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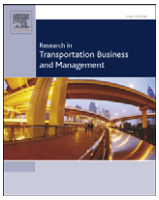

Understanding the causes of recent cruise ship mishaps and disasters

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ABSTRACT

The core of the cruise industry experience is to provide a pleasant recreation for the customer. When a mishap/disaster on a cruise ship occurs it can put the customer at serious risk. Although rare and, precisely why they are a rare phenomenon, cruise ship mishaps receive global media attention when they do occur which can cost the cruise ship companies millions of dollars in lost revenue. Further, some regulators are questioning the safety practices of the cruise industry.

There is little academic research on the causes of cruise line mishaps. Merchant vessel mishaps, however, have been greatly investigated. The goal of this research is to contribute to the understanding of the nature of mishaps in the current cruise industry by evaluating 580 mishap incidents from 1989 to 2013 through a two-stage measurement design. This novel application of this methodology may provide a new insight into mishap evaluation research. Under this method, an evaluation of what happened during a reported mishap is done. Then, the incident report data are used to evaluate and classify the cause of the mishap. This classification may reveal what factors contribute to cruise ship mishaps and start to lay a foundation of operator preparedness.

1. Introduction

The cruise ship experience as a recreational experience has been a relatively recent phenomenon. Due to the dominance of passenger air transportation, passenger ocean liner services ceased operations in 1986. However, beginning in 1986, the Cunard Lines saw that a niche market could be exploited where passengers would prefer ocean cruising as recreation (Cunard Lines, 2014). Since that time, cruising has shown to be one of the fastest growing vacation ventures over the last 20 years (Holt & Wang, 2014). In the United States alone, the cruise industry generated more than $42 billion in total economic activity, involving over 356,000 jobs (Cruise Line International Association (CLIA), 2014). In Europe, the cruise sector generated a direct and indirect employment of over 315,000 jobs, reflecting a 75% increase in a five year timespan (Cruise Line International Association (CLIA), 2014).

In 2013, 20.9 million passengers experienced a cruise and the industry saw an annual growth rate in passengers traveled ranging from 1.3% to 184.6% depending on the market location (CLIA, 2014). The annual growth rate of cruise ship passengers worldwide from 1999 to 2013 has been about 3.1% annually where the number of passengers in 1999 was 6,337,000, and in 2013, it was 20,976,000 (Cruisemarket.Com., 2014[3]). As the demographics of the United States, Western Europe, and parts of Asia age, the demand for cruises is projected to increase as retirees look for vacations to exotic locations while experiencing the glamor and luxury of a cruise ship.

In recent years, we saw several high profile disasters or mishap events with cruise lines. With the 2012 Costa Concordia disaster and subsequent event with Carnival Triumph, questions regarding cruise line safety are beginning to surface. In the case of the Costa Concordia the ship struck a rock near the Italian island of Giglio causing the ship to roll on its side costing 32 passengers their lives (Cruisecritic.Com., 2014). When the Carnival Triumph lost electrical power due to an engine room fire, 3143 passengers were left adrift in the Gulf of Mexico for days (Griffin & Bronstein, 2013). With the global media attention of these events, the industry faced investigations and other legal actions on safety concerns.

Although the industry is well regulated by the SOLAS Convention (Safety of Life at Sea), the United States Senate Committee on

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[3] Cruisemarket's proprietary database tracks daily ticket prices at the cabin category level and passenger volumes to port destinations from over 10,000 annual cruises worldwide from 35 cruise lines. Further, it tracks daily ticket prices at the cabin category level and passenger volumes to port destinations from over 10,000 annual cruises worldwide from 35 cruise lines.

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Transportation and other governmental organizations within and outside the United States have begun to investigate some of the causes of these events and practices of the industry in an effort to address new potential regulations on cruise ships. Although there is a wealth of scholarly literature addressing the merchant disasters and mishap events (NTSB, 2014), there is a paucity of scholarly research on current cruise ship mishaps. This research paper attempts to fill the gap in the research by exploring the causes of cruise ship mishaps through the evaluation of 580 cruise ship events from 1989 to 2013. Using the two-stage measurement design methodology on the data gathered from www.cruisejunkie.com on each incident and confirmed with other sources, we first evaluate what happened and what caused what happened classifying the cause of each mishap.

2. Previous literature on cruise line shipping

Much of the academic research on cruise line shipping has focused on the tourism and business opportunities for the operators and ports of call. For example, Veronneau and Roy (2009) investigate practices and challenges of the cruise line corporation. These practices and challenges can include increased consolidation of cruise line operators (Hobson & Perry, 1994). Wood (2000) evaluates the growth of Caribbean cruise tourism whereas Cartwright and Baird (1999) look at the global development and growth of the cruise industry. Other literature reviews the economic impact of cruise tourism on nations and ports including how much passengers spend (Dwyer, Douglas, & Livaic, 2004; Dwyer & Forsyth, 1996; Henthorne, 2000). Further, passenger satisfaction with the cruise experience is also highlighted in several articles including the recovery of ticket price if the recreational experience is jeopardized through a cruise ship mishap (Kirby, 1991; Marti, 1992; Teye & Lecerc, 1998).

The business decision by cruise ship operator of port selection has also been well researched (Marti, 1990, 1991) as has the history of the renaissance of cruising as a recreational, vacation destination (Kwortnik, 2006). Failures and successes of cruise line businesses are been also studied including successful patterns of operations (Lawton and Butler, 1987; Douglas, 2001). In this paper, however, we will focus on mishaps/disasters of cruise ship operations.

3. Safety regulations and possible causes of mishaps

The origins of cruise safety regulations were precipitated by the Titanic disaster in 1912. The SOLAS Convention or the International Convention for the Safety of Life was first adopted in 1914. This convention and all its successive forms are regarded as the most important of all international treaties concerning the safety of merchant ships (IMO, 2014). Cruise ships are “like cargo vessels” for the purpose of this Convention (Stopford, 2009).

There is vast and abundant literature on merchant ship safety and mishaps. Much of the literature addresses the health of seafarer at sea including stress, fatigue, communicable diseases, exposure to hazardous substances and skin cancer (Oldenburg, Baur, & Schlaich, 2010). Further, the research confirms that seafaring has been recognized as one of the most dangerous occupations with deaths from maritime disasters, illness, suicides, homicides and occupational accidents (Nielsen, 1999; Nielsen & Roberts, 1998; Roberts, 2008). Major causes of mortality from shipping disasters include vessels foundering in typhoons, storms and severe gales, explosions in cargo holds and collisions in poor visibility (Roberts, 2008). For the current cruise line mishap literature, the health of the passengers and crew dominants the research such as the outbreak on the Aurora and the negative reaction of Greek and Spanish governments to the incident (Elliot, Harris, & Baron, 2005). Of course, terrorism on cruise ships is a new concern (Bowen, Fidgeon, & Page, 2014; Carafano, 2007).

In general, most of the literature confirms that the majority of mishaps (up to 80%) are due to an element of human error. The literature further focuses on the best practice of creating a climate of safety aboard vessels (Baniela & Rios, 2011; Lu & Tsai, 2008). There is, however, a paucity of current research specifically on cruise ship operation mishaps outside of the illness outbreaks of passengers and crew. This paper will attempt to address this gap in the literature. Further, since the loss of life on a cruise ship may be greater in a mishap due to the sheer number of persons aboard a cruise ship versus a merchant ship, cruise ship mishaps may require special attention in the research.

4. Literature on cruise ship mishaps/disaster

The attention of cruise safety has been an imperative because of the number of human lives at stake on any given cruise. The number of passengers per cruise can be as high as 4000+ passengers per vessel. Although the risk may be small for the loss of human life, the issue of safety for cruise ships is emotional, and it is this emotional response to human life that causes cruise ship incidents to receive high attention from the media and the public.

Unlike the intensified concern for tanker vessel accidents after the Exxon Valdez in 1989, the studies of cruise failures or passenger vessel accidents have received less attention in maritime literature. Even though previous cruise accidents have resulted in huge damage of property and a large numbers of fatalities, the causes of the incidents of passenger vessels are rarely found in the literature. Among 116 marine accidents from 1988 to 2014 that involved US vessels or on the US waters, 37% were related to passenger vessels (National Transportation Safety Board (NTSB), 2014). In 2013 alone, the United States Coast Guard (USCG) Maritime Information Exchange reported that 44 inspected passenger vessels were directly involved in the incidents, such as collision, sinking, capsizing of vessels, or indirectly, such as vessels providing emergency assistance or witnessing the event. Cruise ship safety is, in fact, excellent with only 16 fatalities out of more than 100 million passengers worldwide for the years 2005 to 2012 (Carne, 2012). In the period from 1988 to 2014, only eleven incidents were associated with large cruise lines. To reduce accidents and save lives, one of the top ten safety issues highlighted by the NTSB in the US in 2014 is the advance passenger vessel safety (Holt & Wang, 2014).

As noted above, given that the cruise industry has gained interest from the academic world with research addressing the development of cruise markets, geography of port selection, itinerary and choice of destination, and cruise tourism, attention on cruise failures and accidents are very limited. Few examples are Talley, B. D. J., and Kite-Powell (2008) on the severity of cruise vessel accidents, Lois, Wang, Wall, and Ruxton (2004) on cruise safety assessment, and Lu and Tseng (2012) on ferry passenger safety.

Talley et al. (2008) study the determinants of property damage and injury severity from cruise vessel accidents. In their study, they evaluate various types of accidents including collisions, equipment failure, explosion, fire flooding, grounding, breakaway, capsize and sinking with regard to the cost of damage. They find that explosion accidents have the highest unit damage cost per vessel gross ton. Further, they determine that human factors increase fatal and non-fatal injuries more than vessel and environmental factors.

Lois et al. (2004) address cruise ships from a pre-disaster perspective. They evaluate nine case studies and propose a safety assessment methodology. They conclude that there are four potential countermeasures to address prior to a cruise safety mishap. First, interventions can prevent certain causes of disaster. Here they list proper equipment, training, detailed procedures and preventative maintenance as the appropriate interventions. Second, they list intervention before an incident where enhanced surveys, communication equipment, alarms, remote sensors and check-off list for routine evolutions are imperative. Third, drills to respond to common incidents and special procedures for higher risk evolutions are interventions before an incident. And finally, they enumerate interventions before the consequence of the incident such as response plans, emergency drills, lifesaving equipment, emergency instructions and crew training.

Lu and Tseng (2012) do not study cruise ship safety but do evaluate safety on passenger ferries. They identify crucial safety assessment criteria using empirical methods. They find that crewmembers' abilities were the most important factors in assessing passenger ferry safety. Safety equipment, ship structure, navigation, communication, ship documentation inspection and safety instructions, all required under SOLAS, are considered secondary.

5. Research questions and methods

The goal of this paper is to fill the gap on the research and to contribute to the understanding of the nature of mishaps in the cruise industry by evaluating 580 mishap incidents from 1989 to 2013 through a two-stage measurement design (Fischer, Cullen, & Turner, 2000). In analyzing a problem, often determining what happened in the past is critical to any further analysis. Further, the cause of what happened is the first step in correction or solution of the problem. This methodological application, used in criminal reporting sociological studies, is a novel approach to the investigation of mishaps/disasters. First what happened is determined and then the cause of what happened is determined. This methodology looks at the frequency of an occurrence as a measure of the severity and societal cost of a problem where monetary values are not reported, not estimated or not comparable. Prevention of disaster/mishap can be evaluated similar to prevention of crime where understanding the type of crime and cause can address prevention.

Qualitative analysis research looks at in-depth case study while quantitative analysis addresses panel data with time series and cross sectional dimensions. However, this study provides a broad overview to create an awareness of incidents which are rare but may be more costly than other vessel market segments. Further, due to the uniqueness to cruise ship operation, prevention solutions may differ greatly from merchant vessels. The two-stage measurement design is an inquiry that investigates a contemporary phenomenon in which multiple sources of evidence are used across multiple cases and time periods. This methodology relies on descriptive statistics in reporting findings.

6. Two-stage measurement design

The two-stage measurement design draws on the ability to analyze with two questions simultaneously: What happened? And what caused what happened? This parallel use of the data may better assist collection of data on mishaps/disasters.

In order to execute the two stages of what happened and what caused what happened, we delineate the entire process of the two-stage design. First, we define a mishap/disaster. Second, we define the population of mishaps to be collected and reviewed. Third, we review and collect data on the mishaps. Fourth, we determine the cause of the mishap. Fifth, we categorize the mishaps in a systematic way to determine a pattern of causation. The entire process is performed cooperatively by all authors.

The definition of mishap/disaster, the unit of analysis for this study, is the cruise ship incident where there is an adverse outcome reported, regardless of severity, to the recreational experience involving the operations of the ship. It does not, however, include illness outbreaks. We define the population of mishaps as 580 separate cases of cruise mishaps for the years 1989 to 2014 reported to and collected by cruisejunkie.com, and we rely on the cruisejunkie.com dataset to initially screen that a reported event is a mishap. However, we do verify the incidents through other sources described below. This reference period for defining the population, with the initial year of 1989, represents the beginning of the growth of cruise ship experience as a form of recreation (Cunard Lines, 2014) rather than transportation.

Next, we attempt to collect detailed information on what occurred during the mishap incident including the type of mishap and the cause or causes as reported from various sources. This information becomes a part of the incident report in the dataset. We describe this detailed information under the data source section. We then determine what factors contributed to the mishap verifying the cause. Further, we address in this step the SOLAS regulations in mind. SOLAS identifies the safety concern requirements into three areas: the ship design, the crew safety procedures and the maintenance of ship equipment. Further, in Mileski and Honeycutt (2013), failures can occur in three areas causing the mishap or disaster: pre-incident planning, the right implementation of the plan or use of resource, and flexible, well-maintained resources.

Finally, we categorize the cause of the reported mishap. The specificity of the categories is described below. The severity of the mishap is not classified merely the cause, although severity is another valid way of categorization. The types or categories of cause are constructed by marrying the SOLAS safety concerns with the elements to avoid disaster under Mileski and Honeycutt (2013). We anticipate that the causal factors of mishaps may fall into the following categories: the ship design (pre-disaster planning), crew training or human error (right implementation of the plan or use of resources) and maintenance of the ship (flexible well-maintained resources). However, we review all incidents to determine other causes not listed above.

The resulting data furnish a systematic analysis of the causes of recent cruise mishaps. Construct validity and external validity are established through the use of multiple sources within the main dataset described below. Internal validity is addressed by evaluating the findings of the investigation of a cruise event, i.e., x led to y, reported in the dataset. Finally, reliability is established through the protocol of categorization of the incident also described below.

7. Data sources

The information on cruise ship mishaps is available through an archival dataset of incidents reported. The dataset contains detailed reports on the nature of the events that happened (what happened) during cruise ship event (mishap). The information in the dataset is numerous and detailed enough to evaluate what occurred during the incident. The information is also used to classify or categorize the type of cause of the incident. Further, the dataset is chosen for its standardization of measurement across incidents and years providing valid comparability. The archival information is available through the website, www.cruisejunkie.com. The author of this website is Ross A. Klein, Ph.D. of Memorial University of Newfoundland in St. John's, Newfoundland. Dr. Klein has authored many books and publications regarding the cruise ship industry, and has testified before the US Congress in 2012 and 2013 regarding cruise incidents Klein, 2014.

The data in this publication are collected from archival sources of publically know cruise ship incidents. The information is published for the years 1972 to date. The multiple archival sources include news reports, Lloyd's List Casualty Report, Cruise Industry News Quarterly, IHS Fairplay, US Security Exchange Commission filings, various government transportation and maritime incident reports which include but are limited to Italian Ministry of Infrastructure, and Transport UK Marine Accident Investigation Branch (MAIB), US National Transportation Safety Board, Transportation Safety Board of Canada, Australian Transport Safety Bureau, Bureau of Maritime Affairs — Republic of Liberia, Italian Ministry of Infrastructures and Transports, United States Coast Guard and Marine Safety Investigation Unit — Malta Transport Center.

In addition to reviewing the multiple archival sources, Dr. Klein uses Google Alert to find relative information pertaining to worldwide cruise ship incidents. Further, eye witnesses to cruise incidents can self-report to the website as well. Dr Klein's data have been collected and archived since 1997. Dr Klein states that every effort is made to verify data presented. His methodology for verifying the validity of each incident made public is to cite multiple sources that relate to the incident.

Although this website appears to be a comprehensive, multiple source dataset on cruise disasters and mishaps, it is difficult to determine if incidents were omitted. In order to confirm that the dataset is

reasonably comprehensive, we confirmed that all cruise ship fatalities reported in Lloyd's Register World Casualties Report appear in the dataset. Therefore, based on the number of incidents and the years covered, it appears reasonably accurate. However, prior research shows that the number of unreported maritime vessel accidents make up about 50% of all occurred accidents (Hassel, Asbjørnslett, & Hole, 2014). Further, the comparability of information in the tables of incidents provided in the dataset appears to be comprehensive.

Archival datasets are considered objective; however, they are a result of the information gathered which may have subjective accounts of events. This website and its data are free to the public. Thus, there is no incentive to inaccurately skew or report the data. However, in reporting events, investigators, government agencies, and witnesses as humans can make errors. Further, errors in compilation can also occur. The public availability and nature of this dataset's information provide edit checks and review for consistency. Therefore, there is little incentive to maintain incomplete and erroneous information by the author. However, Dr Klein does not assume liability for the correctness of the information.

8. Categorization of incidents

In this paper, we focus on the causes of mishaps not fully addressed in the previous literature, and on the requirements of SOLAS in the broad categories of the ship and its crew (rather than on the passengers). For example, we do not address illness outbreaks that have been prevalent in the recent news reports. Furthermore, we look to the disaster research to augment the previous research on incident causes.

The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety (IMO, 2014). The country under which the ship is flagged is responsible to ensure compliance with the Convention and the documentation as proof of compliance. Under the minimum standards of construction, passenger ships must have subdivision into watertight compartments, stability requirements and safe electrical systems and machinery. Fire protection, detection and extinction equipment are also required as are lifesaving appliances, and radio communications. Furthermore, certain safety of navigation procedures and standards must be maintained on board including procedures for dangerous cargo (IMO, 2014). Therefore, we can categorize the safety concerns addressed under SOLAS into three areas: the ship design, the crew safety procedures and the maintenance of ship equipment.

In research design, the criteria for interpreting the findings are critical (Yin, 1989). The protocol here includes consistent categorization. After reviewing the dataset (with the specialized knowledge from a marine engineer who is one of the authors) focusing on incidents caused by the ship or crew, it appears that there are four main causes for mishap/disaster. However, the incidents are placed into seven categories (acknowledging more than one cause may be possible): (1) lack of proper maintenance, (2) human error by crew, (3) flaw in ship design, (4) unknown, (5) the combination of ship design flaws and the lack of proper maintenance, (6) the combination of human error by the crew and the lack of proper maintenance, and (7) the combination of ship design and human error. These categories represent the three areas of safety concerns addressed under SOLAS: the ship design, the crew safety procedures and the maintenance of ship equipment and the various combinations of the three areas.

A flaw in ship design incident (mishap/disaster) is defined as an incident with faulty equipment such as values, pipes, or incidents where long structural cracks appeared. Human error or lack of crew training incidents are incidents where the crew ran the ship aground, collided with piers and other ships, or failed seamanship in rough seas or inclement weather. Further, these incidents include incidents where general crew is involved in fires or other aboard ship mishaps. Lack of maintenance issues includes incidents involving engine trouble, propulsion trouble, generator malfunction, mechanical issues, gangway repairs, bridge equipment failure and electrical and plumbing failures. Unknown incidents included incidents with very little information available such as a reported fire on board with no cause or location. For example, if a cruise ship experienced a mechanical issue but no specific information is given as to the cause, then it is placed in the unknown category.

Here are some examples that illustrate the categorization of incidents. An example of the lack of proper maintenance is the recent generator failure aboard the Carnival Triumph. As a result of this failure, the plumbing, electrical systems and the ship's propulsion did not work leaving passengers without essential services for several days (Griffin & Bronstein, 2013). An example of human error by the crew is illustrated by the 2012 Costa Concordia incident. Here, the lack of attention from the captain and his deck crew resulted in a navigation error. The ship ran aground and 32 people lost their lives (Ministry of Infrastructure and Tranports, 2013). Finally, an example of a flaw in ship design is the 2006 fire aboard the Star Princess. This fire spread through 150 cabins and could have been contained by a better sprinkler system. Further, the balconies lacked fire protection and contained combustible materials (Marine Accident Investigation Branch, 2006).

9. Findings and discussion

The following table shows the results of the two-step measurement analysis and the categorization protocol. Table 1 shows the number of incidents of cruise ship mishaps and disasters by cause by year including the percentage of total incidents by cause over the entire time period from 1989 to 2013 and the total number of cruise passengers each year. The most common cause was found to be the lack of proper maintenance causing 60.52% of the mishaps, followed by human error by crew at 26.2%, an unknown cause at 3.79%, the combination of ship design flaws and the lack of proper maintenance at 3.45%, ship design flaws alone at 2.93%, the combination of human error by the crew and the lack of proper maintenance at 2.76%, and the combination of ship design and human error by the crew at less than 1%. As a percentage of the total passengers traveled in a year, not one cause in any year affects more than .8% of the total passengers traveling on cruise ships.

10. Contribution to scholarly knowledge

In analyzing a problem, often determining what happened in the past is important. Further, the cause of what happened in the past is the first step in prevention of future events. This is the point of this research paper — to identify the cause of disaster/mishap to begin to suggest solutions for prevention. This methodologically sound assessment and evaluation of a large number of cruise ship mishaps/disasters over 24 years attempts to add to the knowledge for ship cruise operators to help develop new methods of prevention and reduction of mishaps/disasters. This methodology has helped reveal four causal factors of cruise ship mishaps: ship design flaws, human error by the crew, the lack of proper maintenance of the ship and an undetermined cause. If more than one of these factors is present, the combination of the factors may cause more damage and loss of life (Talley et al., 2008).

The ship design for cruise ships is very complex as opposed to merchant ships. Cruise ships provide hotel service (e.g. heating, plumbing, electricity, etc.) for up to 4000+ passengers whereas merchant ships need hotel service for only about 15 to 30 crewmembers. Further, passenger ships and ferries have a high demand on timely service and quick port turnaround. Also, the ship design of cruise ships makes ship maintenance more complex than merchant ships yet turnover time in port is faster than merchant ships — typically less than one day (Port Of Canaveral, 2014; Rodrigue & Notteboom, 2008). This short amount of time may result in neglected repairs and exhausted crew. This exhaustion may increase human error by the crew. Further, human error may result from lack of crew training due to short turnaround

Table 1
Number of incidents of cruise ship mishaps by cause by year.

Years	Ship Design	Human Error by Crew	Maintenance	Design and Human Error	Design and Maintenance	Human Error and Maintenance	Unknown	Worldwide Passengers 1,000s (per cruisemarketwatch.com)
2013	2	4	8	0	3	2	2	20,976
2012	2	15	36	2	15	4	7	20,335
2011	1	8	29	0	0	0	0	19,377
2010	2	14	41	0	1	1	0	18,421
2009	1	10	27	0	0	1	1	17,216
2008	1	20	39	0	0	0	1	15,779
2007	0	15	22	0	0	3	1	14,625
2006	1	14	35	0	1	0	1	12,006
2005	0	4	34	0	0	1	2	11,180
2004	2	9	19	0	0	1	0	10,460
2003	2	5	11	0	0	1	1	9,526
2002	1	8	15	0	0	0	0	8,648
2001	1	4	7	0	0	1	0	7,499
2000	0	2	14	0	0	0	2	7,214
1999 and earlier	1	20	14	0	0	1	4	6,337 (1999 only)
Total	17	152	351	2	20	16	22	199,599
Percent	2.93%	26.21%	60.52%	0.34%	3.45%	2.76%	3.79%	XXXXX

times in port. The training of a ship's crew is critical to crew performance particularly during a ship crisis. Further, the global nature of the crew membership and passenger mix creates language and cultural barriers, which may cause miscommunication resulting in mistakes. These factors may help explain over 77% of the mishaps evaluated here.

Since cruise disasters/mishaps are infrequent, they generally have low planning priorities. Response planning tends to be either overestimated or underestimated (Tierney, Lindell, & Perry, 2001). Effective disaster response requires proper preparation. Proper preparation involves not only pre-planning for prevention, but the right plan for implementation of the right decisions for the post-disaster response (Mileski & Honeycutt, 2013).

Mileski and Honeycutt (2013) look at three factors in dealing with a maritime disaster. The first factor is the ability for response. The ability of the response is dependent on the ability to use the maritime assets available and the level of design specificity of the maritime assets. The second factor is the experience for the response. Those who respond must have the experience to deploy necessary resources. Experience with disasters is a key factor to an effective response (Tierney et al., 2001). And, the third factor is the staging of the response. Understanding the where, when and with what of strategic positioning of maritime resources also involves experience. Yet understanding how maritime assets can be integrated in a disaster response requires the skill of crew.

Cruise ships can drill for disaster response, but it can often become routinized. Further, the crew may draw on the experience of ordinary emergencies. Realistic abilities and maritime assets are needed for planning for a cruise ship disaster. Therefore, greater contingency flexibility is needed in all disaster planning (Quarantelli, 1982). Maritime assets that are flexible in deployment with crew skills can better serve in maritime disasters (Mileski & Honeycutt, 2013).

So reiterating the above findings into prior research, cruise ships need to focus on three elements to avoid disaster/mishap problems. The first element is the pre-disaster planning or the right ship design. The second element is the right implementation of the plan or the correct use of the ship. For this element, a well-trained crew or lack of human error is required. Finally, flexible resources that are well maintained are needed, and thus maintenance of all resources on a ship can avoid the damage of a cruise disaster.

11. Implications for managerial practice

- For risk assessment
  Shipping companies often expose themselves in a highly competitive market. Cruise business features risks which challenge the companies' efforts to stay competitive under the current economic conditions. Companies can manage their risk-taking behavior through risk assessment and financial management. However, technical and physical risks that refer to the possible break down of a vessel, mishaps, and loss of vessel and human life will result in inevitable damage to a company's reputation. The results of the paper provide important information to the cruise community and regulators as to what safety standard should be implemented and review regularly and how risk management procedure should be taken to ensure the shipping companies' sound operation under various uncertain circumstances.
- Maintenance procedures
  Although cruise ship disasters are rare, more can be done by the industry to make the recreational cruise experience safe and uneventful. Based upon the results of this research, we now know the main cause of cruise ship mishaps and disasters. In addition to a well-trained crew and flexible resources available to the crew during a mishap/disaster, new technologies in the ship design may be needed to enhance

maintenance schedules such as compartmentalization of ship component parts for ease of removal and replacement in port. Evaluation of the effectiveness of current best practices of maintenance must be considered such as the turnaround time of the vessel, the number of maintenance crew members and the technology support for maintenance in the ports selected by the cruise lines. However, more research is needed to pinpoint specific maintenance issues, and work needs to be done on whether specific ship characteristics contribute to increased risk for mishaps/disasters such as flag, crew composition, ports or call. Future research should focus on the risk prediction of the likelihood of a mishap.

Merchant vessel safety research has focused on creating a climate of safety on vessels. Unsafe crew actions noticeably contribute to accidents. Management commitment is the main focus of contemporary safety climate implementation including training and the presence of safety committees and safety officers (Lu & Tsai, 2008). Creating a climate of safety both on cruise ships and in the maintenance operations of cruise ships may provide an answer to reducing mishaps in an already safe industry.

12. Conclusion

This research provides the first step to future research regarding cruise operations, cruise company efficiency and cruise risk assessment and to bring insightful empirical ground for practitioners and policy makers. Events, though rare, attract global media attention and can tarnish brand reputation critical for successful business performance. Further, knowing the factors that contribute to cruise ship mishaps and failures can provide a foundation of preparedness that may prevent future disasters in the cruise industry.

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