Assessing the effectiveness of the ISM Code in developing a safety culture

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Abstract

The adoption of the International Safety Management Code by the International Maritime Organization as a means to promote a change in maritime industry's attitude towards safe operating practices has been well documented. The code placed a strong level of responsibility on the ship owner or operator to conduct a self-assessment of their policies and practices in order to develop and implement a safety management system that was auditable by internal personnel and the company's chosen regulatory bodies – Flag Administration and Classification Society. IMO's regulatory efforts had previously be prescriptive and dealt with the design, outfitting and operation of a ship. The code extended this regulatory oversight to the shoreside management. After over two decades of use, few studies have been conducted to examine the impact and effectiveness of the ISM Code in modifying and improving the safety culture within the maritime industry. As IMO has yet to set a specific end state they wish to achieve through the implementation and enforcement of the ISM Code this paper utilizes trend analysis to review data from four different sources – port state control inspections, accident investigation reports, environmental crimes cases, and a specially developed questionnaire sent to a representative cross section of the maritime industry. The collected data has been displayed graphically and examined to identify trends. For most data collected, the presence of a downward trend (i.e. a reduction in the quantity) is considered a positive safety trend. Based upon these trends, and utilizing studies on culture and behavior changes, an assessment of the impact and effectiveness was concluded. The results can form the basis for moving the discussion on the presence of a safety culture in the maritime industry forward and for highlighting gaps where the ISM Code may need future revision.

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Research Objectives

Since the 1980's, major accidents, including the fire and explosion on Piper Alfa, the fire on Scandinavian Star, the capsizing of the Herald of Free Enterprise, loss of the cruise ship Costa Concordia, loss of the cargo ship El Faro and more recently the major criminal pollution investigation into Princess/Carnival Cruise Lines have shown that often the root causes for these type of incidents can be directly attributed to the actions or inactions of the company's shoreside management. "The management system of the organization has substantial influence over and responsibility for the exposures that occur at the shop floor level. It is further assumed that management actions and the development and implementation of specific safety policies and programs are heavily influenced by the culture of the organization" [DeJoy, 2005]. In a June 2019 report, the insurance underwriter Allianz Global Corporate & Specialty observed that approximately 60,000 ships, registered in over 150 nations were involved with transporting the world's cargo. A statistical review indicated only 46 vessels of over 100 gross tons were lost in 2018, the lowest reported number since the turn of the century and a total decline of over seventy-five percent from the 207 vessels lost in 2000. The year-over-year numbers were just as impressive – a fifty-three percent decline from 2017. As part of their analysis, Allianz credited four reasons for the reduction: improved ship design and technology, stepped up regulation, advances in risk management and safety, and more robust Safety Management Systems and procedures factoring in the prevention of breakdowns, accidents, and other mistakes escalating into total losses [Allianz, 2019]. The study also highlighted that the number of shipping casualties or incidents only declined by one percent between 2017 and 2018. Based upon these statistics, it would appear that progress towards an improved safety culture has stagnated and led to the question – how effective has the International Safety Management (ISM) Code been in implementing a cultural change in safety and environmental awareness within the maritime industry?

This paper presents the finding of research into the effectiveness of the ISM Code in altering the safety and environmental cultures within the maritime industry. While the ISM Code is considered to principally focus on safety, an additional objective of the Code was for the maritime industry to avoid damaging the marine environment [IMO, 1993]. The primary question to be answered was that twenty years after coming into force, has the ISM Code been effective at altering the safety/environmental culture in the shipping industry? If not, how can its effectiveness be improved? The main aim of the study was to determine whether the ISM Code has had the anticipated effect of improving the safety and environmental cultures of the marine industry and if not, why.

In order to accomplish this, the following analysis was carried out: evaluation and comparison of port state control inspection and detention data, evaluation of accident investigations prior to the implementation of the ISM Code and those occurring in the last three years to identify any trends in root cause or causal factors, particularly regarding any contribution that shore side management has had in accidents during the last three years, assess the presence of an environmental awareness culture by reviewing environmental crimes cases to identify trends and any contribution from shoreside management, and evaluate the responses to a questionnaire sent to individuals representing shipboard crew, shore side management, and flag administrations.

For the purposes of this study, the term 'safety culture' wherever used includes both safety and environmental awareness.

Literature Review

The ISM Code is a departure from the regulatory schemes used to ensure the safety of vessels, crew and passengers, and the marine environment for almost 80 years. Starting with the sinking of the Titanic in 1914, various international conventions were adopted with the sole purpose of prescribing key design, structural, outfitting, or operational requirements that must be complied with in order for a vessel to be certified to carry cargo between signatory nations. The incidents previously discussed shone a spotlight on the fact that safety did not solely rely on the actions (or inaction) of the crew. It also included the actions or inactions of the shoreside management team and highlighted a general lack of a safety culture amongst

all parties involved. A new regulatory effort to ensure shoreside management provided the organizational support needed to promote the safety and well-being of the vessel, crew, and environment needed to be developed. Following on the heels of the tragic accident involving the Herald of Free Enterprise, and coinciding with an increased focus on quality management in commercial businesses through the development of the ISO 9001 standard, IMO passed a resolution that provided guidelines on the safe operation and management of ships. When the rate and severity of shipping accidents did not appreciably change, these guidelines were incorporated into the Safety of Life at Sea convention; enabling the requirements to be enforced by both the vessel's Flag administration as well as the various port states the vessel called on during the course of its voyage.

As with any quality management philosophy, once a change is envisioned, the organizational leaders should go through a four-step process – plan, do, check, and act. The drafting of the guidelines and adoption of the ISM Code into SOLAS can be seen as the planning and doing phases of quality management. The question arises whether the third phase – checking – has been adequately accomplished; especially considering that the Code has been amended on five separate occasions. In attempting to assess the impact or effectiveness of the ISM Code in improving the safety culture within the maritime industry, a review of existing research was conducted. The goal was to identify whether a substantive analysis of the impact of the ISM Code had been carried out since the final phase of implementation in order to build on its foundation. Research typically fell into one of three areas of emphasis. The first was analysis of the effectiveness of the ISM Code in developing a safety culture within the shipping industry. There were few studies in this area. A second, more prevalent area of research dealt with safety culture at the company level. In these studies, the impact of the ISM Code was typically viewed as an ancillary factor, with the studies typically focusing on the safety culture within the organization. Scant attention was paid to how the Code was interpreted and implemented by the company. Since the organization was required to comply with the regulatory scheme there was little attention focused on whether the regulations had any impact. The most prevalent area of research dealt, not with the ISM Code, but safety cultures, in general. Research in this area was found to be beneficial in assessing whether a safety culture exists within the shipping industry. It also provided a peak into strengths and weaknesses within the ISM Code.

Changing safety cultures

"Safety culture is a series of beliefs, norms, attitudes, roles and social and technical practices which are established to minimize the exposure of employees, managers, customers and third parties to hazard" [Dyrhaug, A. and Holden, 1996, pp.7]. When discussing the culture of an organization, Schein's work is generally noted as the baseline. In his studies, three key elements were highlighted as being necessary to discuss the culture of an organization. These consisted of artefacts, values, and basic assumptions [Schein, 1985]. While these can be easily identified within a single organization such as a company, these elements are much harder to clearly identify when you look at an industry. Due to the extreme diversity amongst ship owners and industry segments regarding organization, management style, customer needs, ship design and construction, and vessel operating procedures, using Schein's analysis to evaluate the culture of the shipping industry is not appropriate. However, the statement that "organizational culture is a pattern of basic assumptions – invented, discovered, or developed by a given group as it learns to cope with its problems of external adaption and internal integration – that has worked well enough to be considered vital and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems" [Schein, 1985: pg 9] can be seen at the heart of the changes the ISM Code hoped to bring about.

If the implementation and adherence to the constructs of the ISM Code was to lead to the development of a safety culture in the maritime industry, an evaluation of safety behaviors prior to the introduction of the Code is required. The safety discussions typically found in the general workplace can be considered as a comparison to similar specific discussions about the shipping industry; the difference is the scale of the accidents being discussed. One can substitute a discussion of causes for collisions, groundings, sinkings, etc. for discussions regarding personnel injuries, slips, trips, and falls; one discussion focuses on the micro level and one on the macro level. DeJoy [2005] looked at divergent approaches to managing workplace safety. Specifically, DeJoy identified two methods for managing workplace safety: a behavior-based

approach focused on identifying and altering critical safety behaviors by extolling how they impact personnel injuries and losses and an emphasis on the importance of the organization's safety culture and how it influences the actions of company personnel.

The behavior change theory utilizes rewards and punishments to encourage work groups to correct their actions in order to conform with an acceptable practice – that being safe work practices in this case. Organizations that utilize this behavior change theory use three steps to drive the change. First, they identify and clearly define the behavior to be changed. They set goals to focus the behaviors and to track performance and finally they gather feedback in order to encourage continuous improvement. In order to encourage the changes, some means of external reinforcement is required (could be as simple as a bonus for good performance or loss of employment for poor performance). In utilizing this approach, as long as the external reinforcement is present, the changed behavior should continue. Once the reinforcement is removed, the behavior will tend to return to the previous norm. DeJoy highlighted that in some of the recent studies, the periodic re-application of the reinforcement could result in more lasting results. This could lead to more of a cultural change if done long enough.

Behavioral change is employee focused. It requires the workers to buy in – usually encouraged by the reinforcer. This does not necessarily address the issues that tend to negatively impact the safety culture in shipping – pressures from shoreside management to meet financially driven objectives. One potential drawback to the behavior approach is it assumes that faults for accidents lie with the crew. Following an accident, behavior systems tend to look at the specific actions that preceded the incident to determine what changes to procedures need to occur. It does not carry out a full root cause analysis. As borne out during analysis of ship accidents and detentions, it would appear that many organizations in shipping fit this theory. This is exactly why the ISM Code was developed.

DeJoy's second method, culture change, was derived from the expectation that the values of the organization regarding safety will drive the success of any plans or initiatives to manage safety. These efforts will mold the beliefs of employees regarding the organization's safe work practices. Under the ISM Code, the company's Safety Management System (SMS) is supposed to accomplish this culture change, especially since the Code mandates the SMS undergo periodic review by the users (ship's crew). For this method to be successful, management must truly believe in the importance of safety and must incorporate the employee into the management of safety within the organization by seeking input into policies and procedures. However, if management only pays superficial heed to the management system, the culture change doesn't occur. The company's Safety Management System cannot only exist on the shelf. The organization must have the total commitment of senior management to the SMS. In order for the Code to be successful in changing the safety culture, it relies on the organization to place the value of safety above everything, with the threat of a ship being detained the only reinforcement. For companies with large fleets that operate in spot market or tramp services, they may be willing to take a calculated risk that one ship being detained for a short period of time will not significantly impact their bottom line thereby resulting in a less noticeable change in culture (companies in liner service or highly competitive markets do not have this luxury and tend to be more risk averse). Consequently, relying on management's total commitment may be a fundamental flaw in the ISM Code that warrants further study beyond the scope of this project.

A potential weakness in the culture-based approach exists. Under this approach, the culture is continually assessed and methods to continually improve are sought. However, the assessment of the change is subjective and can result in the organization becoming complacent. This can most often show up in the organization's implementation phase. The Code requires the company to internally assess and document its procedures and current culture. Then, through periodic internal audits and management reviews, revise the initial assessment and documentation to address gaps, trends, or changes. Consequently, the assessments are subjective and are only as effective as the effort put in. These assessments consist of the annual internal audits and periodic external audits required under the Code. The organization must have high quality audits to identify gaps or shortcomings and seek out he required improvement.

Following the behavior versus culture change theories, it would appear that IMO is attempting to use behavior change theory masquerading as culture change to raise the level of safety in the industry. The

effectiveness of the ISM Code still appears to rely on the threat of a ship being detained (or banned from a region) or a poor performing company to be targeted for increased frequency of inspection in order to compel compliance.

Does a safety culture exist within the maritime industry? Havold [2000] attempted to identify the presence of a safety culture within the maritime industry by analyzing existing research. At the time, there were two terms being utilized, often interchangeably – organizational culture and organizational climate. Havold distinguished between the two terms by using Schein's previously mentioned definition of organizational culture and Campbell, et al's [1970, pp. 390] definition of organizational climate: "a set of attributes specific for an organization which can be observed by the way the organization is dealing with its members and its environment. For each member of the organization the climate will appear as a set of attitudes and expectations that describe the organization both in static characteristics (like the degree of autonomy) and links between actions and result, and one result related to another." However, Arslan et al [2016, pp. 3895] had a more succinct definition of safety culture: "how an organization behaves when no one is watching." Havold's analysis indicated that to be considered a culture, the behaviors had to be part of the subconscious while to be considered a climate the behaviors were part of the conscious. If one considers safety to be a culture that exists in the subconscious, then a safety climate would also exist within the organization as a part of that culture. But the converse would not be true.

The stated objective of the ISM Code was to create a cultural change within the maritime industry regarding safety. But in order to change the culture, one must imbue a safety awareness into the subconsciousness of thousands of shipboard crew members from different cultural backgrounds as well as the shoreside personnel tasked with supporting them. In order for that to occur, the ship owner must buy in to the process by critically assessing the organization and then developing and implementing the policies necessary to bring about the desired changes. There is a strong likelihood these changes will impact the bottom line, at least in the short term, which causes organizations with little margin to identify ways to minimize the changes or circumvent the requirements. As soon as the top-level management stops supporting the process, the cultural change ceases and the ISM Code loses its effectiveness.

Safety culture at the company level

The difference between a culture and a climate were clearly indicated during Zohar's study of 20 industrial organizations in Israel regarding the employees' perception of the importance safety plays within their company. The study indicated that outside safety inspectors observed a strong correlation between employee perception and the effectiveness of the company program [1980]. Additionally, companies with strong safety culture and low accident rates had direct involvement from top-level management. This is correlates to DeJoy's observations regarding culture and behavior theories.

Zohar identified eight factors that differentiated the safety cultures between organizations. These factors included the perceived importance of: safety training programs, management attitude towards safety, effects of safe conduct on promotions, level or risk, effect of work pace, status of safety officer, effect of safe conduct on social status, and the status of the safety committee [1980, pp. 98]. To these, Havold added a ninth factor: the degree to which accidents and incidents are investigated to determine causal factors and modify procedures to reduce the likelihood of future incidents [2000, pp. 81].

Both Havold and Zohar observed that management commitment and employee involvement are critical to development of a safety culture; an observation that mirrored DeJoy's belief that organizations with a true safety culture have a strong commitment from the top down and the employees are actively involved in the management of safety. Havold summed it up succinctly by opining that "good safety performance is, therefore, a matter of much more than the preparation of well-structured company safety procedures [2000, pp. 82]."

The key to achieving that performance, noted by Akyuz and Celik [2014], was implementation and enforcement. Periodic assessments (the ISM Code required annual internal audits) was necessary to

increase the effectiveness of the company's safety management system. Enforcement was a reinforcer for getting the work force to develop appropriate habits.

In his study, Zohar noted that a consistent feature of high performing companies was a strong emphasis placed on safety training. Almost as important was the open communication between management and workers. Under the ISM Code, that function can be seen with the role of the Designated Person Ashore (DPA) who is tasked with providing a direct link, outside the normal chain of command, between the lower levels of the organization and the top managers.

High performing companies have clear and distinctive ways of promoting safety within the organization, including guidance and counseling instead of simple enforcement and punishment. The urgency in accomplishing this can be found in ICS' observation that "the indirect financial costs of accidents for a company are generally about three times those of insurance claims involving personnel, cargo damage, or pollution [ICS: pp. 5]." Under IMO's various regulatory schemes particularly under the ISM Code, safety is primarily promoted via negative reinforcement – companies are punished (e.g. - detentions, blacklisting, banned) and it is left to commercial market forces to positively reinforce. Under DeJoy's theories, this is a further example of behavior change theory and not culture change, as IMO intends. Some port state control (PSC) regimes have tried to alter the paradigm through the use of quality performance incentives for PSC exams, typically by reducing the frequency of a ship's PSC inspections for companies that meet a specific threshold of performance over a period of time.

So how do these companies act? Aslan et al [2016] conducted a safety climate assessment within a single company in an attempt to develop an assessment and implementation framework necessary to identify weaknesses in the company's safety culture and develop strategies to close any gaps or to raise performance. The study utilized questionnaires designed for specifically for shipboard and shoreside personnel with follow up interviews for a percentage of the respondents. The results were broken down into ten factors (dimensions) and the scores between the shoreside personnel and shipboard crew were compared in order to develop the overall safety score of the company. Some key findings included the observation that shoreside personnel had a better attitude towards safety than the crew, especially when the questions delved into issues of employer-employee trust. This phenomenon will be discussed further in the following section. Another keen observation was that the factor of promotion of safety within the company was the second lowest score for both groups. This flies in the face of DeJoy's assertions that in order for an organization to follow a path of culture change, there must be total buy in from senior management and is another indicator that the ISM Code may not be able to provide the wholesale cultural change that IMO envisions.

As part of the prelude to the one hundredth anniversary of the adoption of the first SOLAS convention, the International Chamber of Shipping published a document to assist shipping companies in implementing an effective safety culture [ICS, 2013]. The paper noted, as with the Allianz study and others, that following the initial implementation of the ISM Code there was a noteworthy decrease in the number of accidents, spills, and lives lost. But by the start of the second decade of the millennium, there were a number of high-profile incidents (Deepwater Horizon and Cost Concordia to name two) that highlighted that the industry still faced an overall lack of a safety culture. One of the key aspects to fully developing a safety culture was for companies to maximize the potential of the SMS to create and manage barriers to accidents. Barrier management is the key to reducing or eliminating accidents. A properly implemented SMS enacts physical and procedural barriers that reduce the likelihood that all the causal factors necessary for an accident to occur will align themselves.

The ISM Code, through the company's SMS, encourages the self-regulation of safety. The critical link to accomplishing effective self-regulation is by setting safety goals and targets. This is the basis of DeJoy's cultural change theory. In order for the company to set SMART safety goals, one must acknowledge that incidents are preventable, all company personnel must be continuously vigilant, and key performance indicators for tracking safety improvement must be identified. These points broadly support the findings of Havold's and Zohar's studies.

Few direct analyses of the effectiveness of the International Maritime Organization's (IMO) regulatory scheme for driving cultural change were carried out. At the direction of IMO an assessment was conducted by a selected panel of industry experts. The study commenced shortly after the final phase of implementation was completed and had the directed purpose of determining whether the ISM Code had the expected impact on the safety culture within the shipping industry. The stated goal was to determine if the ISM Code had improved the safety culture and quality of shipping [IMO,2005] and the study consisted of both primary and secondary data analysis.

The first phase of the study analyzed secondary data consisting of the number of deficiencies issued during port state control inspections. The results were inconclusive. Due to the number of variables regarding the identification and reporting of deficiencies, no identifiable trends between the number of inspections, deficiencies and the implementation of the Code were found. The panel determined that, while objective evidence of a decrease in deficiencies was noted, the impact of other regulatory work involving national, regional and international organizations could not easily be isolated from the impact of the ISM Code. Therefore, the decrease in deficiencies could not be solely attributed to the ISM Code.

The second phase of the study involved developing and distributing questionnaires through various third-party organizations to flag administrations, ship owners and seafarers. The IMO panel found the data tended to indicate a positive impact from the implementation of the Code. However, that information differed from the experiences of the panel members. The low percentage of responses within each industry segment to the questionnaires did not allow for definitive opinions to be developed.

A total of 162 questionnaires were sent to Flag administrations of which less than twenty percent responded. Those that responded covered a wide size range – from registries with less than 50 ships to those with more than 1000. Noteworthy was that half of the respondents saw a decrease in detentions, thirty percent saw no change in the number of detentions and ten percent saw an increase. The trends regarding accidents was similar following the final phase of implementation [IMO, 2005]. This would indicate that the initial impact of the Code was a positive trend towards increasing safety in shipping.

The study received a total of 39 responses to the shipping company questionnaire. The companies represented a broad swath of the shipping industry with fleet sizes from small to large. Statistically, the response showed that almost one-quarter of the companies felt that they had found no major measurable benefit to the implementation of the Code [IMO,2005]. The study also highlighted the significant costs associated with obtaining and maintaining compliance. Those costs included monetary amounts for implementing and maintaining compliance, as well as personnel, where companies had to increase the number of shoreside employees to manage the SMS and compliance systems. This makes compliance one area easily targeted for financial savings for companies with little profit margins.

Harking back to DeJoy's theory on cultural change, top level management must be all in on the safety culture in order for the changes to take hold. For companies that are seeing little return on the investment, financially committing to sustained compliance may become difficult. Effectively, the IMO assessment indicates that over time, as the return on investment diminishes, twenty-five pert of the industry will see safety improvements level off or begin to trend negatively. For those companies, DeJoy's culture change has not occurred; only behavioral changes encouraged by a reinforcer have taken place. If monetary support is reduced, the reinforcer is removed and a regression in safety can easily occur. Regardless, one significant positive change did occur, communications between the shipboard crew and shoreside improved. If that continues to hold true in the future, the momentum for cultural change in these companies can be recaptured.

The response from seafarers was particularly lacking, less than 3,000 (less than one percent of the estimated crew world-wide) responded. Those that responded almost universally felt that the ISM Code had a positive impact on their work and their safety. While this would appear to be a strong endorsement of the ISM Code, the study group had to discount the results due to the sample size of respondents not adequately reflecting the industry as a whole. It appeared that only those with favorable attitudes towards

the ISM Code took the time to respond, those with neutral or negative impacts where not represented in the responses.

In the end, the study team determined, typically, only those organizations or individuals that had a positive experience with the implementation of the ISM Code tended to respond. This meant the input from a large segment of neutral or negatively impacted organizations and individuals was missing. In the end, IMO's committee stated "the success of its implementation depends to a great extent on the continued commitment, competence, attitudes, and motivation of individuals, at all levels, in the company and on-board ships to which the ISM Code applies" [IMO, 2005 pg 2]. The panel concluded the implementation had been successful and had generally resulted in positive changes to the safety culture.

Bhattaraya [2011, pp.528] observed that through his research that studies showed that roughly twenty percent of ship owners fully adopted the ISM Code and integrated it into their management philosophies. The remaining eighty percent saw the Code, to one degree or another, as a paperwork exercise that must be completed in order to continue operating. This contradicted the observations from the IMO study.

Members also concluded that reducing the administrative burden to achieve compliance through the following methods would result in increased compliance: streamlining paperwork required to be completed by the crew, make effective use of technology, encourage the crew to take ownership of the company Safety Management System (SMS) by refining the procedures it contains, and finally by increasing training for all users. As highlighted in Sanguri's [2016] article, the typical seafarer still believes the administrative burden of completing all the reports, logs, and checklists required under the SMS, as well as the inadequate training regarding what is required have negatively impacted them.

As a final action, the panel recommended that IMO carry out a follow up study in the future to obtain a better understanding of the Code's impact by reviewing Flag State safety records and port state control deficiencies for ISM compliance data. This study does not appear to have been carried out. However, some of the data collected for this research can provide some insight into the potential results from such a study.

If one presumes that an effective safety culture has been developed through the effective implementation of the ISM Code, then over time, the accident rate onboard ships should decrease. Similarly, the number of detention due to non-compliance, or the quantity of detainable deficiencies found on any given inspection should likewise decrease. Papanikolaou, et.al [2015] conducted a statistical analysis of ship accidents for the world's shipping fleet over a 22-year period starting in 1990. The study built upon data from a previous Det Norske Veritas (DNV) study. The goal was to identify the relative safety level of each ship type to determine if any one type had a greater likelihood for accidents to occur. The results indicated that during the time period between 2002 and 2012, the frequencies of incidents generally increased. Since this is the time frame immediately after the implementation of the ISM Code, it could be argued that, if the Code was effective, these frequencies should have decreased.

Similarly, in a study of port state control data from the Tokyo Memorandum of Understanding for the Asia-Pacific region, Chen, et al [2019] observed that the number of detainable deficiencies found on vessels had increased during the period from 2015 to 2018. The study highlighted the factor that played the largest role in a ship being detained within the Tokyo MOU between 2008 and 2017 was a failure to comply with the ISM Code. This would seem to contradict the Allianz study's conclusion and the desire of IMO for the Code to promote a safety culture within the shipping industry.

An examination of the ISM Code's impact and effectiveness from a qualitative perspective in an attempt to correlate research on "whether employment and social conditions identified as necessary to support effective implementation of self-regulating workplace health and safety procedures by shoreside management of are present in the maritime industry" [Bhattacharya, pp. 528]. Part of the reasoning behind the project was a 2008 International Union of Marine Insurance study that showed the total number of ship losses (sinking, etc.) had decreased over the first 10 years the ISM Code had been in place while the number of other types of incidents had actually increased. The data for the Bhattacharya's study was developed during a three-year case study involving two tanker operators with a good business reputation and with a port state control detention ratio that was better than the industry average. Data was collected

from the shoreside offices as well as from two vessels for each organization. The vessels selected had average or better safety records.

One hurdle acknowledged as making an effective analysis of the impact of regulatory schemes in the maritime sector difficult is that shipping companies differ greatly in their organization, structure and function. For that reason, Bhattacharya felt that regulatory schemes designed to deal with operational management consequently must be broad frameworks that provide the guidance to companies on how to develop their own policies and procedures into risk management, maintenance, emergency preparedness, and incident reporting.

Bhattacharya's study concluded that mariners have a reduced level of participation in workplace safety management which has the effect of limiting the impact of a self-regulating management process. Often management is convinced that robust policies and procedures are the lynchpin to safety. For the case study, it resulted in shoreside micromanaging the ships to ensure compliance. This opinion was furthered by management's theory that there should be one common procedure throughout the fleet – they did not take into account the differences between vessels or agree to allow the ships to develop their own ship-specific procedures. Considering the crew felt it was their knowledge and experience that was responsible for safety onboard and the company's Safety Management System (required under the ISM Code) only needed to provide guidance for new crew onboard or for those procedures not done routinely, this led to distrust between the groups. This led to a critical failure under the ISM Code – the crew on one ship developing and maintaining their own special manual that consisted of a compilation of specific engine room maintenance jobs.

Both companies had adversarial relationships between ship and shore which resulted in an atmosphere of blame (shoreside) and fear (crew). As highlighted in this study, when the effectiveness of the ISM Code is analyzed from the bottom up (crew perspective) as previously discussed by DeJoy, it appears to have fallen short of the expectations of IMO. The bureaucracy that the code has created mandates that crew do what is necessary to pass the audits in order to keep their jobs. Consequently, no real effective change to the safety culture within the industry has occurred.

Research Design and Methodology

In planning the research for this project, a single phased mixed method approach was utilized for the purpose of carrying out exploratory research. A single phase of data collection was adopted due to the limited time frame for collecting the data. Since a significant portion of the data is from secondary sources, the only need for an additional data collection phase was to follow up on the responses to the questionnaire from as many participants as possible.

Due to the relatively short time frame allotted to this project, it was not possible to interview a broad selection of industry personnel. Therefore, a questionnaire was developed and sent to various individuals within the maritime industry. The questionnaire asked the individual to respond to both quantitative questions using a rating scale and to qualitative questions where they could expand upon their answers. The quantitative data assessed the presence of safety and environmental awareness cultures within the maritime industry. While the qualitative data looked at methods to improve the effectiveness of the ISM Code.

The secondary source data was obtained via annual Port State Control reports submitted to IMO and published on the websites of the Port State Control MOU's, from accident investigation reports published by national investigative bodies from countries active within the maritime industry, and published plea agreements for environmental crimes cases. For the data collected from the accident reports, the root causes and causal factors, as determined by the investigative body, were accepted at face value; the facts in the case were not re-evaluated and independent conclusions were not drawn. A similar process was taken for the environmental crime cases.

Attempts to minimize data bias was achieved by sending the questionnaire to select groups of individuals comprising different roles within the maritime industry – Flag Administration/Class Society auditor, shoreside management, and shipboard crew. Recognizing that the opportunity to conduct a multi-phased approach to collecting the input from a broad spectrum of maritime industry sectors, one of the criteria used in identifying individuals to send the questionnaire to be an assessment of the variety of experience and positions held within the shipping industry. It was anticipated that this would provide a more robust data collection. Also, by varying the roles within the industry that were questioned, it was anticipated that the free form responses from the individuals would provide a broader view of the industry's perception of the ISM Code. However, due to the relatively small sample size, the conclusions drawn from the responses can only be general in nature.

As designed, the research explores the relationship between the implementation of the ISM Code and the presence of (or lack of) a safety and environmental awareness culture within the maritime industry by assessing the trends in the Port State Control data – particularly the number of detentions, the detention ratio, and the detention per inspection ratio annually within two major port state control regimes. Since detentions are typically based on significant lack of compliance with safety or environmental requirements, this data should indicate whether a culture change occurred subsequent to the implementation of the ISM Code. Similarly, a review of accident investigation reports provides both quantitative and qualitative insight when reviewing the causal factors. The number of accidents with causal factors directly related to the ISM Code or the safety management system required by the Code can be indicative of the ISM Code's effectiveness. Those same accident reports provide qualitative data regarding the types of management failures occurring under the auspices of the ISM Code.

As the secondary data has been published and released publicly through various industry-related websites, there is little ethical concern over the use of this data. The biggest unknown is the quality of the data. Prior to the implementation of the ISM Code, PSC regimes reporting inspection, detention and deficiency statistics was in its infancy. As port state control regimes matured after the implementation of the Code, the quantity and quality of the data improved. One obvious sign of that maturation was the development and implementation of targeting schemes used to maximize the efficiency of PSC officers in targeting vessels that had a greater likelihood of being substandard. The creation of Black, Grey and White lists used in the targeting schemes may potentially skew the data. For the pollution cases, no single data base was identified that contained all plea agreements accepted by the U.S. federal court system. Therefore, the data collected may be skewed, but if so, the number of criminal pollution cases would only be increased.

When assessing the questionnaire data, there are two concerns that need to be kept in mind. The first deals with access to the individuals to send the questionnaire. The questionnaire was emailed to the participants. The contact information for the participants often was their official work email address. Due to company restrictions on the use of email for non-work-related items or concerns over the response being retained in the company servers (particularly for senior shipboard crew), this is believed to have played a role in the number or responses received.

Data Analysis

Data for this study was collected from four different sources in order to provide a diverse look at the effectiveness of the ISM Code: annual reports submitted to IMO containing statistics regarding port state control inspections, accident investigation reports, plea agreements for environmental crimes cases, and a questionnaire developed and disseminated to individuals representing shipboard crew, shoreside management, and flag administrations.

Port State Control Data

Havold [2000] believed that to effectively assess culture, quantitative methods were necessary because qualitative methods relied too much on perception (culture is considered a subconscious act; therefore, perception or opinion would be conscious thoughts and indicative of a climate or behavior). Qualitative

data was extracted from annual port state control reports submitted to IMO by two of the ten port state control inspection regimes and a trend analysis was carried out. It was anticipated the PSC data would provide the most effective means to determine the effectiveness of the ISM Code.

A second batch data was gathered by reviewing accident investigation reports which provided both quantitative data (the trend in the number of accidents and the number involving safety culture failures) and qualitative data (the causal factors that played a role in enabling the accident to occur).

The final data collection was through a short questionnaire that asked respondents to assess various aspects of the ISM Code in contributing to a safety culture within the maritime industry. It also provided respondents the opportunity to answer questions in written form to enable for expanded answers.

Previous studies looking into the ISM Code and the presence of a safety culture in the maritime industry (including IMO's assessment of the ISM Code and Chen et al's study) all evaluated two sources of data: the number of deficiencies issued to vessels being inspected by port state control or the number of accidents. Neither of these provides a truly effective measure for the presence of a safety culture.

The use of deficiencies as the determining factor is not an accurate measure, particularly when assessing the impact of the ISM Code. The reasons are twofold. First, the quantity of deficiencies issued may not always be accurate. Experience has shown that some inspectors may not record deficiencies for items that are brought into compliance prior to completing the inspection. Secondly, how the deficiency is assessed by the inspector regarding regulatory compliance can impact the numbers in the study. Again, based upon experience, an inspector observing an inoperable piece of required equipment could issue multiple deficiencies depending on their knowledge and experience – one deficiency for the inoperable equipment and a second if the inspector feels that the malfunctioning equipment is an indication of a failure of the vessel's SMS. This often comes down to the experience of the inspector and guidance from the port state authorities.

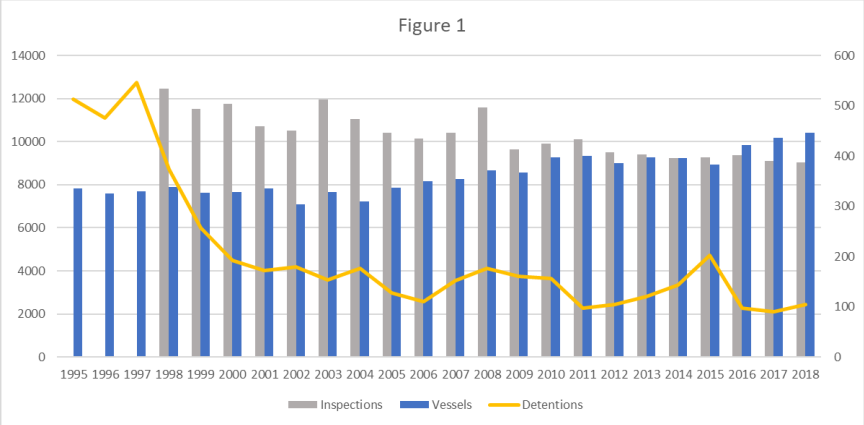
Consequently, this study utilized the number of detentions as a more accurate representation of changes to the safety culture. Additionally, most port state control regimes have a process whereby ship owners can appeal a detention if they feel the vessel was held in error. This provides a level of review and verification to the detention that is not always present when assessing a deficiency (while most deficiencies can be appealed as well, the occasions where this occurs are fewer since the ship owner does not wish to antagonize the inspector for future port calls).

The Paris MOU and the United States Coast Guard were the two regimes selected due to status as two of the most proactive regimes, the length of their existence as well as the robustness of the inspection and assessment schemes. The inspection programs from these two organizations have been used as a benchmark by many of the remaining port state control regimes.

Annual reports dating back to 1996 were found available on the websites of both organizations. Data on the number of vessels that called in the regions, the number of inspections conducted, and the number of vessels detained were collected, collated and analyzed for trends. Noting that the ISM Code was implemented in two phases, starting 1998 for passenger ships and tankers, and in 2002 for all remaining vessels, the analysis of the trends were broken into three portions – pre-ISM Code, ISM Code phase I (1998 – 2002), full implementation of the ISM Code (2002 through present).

In 1994, the United States Coast Guard (USCG) initiated an active port state control inspection program with the stated goal of eliminating substandard vessels from operating in U.S. waters. The program developed a weighted system to screen vessels for port state control exams. The system identified five factors that were critical to a ship being found in compliance with applicable standards. These included the vessel's owner's operational history, the historical performance of the flag administration in ensuring compliance, a similar assessment of the Classification Society's historical performance, the history of the vessel over the last twelve months (this focuses on whether the vessel has been previously detained or involved in an incident – pollution or accident – as well as crew performance), and finally the type of ship (recognizing that some ships are more likely to be substandard based upon the type of cargo carried or the type of operations they conduct). Over time, these factors were revised, and additional ones added –

including the ship manager (for compliance with the ISM Code) and eventually for compliance with the Security Code.



The idea behind the screening process was to focus limited resources on the most likely vessels to be found substandard (low levels of compliance with critical safety and environmental regulations). Each ship was processed using the screening matrix and the point levels tabulated. These point levels were compared, and minimum thresholds were identified for four separate vessel priorities. All Priority 1 vessels had to be examined. Priority 2 vessels had to be inspected at least annually (or semi-annually in some instances). Finally, Priority 3 and 4 vessels were only inspected if there were no higher priority vessels and resources were available.

In an ideal situation, the trends should indicate that over time, the number of inspections conducted annually should decrease until a plateau is reached. At that point, substandard vessels (those likely to end up detained or with multiple inspections per year) should no longer be operating within U.S. waters for three reasons. First, the threat of being detained and losing money while the ship is tied up alongside the dock would make it unattractive to bring the vessel to the U.S. Secondly, the detention would bring the vessel to the attention of Flag and Class who would then require the owners to bring the vessel into compliance and ensure it's maintained at that level of performance. Finally, once the substandard vessels are eliminated, only good performers would remain and those would require only scheduled periodic inspections.

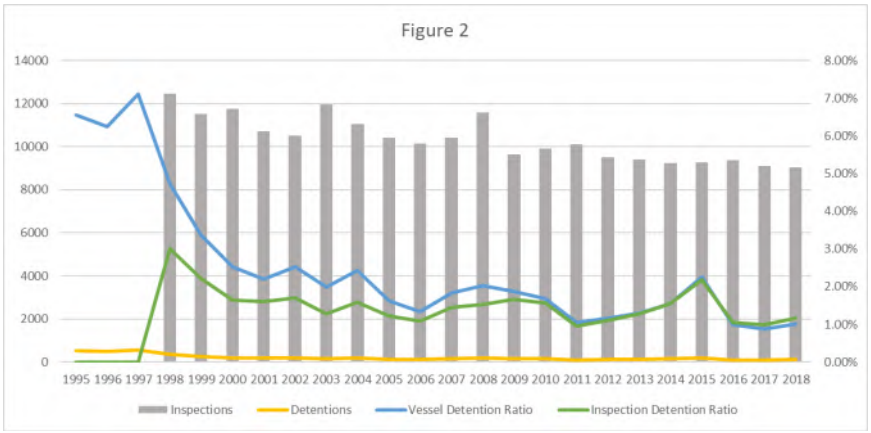
Figure 1 shows the number of distinct vessels calling in United Sates ports, the number of inspections carried out annually, and the number of detentions annually, as submitted to IMO, between 1995 and 2018.

The number of distinct vessels that called at U.S. ports remained relatively consistent between 1995 and 2005 with between 7,500 and 8,00 vessels arriving annually. There were two anomalies during that decade, 2002 and 2004. In 2002, the number of vessel arrivals was down due the slowdowns following the September 11, 2001 terrorist incidents. Similarly, in 2004, as the International Shipping and Port Security Code came into force, another anomaly was seen. In both instances, just over 7,100 distinct vessels called in the US (about a 10 percent decrease). Starting in 2006, the number of distinct vessels has increased approximately twenty-five percent (8,000 to 10,500).

The figure also indicates during the twenty-year period covered, the number of inspections decreased from a high of over twelve thousand to an average of less than 9,500 inspections per year, with the last three years having fewer inspections than the number of distinct vessels operating in the U.S. This difference may be partly due to the increase is some incentive programs for top performing flag administrations and ship owners.

At the same time the quantity of inspections was decreasing, the number of vessels being detained for non-compliance was observed to decrease as well. The most significant decrease occurred between 1998 and 2003 where the number of detentions dropped by roughly sixty percent. This coincided with the implementation of the ISM Code. The USCG noted that during the implementation of Phase I of the ISM Code, over 100 vessels were detained between 1998 and 2001 for failing to adequately implement the ISM Code's provisions {USCG 2001 Annual Report]. The drastic overall decrease in detentions between 1998 and 2002 is a strong indicator that the Code had a significant impact in improving the level of compliance within the shipping industry operating in the United States. However, no direct analysis regarding the development of a safety culture can be identified. In fact, one could argue that, using DeJoy's study, a behavioral change had occurred since there was a very strong reinforcer in place during the course of the implementation of the ISM Code. That reinforcer was the close scrutiny that the USCG and other port state

regimes placed upon vessels required to comply with the Code. Since the beginning of 2004, the rate of decrease in the number of vessel detentions has slowed significantly with a total decrease of twenty-five percent between the end of implementation in 2002 and the most recent reports.

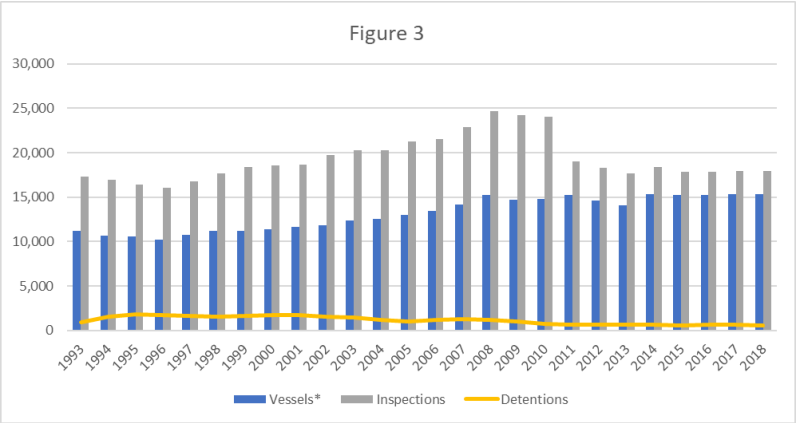


The USCG utilizes a vessel detention ratio as part of their screening process regarding the performance of Flag Administrations and Classification Societies in ensuring their fleets are maintained in compliance. The vessel detention ratio (see Figure 2) consists of the number of vessel detentions in any given year divided by the number of distinct vessels operating in the U.S. that year. The USCG calculates a rolling three-year average and then determines how the individual Flag or Class Society performs against the average. Points in the screening process are then adjusted to reflect the level of performance. Over time, this ratio should trend towards zero as a safety culture is developed within the industry and the impact of the ISM Code is felt.

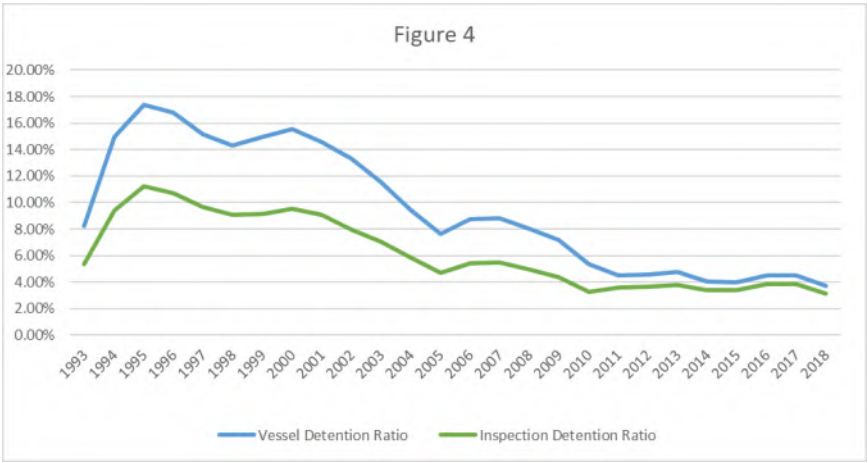
An inspection ratio consisting of the number of detentions per inspection is also indicated. The inspection ratio considers the effect of the screening process since not all vessels may be inspected each year (or some more frequently than others). It indicates the likelihood that any particular inspection may result in a detention. If a true safety culture is developing (especially considering the requirements in the ISM Code for periodic review and continuous improvements of the company SMS), this ratio should continuously decrease. Both of these ratios have shown positive trends from the implementation of the ISM Code. The vessel detention ratio has decreased over eighty percent since its high in 1997. Currently at approximately one percent annually, this ratio indicates that compliance is at an extremely high level across the industry. Assessing the inspection detention ratio, it too has seen a dramatic decrease (by approximately two-thirds) from the initial implementation of the ISM Code. The vessel detention and inspection ratios are virtually identical, year over year for most of the last decade.

However, port state control inspections are a behavioral reinforcer more than a method for cultural change. Recognizing this, the USCG created an incentive program for vessels operated by a high performing owner, classed by an organization with a strong track record for compliance and registered under the top-most performing flag administrations (from a port state control inspection history). Successfully crossing these hurdles afforded the vessel owner with less frequent inspections, plus public recognition by means of a certificate and the vessel name posted on a public website documenting the strong performance [USCG 2000 Annual Report]. During the fifteen years the program was in effect, the number of flag administrations listed as being eligible for the incentive program more than doubled and the number of vessels enrolled exceeded 1400 by its end. Starting in 2016, the program was revamped, and new eligibility criteria determined.

The Paris Memorandum of Understanding on Port State Control dates back to its inception in 1982 as a response to the *Amaco Cadiz* pollution incident in 1978. It originally consisted of fourteen member states from Europe [Paris MOU, 2020]. Similar to the US Coast Guard, the Paris MOU submitted to IMO annual reports summarizing the Port State Control activities in the region. As part of the MOU, member states were obligated to conduct PSC inspections on twenty-five percent of the vessels calling in their ports [Paris MOU, 1996 report]. Figure 3 showcases the data regarding the number of vessels, inspections, and detentions were collected from reports dated 1996 through 2018. Assessing the data, there is a definitive growth trend regarding the number of vessels and inspections conducted between 1996 and 2010. Reviewing the reports, there are a couple of reasons for this growth trend. The first is the growth of the global economy during the time frame. However, a bigger factor was the almost doubling of the MOU's membership, with each country attempting to meet an annual goal of twenty-five percent inspection rate. Despite the significant increase in the number of inspections, there was a general decline in the number of detentions annually during this time frame.



In 2011, a twenty percent decrease in the number of inspections occurred. The MOU revised the inspection requirements for its member states. Recognizing that with a significant portion of international shipping operating in some version of a liner service, certain types of vessels and operators were seeing an in ordinate number of inspections annual since their vessels called in multiple Paris MOU member states. The MOU eliminated the twenty-five percent inspection mandate and instead implemented a screening system that acts similar to that used by the US Coast Guard. This did not significantly alter the trend for vessel detentions. Prior the change in inspection requirements, detentions were decreasing at about three to five percent annually. This rate continued after the change in screening process and elimination of the minimum inspection quotas. This was unexpected since the change to a screening process should have resulted in an increase in the number of potentially poor performing vessels being targeted for inspection. In order to examine the data closer to identify possible reasoning behind the lack of change, the same vessel detention and inspection detention ratios were calculated and examined (see Figure 4).



This data showed a different perspective, particularly around the time of the implementation of the ISM Code. From 1998 (Phase I of the ISM Code) and the end of 2003 following complete implementation of the ISM Code (the final vessels had to comply in mid-2002), there was a twenty-five percent decrease in the vessel detention ratio and over a twenty percent decrease in the inspection detention ratio (the spike in 2000 was attributed to growing pains with the early phase of the ISM Code implementation).

Some key observations from internal review of the annual data by the Paris MOU were included in the annual reports. In 2001, the Paris MOU report stated that "when looking at the chain of responsibility in the shipping industry it is evident that many companies operating older tonnage do not show a great interest in proper safety standards." The organization acknowledged that age of a vessel alone was not indicative

of a bad ship, but rather since the profit margins for older tonnage are much smaller, owners trying to make a go with these vessels pose a greater risk due to the lack of a functional safety management system, operational standards, or a general safety or environmental awareness culture. A similar warning was included in the 2002 report: "A minority of rogue ship owners still manage to escape the net of control measures and continue to give the shipping industry a bad name. Old ships registered under "fly-by-night" flags, surveyed by shady classification societies, manned by poorly certified seafarers and operated in defiance of all safety management principles pose an unacceptable risk to human life and the environment. Seventy eight percent of the class related detentions took place on ships flying a flag on the blacklist."

In 2007, the MOU noted a slight upward trend regarding detentions during 2006 and 2007. This was attributed to the first five-year renewal of the certificates under the ISM Code. The reasoning was that some ship owners that saw ISM as a paperwork exercise were caught out by the continued high level of focus paid to the SMS and development of a safety culture.

Accident Investigation Report Data

Havold {2000] emphasized one factor that strongly indicated the presence of a safety culture was the degree to which incidents (accidents or near misses) are investigated. A positive trend (reduction) in the number of incidents that involve unsafe practices or lack of support from shoreside management would indicate the presence of a sound and active safety culture. In 2010, IMO's Casualty Investigation Code came into force. The Casualty Code provided guidance for flag administrations to carry out their responsibilities to investigate incidents involving vessels flying their flag. One of the most respected and active investigative bodies, the National Transportation Safety Board (NTSB) conducts investigations for incident the exceed a specific threshold (lesser incidents are typically investigated by the US Coast Guard). NTSB reports for incidents that occurred during the period of 2015 through 2018 were reviewed and the causal factors collated and analyzed (see Figure 5 for specifics).

Figure 5

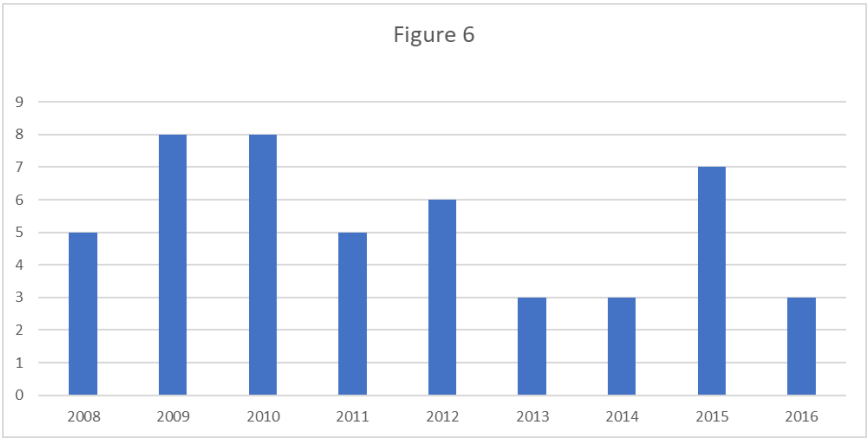
Year	No. Incidents	Incidents - Safety Management Factors
2015	11	5
2016	10	1*
2017	5	0*
2018	5	2*

* NTSB did not indicate safety was a cause or causal factors for some incidents. However, it was felt that the cause or at least one causal factor resulted from a breakdown in safety culture

Bhattacharya [2011] noted that while incidents involving the loss of vessels decreased during the first 10 years of the ISM Code, during the same time frame the number of other incidents increased. The data from the NTSB reports confirms those findings. Approximately twenty-five percent of all incidents examined involved specified failures of the safety management system – either as the direct cause or as a causal factor that facilitated the incident's occurrence – and six additional incidents where the cause could be attributed to a breakdown in the safety culture (lack of communication, lack of oversight, failure to follow procedures, etc.). In other words, fourteen out of thirty-one incidents (45%) over a four-year period involved a compromised safety culture! The worst example of the failure of the safety culture involved the total loss of one vessel and its crew of 31. The investigation highlighted the failures of the vessel master to monitor approaching weather and take proper action to avoid it. However, the report highlighted the inadequacy of both the ship operator's oversight of the vessel and the company's safety management system as contributing to the loss. More typically, incidents that involved a breakdown in the safety culture included situations similar to one incident where the bridge team failed to use bridge resource management techniques while maneuvering in confined waters or a second incident where the failure of a chief engineer to notify the master about potential protective engine slowdowns caused by the automation due to a malfunctioning engine that resulted in an allision while maneuvering in confined waters.

Environmental Crimes Data

A key objective of the ISM Code is the development of an environmental awareness culture that mirrors the safety culture. Internet searches were conducted to identify criminal cases involving vessels that violated pollution prevention laws and conventions. The United States is generally the most active jurisdiction regarding the prosecution of environmental crimes. Environmental crime cases are initiated in two fashions, typically either through anomalies discovered by the US Coast Guard during a port state control inspection, or by whistleblowers in the ship's crew bringing the violations to the attention of US Coast Guard personnel or other authorities. An internet database posted by a law firm that provides protection for whistleblowers [Kohn, Kohn & Colapinto, n.d.] contained a comprehensive list of pollution cases dating between 1993 and 2016 (the dates are typically when the plea agreement was accepted by the judge presiding over the case and not the year when the pollution violations occurred) that involved whistleblowers providing critical evidence to the authorities. While the data is comprehensive, it could not be verified as wholly complete. However, the number of cases represented would be the minimum number of pleas entered in any given year. Therefore, for the purpose of carrying out a trend analysis, the data was considered representative of the culture.



The cases almost universally consisted of the deliberate improper discharge of oily water from a vessel's machinery spaces that by passed the vessel's required pollution prevention equipment. Additionally, since these discharges were not entered into the Oil Record Book or other official logs, additional charges regarding false official statements were included since these falsified records were presented to authorities with the intent of deceiving them.

The trend in the number of environmental crime cases was evaluated for the period 2008 to 2016 (see Figure 6). Since the final implementation of the ISM Code occurred in 2002 and the first renewal of the ISM certificates would have been completed in 2007, this ensured that a sufficient length of time for the environmental awareness policies and procedures in the SMS to be audited, reviewed, and revised or updated as necessary. Total of forty-eight plea agreements were entered into during this nine-year period. Four of the last five years showed a downward trend in the number of cases that were brought before a judge. However, the punishments doled out during that time frame were some of the highest (2016 saw the largest criminal fine issued against the world's largest cruise company). Since the severity of the discharges and the flagrant disregard for pollution prevention requirements often resulted in higher fines and lengthier probation, the trend towards fewer cases may be offset by the willful acts of the crew on the vessels involved.

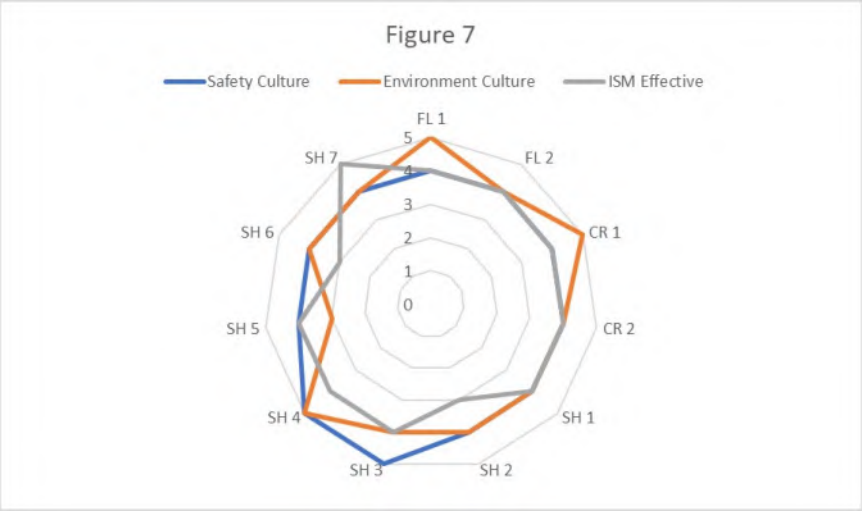
Questionnaire Data

A short questionnaire was developed and sent to a representative cross section of the shipping industry using contacts from previous business dealings. A total of twenty four individuals were selected for the questionnaire - five senior crew members (Captain, Chief Engineer, and Chief Mate) from two different companies and three different vessels, eleven shoreside managers in ten different companies and ranging in authority from the vice president level down to the superintendent level, seven Flag Administration or Class Society auditors and officials representing six different organizations, and one individual with experience as a port state inspector, flag auditor and ship operator were asked to provide their input. All have been in the maritime industry since the implementation of the ISM Code. The questionnaire asked each individual to rate the presence of a safety culture, the presence of an environmental awareness culture,

and the effectiveness of the ISM Code in developing a safety culture on a scale of one (complete lack/very ineffective) to five (extremely strong/extremely effective). Two additional queries were included to seek comment on steps that could be taken to improve the safety culture within the industry and on how the ISM Code was implemented within the various organizations each individual had worked with or for. A final section for additional comments was provided. Of the twenty-four questionnaires administered, eleven responses were received – two from Flag/Class, two from shipboard crew and seven from shoreside managers. Since the sample size is small, definitive conclusions are not realistic. However, some general conclusions can be drawn from the results.

A radar plot (Figure 6) was developed to examine the responses for the three rating questions. All participants indicated that they observed a strong (4) to extremely strong (5) safety culture within the shipping industry. Similarly, the responses indicated the environmental awareness culture was found, to be strong within the industry. The results for the final question had slightly more variation with responses regarding the effectiveness of the ISM Code ranging from a neutral opinion (two individuals indicated a rating of 3) to one individual indicating the Code was extremely effective (a rating of 5). The remainder felt the Code was generally effective (a rating of 4).

Figure 7



In the questionnaire, question 4 asked the participants to assess, based upon their extensive experience in the maritime industry, what steps could be taken to improve the safety and environmental awareness cultures from the current status.

The responses from the Flag/Class auditors and officials highlighted two avenues for improvement. The first was to increase training onboard the vessels. The ISM Code currently only mentions training in two places: new personnel or personnel assuming new duties must be trained for those duties and establishing programs for conducting emergency response drills and exercises. The second dealt with the manner in which external audits were conducted and perceived by the company and crew. This response highlighted the need for external authorities to use the audits as teachable moments rather than simply enforcing compliance. The participant noted that with small companies the cost of implementation is a significant barrier that must be overcome. Based on their experience, large, well-established operators have internal audit departments to focus on safety and environmental compliance required within the company's SMS. This is often due to the internal auditors being dedicated to verifying internal compliance (in some cases these individuals also conduct internal investigations into incidents and near misses) and the individuals often have some level of operational experience (for example having been employed as a crew member). For small companies, the internal resources are stretched thinner and the auditors are often pulled from other duties to carry out the required annual audits. These individuals often don't have the depth of knowledge or experience to effectively assist in changing the culture.

The responses from the crew indicated a strong awareness of safety onboard vessels within their current employer's fleet. One noted that, as the demographics of the crew change, the methods used to transmit the safety message need to evolve; meaning that the use of technology or other mechanisms to deliver the message need to be considered.

Responses to this question from the shoreside managers were almost universal. Five participants indicated that safety must continue to be driven from the top levels of management. Senior leaders must commit to it in a manner similar to that towards generating revenue and product delivery. This commitment has to include personal engagement from senior leaders. The remaining two participants highlighted training as

the steps that could improve the effectiveness of the Code. One participant noted the Flag administrations and Class Societies are not actively engaged sufficiently to assist in driving cultural change.

The final question sought input on how the ISM Code was implemented in various organizations. The majority of the participants had positive experiences during the implementation phase of the ISM Code. Many indicated that implementation was accomplished through training sessions used to review documents and procedures spending too much time getting into the small details. At the time, the use of hard copy manuals made this a daunting task and in some cases the company SMS was simply rolled out with the idea that it was better to just get something out there and then refine and improve it over time.

A final section for additional comments was provided to the participants. Some comments of note included on Flag/Class auditor noting that training is critical to implementing a safety culture and the training needs to be repeated frequently in order for the culture to change and grow. The individual noted that it typically takes a minimum of two years to see a change in the safety culture begin to take root. One participant highlighted that while the ISM Code indicates that a key objective is to develop a safety culture, the term is not clearly defined which makes it difficult to assess whether the objective has been met. Another noted that, consistent with other significant regulatory changes, the first ten years see positive results due to intense focus from all parties, but as time goes by and the potlight on the issue begins to waver, the desired changes or trends begin to level off. The individual noted that even the regulatory authorities do not enforce the Code with the same vigor that was done during the initial implementation. One final comment highlighted again the need to re-evaluate the Safety Management System required under the ISM Code. The observation noted that many of the more advanced companies have evolved into a total fleet management system and are making effective use of technology to tune the system to meet their specific needs and operations. The bookshelf containing hard copy manuals or even the computer-based electronic files have been superseded.

Conclusions

The aim of this project was to assess the level of effectiveness the ISM Code has been in implementing a cultural change in safety and environmental awareness within the maritime industry by evaluating trends in port state control data, reviewing accident investigation reports to consider the root causes and causal factors to determine if shoreside management contributed to the accident, reviewing environmental crimes cases to identify trends and contributions from shoreside management, and seeking input from industry personnel through a questionnaire.

During the analysis of the US Coast Guard's Port State Control data, it was observed that the vessel detention ratio and the inspection detention ratio both declined over time following the implementation of the ISM Code. The initial implementation showed drastic improvement with the rate of improvement slowing the further away from the start of enforcement. These decreasing detention ratios indicated an increase in the compliance level of ships calling on United States ports. But increasing the level of compliance with regulatory requirements does not correlate automatically to a change in safety culture. Companies were able to achieve reductions in detentions by providing behavior reinforcers to encourage positive performance. Companies that adopt this methodology, for example utilizing the employee's concern over their long-term employment as a means to focus their behavior on successfully completing inspections or audits, can achieve improvements in compliance or safety, but for shorter periods of time.

This type of scenario was present in the data. From 2011 to 2015, the detention ratios (and the number of detentions) increased, more than doubling from the low point. This occurred approximately 10 years after the implementation of the Code and during the second renewal cycle of the certificates. Companies suing the carrot and stick approach had difficulty maintaining the momentum of behavioral change resulting in a few additional ships being detained each year. For these reasons, the safety improvements noted in the U.S. Coast Guard Port State Control data constituted a behavior change and not a culture change. The ISM

Code had a positive impact, but it was not a cultural change, therefore it required the continued application of positive and negative reinforcers to continue the positive trends.

A broad view of the trends associated with the various detention ratios within the Paris MOU would appear to indicate an improved level of compliance and the development of a safety culture. Similar to the U.S. Coast Guard PSC data, the data from the Paris MOU showed strong improvement in the levels of compliance during and immediately following the implementation of the ISM Code. The detention ratios saw an approximate fifty percent decrease during the first six-years of enforcement. Again, this would give one the impression of a cultural change. However, the intense focus on implementation from all parties – Flag, Class, and most ship owners – not to mention the enforcement by means of Concentrated Inspection Campaigns, meant that the crew and shoreside management teams paid particular attention to ensuring the vessel's compliance level. As mentioned previously, this negative reinforcement (the scrutiny the vessel and company would face if detained for non-compliance with the ISM Code) drove a change in behavior. But as the first renewal period for the vessel and company certificates approached, there was a rise in the detention ratios. Just as with the vessels operating in the U.S., the vessels in Europe saw a positive impact from the implementation of the ISM Code, but it was not the cultural change that IMO sought.

Since a key feature of the ISM Code is continuous improvement, if the industry has had a cultural change, these spikes a few years after implementation should not occur. These negative trends to the detention ratios, regardless of when they occur or for how long, reinforces the notion that regulatory enforcement programs (port state control, external audits, etc.) are not conducive to changing the culture of an organization or an industry because they use negative reinforcement as a means to compel compliance.

Noting Havold's thoughts regarding the importance of vigorously investigating accidents and incidents in order to identify gaps in safety and to improve processes and procedures, an attempt was made to review and analyze the root cause and causal factors for shipping accidents immediately prior to the implementation of the ISM Code and those accidents from the last three years. It was anticipated that a qualitative analysis of the number of accidents that involved the lack of a safety culture onboard the vessel or within the company could be completed. A significant reduction in the number of accidents that involved failures of a safety culture would be an indication that the ISM Code was effective in promoting a positive culture change. Since the United States has a long history of investigating casualties and using the results to foster changes, it was decided to review the accident reports published by the National Transportation Safety Board (NTSB). Unfortunately, prior to approximately 2005, the NTSB had a limited role in investigating accidents involving ships (only those that had a large loss of life or loss of a vessel were typically investigated by the NTSB at that time). Most accidents were investigated by the US Coast Guard and accessing their data files would have required requesting special access to public records which needed retrieval from archives. The bureaucratic process would have taken longer than the time allotted for this project, so the pre-ISM Code data was not collected. However, following a entering an agreement with the USCG, NTSB has been more involved in investigating shipping accidents during the second half of the 2000's. Therefore, a review of their published reports for the time period 2015 through 2018 was able to be carried out. No obvious trends were identified. However, fourteen of the thirty-one investigations conducted had a breakdown in the safety culture or behavior that played a role in causing the accident. In the accidents with safety as a causal factor, the breakdown was typically an error of commission – the direct action (or inaction) of the crew or shoreside management that was not in accordance with the company's written operating procedures. These types of errors are indicators that the ship owner has not developed a safety culture as anticipated by the ISM Code. Instead, these indicate the presence of safety behaviors that require reinforcing tools such as audits or external inspections to ensure the crew practice safety and environmental awareness.

An important component of the ISM Code was the development of an environmental awareness culture. The shipping industry needed to be mindful of their impact on the environment and take steps to minimize that impact and complying with applicable pollution prevention requirements was the starting point. The difficulties with utilizing deficiencies to assess the presence of a culture has been previously discussed. One means to carry out such an assessment was to examine investigations into incidents where pollution regulations were violated. As one of the participants in the questionnaire rightly stated, honest mistakes

can be accepted (but the organization must undertake the responsibility to educate after the fact), but lying and malicious acts or compliance cannot be tolerated. These types of acts are clear indicators of a lack of culture. Over the last two decades, the United Sates has been active in prosecuting ship owners and shipboard crew for improper discharges. The quantity of cases was examined for any trends. Due to the lengthy process between the improper discharge, the time it was discovered, and the time the court system adjudicated the case, incidents prior to 2008 were not considered since it was probable that the discharge occurred during the implementation of the ISM Code or immediately after and the Code's effect could not be easily identified. Over a nine-year period, forty-eight environmental crime cases had plea agreements entered into. Under these agreements, the ship owner, operator, or manager pled guilty to intentionally polluting the marine environment and, in almost every case, failing to document the discharges or presenting false documentation to authorities in order to cover up the discharge. In most cases, the ship owner operated multiple vessels. It would be reasonable to assume that a similar attitude towards pollution prevention and protecting the environment existed on the remaining vessels of their fleet. Based upon the volume of violations that were detected, the ISM Code has not created a culture of environmental awareness and, for a percentage of ship owners, has not altered their behaviors.

The data from the questionnaire indicated a strongly positive view of the ISM Code and its effects on the shipping industry. The individuals that were chosen all worked for organizations that embraced or had positive experiences with the ISM Code. This may have skewed the data to some degree, particularly for the shipboard and shoreside management participants. The two participants representing the authorities (Flag and Class) had the opportunity to examine a broader sample of the industry because the organizations deal with ship owners and crews that may place less emphasis on safety management. The fact that those individuals indicated there was a safety culture present in the industry and that, based upon their experiences, the ISM Code has been effective in developing the safety culture indicates the data is representative of the industry. Based upon the responses to the questionnaire received from the representative cross-section of the industry, the ISM Code has had a significant positive impact on the safety culture.

In the end, the data collected all indicates that the International Safety Management Code has positively impacted the maritime industry resulting in, as highlighted by Allianz [2019], improved ship design and technology, advances in operational risk management and safety, more robust Safety Management Systems and procedures, and more knowledgeable crew. But the data indicates these are all behavioral in nature, the relaxation of regulatory oversight can result in the progress backsliding (the port state data demonstrates that potential). While progress has been clearly demonstrated, the ISM Code cannot be said, using DeJoy's definition, to have created a true safety culture.

Recommendations

As with most regulatory schemes, the ISM Code was a response to a series of high-profile accidents in an effort to eliminate the causes. IMO has recognized that prescriptive requirements are not always the best solution to ensuring safe operations. The organization recognized each ship owner has a unique operation and a diverse fleet. Therefore, a one-size-fits-all philosophy will not work. Over the last fifteen years, the regulatory body has begun the use of goal-based requirements. It can be argued the ISM Code was an early step in that process. However, IMO did not clearly define what they considered a safety culture and no baseline or benchmark were identified in which to measure the cultural changes the ISM Code was expected to drive. The hope of IMO was that by each individual organization (ship owner) changing their culture internally, a cumulative cultural change would occur. The inability for IMO to track progress means the ISM Code as a regulatory scheme cannot effect cultural change, it can only influence behavioral changes.

In order to continue the progress and take the next step the ISM Code needs to be reviewed, revised, and updated. As noted previously, the ISM Code and quality management philosophies use the plan, do, check, and act process to effect continuous improvement. The drafting of the Code was the planning phase. The adoption and implementation were the doing phases. The study IMO undertook in 2003 was an early

attempt at checking. Unfortunately, that study was unable to draw definitive conclusions and recommended that future studies be undertaken. Since then, five series of amendments to the ISM Code have been adopted. It is time for IMO to revisit the check phase of quality management and prior to further amending the ISM Code (the act phase) conduct a full study of the impact and effectiveness of the current Code. The study should incorporate the following recommendations.

Clearly define what IMO considers a safety culture to be. It is impossible to evaluate the cause and effect of a regulatory scheme without having a clear idea of your ultimate goal. Also, simply stating that companies should strive for continuous improvement is not sufficient. A process should be developed whereby Flag Administrations, regional authorities, port state control regimes or the International Maritime Organization itself can take periodic measurements to track progress towards achieving the stated goal of a safety culture. An example might include a process as simple as a consolidation of the PSC regimes' annual reports with a goal of 10% aggregate reduction in detentions globally over a specified period of time.

As discussed previously, simply utilizing port state control data such as the number of deficiencies issued, or vessels detained is not sufficient to get an effective overview of safety culture. Quantitative analysis of incidents can provide and effective measure of safety within an organization. A study using data on the volume of lost-time incidents to determine the effectiveness of the ISM Code can provide a more focused effort to address safety culture at the individual level, particularly amongst the crew onboard ship. The International Chamber of Shipping [2013] recommended this as an effective measure for individual companies and a similar analysis for various segments of the industry can identify gaps that the current requirements of the ISM Code are not addressing.

One of the highest hurdles that IMO's initial study could not overcome was the quality and quantity of data collected. As with the questionnaire in this study, IMO used various groups, representatives, and methods to send out the various questionnaires developed for the study. The volume of responses was typically underwhelming and left the group with incomplete data from which to draw definitive conclusions. A more effective method of gathering data can be implemented during a future study. IMO can develop a list of the quantitative data to be collected (detentions, deficiencies, lost time accidents, etc.). The Flag Administration or Class Society can gather this data during the annual audits for the company's Certificate of Documentation. Since every company must be audited annually, a larger volume of data will be collected that better represents the industry.

IMO should also consider using the port state control data to evaluate the performance of the Flag Administration and Classification Societies in their roles as a safety net for the industry. An issue that was outside the purview of this study involved the current practice of Flags and Class Societies competing for market share and using costs or other financial incentives to entice ship owners to change authorities. These practices negatively impact the overall safety culture within the industry. The certificates that are supposed to represent the vessel's compliance with regulatory safety measures can be perceived by some ship owners as a commodity to be shopped for and obtained at the cheapest price.

Benchmarking is an effective means to improve productivity or reduce costs within manufacturing. A similar approach to safety should be undertaken. There are a number of industries that require zero tolerance for safety failures. Some of these include space exploration, air travel, and the medical field. Conducting a benchmarking study against leaders within these industries would provide additional insights into safety culture for regulatory authorities. Zohar [1980] highlighte4d the importance of safety-related training. As noted by many of the questionnaire participants, training is not effectively dealt with in the current version of the ISM Code. Strengthened requirements regarding the types and frequency of safety training, including possibly developing model courses for companies to implement, should be incorporated into future revisions of the Code. Additionally, the airline industry, with their use of simulators and requirements for periodic refresher training, should be examined for possible cross-over solutions.

Sanguri [2016] highlighted the concerns over the impact on the time and workload of the seafarer produced by the administrative burdens of the code. As part of the benchmarking, particular focus on the use of

technology or alternative methods to reduce the volume of reports, logs, and checklists used by companies to comply with the Code must be incorporated.

Finally, as noted by one of the questionnaire respondents, understanding the cost of barely complying (or not complying) versus fully embracing the Code can be an effective tool to identify gaps or loopholes that can be exploited by those organizations that have not bought into the need for a culture change.

It is only after gathering and analyzing sufficient data to understand the current safety culture within the shipping industry currently should IMO consider revising or further amending the ISM Code.

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Appendix 1 – U.S. Coast Guard Port State Control Data

Year	Vessels	Port Calls	Inspections	Detentions	Vessel Detention Ratio	Inspection Detention Ratio	Comments
1995	7,846	Not Avail	Not Avail	514	6.55%	0.00%	
1996	7,608	Not Avail	Not Avail	476	6.26%	0.00%	Targeting of vessels using Flag State as a differentiator started around this time
1997	7,686	Not Avail	Not Avail	547	7.12%	0.00%	
1998	7,880	50539	12448	373	4.73%	3.00%	Total number of vessels visiting U.S. ports increased, the number of detained ships reached the lowest level since 1994
1999	7,617	51851	11540	257	3.37%	2.23%	
2000	7,657	51871	11767	193	2.52%	1.64%	ISM Code related deficiencies increased this year, as many Phase I vessels approached the mid-point of their verification cycles. While the ISM Code undoubtedly contributed to the overall improvement in ship quality, there were notable exceptions that indicated that the ISM Code was not taken seriously by some managing companies. The Coast Guard will begin the Phase II ISM Code education campaign on January 1, 2002 - six months in advance of the required implementation date.
2001	7,842	51345	10711	172	2.19%	1.61%	Qualship 21 initiative started. In the four years since 1998, over 100 vessels have been detained for failing to adequately implement the ISM Code, and the number of ISM deficiencies identified on Phase I vessels has risen to approximately 128 which represents nearly 20% of the overall deficiencies identified on detained vessels.
2002	7,106	53722	10518	179	2.52%	1.70%	Possible decrease in vessel arrivals post-9/11? Nearly 400 vessels enrolled in Qualship 21. Detentions with at least 1 ISM deficiency rose from 47 to 55 with Phase II vessels contributing over half of those detentions
2003	7,673	61322	11955	153	1.99%	1.28%	51 vessels detained with at least 1 ISM deficiency. Lack of documentation/failure to fully implement the ISM Code the most common
2004	7,241	72178	11054	176	2.43%	1.59%	51 vessels detained with at least 1 ISM deficiency. The most common ISM deficiencies stemmed from failures to follow shipboard safety and environmental policies and shortfalls in company related obligations. Effective implementation of ISM is a proven tool that improves compliance with all applicable standards.
2005	7,850	62818	10430	127	1.62%	1.22%	35 vessels detained with at least 1 ISM Deficiency. The most common ISM deficiencies stemmed from crewmembers failing to follow shipboard safety and environmental policies and failing to maintain equipment in accordance with SMS procedures. Some companies also failed to assign responsibility and authority to maintain the vessels Safety Management System and report vessel nonconformities.
2006	8,178	78668	10136	110	1.35%	1.09%	
2007	8,281	82937	10423	152	1.84%	1.46%	Ships flagged by 9 additional administrations eligible for Qualship 21
2008	8,661	82103	11578	176	2.03%	1.52%	Ships flagged by 5 additional administrations eligible for Qualship 21
2009	8,557	75902	9657	161	1.88%	1.67%	Ships flagged by 4 additional administrations eligible for Qualship 21, developed policy for banning vessels detained 3 or more times in the calendar year
2010	9,260	76372	9907	156	1.68%	1.57%	Ships flagged by 6 additional administrations eligible for Qualship 21, 3 vessels banned
2011	9,326	79031	10129	97	1.04%	0.96%	Ships flagged by 3 additional administrations eligible for Qualship 21
2012	9,011	72309	9496	105	1.17%	1.11%	Ships flagged by 5 additional administrations eligible for Qualship 21
2013	9,278	83535	9394	121	1.30%	1.29%	Ships flagged by 6 additional administrations eligible for Qualship 21
2014	9,227	79091	9232	143	1.55%	1.55%	Ships flagged by 4 additional administrations eligible for Qualship 21
2015	8,925	73752	9265	202	2.26%	2.18%	Ships flagged by 3 additional administrations eligible for Qualship 21. ISM deficiencies 2nd most common (17%)

2016	9,859	81877	9390	98	0.99%	1.04%	16% of deficiencies related to ISM - 2nd most common
2017	10,190	83566	9105	90	0.88%	0.99%	18% of deficiencies related to ISM - 2nd most common
2018	10,418	84141	9025	105	1.01%	1.16%	11 detentions under appeal. 12% of deficiencies related to ISM - 3rd most common

*Distinct Vessel Arrivals are the number of ships (≥300 GT) that make at least one visit to a U.S. port. For example: A vessel that makes 12 U.S. port calls in one year would be counted as 1 distinct vessel arrival.

Vessel Detention Ratio = # of Detentions / # of Vessels

Inspection Detention Ratio = # of Detentions / # of Inspections

USCG PSC commenced program to eliminate substandard vessels from US waters in 1994. Since that time, USCG has implemented a screening process to identify potentially high-risk vessels for increased scrutiny

Appendix 2 – Paris Memorandum of Understanding Port State Control Data

Year	Vessels	Port Calls	Inspections	Detentions	Vessel Detention Ratio	Inspection Detention Ratio	Comments
1993	11,252		17,294	926	8.23%	5.35%	Paris MoU has an annual inspection commitment of 25% dating back to the creation of the Paris MoU following the Amaco Cadiz disaster in 1978. Agreement finalized in 1982. Commenced publishing a list of poor performing flags that was to assist PSC officers in targeting substandard vessels
1994	10,694		16,964	1,597	14.93%	9.41%	Stats for 1993 -1995 were obtained through a recap in the 1996 annual report
1995	10,563		16,381	1,837	17.39%	11.21%	
1996	10,256		16,070	1,719	16.76%	10.70%	
1997	10,719		16813	1,624	15.15%	9.66%	Paris MoU has been encouraging the targeting of potential substandard vessel during the last few years.
1998	11,168		17,643	1,598	14.31%	9.06%	373 ISM-related deficiencies issued during the last half of 1998, including the CIC on ISM compliance in 3rd quarter
1999	11,248		18,399	1,684	14.97%	9.15%	
2000	11,358		18,559	1,764	15.53%	9.50%	Enhanced targeting system of vessels introduced. In recent years, a Black, Grey, White list of owners was also developed similar to the flag lists
2001	11,658		18,681	1,699	14.57%	9.09%	When looking at the chain of responsibility in the shipping industry it is evident that many companies operating older tonnage do not show a great interest in proper safety standards. Recognizing that not every old ship is necessarily a bad ship, the figures indicate that in areas related to safety, the marine environment, operational standards and implementation of a safety management system in particular, such owners pose a great risk.
2002	11,823		19,766	1,577	13.34%	7.98%	Increase in the number of inspections related to improved targeting and better use of resources. A minority of rogue ship owners still manage to escape the net of control measures and continue to give the shipping industry a bad name. Old ships registered under "fly-by-night" flags, surveyed by shady classification societies, manned by poorly certified seafarers and operated in defiance of all safety management principles pose an unacceptable risk to human life and the environment. 78% of the class related detentions took place on ships flying a flag on the blacklist. CIC on ISM Phase II. Results show that a total of 3846 eligible ships were inspected in the Paris MOU region during the campaign. A total of 163 ships were detained for major nonconformities in their system, resulting in an average detention percentage of 4.2%.
2003	12,382		20,309	1,428	11.53%	7.03%	Further refinement of targeting system - post 'Erika'. Good ships less likely to get inspected every 6 months, poor ones more likely. If all parties are quality minded there is a strong bond and the involvement of port State control should be minimal. On the other hand, the objectives may be focused only on profits, at the expense of a safety culture. The Paris MOU has voiced repeated concerns over implementation of ISM systems on board. Deficiencies since 2001 have nearly tripled.
2004	12,538		20,316	1,187	9.47%	5.84%	agreed on a fundamental review of its inspection regime. The port State control region is aiming to enhance its fight against substandard shipping by adopting a more risk-based approach while at the same time reducing the burden on good operators. Key proposal is that ships with a good safety record will only be inspected every 2 years,
2005	13,024		21,302	994	7.63%	4.67%	Number of member countries increased to 27 by 2007 - double the original membership (this can partly explain the continued increase in the number of reported vessels and inspections). 25% annual mandate for each country will be eliminated.
2006	13,417		21,566	1,174	8.75%	5.44%	
2007	14,182		22,877	1,250	8.81%	5.46%	After several years where detention rates have showed a declining trend, in the past 2 years this trend has been reversed and detentions are on the rise again. Several factors may play a role, such as the increased demand for tonnage worldwide and also the reported difficulties of ship owners in finding well qualified and experienced seafarers. CIC on ISM compliance for 5-year anniversary. 5427 inspections were carried

						out within the Paris MoU on 5120 ships. Several ships were inspected more than once. A matter of serious concern is that 1 out of 5 inspections showed ISM deficiencies. 176 inspections resulted in a detention where one or more major non-conformities (MNCs) were found.
2008	15,237	24,647	1,220	8.01%	4.95%	day-to-day practice the inspection was mostly left to the "professional judgement" of the inspector. the introduction of a professional development scheme for all persons involved in the inspection of ships.
2009	14,753	24,186	1,059	7.18%	4.38%	
2010	14,762	24,058	790	5.35%	3.28%	Last year for the original inspection regime for the MOU; inspection numbers will change in 2011
2011	15,268	19,058	688	4.51%	3.61%	New regime in place - shifts from national commitment of 25% of vessels to one where all ships will be inspected on a regional basis; this should be more on par with USCG detention ratios which are calculated based upon the number of individual vessels. In years prior, the Paris MOU could have multiple inspections of a ship since it might be targeted by individual members to meet the 25% commitment
2012	14,646	18,308	669	4.57%	3.65%	
2013	14,108	17,687	668	4.73%	3.78%	
2014	15,377	18,430	623	4.05%	3.38%	
2015	15,246	17,858	610	4.00%	3.42%	
2016	15,234	17,840	685	4.50%	3.84%	
2017	15,352	17,916	693	4.51%	3.87%	
2018	15,301	17,952	566	3.70%	3.15%	No analysis regarding why the significant drop in the number of detentions

*Vessels = the number of distinct vessels inspected during the year. The number of distinct vessels calling in European ports is not tracked.

Vessel Detention Ratio = # of Detentions / # of Vessels

Inspection Detention Ratio = # of Detentions / # of Inspections

Appendix 3 – National Transportation Safety Board Accident Report Data

NTSB Title	Report No.	Incident Date	Cause	Safety Management Factors
Allision of Offshore Supply Vessel Connor Bordelon with Unmanned Platform South Timbalier 271A	MAB1603	23-Jan-15	The failure of the mate on watch to ensure that the bridge team maintain ed a proper lookout , and his delay in changing from the autopilot to manual steering, which precluded hi m from taking the necessary action to prevent the allision with the platform.	Yes. 1 safety issue dealt with ensuring that procedures in the safety manual regarding voyage planning are being followed
Collision between Containerships St. Louis Express and Hammersmith Bridge	MAB1610	22-Feb-15	The failure of the pilots and bridge teams on both vessels to assess the risk of collision, inadequate bridge resource management on both vessels, and a lack of communication between the pilots.	None raised by the investigation team
Collision between Tanker Chembulk Houston and Container Ship Monte Alegre	MAB1604	5-Mar-15	The pilot's decision to increase speed on the Monte Alegre without informing the deputy pilot on the overtaking Chembulk Houston	None raised by the investigation team
Collision between Bulk Carrier Conti Peridot and Tanker Carla Maersk	MAR1601	9-Mar-15	The inability of the pilot on the Conti Peridot to respond appropriately to hydrodynamic forces after meeting another vessel during restricted visibility, and his lack of communication with other vessels about this handling difficulty	Yes. 1 recommendation dealt with the failure of bridge personnel to use bridge resource management during all operations and suggested that audit procedures be developed to verify this is being done
Breakaway of Bulk Carrier Privocean and Subsequent Collision with Tanker Bravo and Tugboat Texas	MAB1608	6-Apr-15	The inadequate mooring arrangement for the Privocean and the insufficient number of hold-in tugs provided by the vessel operator given the prevailing conditions.	None raised by the investigation team
Fire aboard Vehicle Carrier Courage	MAB1724	2-Jun-15	Electrical arcing in the automatic braking system (ABS) module of a vehicle carried on board.	None raised by the investigation team
Equipment Failure on Bulk Carrier Asia Zircon II	MAB1710	8-Jul-15	Inadequate lubrication due to ineffective maintenance resulting in excessive wear of the wire rope.	None raised by the investigation team
Engine Room Fire Aboard Cruise Ship Carnival Liberty	MAB1721	7-Sep-15	Loosened bolts, likely resulting from improper tightening during prior maintenance and vibration of the piping over time, on a fuel supply inlet flange on diesel generator 4, which triggered an uncontrolled fuel spray from the inlet flange onto a hot surface on the diesel generator.	None raised by the investigation team
Sinking of US Cargo Vessel SS El Faro	MAR1701	1-Oct-15	The captain's insufficient action to avoid Hurricane Joaquin, his failure to use the most current weather information, and his late decision to muster the crew.	Yes. A contributing cause of the sinking was the inadequacy of both ship operator's oversight and its safety management system
Collision of Cargo Vessel Ocean Freedom with Tank Barges	MAB1711	29-Oct-15	The pilot's rudder order in a direction opposite of which he intended.	None raised by the investigation team
Fire Aboard Containership Gunde Maersk	MAB1624	8-Dec-15	An improperly installed fitting on a fuel line supplying a fuel injector pump for auxiliary engine no. 1.	Yes. Failure to adhere to standardized procedures for maintenance, repair and testing of equipment
Collision between Cargo Vessel Manizales and Bulk Carrier Zen-Noh Grain Pegasus	MAB1703	17-Jan-16	The decision by the New Orleans-Baton Rouge Pilots Association to assign the Manizales to the Belmont Anchorage during high-water conditions with three other vessels already anchored in the area.	None raised by the investigation team
Collision of Bulk Carrier Aris T with Tank Barge WTC 3019, Towing Vessel Pedernales, and Shoreside Structures	MAB1701	31-Jan-16	The failure of the pilot on the Aris T to take early and effective action to mitigate the risk presented by the developing upriver traffic situation, and the distraction of the captain on the Loretta G. Cenac from safety-critical navigational functions as a result of his cell phone use.	None raised by the investigation team

Allision of Tanker Nordbay with Docks and Water Intakes	MAB1730	2-Feb-16	The pilot and the master not adequately assessing the risks of handling the ballasted vessel during high-river conditions with strong following currents while turning into the wind.	None raised by the investigation team
Grounding of Bulk Carrier Sparna	MAB1708	20-Mar-16	The failure of the pilot and the bridge team to monitor the helmsman's response to the pilot's rudder orders.	None raised by the investigation team
Allision of Bulk Carrier Star of Abu Dhabi with Louisiana Sugar Refinery Unloading Dock	MAB1709	25-Mar-16	The failure of the master to ensure the ship's propulsion engine was ready to maneuver while the vessel was anchored in a river with high water conditions.	None raised by the investigation team
Allision of Passenger Vessel Carnival Pride with Pier and Passenger Walkway	MAB1706	8-May-16	The staff captain's errors during the docking maneuver—approaching the pier with excessive speed and at too steep of an angle—and the captain's insufficient oversight during the maneuver.	None raised by the investigation team
Allision of Cruise Ship Celebrity Infinity with Dock	MAB1736	3-Jun-16	The master's failure to plan, monitor, and execute a safe docking evolution.	None raised by the investigation team
Fire aboard Roll-on/Roll-off Passenger Vessel Caribbean Fantasy	MAR1801	17-Aug-16	The ship operator's poor safety culture and ineffective implementation of their safety management system on board the vessel, where poor maintenance practices led to an uncontained fuel spray from a blank flange at the end of the port main engine fuel supply line onto the hot exhaust manifold of the engine.	Yes. The probable cause was a lack of safety culture and ineffective implementation of the SMS
Allision of Tanker Aframax River with Mooring Dolphins, and Subsequent Fire in Waterway	MAB1806	6-Sep-16	A momentary abnormality of the tanker's main engine governor actuator system in responding to command inputs from the bridge.	None raised by the investigation team
Grounding of Bulk Carrier Nenit	MAB1801	19-Nov-16	The failure of a main engine cylinder cooling jacket that initiated an automatic reduction in engine speed, resulting in the eventual loss of steerageway.	None raised by the investigation team
Fire aboard Vehicle Carrier Alliance St. Louis	MAB1808	16-Jan-17	Improper tightening of a pipe plug on the top cover of the no. 6 cylinder fuel pump housing, which resulted in a high-pressure release of marine gas oil.	None raised by the investigation team
Fire on board Vehicle Carrier Honor	MAB1807	24-Feb-17	A fault in the starter motor solenoid in one of the personally owned vehicles being transported in the vessel's cargo space.	None raised by the investigation team
Allision of Bulk Carrier Mia S with Nashville Avenue Wharf	MAB1822	18-Aug-17	The chief engineer's poor communication to the master regarding the potential for additional protective engine slowdowns at orders above dead slow ahead, and the master and pilot's decision to proceed at full ahead, which resulted in a reduction in engine speed and subsequent loss of maneuverability while navigating through a sharp river bend.	None raised by the investigation team
Collision between US Navy Destroyer John S McCain and Tanker Alnic MC	Mar-01	21-Aug-17	A lack of effective operational oversight of the destroyer by the US Navy, which resulted in insufficient training and inadequate bridge operating procedures.	None raised by the investigation team
Diesel Generator Failure aboard Offshore Supply Vessel Red Dawn	MAB1902	13-Dec-17	A connecting rod assembly on the no. 2 diesel engine that came loose and separated from the crankshaft due to improper tightening (torqueing) of the connecting rod bolts during the previous engine overhaul.	None raised by the investigation team
Contact of Bulk Carrier Shandong Fu En with Ergon-St. James Terminal Wharf	MAB1914	6-Apr-18	The fatigued pilot's misjudgment of a downstream turning maneuver during high-water conditions.	None raised by the investigation team

Fire aboard Cargo Ship Chipolbrok Moon	MAB1909	23-May-18	The crew's lack of adherence to the company's safety management system and the marine chemist's instructions pertaining to hotwork precautions, which allowed sparks and slag to fall through unprotected gaps between the removable decking pontoons and ignite the dust-protective covering of the transmission hubs.	Yes. The crew's failure to follow the company's SMS hot work procedures
Collision of Bulk Carrier Yochow with Articulated Tug and Barge OSG Independence/OSG 243	MAB1908	13-Jun-18	The mate's failure to effectively monitor the helmsman, contrary to the principles of good bridge resource management.	Yes. Lack of company oversight regarding work/rest requirements
Contact of Cruise Ship Carnival Horizon with Manhattan Cruise Terminal Pier 90	MAB1929	28-Aug-18	The ineffective interaction and communication between the master and the docking pilot who were maneuvering the vessel, and the bridge team's ineffective oversight of the docking maneuver.	None raised by the investigation team
Contact of the Cruise Ship Nippon Maru with Mooring Dolphins	MAB1930	30-Dec-18	Alcohol impairment of the master while he conned the vessel, resulting in an errant astern engine input.	None raised by the investigation team

Appendix 4 – Environmental Crimes Data

Year Convicted	Case title	Cause	Penalty
2008	United States v. B Navi Ship Management Services	The crew knowingly failed to maintain an accurate record book. Some members of the engineering crew were engaged in dumping oily waste directly into the sea without passing the waste through the Oily Water Separator.	A criminal fine of $1.2 million and serve a three-year term of probation during which time the company must implement an Environmental Compliance Plan
2008	United States v. Clipper Marine Services	Pled guilty to conspiracy to defraud the United States, violation of the Act to Prevent Pollution on Ships, and false documents for violations of dumping oily waste overboard	A criminal fine of $3.25 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2008	United States v. Diamlemos Shipping Corp	Using a hose to bypass the Oil Water Separator in order to discharge oil sludge and bilge water directly into the ocean and falsifying Oil Record Book entries.	Not available
2008	United States v. Ofer (Ship Holding) Ltd.	Oil Record Book entries contained false information about quantities of oil contaminated waste remaining on board, and omitted records of overboard discharges of oil-contaminated waste, knew the true quantities of oil-contaminated waste remaining on board and that oil-contaminated waste had been discharged directly overboard through a bypass pipe.	A fine of $780,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2008	United States v. STX et. al	The Chief Engineer and 1sr engineer ordered crew to deliberately discharge barrels of oily waste overboard, Chief Mate ordered deck crew to discharge oily water from the deck cranes overboard	A criminal fine of $2 million and serve a four year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. Casilda Shipping Ltd et al.	Ship owner ordered crew members to illegally bypass the Oil Water Separator to discharge oily waste overboard, discharge two large plastic barrels, one filled with oil sludge and the other filled with hydrochloric acid. Defendants also falsified the Oil Record Book to conceal these activities.	A criminal fine of $750,000 and serve a three year term of probation
2009	United States v. Consultores de Navegacion et al.	a “magic” bypass pipe hidden beneath the engine room deck plates and false oil record books.	A criminal fine of $2.08 million
2009	United States v. General Maritime Management (Portugal) L.D.A. et al	failed to keep an accurate Oil Record Book and illegally bypassed the Oily Water Separator to dumpy oily water directly into the ocean.	A criminal fine of $1 million and serve a five year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. Hiong Guan Navegacion Japan Co	illegally discharged oily waster directly into the sea without first using the Oily Water Separator and failed to maintain an accurate Oil Record Book.	A criminal fine of $1 million and serve a 2.5-year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. Holy House Shipping AB	failed to keep an accurate Oil Record Book	A criminal fine of $1 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. Polembros Shipping	oily water separator violations and false oil record book.	A criminal fine of $2.7 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. Reederei Karl Schlueter	discharged bilge waste directly overboard. The discharges were made using a hose to bypass the vessel’s pollution prevention equipment, specifically the Oily Water Separator and Oil Content Meter	A criminal fine of $1 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2009	United States v. STX Pan Ocean Co. Ltd.	members of the engineering crew were engaged in dumping oily waste directly into the sea overnight using plastic bags and barrels.	A fine of $500,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Aksay Denizcilik Ve Ticaret A.S.	Failure to maintain an accurate Oil Record Book and making a false statement	A $725,000 penalty and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Atlas Ship Management Ltd.	Engineering officers and other crew members installed a bypass hose to bypass the Oil Water Separator to pump unfiltered pollution directly into the sea. These crew members also failed to keep an accurate Oil Record Book of the illegal dumping of oily water overboard.	A fine of $900,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan

2010	United States v. Cooperative Success Maritime S.A	bypassing the Oil Water Separator and discharging oil-contaminated waste directly into the ocean and keeping a false Oil Record Book.	A criminal fine of $850,000 and serve a five year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Fleet Management Limited	failed to maintain an accurate Oil Record Book and record that the Oily Water Separator had been bypassed to directly dump oily water into the ocean.	A criminal fine of $3 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Giusseppe Bottiglieri Shipping Company S.P.A	illegally discharged oily waster directly into the sea without first using the Oily Water Separator.	A criminal fine of $1.3 million and serve a four year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Irika Shipping S.A .	The Chief Engineer ordered that the oily discharge be dumped directly overboard as frequent alarms keeps going off on the Oily Water Separator. The successor Chief Engineer ordered a bypass pipe be installed to dump oily bilge water directly into the sea.	A criminal fine of $3 million and serve a five year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Styga Compania Naviera S.A.	A magic pipe used in dumping oily waste directly into the sea without passing the waste through mandatory pollution reduction and prevention equipment.	A criminal fine of $1.25 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2010	United States v. Transmar Shipping (Dimitrakis)	Crew members instructed to illegal dump oily sludge into the sea by way of a bypass value.	A fine of $750,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2011	United States. v. Dianik Bross Shipping Corp	improper use of the Oily Water Separator - the meter did not read the actual effluent going overboard and actual read a sample from a fresh water line.	A criminal fine of $500,000 and serve a two year term of probation during which time the company must implement an Environmental Compliance Plan
2011	United States v. Efploia Shipping Co	disposing of oil-contaminated waste in the ocean with the use of a “magic pipe” and falsifying entries in the Oil Record Book.	A fine of $925,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2011	United States v. Ionia Management	oily water separator violations (magic pipe) and false oil record books.	Not available
2011	United States v. Noka Shipping Company Ltd	members of the engineering crew were engaged in discharging oily wastes directly into the sea without first being processed through mandatory pollution prevention equipment as well as saying that at night crew members dumped liquids over board.	A fine of $900,000 and a five year term of probation during which time the company must implement an Environmental Compliance Plan
2011	United States v. Stanships, Inc. (Marshall Islands)	an inaccurate Oil Record Book and discharging oil-contaminated waste without properly using an Oily Water Separator.	A fine of $700,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2012	United States v. Cleopatra Shipping Agency, Ltd.	Illegally discharged oily bilge water and failed to maintain an accurate Oil Record Book	A fine of $300,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2012	United States v. Ilios Shipping Company S.A.	oily water separator violations (magic pipe) and false oil record books.	A criminal fine of $2 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2012	United States v. Keoje Marine Co	the vessel had been discharging bilge waste without the use of an Oil Water Separator and making false entries in the Oil Record Book.	A criminal fine of $1.15 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2012	United States v. Nimmrich und Prahm Bereederung GmbH CO.KG et al	failed to keep an accurate Oil Record Book and illegally bypassed the Oily Water Separator to dumpy oily water directly into the ocean.	A criminal fine of $1.2 million and serve a five year term of probation during which time the company must implement an Environmental Compliance Plan
2012	United States v. Odysea Carriers, S.A.	Use of a “magic hose” connected from the sludge pump and then to an overboard discharge valve. the Chief Engineer ordered the desytruction of the sounding log of the oil and sludge tanks to hide the falsity of the Oil Record Book.	A criminal fine of $1.2 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2013	United States v. Columbia Ship Management	pled guilty to knowing failure to maintain an accurate Oil Record Book, obstruction of an agency proceeding, obstruction of justice, and knowingly and willfully making and causing the making of materially false writings (oily water separator violations, false oil record book, defective waste oil incinerator, and unauthorized discharges of the bilge holding tank).	A criminal fine of $7.8 million and serve a four year term of probation during which time the company must implement an Environmental Compliance Plan

2013	United States v. Gulf Stolt Ship Management	failed to keep an accurate Oil Record Book and illegally bypassed the Oily Water Separator to dumpy oily water directly into the ocean.	A criminal fine of $750,000 and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2013	United States v. Sanford Ltd.	an inaccurate Oil Record Book and discharging oil-contaminated waste without properly using an Oily Water Separator.	A criminal fine of $1.9 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2014	United States v. Diana Shipping Services	Two illegal bypass valves that dumped oily bilge water directly into the ocean knowingly failed to maintain an Oil Record Book ("ORB") .	A criminal fine of $750,000 and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2014	United States v. Herm. Dauelsberg GMBH & CO. KG	failing to record the discharging of bunker fuel overboard in the Oil Record Book as well as not reporting a hull fracture on the side shell of the Number 4 Starboard Fuel Oil Tank	A criminal fine of $1 million and serve a three year term of probation during which time the company must implement an OWS training program
2014	United States v. Odfjell Asia II Pte Ltd. and Leuterio	unauthorized discharges of the bilge holding tank.	A criminal fine of $1.2 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. AML Ship Management GMBH	Failure to maintain an accurate Oil Record Book and illegally discharged oil	A fine of $375,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. Carbofin	A hose was connected to the bilge tank and boiler blow down overboard discharge valve (typically to discharge hot water, steam, and alkaline) to illegally dump oily sludge. Pled guilty for failure to maintain an accurate Oil Record Book.	A criminal fine of $2.15 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. Hachiuma Steamship Co Ltd. & Ireneo Tuale & Noly Torato Vidad	failed to keep an accurate Oil Record Book and illegally bypassed the Oily Water Separator to dumpy oily water directly into the ocean.	A criminal fine of $1.3 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. Marine Managers	discharging oil-contaminated bilge water without the use of a properly functioning Oily Water Separator and created false records in the Oil Record Book.	A fine of $900,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. Noble Drilling (U.S.) LLC	a false oil record book, a falsely reported operational oil water separator, and the illegal overboard discharge of machinery space bilge water.	A criminal fine of $8.2 million and serve a four year term of probation during which time the company must implement an Environmental Compliance Plan
2015	United States v. Norbulk Shipping UK Ltd. & Valerii Georgiev	Failure to maintain an accurate Oil Record Book and illegally discharged oil	A criminal fine of $750,000 and serve a three year term of probation
2015	United States v. DSD Shipping A/S	Failure to maintain an accurate Oil Record Book, failure to maintain an accurate Garbage Record Book, obstruction of justice, and witness tampering	A criminal fine of $2 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan
2016	United States v. Ciner Gemi Acente Isletni Sanayi Ve Ticaret S.A	Crew members were directed to drain oily water from the Waste Oil Tank to buckets and/or absorb the oil from the contents of the buckets using a scoop and rags, and then discharge the remaining contents overboard. Other times crew members would connect a hose from a 55-gallon drum containing oily sludge and discharge the contents overboard. The dumping of oil overboard was not recorded in the Oil Record Book.	A fine of $900,000 and a three year term of probation during which time the company must implement an Environmental Compliance Plan
2016	United States v. Princess Cruises	Dumped approximately 4,227 gallons of illegally discharged oily bilge water through a bypass pipe (also known in the maritime industry as the "magic pipe") being used to bypass the oil water separator and dump directly into the ocean	A criminal fine of $40 million and serve a five year term of probation during which time the company must implement an Environmental Compliance Plan (additional $20 million fine added in June 2019)
2016	United States v. Aegean Shipping Management SA	Failure to maintain an accurate oil record book, unauthorized discharge of the bilge holding tank, and oily water separator violations.	A criminal fine of $1.7 million and serve a three year term of probation during which time the company must implement an Environmental Compliance Plan

Appendix 5 – Questionnaire Data

	Questions					
Participant	Safety Culture	Environmental Culture	ISM Effective	Improve Culture Response	ISM Code Implementation	Additional Comments
Flag 1	4	5	4	Training	I do see a huge difference in safety culture from what it was in 1998 and today. So much so, when we talk to present day seafarers, they are surprised that there was not much of a safety culture in those days. None missing fingers and toes these days!!!	Training plays a major role in implementing safety culture. Unfortunately, this needs to repeated / reiterated frequently to develop a safety culture in any company. Our experience shows, about two years is the time taken to implement a safety culture, which is effective.
Flag 2	4	4	4	The Safety and Environmental awareness is bigger challenge for small ship operators operating on International tramp trade where the cost of implementation is seen as a barrier. To improve the safety culture and environmental awareness it is important for regulator to not carry out audits and inspections by waiving a stick but rather help the crew to understand the why it is important to encourage a safety culture and protect the environment. Using audits and inspections I found are best served if used for teachable moments. For larger and more well established international operators, they have audit departments that focus specifically on safety and environmental aspects whereas for small operators they don't have the resources and as are simply trying to make ends meet. It needs to be recognized that there is a huge cost to implementing the ISM Code. It would be interesting to know the cost of not implementing it as this is the route smaller operators take.	The implementation was thru external training sessions focusing on the why and not the what.	See comments in the what steps can be taken.
Crew 1	4	5	4	I think the safety and environmental awareness are pretty good on our ship, the training is happening constantly. Of course its always room for improvement.	The implementation was heavy in the beginning, it was a lot of manuals and very hard to work with. When the pcs came it became easier to get an overview but still it's a lot of information and very complex system.	
Crew 2	4	4	4	The trade that I am referring to is the Cruise industry. The awareness is very much there, however as the customers (crew) demographics changes with the years more user friendly, quicker and intuitive way to deliver the message is needed.	The ISM is anchored in the SQM.	The ISM is a very important part of our operation and it set a world-wide standard which can be monitored by third parties through Flag and PSC inspection. The ISM is also a good tool ensuring the Master and his/her crew receive the support needed from the ship owners and ship charters.
Shore 1	4	4	4	There are perhaps three key components to improve an effective safety and environmental culture: Commitment from the top; Measuring	As identified by the ISM Code, commitment from the highest level of the company is vital to ensure that personnel will act safely at all times. Without commitment from senior	It is important for everyone in the company, ashore and shipboard, to have an understanding and appreciation of the concept of safety culture. For a safety culture to be truly

				current performance and behaviour; and Modifying behaviour	management the efforts of everyone else in support of the Safety Management System will be wasted. I believe, the Sr. management was very involved and committed to succeed.	effective, the company must encourage and motivate its personnel to make safety and environmental awareness their highest priorities. While the ISM Code states that one of its key objectives is to establish a 'safety culture' in shipping companies, it does not actually define the meaning of the term. However, a safety culture may be described as the values and practices that management and personnel share to ensure that risks are always minimised and mitigated to the greatest degree possible. In other words, with an effective safety culture, safety and pollution prevention are always the highest priority. The company and its staff will always, and automatically, think about the implications for safety of every action, rather than simply following safety procedures because they have been imposed from outside. In an effective safety culture, everyone employed by the company, whether a manager, Master or a junior rating, truly believes in and understands the purpose of established procedures, and will think about safety, and the means of improving it, as a matter of course.
Shore 2	4	4	3	Genuine commitment from senior leadership, including personal engagement and high levels of investment in such efforts.	It has been implemented effectively, but the flexibility that comes with a goal-based set of requirements predictably leads to a certain level of inconsistency. Those companies that are truly committed to the principles have better results, whereas those that do not can comply with the minimal requirements and have only nominal impact.	There remains much work to be done in our industry and the principles of safety culture both apply and are quite essential in both the areas of environmental protection and marine safety.
Shore 3	5	4	4	Safety & environmental culture has to first comes from within, and ie from the owner or top leadership in a management company. Today authority and Class are not doing enough to drive this culture change.	Sad to say it is mainly driven by surface compliance or a need to achieve certification.	Like many IMO driven regulation, the first 10 years seems to be active and then they get diluted and ISM is one of them. Today even Class Societies seem to be dragging their feet or the quality and experience of their Auditors are much lower than when ISM started. Since I am in shoreside management I do not understand how a Class Auditor could not see some of the non compliance to ISM Code when they are so obvious and yet they look away. All the accidents and incidents statistics are still way high and that is the proof that ISM is diluted and failing.
Shore 4	5	5	4	share with them lessons learned from other ships who did not take correct action in way of safety and enviroment	Safety Management System put in place with internal and external auditing, KPIs for corrective action implementation, programs to raise awareness if correct action	awareness is present; however, implementation is still a challenge.

					is not implemented, external "hotlines" for reporting, avenues for self reporting	
Shore 5	4	3	4	From the operating company perspective, there are a number of things that can and should be done: • 1st – The safety, environmental and occupational safety culture needs to be driven from the top. It needs to be a co-equal partner to revenue and product delivery. • 2nd – Takeaway something from the emergency response world, i.e. the first three rules: Communicate, Communicate, & Communicate. You never cannot talk too much about safety, environmental awareness and compliance, and company culture. • 3rd – PDCA (Plan, Do, Check and Act)…. Also Trust, but Verify. Accept honest mistakes, but educate after the fact. However, lying and malicious acts or compliance cannot be tolerated.	For the most part the ISM Code was rolled out because it was required…. Then companies worked, based on Flag and Class engagement to meet the elements of the code and all other collateral codes and regulations.	The ISM code requires each company to have a Safety Management System (SMS). However, the classically envisioned SMS only exists in limited locations/companies anymore. The reality is that all SMS's have involved into Fleet Management Systems. Also the falsely that SMS should be compact and small is not realistic anymore. They need to be purpose built and designed by whatever means, including technology, to meet the generational needs of today's seafarers and shore side managers.
Shore 6	4	4	3	Continuous and constant training at all levels Tighter selection of crew Qualify Team members as specialists	I would say extensively, sometimes too widely and too much into small details	Safety culture is something that should follows quality of systems and higher standards, it is useless having well qualified individual working with unsafe or of lesser quality equipment and systems. IMO has never actively pursued Quality assurance as inherent part of safety
Shore 7	4	4	5	On board training / Seminars and shoreside management implementing / and educating crew more on equipment operations / short comings etc. Involving more buy in from equipment manufacturers.	No doubt a daunting task, the companies I have worked with continue to focus on continuous improvement and implementing this very seriously.	Starting with working on ships with just a basic safety culture of LB drills and FF drills have grown into my profession seeing this evolved to new heights and feel that no doubt this has made the whole industry safer and more environmentally friendly and responsible. I personally am very proud to be a part of this and Kudos to the relentless efforts of all contributors / policy makers etc.