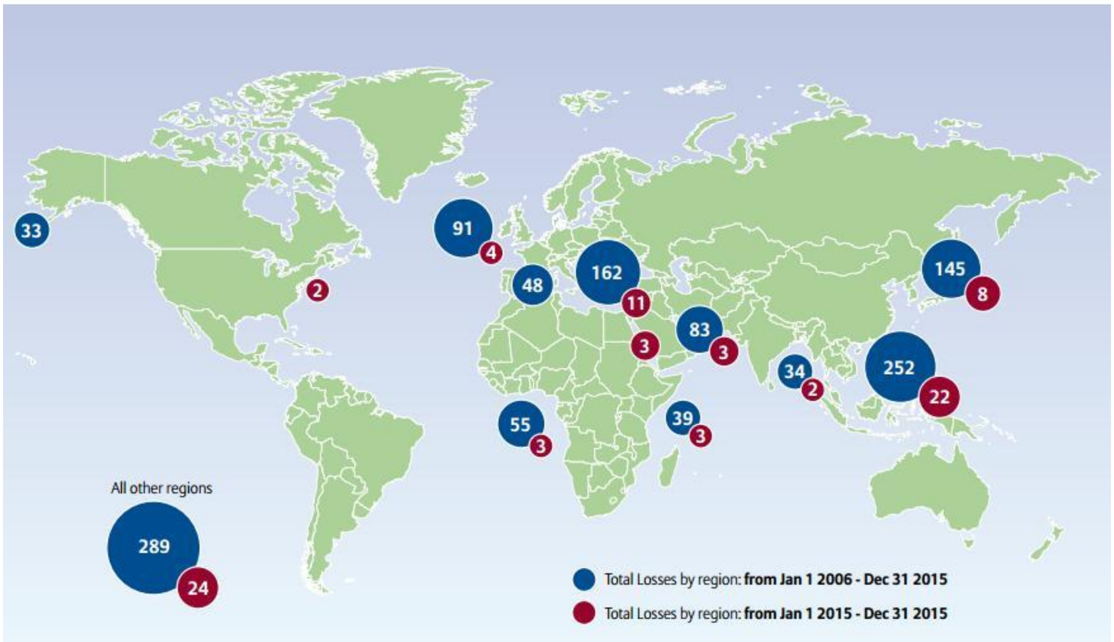
Causes Of Total Losses In 2015



Foundered	63
Wrecked/stranded	12
Collision	3
Fire/explosion	3
Hull damage	2
Machinery damage/failure	2
Total	**85**

In total, there were 2,687 reported shipping casualties (incidents) during 2015, down 4% year-on-year. The East Mediterranean and Black Sea region remains the global hotspot with 484 incidents. Together, with the British Isles, North Sea, English Channel, Bay of Biscay, it accounts for a third of all incidents over the past decade.

Total Losses by Top 10 Regions: 2006-2015 and 2015



7.2 Accidents Involving Sinking or Capsizing Of A Vessel

7.2.1 Costa Concordia Sinking

Costa Concordia was a Concordia-class cruise ship built in 2004 by the Fincantieri's Sestri Ponente yards in Italy. Costa Concordia was 290.20 meters long, had a beam of 35.50 meters and drew 8.20 meters of water. The cost for these types of vessels is usually high but in the Costa Concordia's case reached a new level costing over 450 million euros.

On 13 January 2012, after departing Civitavecchia, the port for Rome, Italy, Costa Concordia hit a rock off Isola Del Giglio. A 53-metre long gash was made in the port-side hull, along 3 compartments of the engine room. Power from the engines and ship services ceased. Taking on water, the vessel listed to the port side. Twenty-four minutes later, strong winds pushed the vessel back towards the island. The water in the ship poured into the starboard side of the ship, causing it to reverse list to starboard. Without power, the ship drifted astern, listing heavily to starboard.

Picture 9: Costa Concordia partly sunk near the coast

Costa Concordia drifted back and grounded near the shore then rolled onto her starboard side, lying in an unsteady position on a rocky underwater ledge. Almost half of the ship remained above water, but it was in danger of sinking completely into a trough 70 meters depth. She was carrying 3,206 passengers and 1,023 crew members, all but 32 of whom were rescued. As of 22 March 2012, 30 bodies had been found, with two people known to be missing and presumed dead.

7.2.2 Cemfjord Mysterious Sinking

The Cemfjord was a Cyprus-registered cargo ship and was 83.13 meters long overall, with a beam of 11.34 meters. She had a draught of 4.40 meters and a height of 21.00 meters. Built as the general cargo ship in 1984, she was converted to a cement carrier and a Pneumatic equipment was installed which enabled her to self-load and self-discharge.

On her last voyage, Cemfjord was carrying 2,000 tones of cement from Aalborg in Denmark to Runcorn in Cheshire and was due to arrive on 5 January 2015. She was last sighted at 13:00 on 2 January 2015 in the Pentland Firth. At 14:30 on 3 January, her upturned hull was sighted 11 nautical miles east of the Pentland Skerries by the NorthLink ferry Hrossey, which was sailing from Shetland to Aberdeen. Only the bow was visible above the waves. The ferry searched for survivors for two and a half hours pending the arrival of lifeboats. No distress call had been received and the weather at the time was bad, with storm force winds. There was no trace of her eight crew, comprising seven Poles and a Filipino. The lifeboats were launched but there were no survivors in them. Two helicopters and an aircraft also joined the search for the missing crew members, as did HMS

Picture 10: The bow of the sunken Cemfjord

Somerset. By mid-afternoon on 4 January, the ship had sunk entirely.

The Marine Accident Investigation Branch (MAIB) conducted an investigation into the sinking. An MAIB underwater survey located the vessel on the seabed at a depth of around 82 meters, 12 miles east of Muckle Skerry. The wreck was found to be intact but inverted and resting on its superstructure. No evidence was observed of structural failure. It is thought that the Cemfjord may have been overwhelmed so quickly by bad weather that the crew did not have time to evacuate. No bodies were seen or recovered during the survey or subsequently. The ship's owner, Brise of Hamburg, has said that no attempt to raise the wreck would be made and it will be left as a sea grave.

Less than two months prior to her sinking, on 7 October 2014 Cemfjord was left with a list in the Pentland Firth, after her cargo shifted. The list was corrected by ballasting the ship. Contrary to regulations, the incident was not reported to the MAIB, although an internal investigation was carried out by Brise Breederungs, the ship's managers.

7.2.3 MV Hoegh Osaka Incident

Hoegh Osaka is a car carrier (RO-RO) that was built in 2000. The ship is 179.90 meters long overall with a beam of 32.20 meters. She has a depth of 21.62 meters and a draught of 10.15 meters.

On 3 January 2015 Hoegh Osaka was loaded at Southampton, Hampshire, United Kingdom with a ro-ro cargo of buses, construction equipment and Range Rover cars. This was in addition to some cargo she was carrying on arrival at Southampton. She departed from Southampton for Bremerhaven, Germany, where more cargo was to be loaded. The intention was that she would then sail to Hamburg, Germany to load the rest of her cargo and be refueled. This was a change from her normal route of Hamburg, Bremerhaven, then Southampton.

A pilot was embarked at 19:30 and the ship departed at 20:06. At 20:59, she made a starboard turn and entered the Thorn Channel. She was travelling at 10 knots. After entering the channel, her speed was increased to 12 knots. At 21:09, Hoegh Osaka made a port turn at the West Bramble Buoy and developed a severe list. The pilot gave the order to stop engines, and expressed doubts in respect of the metacentric height (GM) of the vessel. As the list increased, the ship's propeller and rudder came clear of the water. The ship grounded on the Bramble Bank off the Isle of Wight and settled with a list that would eventually reach 52°. According to the owners she was beached intentionally on the Bramble Bank in the Solent.

Picture 11: MV Hoegh Osaka's heavy list

At 21:19 the D-class inshore lifeboat from Calshot Lifeboat Station was called out. The tugs Svitzer Ferriby and Svitzer Surrey, in Southampton Water at the time, were also sent to the assistance of Hoegh Osaka. Additional Severn-class lifeboats were called out from Cowes and Yarmouth, Isle of Wight. The second Calshot Lifeboat was then called out. A Coastguard Westland Sea King helicopter from RNAS Lee-on-Solent (HMS Daedalus) was called out and the tug Apex was also sent to her assistance. At 21:54, Svitzer Ferriby arrived at the Bramble Bank and assisted in beaching the ship. One crew member broke an arm and a leg when he fell and slid for about 18 meters in a corridor as the ship listed. A crew member jumped into the water as a lifeboat approached and was rescued. Six crew members were winched aboard the helicopter from Lee-on-the-Solent and landed there. RFA Lyme Bay assisted in the coordination of the rescue efforts. A crew member from the Yarmouth Lifeboat was winched onto Hoegh Osaka by a helicopter to assist with the evacuation of the vessel.[6] A Royal Air Force Westland Sea King helicopter was called out from RAF Chivenor.[12] The National Police Air Service also sent a helicopter to the scene. It was equipped with night vision equipment. All crew except the pilot, captain and chief officer had been rescued by 00:15 on 4 January. They were evacuated at 02:09 because the vessel's list was increasing as the tide fell.

The ship was carrying a cargo of 1,400 vehicles and about 70 pieces of construction equipment. A 200 meters maritime exclusion zone was put in place around the ship, and airspace below 2,000 feet was also closed to aircraft within 1 mile. An attempt to refloat the ship was scheduled for 7 January, but was cancelled when more water than expected was discovered inside the vessel. The ship refloated without outside assistance later on 7 January due to high tide and strong winds.

Conclusion

With the above said, it's easy to easy to discern that working upon a merchant vessel is a risky and a responsible occupation. There are numerous incidents just waiting for the wright moment and conditions to injure or even claim lives of crew and passengers. As we have seen, maritime accidents constitute a big chapter of the maritime industry and are of great concern. All the safety rules and regulations have been invented in order to prevent the marine accidents from happening or at least to prevent an unpleasant result. Many times, the series of events that lead to a marine casualty are irreversible. There are cases where external factors have contributed for a marine casualty to occur. Of course, in the majority of the cases, if something had been done differently maybe nothing would have happened.

We can easily conclude to the fact that the human factor is the number one cause for marine incidents, serious and very serious accidents. From the time that a vessel is being built till it is launched at the sea, and during all of its sea life, everything depends on how people operate the processes in every stage of the vessel's life. Even a machinery failure may have been caused by a human mistake in the manufacture or by the operation. So, both people on board vessels and people who operate from the shore are to blame for false decisions.

When an accident occurs it can also have vast consequences. The worst is the loss of human lives, which in passenger ships accidents is almost inevitable not to have a casualty. The passengers are a very sensitive element during an urgent situation and the crew must be well trained to face urgent circumstances and guide the passengers, not giving them the opportunity to take initiatives concerning which are in these circumstances based on fear. Furthermore, the pollution of the marine and coastal environment is a great concern.

Overall, as we can assume from the case studies that we presented, it is very difficult to find exactly who to blame for a marine casualty loss or accident. In most cases, the events are complicated and it takes an endless effort for the investigators to come to a conclusion.

Lastly, marine safety affects everyone involved in it. The greatest concern is to minimize the number of marine accidents per year. The aim is to ensure safer seas for the thousands of passengers and crew members who either work on board or travel but also for the thousands of tonnes of cargo that is traded by sea. By building a solid future and focusing on improvements concerning the safety regulations, the good training of the crew, the technological improvement of navigation systems on board all vessels and good management, the number of maritime accidents can be significantly reduced. As a future captain, I can only hope for the merchant shipping to get safer and to do my best so a secure and more productive shipping industry can be born.

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