

THE IMPACT OF LOW EFFICIENT EVACUATION PLAN DURING COSTA CONCORDIA ACCIDENT

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ABSTRACT

The tragic accident of the Costa Concordia in January 2012 was one of the most fatal large passenger ship accidents in Europe recently followed by a great public interest.

The Italian cruise ship sank on the evening of Friday 13th off the Tuscan West Coast of Italy near the island of Giglio. The ship's sinking was a tragedy in lost lives as well as the huge financial losses. The accident also raised a major cruise ship safety issue.

As witnesses reported, it all started with a loud bang. The huge ship suddenly stopped, then plunged into darkness experiencing a total power loss. This was the beginning of the 2 long hours of a Titanic-like experience affecting all the 3206 passengers and 1023 crew on the unfortunate ship. News teams reported from the scene many of the passengers jumped overboard and swam to shore as the vessel took on a 20-30 degree list to starboard presenting a real danger of sinking. When the panic subsided and all passengers and crew left the vessel, it remained capsized, resting against a small breakwater.

In this paper, the circumstances of the accident, problems encountered during evacuation, maritime search and rescue, similarities between the Titanic and the Costa Concordia accidents, the aftermath and salvage operations are discussed in detail.

KEYWORDS: The Impact of Low Efficient Evacuation Plan during Costa Concordia Accident

INTRODUCTION

The history of the shipping industry has witnessed many maritime disasters that led to the loss of many lives, including passengers and crew, and in spite of the global trend towards more stringent control over the construction and operation of ships since the Titanic incident in 1912. Some of these disasters resulted in a large number of deaths, such as the incident of the passenger ship Admiral Nakhimov in 1986, which resulted in the death of 425 people, the incident of passenger ferry Herald of Free Enterprise in 1987 which resulted in 193 deaths, the sinking of ship Dona Paz in 1987 which led to the death of 4386 people, the fire of passenger ship Scandinavia Star in 1990, which led to the death of 158 individuals, and also the sinking of the passenger ship Estonia in 1994 which resulted in 852 deaths, and the fire which later led to the sinking of the ship Dashun in 1999 and resulted in 282 deaths. (MAIB, 2000)

On June 21, 2008, passenger ferry Princess of the Stars, which capsized and sank in a hurricane in the Philippines, was carrying 747 individuals. Only 57 of them survived. On February 3, 2006, passenger ferry Al Salam Boccaccio 98 sank in the Red Sea while sailing from the port of Duba in Saudi Arabia heading to the port of Safaga in southern Egypt. The ship was carrying 1312 passengers and 96 crew members. Only 388 people survived. (RINA, 2006)

The Costa Concordia sank in the early morning of January 14, 2012 near the island of Giglio in the Mediterranean Sea. A few hours earlier, the vessel had hit an underwater rock when performing a tight turn at high speed very close to the shore. As a result of this collision, it powerlessly drifted near to the harbor of Giglio where it grounded a second time and evacuation procedures were started. The list gradually increased until the ship eventually capsized and came to rest on the rocks in shallow waters. Thirty-two of the 4229 people on board lost their lives during the flooding and capsizing of the ship. (OMAE, 2014)

The ship was sailing too close to the coastline in a poorly lit shore area. The Master planned to pass at an unsafe distance at night time and at high speed (15.5 knots). The danger was considered so late that the attempt to avoid the grounding was useless. Everyone on board realized that something very serious was happening, because the ship violently heeled over and the speed immediately decreased. (MIT, 2012)

The vessel lost propulsion right away and was consequently affected by a black-out. The Emergency Generator Power switched on as expected, but was not able to provide the utilities to handle the emergency and on the other hand worked in an intermittent way. The rudder remained blocked completely starboard and no longer handled. The ship turned starboard by herself and finally grounded (due to favorable wind and current) at the Giglio Island at around 23.00 and was seriously heeled (approximately 15°). (MIT, 2012)

From the analysis carried out under the direct coordination of the Master, the seriousness of the scenario was reported after 16 minutes. After about 40 minutes (22: 27) the water reached the bulkhead deck in the aft area. (MIT, 2012)



Source: BBC News Europe, 2015

Figure 1

The vessel’s operator – the Costa Crociere brand – is a major subsidiary company of the largest cruise ship owner in the world – Carnival Corporation & PLC. The Europe’s cheapest cruise line, Costa operates predominantly in the Mediterranean with a fleet of mostly big-sized ships. Costa Concordia salvage operations turned out to be the most

expensive and hazardous ever. The wreck of the liner continued to sit off the Tuscany's coast semi-submerged right until May 2015. (Cruise Minus, 2015)

The difficulty of predicting all the factors affecting the success of the evacuation process, such as ship listing, weather conditions and passengers' behavior increases the challenges faced by the preset emergency plan for the evacuation of passengers from the on-board process. Despite the vast amount of international and domestic legislation providing for uniform standards for evacuation procedures to be followed during the emergency, newspapers still inform us from time to time about a tragic incident of a passenger ship leaving behind loss of lives.

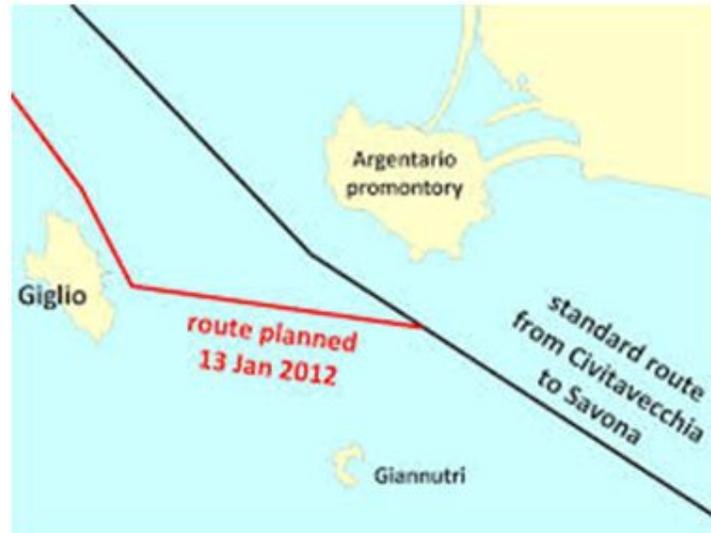
Among the many aspects of the safety of passenger ships, which had a share of research and study in order to take advantage of the current technological development, it is found that the evacuation of passenger ships process has witnessed a lot of development. Technological development contributes to reducing the time needed to count passengers in muster stations by replacing the traditional method of counting with electronic devices that rely on modern technology. This development also extends to become a means through which the crew of the vessel can track and locate the passengers to reach and evacuate them during an emergency. In addition, among the development of current ways is to help guide passengers through the various escape routes and effective alternatives in the case of lack of visibility as a result of the spread of smoke through the ship's corridors and ladders that make the visual guidance signs in effective and unreliable, as proved by some ships accidents.

The Costa Concordia Accident

Having left the port of Civitavecchia near Rome on the evening of January 13, 2012, the ship was on her way to Savona in Northern Italy with 3206 passengers and 1023 crew on board. En route, she changed her planned course and headed for Giglio at a speed of over 15 knots where she was to perform a tight starboard turn near the coast.

Approaching the shore, she collided with the "Scole Rocks" below the waterline on her port side, which led to the damage of 5 watertight compartments (WTCs). In addition, the electric propulsion motors, all diesel generators as well as the main switchboard were damaged. The initial list was to port due to the leak being on that side and because of the heeling moment caused by the rock, which stuck amidships after the impact. After a while, the flooding became almost proportional and the ship went upright again. (MIT, 2012).

Having been damaged in compartments vital for power generation, power distribution and propulsion, the ship was soon adrift without electricity. Even though the emergency diesel generator started up, it did not work reliable enough to provide power. Therefore, emergency power was supplied by UPS (Uninterruptible Power Supply) batteries. However, the steering gear did not function and thrusters needed more than the emergency power provided. Due to wind and current, the vessel was ultimately moved north of Giglio harbor before the forces of nature turned her around 180 degrees and pushed her in the direction of the island until she grounded a second time. (OMAE, 2014)



Source: (Ministry of Infrastructures and Transports, 2012)

Figure 2

At this time, the evacuation procedures were started, while the heeling angle to starboard unceasingly increased. In the early hours of the next morning, she had finally capsized and sunk onto the seabed approximately 25 meters deep until she was at last raised on September 16, 2013. (OMAE, 2014)

With many contradictory accounts of the collision and without the release of an official investigative report, the exact timing of the incident is debated. However, the following summarized timeline has generally been accepted:

- 9:45 p.m.: The Costa Concordia collides with La Scole rocks.
- 10:10 pm: The Costa Concordia turns south.
- 10:12 pm: First contact with Italian port authorities. An unidentified officer relates that the ship is simply suffering from an electrical “black-out.”
- 10:26 pm: Captain Schenttino speaks to the harbor master of Port of Livorno, relating that his ship had taken on water and requesting a tug boat.
- 10:42 pm: Port authorities are first alerted of the severity of the situation.
- 10:44 pm: The Costa Concordia comes to a final rest at Punta delGiabbianara at an angle of 70 degrees in 20 meters of water.
- 10:50 pm: Official order is given to evacuate the ship.

Difficulties Encountered During Evacuation

Survival Crafts Deployment

Was the ship equipped with a sufficient number of survival crafts needed for the evacuation process? It is clear that the loss of lives resulting from the incident of the Costa Concordia vessel was not due to a shortage in the number of survival crafts. According to the Italian Maritime Investigative Body Report, the total capacity of the lifeboats and life rafts on board the vessel was up to 6115 people, which is estimated at 125% of the maximum number of individuals authorized

on board the ship (4890 individuals) which is consistent with the requirements of Safety of Life at Sea(SOLAS) Convention. The ship was equipped for the evacuation of 3720 people in lifeboats and 2395 in life rafts. What happened, however, was that 23 from the total number of lifeboats on board the ship (26 lifeboats) were deployed. The crew members were not able to deploy 3 lifeboats on the higher side (port) due to the extreme list degree of the ship towards the starboard side when the list angle exceeded 20 degrees, (according to the requirements of SOLAS, lifeboats must remain deployable with a list up to 20 degrees to either side). Only 6 life rafts were deployed from a total of 70 life rafts that were present on the ship.

The Safety of Life at Sea Convention provided that the ship should be able to deploy the survival crafts within 30 minutes of the abandon ship order (SOLAS Ch.III Reg.21.1.3). This time includes the period of time spent in the ascent of the passengers and crew to the survival crafts, then the deployment of the survival crafts at their full capacity load. It should be noted that this time period does not include the muster of passengers where during this time, all the passengers are assumed to have already been gathered in their muster stations, are under control by the evacuation crew, and awaiting for the Master's order to abandon the ship. The crew should be highly qualified and sufficiently trained to manage the crowds, the passengers should not face panic, and ship should be in standard conditions in terms of the list degree, longitudinal and lateral movement and weather conditions favorable to a large extent.

Abandon Ship Process

The abandon ship process took longer than it should to evacuate all the passengers (five hours). The requirements of SOLAS Convention provide that ship systems must remain active for at least three hours to allow sufficient time to muster the passengers, have them wear life jackets and to move according to the plan of evacuation until they arrive at the boarding stations to survival crafts. From this point, the requirements also stipulate that all people on board the ship should be evacuated within 30 minutes after the Master of the ship gives the Abandon Ship order. In this case, the Costa Concordia had a speedy list where it was not possible to deploy all the lifeboats.

The Traditional Method of Counting Passengers

The arduous process of counting the number of passengers aboard a ship requires much time aboard gigantic passenger ships that carry thousands of passengers by following the traditional way of counting the passengers and checking their names using traditional paper-based lists of passengers. Those lists must be constantly updated and printed for use in the assembly station to be used immediately after the occurrence of an emergency situation. They are used by the ship's evacuation crew by calling out the names of all passengers to check their presence. (Gadalla, 2015)

Miscommunication during Evacuation

The different nationalities, and so the different crew members' languages made up of 1,000 people, may lead to poor communication among the crew, which sometimes causes a lack of understanding of the given commands and negatively affects the degree of cooperation among the crew. In addition, it has been found that people panic in their own language which increases the confusion during maritime disasters. This is what has been interpreted as one of the causes of the disaster of the ship Estonia. (ABS, 2010)

Many of the passengers had received contradictory instructions from the crew members. Some of the crew did not speak a language understood by the passengers, making it difficult to achieve effective communication between crew

members assigned to the evacuation of all passengers. (Italian Maritime Investigative Body Report)

To create a ship working language, which can be understood by crew members made up of 38 different nationalities dealing with passengers belonging to 26 countries, as in the case of the Costa Concordia vessel, is essential to achieve the necessary communications for the effective operation of the ship communications and foremost, to make sure of comprehending the actions planned in emergency situations, most importantly, the crowds management. Costa Concordia Cruise Company chose the Italian language as a working language of the ship, following what came in the ship safety management system in accordance with the Investigative Body Report. (Gadalla, 2015)

It seems that this choice is, of course, linked to the Italian flag under which the ship sailed, despite the multiplicity of nationalities of the crew members on board. It was more logical, though, to select English as it is the most widely-spoken language, a well-known and common language usually used by crews of multinational passenger ships. This would, naturally, give tangible benefits for communication among crew members, and most importantly between the crew and passengers, particularly in those cases where the understanding among each other is imperative, such as emergencies.

The Different Nationalities of the Crew Members aboard the Cost a Concordia at the Time of the Incident

NATIONALITY	NO. OF CREW MEMBERS	NATIONALITY	NO. OF CREW MEMBERS
AUSTRIA	3	JAMAICA	2
BELGIO	1	JAPAN	1
BRASILE	6	MOLDOVIA	1
BULGARIA	7	MYANMAR	1
CHILE	2	NEPAL	1
CHINA	20	PARAGUAY	2
COLOMBIA	10	PERU*	45
CROAZIA	1	PHILIPPINES	294
DOMINICAN REPUBLIC	7	POLAND	3
FRANCE	1	ROMANIA	26
GERMANY	5	RUSSIAN FEDERATION	3
GREAT BRITAIN	12	SERBIA	1
GUATEMALA	6	SLOVAKIA	1
HONDURAS	17	SLOVENIA	1
HUNGARY	6	SOUTH KOREA	2
INDIA	202	SPAIN	7
INDONESIA	170	SRI LANKA	1
ITALY	150	SYRIA	1
UKRAINE	2	VIETNAM	3

Source: (Italian Maritime Investigative Body Report, 2012)

Figure 3

Staff of many different nationalities struggled to communicate with each other before and after the giant cruise liner slammed into a rocky shoal off the island of Giglio, according to an exhaustive report compiled by a panel of maritime experts.

Although the common language on the ship was meant to be Italian, a radio officer who was trying to organize the lowering of life boats had to resort to English to communicate with a group of crewmen from South America, the report found.

"Not all the crew was able to understand the emergency instructions, which were in Italian," the experts said.

In what one Italian newspaper called "a babel at sea", a Bulgarian first officer struggled to understand Italian, while an Indonesian helmsman twice failed to understand orders given by Captain Francesco Schettino as the Concordia approached Giglio to perform a "sail-past" that ultimately proved calamitous.

There was a lack of understanding or training of some of the crew about their individual roles and responsibilities in an emergency situation. Some of the officers in charge of the lifeboats either did not possess the correct safety

certification or their certificates had expired. The majority of the crew was Filipinos, Indian, and Indonesian. In total, the crew was made up of 38 different nationalities. Most of the crew were unable to understand the emergency instructions given in the ship's working language, which was Italian.

The IMO defined the human error element as a deviation from accepted or preferred practices by an individual or a group that results in unacceptable results (IMO, 2000). In other words, it is a failure in the implementation of the planned actions, which may result in an unacceptable outcome.

IMO Requirements

The safety of passenger ships has always been on top of the priorities list of the IMO. The rules of the IMO address numerous factors influencing the emergency evacuation on board passenger ships, such as the design and equipping of the ship, efficient training of the human element represented in the crew qualification standards and the degree of the passengers' familiarity with the ship evacuation plan process, in addition to emergency procedures and plans and the Decision Support System of the Master.

It was logical after the occurrence of marine accidents for passenger ships that the Organization takes quick steps to amend the relevant rules, as was the case with the quick response to the incident of the Costa Concordia and the adoption of the Maritime Safety Committee (MSC) in the Organization to amend rule 19 of Chapter III of the SOLAS Convention (SOLAS Ch.III Reg.19) to provide for the obligation of ships to conduct passenger safety drills before the ship's departure from port or immediately after the departure instead of the previous text, which allowed for making such drills within 24 hours of departure. This amendment entered into force already on January 1, 2015. The organization also took quick steps to amend the evacuation analysis requirement to become mandatory for all passenger ships during the design phase of the new ships.

The International Maritime Organization focused on verifying if the ship is designed to ensure the smooth flow of passengers and the smooth flow of their movement during mustering passengers. It, therefore, stipulated guidelines for the analysis of evacuation simplified in the ship design stage through both periodic publications of the MSC.(MSC Circ 1033 & 1238)

Under the new muster policy:

- A mandatory muster of all embarking passengers will happen prior to departure from port.
- Late arriving passengers will be promptly provided with individual or group safety briefings that meet the requirements for musters applicable under the International Convention for the Safety of Life at Sea (SOLAS).
- The policy is designed to help ensure that any mandatory musters or briefings are conducted for the benefit of all newly embarked passengers at the earliest practical opportunity.

This change in the muster policy addresses the situation that may have contributed to what was reported as "panic" and "miscommunication" on board Costa Concordia for over 500 passengers who had just boarded that fateful day and had not received a safety briefing or a muster drill.

Similarities between the Titanic (1912) and Costa Concordia (2012) Accidents

The technologies of 1912 and 2012 are dramatically different that they can hardly be compared. Differences exist

in the materials used, the principles of ship's constructions, the equipment available to assist the decision makers, and the technology to support navigation. While the Titanic had access to wireless radio communication solely, the Costa Concordia had all kinds of support and computer systems, including Global Positioning System (GPS), Electronic Chart Display and Information System (ECDIS), Automatic Radar Plotting Aid (ARPA), Automatic Identification System (AIS), etc. Yet despite these differences and despite the fact that the two accidents happened in different sea areas and under different circumstances, the mechanisms were basically the same—colliding with an underwater object that caused significant structural damage to the hull. A closer look at the two accidents reveals even further similarities:

- Both Captains were very experienced and had immaculate service records prior to the accidents. They had spent their entire professional life at sea without larger accidents.
- Both Captains were aware of the imminent dangers, but felt that the risks were so small that they could easily be controlled.
- In both cases, the shipping companies (White Star Line and Costa Crociere, respectively) either tacitly approved or even encouraged the Masters' decisions to prioritize performance over safety.
- Both accidents resulted into emergency situations for which the ships were not built (beyond design-base accidents). Both scenarios were also considered as being highly unlikely.
- In both accident scenarios, difficulties during the evacuation occurred (especially miscommunication when it comes down to the Costa Concordia accident). (Schröder-Hinrichs et al., 2012)

The After Math

In the days and weeks that followed the incident, the efforts to rescue the crew and passengers believed to be still trapped on the Costa Concordia received constant international media coverage. Rescue efforts by divers from the Italian Navy, Coast Guard, and Fire and Rescue Department were initiated immediately on January 14 and lasted until January 31 when Italy's Civil Protection agency ended the diving due to unsafe conditions for divers. On February 1, the missing were presumed dead and the focus of the operation transitioned from 'search and rescue' to 'search and recovery'. The last person to be found alive on the ship was the ship's purser, rescued on January 14. Using passenger interviews and sophisticated scanning equipment, eight bodies were found on February 22 and an additional 5 bodies were found on March 22. Eventually, 32 individuals lost their lives in the tragedy, including 2 missing.

While the rescue of surviving passengers and the recovery of victims' bodies remained the primary objective in the days following the accident, securing the wreck site and protecting the environment were also a focus. The Costa Concordia wreck occurred in the Tuscan Archipelago National Park, the largest marine protected area in Italy. At the time of the incident, the Costa Concordia had nearly 500,000 gallons of oil onboard. Immediately, oil booms were set in place to contain the spread of oil in case of a leak caused by a weakening of the hull. On March 24, it was announced that all the oil had been successfully removed from the vessel.

In the wake of the tragedy, international organizations and governments initiated a review of regulations and laws governing cruise ship operations. Within a month of the tragedy, the U.S.-based Cruise Lines International Association (CLIA), the Great Britain-based European Cruise Council (ECC), and Brussels-based Passenger Shipping Association approved a new policy that required all cruise ships to conduct mandatory muster and safety drills prior to leaving port.

The previous regulation only required the muster and safety drills to be conducted within 24 hours of passenger embarkation. Additionally, the CLIA and ECC passed three new regulations that required more life jackets onboard, limited access to the bridge by non-officers, and required bridge briefing and approval process for all passage planning. The International Maritime Organization, a United Nations agency, conducted a review of the incident and considered a number of regulations changes. Additionally, in direct response to perceived failures on behalf of the Captain, Costa Crociere announced that it would launching a new monitoring system that would enable the company to track vessels in real-time. Moreover, the line was limiting the power of its captains by setting forth regulations that called for other bridge officers to be part of the decision-making process.

Francesco Schettino, the vessel's captain whose maritime maneuver caused the disaster, was found guilty of manslaughter. He now faces 16 years in jail.

Crew and Passenger Deaths, Injuries, and Compensations

Investigation reports showed that the Concordia's Captain, Francesco Schettino, veered from the approved ship course and approached Giglio to perform a "salute" to a former Costa Captain. Schettino turned off the alarm for the computer navigation system and navigated the vessel "by sight". Obviously, he was too late when ordered to turn. The ship ended up in too shallow waters where it struck a rock from the Le Scole reef, causing an almost 160 ft. (50m) gash in the hull.

- Costa Concordia final death toll was 32, with 2 missing (presumed dead) and 157 seriously injured. The ship may have had unregistered passengers as well.
- By nationality, most of the cruise passengers were Italians (989), 569 Germans, 462 French, 177 Spanish, 129 US citizens. On the ship traveled 4229 people from 70 different countries.
- On January 31, 2012, local authorities officially ended the search for bodies in the submerged parts of the wreckage. The deformed hull and bad underwater conditions deemed too dangerous for divers. Searching continued in the waters up to 7 ml2 / 18 km2 around the ship.
- On September 26, 2013, the underwater search for the 2 missing bodies ended. After raising the wreck, divers found in the water near the ship's central section unidentified human remains. Next step was DNA tests to be conducted for identification of the victims. The 2 missing were from the ship's service staff – an Italian female and an Indian male.
- On August 6, 2014, at the Genoa port, during a dive search operation, human remains were discovered on the ship's Deck 3. It was presumed that this was the body of RusselRebello (an Indian waiter) who was the only remained missing person since the ship's sinking.
- As compensation for all damages, the operator Costa Crociere offered Euro 11,000 (approximately US\$15,000) per passenger. The line also reimbursed all passengers with the full cruise cost, plus all travel and medical expenses following the accident. Naturally, 6 of the passengers opened lawsuits against Carnival and demanded a compensation totaling US\$460 million.

A Concordia-like collision with rocks incident happened on the cruise ship Costa Fortuna in June 2005. This accident was subsequently covered up, and came to light during the Concordia investigation, when Palermo Port

authorities mentioned a report by one of the Fortuna's onboard photographers who was on the ship when the collision occurred. The investigators concluded that only the favorable Mediterranean weather prevented a Concordia-like disaster. (Cruise Minus, 2015)

Financial Impact

Among the most expensive big-sized cruise ships, Costa Concordia's cost to build was US\$570 million (Euro 450 mill). The sunken Costa liner also became the biggest insured loss in maritime history. The cruise vessel was insured for US\$513 million (Euro 405 mill). The list of its insurers included XL, RSA, Generali, and Allianz. When the disaster happened, experts estimated the insurance loss from the ship to be between US\$500 million and 1 billion.

While these numbers were big enough, they could have grown even bigger if the over 2,300 tons of diesel fuel on the ship had started to leak. In such a case, a substantial pollution liability claim would have been issued. Carnival Corp officials expected the Concordia sinking accident to cost the company between US\$155 to US\$175 million (Euro 118 to 133 million); including insurance deductibles and loss of use coverage. Because of the Concordia disaster, the Carnival Cruise Lines brand company lowered its cruise prices fleet-wide just to keep up bookings. This, consequently, lowered the company's net revenue for the 2012 fiscal year, and the EPS (Earnings per Share). (Cruise Minus, 2015)

CONCLUSIONS

Human error continues to be the dominant factor in maritime accidents. It has also been supported that among all human error types classified in numerous databases and libraries of accident reports, failures of situation awareness and situation assessment overwhelmingly predominate, being a causal factor in a majority of the recorded accidents attributed to human error. There is a consistency of this finding among the data and reports within the US, UK, Canada, and Australia.

For all accidents over the reporting period, approximately 80 to 85% of them involved human error. Of these, about 50% of maritime accidents were initiated by human error. Another 30% of accidents were associated with human error, meaning that some event other than human error initiated an accident sequence, and that failures of human performance led to the failure to avoid an accident or mitigate its consequences. In other words, conditions that should have been countered by humans were not adequately addressed (ABS, 2010).

It seems clear that continued attention to the human element as a means to improve maritime safety is appropriate, and that initiatives to enhance situation assessment, reduce risk tolerance and risk taking behavior, improve awareness, and perform consistent incident investigations would be highly beneficial to the industry. (ABS, 2004)

Maritime accident investigations have traditionally looked for one or more distinct causes and tried to address them one by one, as if they were independent of each other. The near universal assumption, expressed by the causality belief, is that every effect has a cause, and that the cause usually can be determined to be a failure or malfunction of a component, be it technological, human, or organizational. According to this logic, if the failure or the malfunction can be found and fixed, the risk will be reduced or even entirely eliminated and safety, therefore, increased.

The causality belief, however, limits the scope of investigations to concrete and tangible causes, but neglects a host of other factors that are less conspicuous and have a more indirect influence. As the comparison of the fates that befell the Titanic and the Costa Concordia however shows, accidents seem to happen for the same underlying human and

organizational reasons even though they are separated by a century of significant improvements to technology and safety regulations.

The public discussion following the Costa Concordia accident has mainly focused on the Master of the Costa Concordia. This reflects the social dynamics in risk communication described by Kaspersen et al. (2003). It is, however, to be hoped that the discussions about this accident may become more system oriented once the accident investigation report is available. In the light of the IMO Casualty Investigation Code, the Master is just a part of a wider system, and that it is the system that needs to be improved. Isolated discussions about single actors and single causes in a system, no matter how important they are, will not lead to sustainable system improvements. It is time for a fundamental change to the way maritime accidents are viewed and to the understanding of how maritime safety can be improved by addressing human and organizational factors. (Schröder-Hinrichs et al., 2012)

Information subsequently released has tended to confirm the hypothesis of human error that overrode technical protection mechanisms and automated systems. Besides the implication of negligence, three aspects of this disaster remain particularly surprising.

The first is the procedural failures regarding evacuation. Moreover, opportunities to abandon ship before it started listing were wasted.

Many instances have illustrated the common practice of large cruise liners, including the Costa Concordia herself, cruising unacceptably close to the coast. It is notable that legislation has to be enacted rather than relying on the cruise operators to respect normal prudence and caution. (EUCPT, 2012)

RECOMMENDATION

- Setting more stringent rules when it comes down to determining the official working language of the ship and making sure, through the Flag State authority and Port State Control, that the vast majority of the crew understand it;
- Verifying the existence of a satisfactory level of effective communication between the crew and passengers during the abandon ship maneuver in port;
- Obliging passenger ships to use modern technology in counting the number of passengers by replacing the traditional method with a quicker and more effective one using e-cards comprising the passengers' data;
- Studying the use of a technology for tracking and identify passengers' locations during the evacuation process for the purpose of access to passengers trapped in any of the ship's compartments.

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