Abstract:
This paper examines the accident reporting procedures in the maritime transportation sector. A parallel study, corresponding to this study, revealed a vast amount of underreporting by several western flag states. This is resulting in a poor situational awareness, making it difficult to implement sufficient measures and derive a wanted safety level. Reporting of accidents is globally regulated by IMO and made mandatory by the flag states’ regulations. The Norwegian flag state, regulating the procedures for all Norwegian flagged vessels and for all vessels in Norwegian waters has been the main focus in this paper.

Reporting of an accident can be visualized as a chain of actors which information has to pass through. Underreporting occurs if the links between the actors are broken. The chain starts in one end with the ship’s crew and master, being the first to detect any accident. The information is then passed on to the ship owner, who in turn forwards a report to the respective flag state. Alternatively, an accident can be detected by Vessel Traffic Services or by Rescue Coordination Centers.

Input for this study was gained through interviewing the actors in the reporting chain and through a literature study of the legislation regulating the procedures. Further, a comparative threshold analysis was carried out to measure the differences in the threshold for reporting an incident for the aviation industry in comparison with the maritime industry.

The results indicated that the links in the reporting chain is vulnerable to breaches. The Norwegian legislation seems to be somewhat ineffective with respect to actors placed under a mandatory reporting scheme. The Norwegian legislation is not efficient enough to protect the findings from investigation to be used in other contexts than what it is intended for, meaning that investigation reports are misused as evidences in court. The ship owners appear to be little motivated because they receive little relevant feedback. The seafarers also seem to be withholding reports to their ship owners due to their fear of being punished or fired. Compared to the aviation industry, the maritime transportation sector is characterized by a poor safety culture, meaning that the sector shows little interest in sharing and receiving lessons learned by experience.

Much can be transferred from the aviation industry or from other flag states, like the United Kingdom. Reporting performance may be increased by improving regulations, motivation and safety culture.
Master Thesis

Mapping accident reporting procedures in the maritime transportation sector
Preface
This master thesis is the result of the work carried out in the spring semester of 2010.

This paper is the product of a study of reporting procedures of accidents in the maritime transportation sector and written entirely by the author, Lars Petter Hole. The study is a continuation of the project thesis written together with my colleague Martin Hassel.

I am personally interested in maritime safety and enjoy being at sea. I have naval experience from the Royal Norwegian Navy as a navigator and I am currently serving as a commanding officer in the Naval Home Guard. I appreciate the opportunity to study subject matter that is of personal interest and simultaneously being able to develop my knowledge of maritime safety.

There are some people I wish to thank for their contribution and help in this study. My supervisor has been Dr. Bjørn Egil Asbjørnslett who has coached me throughout the project, and been of considerable support and guidance. I also wish to thank Dr. Svein Kristiansen for support and vital input.

It has been difficult to find people who are willing to share what the industry regards as sensitive information. I am thus very grateful to the ship owner representatives who helped me out by providing information and letting me gain insight into their reporting procedures. I would therefore like to thank the following people:

- Mr. Geir Hudo Jørgensen, HSEQ auditor, Höegh Fleet Services
- Mr. Sindre Stuen, HSEQ officer, Farstad Shipping
- Mr. Phillip Svensson, Vice President, Marine Operation, Wilh. Wilhelmsen
- Mr. Toralf Sørenes, Vice President Risk Management, Odfjell Tankers

I would also like to thank the other contributors who have kindly answered my questions through interviews:

- Mr. Bjørn Brattfoss, Accident Investigator, Norwegian Accident Investigation Board
- Mr. Thomas Olsen, Commanding Officer ‘RS Sundt Flyer’, NSSR
- Mr. Chris Rowsell, Maritime Director, CHIRP
- Mr. Trond Ski, Senior Advisor VTS-department, Norwegian Coastal Administration
- Mr. Ståle Sveinungsen, CEO NOR VTS, Norwegian Coastal Administration

Trondheim June 14th 2010

________________________________________
Lars Petter Hole
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## Glossary and Abbreviations

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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AHTS</td>
<td>Anchor Handling Tug Supply</td>
</tr>
<tr>
<td>AIB(N)</td>
<td>Accident Investigation Board (Norway)</td>
</tr>
<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Controller</td>
</tr>
<tr>
<td>Cefor</td>
<td>Nordic Association of Marine Insurers</td>
</tr>
<tr>
<td>CHIRP</td>
<td>Confidential Hazardous Incident Reporting Programme</td>
</tr>
<tr>
<td>COLREGs</td>
<td>Convention on the International Regulations for Preventing Collisions at Sea</td>
</tr>
<tr>
<td>DSB</td>
<td>Directorate for Civil Protection and Emergency Planning</td>
</tr>
<tr>
<td>EDB</td>
<td>European Marine Casualty Information Platform</td>
</tr>
<tr>
<td>EMCIP</td>
<td>Event Tree Analysis</td>
</tr>
<tr>
<td>ETA</td>
<td>Failure Mode and Effects Analysis</td>
</tr>
<tr>
<td>FMEA</td>
<td>Flag State</td>
</tr>
<tr>
<td>F.S</td>
<td>Formal Safety Assessment</td>
</tr>
<tr>
<td>FSA</td>
<td>General Aviation</td>
</tr>
<tr>
<td>GA</td>
<td>Health, Safety, Environment and Quality</td>
</tr>
<tr>
<td>HSEQ</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>IMO</td>
<td>International Safety Management Code</td>
</tr>
<tr>
<td>ISM code</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>ISO</td>
<td>Joint Rescue Coordination Centre</td>
</tr>
<tr>
<td>MAIB</td>
<td>Marine Accident Investigation Branch</td>
</tr>
<tr>
<td>NCA</td>
<td>Norwegian Coastal Administration</td>
</tr>
<tr>
<td>NIS</td>
<td>Norwegian International Ship Registry</td>
</tr>
<tr>
<td>NMD</td>
<td>Norwegian Maritime Directorate</td>
</tr>
<tr>
<td>NMD</td>
<td>Norwegian Marine Insurers Statistics (subdivision of Cefor)</td>
</tr>
<tr>
<td>NoMIS</td>
<td>Norwegian Ordinary Ship Registry</td>
</tr>
<tr>
<td>NOR</td>
<td>National Transport Safety Board (US)</td>
</tr>
<tr>
<td>NTSB</td>
<td>Platform Supply Vessel</td>
</tr>
<tr>
<td>PSV</td>
<td>Rescue Coordination Centre</td>
</tr>
<tr>
<td>RCC</td>
<td>Safety Management System</td>
</tr>
<tr>
<td>SMS</td>
<td>Safety of Life at Sea Convention</td>
</tr>
<tr>
<td>SOLAS</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SOP</td>
<td>Traffic Separation Scheme</td>
</tr>
<tr>
<td>TSS</td>
<td>Very High Frequency (Radio Communication)</td>
</tr>
<tr>
<td>VHF</td>
<td>Vessel Traffic Services</td>
</tr>
</tbody>
</table>
**Introduction**

My master thesis is a continuation of work started in my project thesis. The project thesis was converted into an academic article and submitted to the European Safety and Reliability Conference (ESREL). It will be presented at ESREL September 2010 in Greece. Due to positive response to the project theses and possible future publication, the master thesis has been written as an academic article according to the IMRAD principle. The main content in this master thesis is therefore written in a two-column forma accordingly to the standards of academic articles published by Elsevier.

Input for this study has mainly been gained through interviews, literature study of regulations and by. The raw material and key points from the interviews considered most important are enclosed in electronic on a compact disc. The CD is not subject to the basis of evaluation, but may however be useful in further work.

All opinions expressed in this reports are solely those of the author and does not represent the Norwegian University of Science and Technology, its academic staff or collaborative partners. Representation of the interviews is attempted to be presented as honest and objective as possible.
Mapping accident reporting procedures in the maritime transportation sector
Lars Petter Hole
The Norwegian University of Science and Technology, Institute of Marine Technology, Trondheim, Norway.

Abstract
This paper examines the accident reporting procedures in the maritime transportation sector. A parallel study, corresponding to this study, revealed a vast amount of underreporting by several western flag states. This is resulting in a poor situational awareness, making it difficult to implement sufficient measures and derive a wanted safety level. Reporting of accidents is globally regulated by IMO and made mandatory by the flag states’ regulations. The Norwegian flag state, regulating the procedures for all Norwegian flagged vessels and for all vessels in Norwegian waters has been the main focus in this paper. Reporting of an accident can be visualized as a chain of actors which information has to pass through. Underreporting occurs if the links between the actors are broken. The chain starts in one end with the ship’s crew and master, being the first to detect any accident. The information is then passed on to the ship owner, who in turn forwards a report to the respective flag state. Alternatively, an accident can be detected by Vessel Traffic Services or by Rescue Coordination Centers. Input for this study was gained through interviewing the actors in the reporting chain and through a literature study of the legislation regulating the procedures. Further, a comparative threshold analysis was carried out to measure the differences in the threshold for reporting an incident for the aviation industry in comparison with the maritime industry. The results indicated that the links in the reporting chain is vulnerable to breaches. The Norwegian legislation seems to be somewhat ineffective with respect to actors placed under a mandatory reporting scheme. The Norwegian legislation is not efficient enough to protect the findings from investigation to be used in other contexts than what it is intended for, meaning that investigation reports are misused as evidences in court. The ship owners appear to be little motivated because they receive little relevant feedback. The seafarers also seem to be withholding reports to their ship owners due to their fear of being punished or fired. Compared to the aviation industry, the maritime transportation sector is characterized by a poor safety culture, meaning that the sector shows little interest in sharing and receiving lessons learned by experience. Much can be transferred from the aviation industry or from other flag states, like the United Kingdom. Reporting performance may be increased by improving regulations, motivation and safety culture.
1. Introduction

1.1 Background
When calculating risk one must consider the probability of an accident to occur and its expected consequence. An approximation of accident probability may be calculated by use of for example Bayesian Networks or by simulation as demonstrated by Friis-Hansen et al. (2006). Calculation and/or expert judgment will however be restricted to the accuracy of estimated inputs from the real world or bound by constrains for a confined scenario. On the other side, the severities of consequences are often estimated through event tree analysis (ETA) or through failure mode and effects analysis (FMEA). A trustworthy reflection of status quo within the maritime sector is thus best ensured by proper reporting of accidents and incidents to searchable databases.

A recognized format of a maritime risk model is the Formal Safety Assessment (FSA). The FSA was developed by the International Maritime Organization (IMO) with the sole purpose to support the development of new rules and regulations. The assessment is supposed to be a proactive tool, which means auditing rules and regulations as well as design and construct safety barriers before accidents occur. The FSA is carried out in five steps each involving different methods and function as an input for the next: (1) identification of hazards, (2) risk analysis, (3) establishing risk control options, (4) cost-benefit assessment and finally (5) recommendations for decision making (IMO, 2002).

Though being invented by IMO, the FSA methodology seems to be recognized by other key players like classifications societies. Classification societies’ intention for using the FSA are developing classification rules and to carry out safety assessments for individual vessels (Kristiansen, 2008). In order to follow the development of vessel accidents and severe incidents the whole process needs to be frequently reviewed and adequate actions re-considered. Situational awareness is provided through constantly monitoring accidents and through collecting reports. This will in turn allow proactive measures to be carried out.

A recent study of underreporting of vessels accidents (Hassel, 2010) revealed a vast amount of missing vessel accidents in the databases of the flag states Norway, Sweden, Denmark, United Kingdom, United States, Canada, Greece and the Netherlands for the period January 1st 2005 – January 1st 2010. The study also includes the database IHS Fairplay Sea-Web™. Different methods were utilized in order to calculate the amount of underreported accidents in the respective databases. First, a best case scenario, representing the absolute lower limit of underreporting was estimated by comparing common accident entries in the Sea-Web™ database with each of the flag state databases. Another method was also used, by applying formulas on conditional probabilities making it possible to calculate the limit of underreporting by comparing flag state databases against Sea-Web™ and counting their common entries. The third method used in quantifying underreporting is a capture-recapture method, called Chao’s lower bound estimate. Finally a sub-set of insurance claim data from the Nordic Association of Marine Insurers (Cefor) database (NoMIS) was scaled to fit the world fleet and used as a guide on amount of reported hull and machinery claims for the different flags. The results of the estimates on accident reporting performance are showed in table 1.
Underreporting in such extensive scale would probably affect the outcome of any risk model if not being accounted for. The hazard identification process will probably be inaccurate and in turn affect the cost-benefit results. Finally the whole risk management process may ebb away with insufficient decisions with respect to barriers required to obtain a desired safety integrity level or a maximum level of risk.

During the last decade there have been a number of accidents with both serious consequences to crew, vessel and environment in Norway. Statistics from the Norwegian Maritime Directorate (NMD) (NMD, 2009) points out a continuous rise in annually reported accidents from 17 in 2000 to 34 in 2008. The same development seems to be valid also globally, according to Nordic Marine Insurers Statistics (NoMIS) (Cefor, 2009). The extent of the accidents ‘Full City’ in 2009, ‘Server’ in 2007 and ‘Rocknes’ in 2004 brought the reality of oil spills to the Norwegian doorstep, by proving that severe accidents frequently occur in Norwegian coastal waters.

Further, an ice free route through arctic waters and a growing potential for petroleum production in northern areas will likely increase the traffic along the Norwegian coast through the Northern Sea Route. Up to 2002 there was a moderate density of sea-born oil transport along the Norwegian coast. Suddenly the annual amount of oil transported from the Russian sector of the Barents region reached four million tons. In 2006 the same amount reached 10 million tons. The Norwegian Directorate for Civil Protection and Emergency Planning (DSB) prediction for 2025 indicates an annual export from Russia between 45 – 80 million tons (DSB, 2009). Knowing the real risk level formed by the present traffic pattern is essential in order to make satisfactory preparations with a growing traffic density in mind.

### 1.2 Previous studies

A previous study performed by Hassel and Hole (2009) showed that the content in the databases of the Norwegian Maritime Directorate (NMD), IMO’s GISIS and the commercially operated Sea-Web was far from complete. A study on underreporting of tankers also showed a surprisingly low reporting performance for NMD (41 %) and Sea-Web™ (30 %) (Psarros et al, 2009).

<table>
<thead>
<tr>
<th>Database</th>
<th>NMD</th>
<th>MAIB</th>
<th>Sea-Web™ Norway</th>
<th>Sea-Web™ UK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Best Case</strong></td>
<td>65 %</td>
<td>89 %</td>
<td>57 %</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Conditional Probability</strong></td>
<td>38 %</td>
<td>57 %</td>
<td>34 %</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Capture/ recapture</strong></td>
<td>38 %</td>
<td>39 %</td>
<td>34 %</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Up scaling of subset data</strong></td>
<td>23%</td>
<td>N/A</td>
<td>21 %</td>
<td>30%</td>
</tr>
</tbody>
</table>

Table 1 Study on reporting performance (Hassel 2010)
Further, the phrase ‘safety culture’ is widely used in this study. Soma (2004) stated that the concept has been explored for almost two decades, but that it still is an ongoing debate concerning its definition. Soma measured the safety culture through a Safety Management Attitude Questionnaire. Reason (1997) has also studied safety culture in an organizational perspective, providing useful models applicable for the marine industry.

The aviation industry is known for being relatively more safety oriented than the maritime industry. Much can be learned from the aviation industry, especially when it comes to safety culture. “A Roadmap to a Just Culture” describes how an airline organization can improve their level and quality of reporting by trying to implement a just culture (Flight Safety Digest, 2005).

1.3 Scope of Study

Reporting of an accident from a vessel in distress or from a vessel exposed to a severe incident can be visualized as a chain of mechanical energy, similar to a simple propulsion line of a ship. Vital information can be lost in each link or the stream of information can even be completely stopped if links become broken. The different segments of actors included in this study are shown in the figure below.

![Diagram](image)

Figure 1 The reporting chain from vessel to investigation board

This paper will primary focus on the underreporting issue in Norwegian waters and vessels connected to the Norwegian flag state. The British Marine Accident Investigation Branch (MAIB) is included for comparative purposes. The master onboard a ship and the ship’s manager are responsible of passing on information about accidents to the respective flag states. Rescue Coordination Centre (RCC) and Vessel Traffic Service (VTS) are able to indirectly contribute with supplementary documentation based on their surveillance and correspondence with vessels in their area of responsibility. The accidents are finally reviewed by an Accident Investigation Board (AIB).

2. Methodology

The methods used in this study are chosen to assure that as much as possible of the reporting chain is covered. Interviews are used when information from specific actors are needed. Literature study is used to cover rules and regulations while analyses of reports are made to evaluate the reporting threshold. The author’s personal experience from naval operations is used to complement some of the areas of interest for this study. Aspects in this study where personal experience is taken into account will be clearly expressed in this paper.

2.1 Interview

The preferred approach to collect data from ship owners and other actors within the reporting chain was done by interviews. This method enables immediate follow-up of issues and explanations. In-depth interviews are often used to provide context to quantitative outcome data. The technique also opens for a qualitative impression to be made with a small amount of interviewees (Boyce and Neale, 2006). Each interview was started with an initial telephone call giving a brief explanation of the study and a request for an interview. An interview question list was then sent by e-mail in order to let the respondent to prepare. The list was used as basis for further examination of procedures as various aspects were brought to author’s attention.
The list of core questions to ship-managers can be found in appendix 3.

The focus of the interview was to, as far as possible, raise open questions in order to allow the respondent to answer as open-hearted as possible. This means questions are started with phrases like “who is responsible for reporting of vessel accidents from ship to the onshore management?” rather than “is the master the one responsible for reporting accidents?” However, it may be assumed that the context of this study may have affected the outcome of the answers given.

Despite equal core questions for all the ship owners; the interviews developed in somewhat different directions as different aspects came to the surface. In two ship owner cases it was necessary to follow up the answers by an additional e-mail to clarify some of the arguments for further analysis.

A questionnaire would probably be easier to distribute in a larger scale, and the input would have provided a greater collection of different reporting routines. On the other hand, a questionnaire excludes the possibility of an immediate follow-up of the answers given in order to reveal the underlying causes as to why underreporting is present. Interview was also used to gain information from the Norwegian Coastal Administration, the Norwegian Accident Investigation Board and the Norwegian Maritime Directorate.

2.2 Literature Studies
Accident reporting procedures are regulated by rules and regulations, both nationally and internationally. In this study, the regulations are reviewed with respect to organizing of reporting and the way the aftermath of a reported accident is carried out. The legislations’ capability to separate determination of culpability and accident investigation is also an aspect reviewed in this study.

The regulations are also investigated with respect to its area of application, meaning which actors are obligated to report and what circumstances that must occur to warrant the reporting of an accident or incident. A comparative analysis is carried out between regulations covering reporting procedures for the maritime industry and the aviation industry to identify different practices. An analogue comparative analysis of regulations is also done between Norway, as a flag state, and United Kingdom.

2.3 Threshold Analysis
In order to gain a better insight in the threshold of reporting incidents, an analysis of voluntary reports has been carried out. Reports through quarterly feedback circulars from the UK Confidential Reporting Programme for Aviation and Maritime (CHIRP) were used to compare the content of reported incidents in the maritime and aviation industry (CHIRP, 2010). Each report is either a description of a specific hazardous incident or a highlight of circumstances in a working environment that is identified as a possible latent cause to an accident. The CHIRP-reports are further described in section 3.5.

As the foundation of the threshold analysis is based upon voluntary effort, it must be taken into consideration that the reporter has already accepted reporting as a step to gain a safer working environment. The analysis is thus only valid for measuring the differences in the ability of self-examination and the openness to share experience gained from self-induced incidents between the aviation- and maritime industry.
The two industries are not completely comparable due to the obvious differences in physical nature and their different operational pattern. However, their common factors are that both businesses are characterized by relatively complex operations that rely on close interactions between human performance and technical systems. In order to compare the reporting threshold for the two industries, the incident reports used in this analysis are divided in six different classifications, assumed valid for both parts. The classification is based on the causal relations claimed in the report, meaning whose acts leading to the incident or causing hazards. The classification is presented in the following sections:

A. Self-induced incidents
B. Colleague's conduct
C. Own organization
D. Co-operative organization
E. Corresponding external organization
F. Procedures & Equipment.

Group A is incident reports when the reporter itself states that own actions were the prime source to the incident. Group A is characterized by poor decision-making or erroneous performance of assigned tasks.

Group B incident reports are similar to Group A, but a colleague is deemed responsible for the erroneous acts.

Group C is reports where conditions in own organizations do not fulfill the reporters premises to safety. Own organization is defined as the company or the branch that the reporter belongs to, for example the reporter’s shipping company, airline or air traffic control department.

Group D incident reports are incidents where the reporter is discontented with a co-operative organization’s performances in a specific case or how the co-operative organization execute its duties overall. This may be the case if a master reports in a pilot or if an aviation pilot posts a report complaining on inadequate ATC-services.

Group E is reports where the reporter imputes a person in a corresponding external organization for incorrectly perform his assignments. A Group E case is typically if a master report in another vessel’s erroneous actions or if an airline pilot reports in another pilot.

Group F is reports that refer to defectives to the procedures that form the safety framework of the business and connect the different organizations together. This may for instance be problem addressed to existing radio communication procedures. Note that reporters concerning about company’s own standards and procedures are defined as a Group C case. Group F also includes reports where the addressee has revealed deviation from a technical component’s required specification.

Examples of each point A-F from both the aviation and maritime industry can be seen in appendix 1 and 2.

Because the published reports are held confidential, it is in some cases difficult to classify the reporter role and its relation to the person or organization imputed in the report. It can for example be hard to identify whether the reporter is an ATC reporting in a pilot’s (co-operative organization) conducts, or if he is a pilot reporting in another pilot (corresponding external organization). All cases of doubt are therefore excluded from this study

The CHIRP-program also receives incident reports from the leisure yachting segment and the general aviation (GA) segment. These segments are exposed to the much of the same hazards as the merchant fleet and the airline industry. They are however
not placed under the same network of regulations setting requirement to neither personnel nor to equipment standard. Several of the reports submitted from these segments are therefore not relevant for the two industries. All leisure and GA reports are thereby excluded from this study, except reports on direct hazardous intervention between GA and airline industry or leisure yachting with merchant shipping. Results are presented in section 4.5

2.4 Safety Culture
“Safety Culture has been considered a core aspect of organizational safety for the last two decades”. Despite a vague definition of what safety culture actually indicates, the expression cannot be omitted when it comes to reporting procedures (Soma, 2004). Openness, self-examination and willingness to exchange and receive learning outcome of accidents and incidents must be fundamental attitudes when it comes to reporting seen from a safety culture perspective. The safety attitude must pervade the whole organization from deckhand to ship owner to actually being able to claim an upright safety culture. It may also be that a company, despite great effort never will reach their target of a safety culture. Sumwalt, Vice Chairman in the United States National Transportation Safety Board states: “A safety culture is something that is strived for, but rarely attained – The process is more important than the product” (Sumwalt, 2007).

Besides revealing the actual reporting routines, the purpose of interviews, literature study and the threshold analysis was to gain a better understanding of the phrase safety culture when it comes to reporting. This can easily be summarized in two challenges: The employees’ willingness to submit a report and the employers’ openness to receive reports and share it with the interested parties. The cultural aspects are discussed in section 5.2

3. Material
The central materials used for this study are described in the following sections. Findings of analyzing this material are presented in the results section.

3.1 Rules and Regulations
IMO has recently approved a new “Code of the International Standards and Recommended Practices for Safety Investigation (Casualty Investigation Code)” followed by a new regulation in the SOLAS convention making it mandatory to all flag states. The Casualty Investigation Code took effect on January 1st 2010. The objective of the new Code is to provide a common approach for states in the conduct of marine incident and accident investigations. The purpose of a marine safety investigation is, as defined by the code not to seek to apportion blame or determine liability, but to prevent casualties and incidents to happen in the future (IMO, 2008).

The Code sets standards and points out recommended practices, but allows interfering national laws to take precedence of the investigation of an accident. This meaning if a person is required to provide evidence, the Code suggest that this evidences should be prevented from admission into civil or criminal proceedings as far as this restriction do not conflict with existing national laws.

Vessels in Norwegian waters and Norwegian flagged vessels (NOR/NIS) are required to follow the accident reporting procedures set by Norwegian legislation: “Forskrift om melde- og rapporteringsplikt ved sjøulykker og andre hendelser til sjøs” (FOR-744, 2008) which translates to:
“Regulations of compulsory reporting of sea accidents and other Incidents at sea”. The national regulations demands any vessel involved by its area of application to report incidents as defined to NMD using a standard form (NMD, 2008).

Similar to the Norwegian regulation of sea accidents, reporting of aviation accidents are placed under an equivalent regulation: “Forordning om vareflyselsområdets opplysning, rapportering og opplysningssamfunnet” (FOR-1393, 2006), which translates to “Regulation on compulsory noticing and reporting of aviation accidents and storage, exchange and distribution of reported information”. The Norwegian legislation regulating aviation reporting procedures industry covers a wider range of actors and includes a more comprehensive description of reporting of incidents than the maritime legislation.

Accidents involving any United Kingdom flagged ship or vessels conducting voyages in United Kingdom waters shall follow the reporting routines given in “The Merchant Shipping (accident Reporting and Investigation) Regulations 2005”. The deregulation came into force after a regulatory impact assessment was conducted in March 2005 (MAIB, 2005). It is of interest to compare the assessment and the UK regulation with the existing Norwegian legislation to see whether experience and practices can be transferred to decrease underreporting in Norway.

3.2 Flag State
According to the IMO Casualty Investigation Code, each flag state is responsible for investigating any casualty occurring to any of its ships when it judges that such an investigation may assist in improving existing regulations. It also states that the flag state has the right to investigate any casualty within their territorial seas. In Norway, investigation of a maritime accident is treated according to LOV 1994-06-24 nr 39: “Lov om sjøfarten” (Lov 1994 nr 39), which translates to “The Maritime Code”.

After July 1st 2008 a new regime for investigation of accidents was introduced in Norway. Odelsting Proposition number 78 2003-2004 was published to notify changes in the Norwegian Maritime Code (Ot.prp no 78, 2003-2004). Earlier inspection of accidents was carried out by Norwegian Maritime Directorate through the institute of maritime declaration. This task is now performed by Accident Investigation Board Norway (AIBN). NMD still holds the responsibility of receiving accident reports as well as responsibility of inspection of Norwegian registered vessels and foreign vessels within Norwegian waters (AIBN, 2010; Brattfoss, 2010).

This paper will discuss the ripple effects caused by the separation of the division receiving reports and the division investigating the reported incidents. This study will also verify interviewed ship owners’ statements about the feedback provided by the Norwegian flag state authorities. Results are presented in section 4.3.

3.3 Other Contributors
Coastal administration and rescue coordination centre are organizations connected to accidents in several ways. The Norwegian Coastal Administration (NCA) is responsible for VTS and pilot services for vessels in Norwegian waters. The Joint Rescue Coordination Centre (JRCC) is often organizing the search and rescue effort through the coastal radio stations. NCA and JRCC are thus ensuring some degree of surveillance of vessels in Norwegian waters with respect to accidents (Ski, 2010; Sveinungsen, 2010).
Their capability of accident detection and their potential to compensate for lacking information has been investigated as a part of this study. The results are presented in section 4.4.

3.4 Ship Owners
In all four Norwegian ship owners were interviewed about their reporting procedures and their challenges related to the reporting issue. The selection covers different segments within the maritime industry. All of the ship owners were represented by their HSEQ-department. A brief introduction of the ship owners is given in the following sections.

Høegh Autoliners (Høegh) operates approximate 30 RORO vessels, mainly carrying cars worldwide. The vessels are mostly Norwegian (NIS) or Bahamas flagged. The onboard crew consists of either only Philippine or only Chinese personnel (Jørgensen, 2010).

Wilh. Wilhelmsen (Wilhelmsen) owns 31 RORO vessels and are managing 132 vessels in total. The fleet consist of mostly truck carriers (80 %) and some pure car carriers (10 %) all operating worldwide. Owned vessels are either NIS or UK flagged while managed vessels are operated under several different flags, providing a widely basis of comparison. The crew is made up form a mixture of nationalities (Svensson, 2010).

Odfjell Tankers (Odfjell) manages 55 worldwide operating chemical tankers, equally distributed to NIS and Singaporean flags. The officers are mainly Norwegian while the rest of the crew consist of Eastern Asian nationalities, mostly Philippine (Sørenes, 2010).

Farstad Shipping (Farstad) operates 32 AHTS vessels and 23 PSV vessels providing services for the offshore oil and gas industry. The company is, for the time being, conducting operations in Brazil, the North Sea and in the Far East (Australia). The fleet is sailing under the flags Australia, Brazil, Isle of Man, Norway (NOR/NIS) and Singapore (Stuen, 2010).

The object of the ship owner interviews were to examine the quality of the procedures and whether absence of reporting accidents can be rooted in one or more of the causes below (IMO, 2005):

- violation (deliberate decision to act against a rule or plan)
- slip (unintentional action where failure involves attention)
- lapse (unintentional action where failure involves memory)
- mistake (an intentional action where there is an error in the planning process; there is no deliberate decision to act against a rule or procedure)

The object is not to denounce any of the interviewed ship owners. Findings indicating violations or questionable behavior or opinions will not be presented by name.

3.5 UK Confidential Reporting Programme for Aviation and Maritime
“Confidential Human Factors Incident Reporting Programme” when referring to the aviation division or “Confidential Hazardous Incident Reporting Programme” when referring to the maritime division are both abbreviate CHIRP. The aim of CHIRP is to contribute to a safer enhancement in the aviation and maritime industry by providing an independent and confidential reporting system available for all individuals employed in the industries.

CHIRP is following up the matter of each reported issue on any safety related matter by addressing it to those who can remedy the problem. The report is made
publicly available and presented in quarterly feedback if approved by the reporter. Personal information are kept confidential throughout the process and destroyed on closure of report. The CHIRP marine division has been operative since July 2003, while the division for aviation has been in operation since 1982. CHIRP maritime annually receives approximately 110 reports of which half normally are received from leisure yachting (CHIRP, 2010; Rowsell, 2010).

The aviation reports used in the threshold analysis are gained from quarterly air transport feedbacks no 88-93 covering the time from autumn 2008 to winter 2009, providing 67 valid entries. The marine reports used are obtained from the quarterly feedbacks no 12-26 covering the period from winter 2006 to summer 2010 providing 66 valid entries.

4. Results
A top view examination of the actors in the accident reporting chain indicates a certain degree of redundancy of the system providing information about an accident, meaning that the stream of information can initially travel alternative routes. However the links between components are vulnerable to breaches. The alternative routes through VTS or RCC are also weakened by their limited efficacy to reveal accidents.

![Figure 2 Reporting reliability block diagram](image.png)

When looking at single accidents, breakage between one of the links in the upper part of figure 2 will result in underreporting, meaning that the figure can be interpreted as a reliability block diagram. In a more global perspective of accident reporting, each of the components can be assign individual efficiency losses, meaning that the figure express the efficiency of the system. Findings for each component are given in the subsequent sections.

4.1 Ship Owners
During a military exercise off the Norwegian Coast in April 2010 the author sailed as the Commanding Officer on the Naval Home Guard vessel ‘Halten’. A distress call was relayed from a rescue vessel, in the close proximity to the exercise area, asking for tug assistance (Olsen, 2010). Upon arrival a 110 meter long coastal freighter were seen drifting towards a reef, at a distance of approximately half a nautical mile. The author later learned that the vessel in distress had made contact with the rescue vessel by telephone asking for “immediate piloting assistance" without mentioning anything about loss of propulsion.

This odd behavior was probably done to protect the ship owner from paying salvage claim, which might have been the case if a proper VHF Mayday or Pan-Pan procedure had been followed. Propulsion was later regained after a successful tow was completed ensuring that grounding was avoided.

Olsen (2010), the master on the rescue vessel later told that the ship owner made directly contact with the rescue vessel berating him for making a public notice on the maritime VHF. The ship owner also begged the towing lines to be dropped and stated that no money would be paid for the rescue operation.

According to Olsen, this particular event is a text book example of an incident which is tried to be covered up. With respect to the reporting regulations this incident...
should also be properly reported. The Norwegian reporting regulations state that “an event leading to immediate danger to environment, vessel or personnel should be reported as a sea accident” (FOR-744, 2008). When the author left the scene the ship’s master promised that the vessel should sail directly to the nearest yard and sort out the machinery problem. AIS-tracking showed that the vessel continued directly to its original destination. The incident was subsequently not reported and is not found in the NMD database as of May 2010.

All interviewed ship owners have specific procedures for reporting accidents from vessel to the onshore organization. Although all interviewees stated that all accidents are reported to the land based organization, variation was found in the communication lines providing flag states with information. For Odfjell, all reports to flag states are conveyed through HSEQ-division. Höegh, Wilhelmsen, and Farstad allow personnel injuries to be directly reported from vessel (Master) to flag state while vessel accident reports are conveyed through ship owners’ HSEQ-division. The familiarization with different flag state’s legislation with respect to reporting procedures were poor for most of the ship owners. Odfjell was the only company claiming to be well informed of regulations in their area of operation. (Jørgensen, 2010; Stuen, 2010; Svensson, 2010; Sørenes, 2010) Findings from the core questions are displayed in table 2:

<table>
<thead>
<tr>
<th>Höegh Autoliners</th>
<th>Wilh. Wilhelmsen</th>
<th>Odfjell Tankers</th>
<th>Farstad Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reporting System</strong></td>
<td>Same EDB-system for Ship and Org.</td>
<td>Same EDB-system for Ship and Org.</td>
<td>In-house procedures of communication chain.</td>
</tr>
<tr>
<td><strong>Accidents/Incidents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>System Access</strong></td>
<td>All parties can submit reports. Reports generally submitted by Masters.</td>
<td>All parties can submit reports. Reports generally submitted by crew division leader.</td>
<td>All parties can submit reports. Reports generally submitted by Masters.</td>
</tr>
<tr>
<td><strong>Crew/Organization</strong></td>
<td>Vessel accidents are conveyed by HSEQ department. Personnel injuries are directly reported.</td>
<td>Vessel accidents are conveyed by HSEQ department. Personnel injuries are directly reported.</td>
<td>All accidents are conveyed by ship owner to flag state.</td>
</tr>
<tr>
<td><strong>Flag State Communication</strong></td>
<td>Rely on assistance from insurance and local agents.</td>
<td>Rely on assistance from insurance and local agents.</td>
<td>Same Routines used in all areas. Reports submitted to own F.S.</td>
</tr>
<tr>
<td><strong>Internationally Reporting of accidents to other than own F.S.</strong></td>
<td>Crew invited to report. Experience challenges due to different onboard cultures.</td>
<td>Minor incidents not reported. Some trouble with incomplete information provided.</td>
<td>Customers set standards to reporting of incidents.</td>
</tr>
<tr>
<td><strong>Incident Reporting Procedures for reporting incidents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Ship owner general results

### 4.1.1 Ship Owners’ Culture

Höegh states that the extent of reports is dependent on the superintendent’s requested level. According to Jørgensen (2010), the company does also experience a low degree of reporting from junior officers and ratings. The officers working in Höegh are normally long term contractors (years), while junior officers are employed for shorter periods (quarters). Ratings are sailing on even shorter contracts and are often exchanged between voyages. Short periods of employment are subsequently making it hard to implement the company’s culture. It also turns out to be a significant difference between onboard nationalities. Philippine crewmembers seem to be more active on reporting incidents than their
Chinese colleagues. Jørgensen believe this may be due to fear of reprisals or being fired (Jørgensen, 2010).

Stuen (2010) inform that Farstad experience little reporting on self-induced incidents, though this trend is about to change. Installation and handling of offshore equipment depends on correct decision and will often leave no room for error. Farstad is therefore trying to lower this threshold for being able to improve the operation procedures.

The selection of ship owner shows unlike tendencies to use available material in their risk assessment. One company has full time employees gathering relevant data through reports and safety circulars to supplement their work in identifying hazards. Another company uses input from business related forums for benchmark purposes. The other companies are identifying hazards using only self produced input and guidance from insurance companies.

4.1.2 Ship Owners’ Incident Reporting Scheme

All interviewed companies are requesting their crew to report incidents in one way or another. Farstad has even made incident reporting mandatory by implement rules in the standard operating procedure (SOP). Until recently an award were issued to the vessel with the highest level of reports. This practice is now ended as reporting of incidents is regarded as one of the daily duties (Jørgensen, 2010).

Wilhelmsen does also mention improvement of operating procedures as their reason for requesting incident reports. The statement is also supported by Höegh, that claim that incident reporting is wanted for reducing risk, not necessarily to fulfill the ISM requirements (Jørgensen, 2010; Svensson, 2010).

Odfjell and Farstad also mention customers’ requirement to safety as a central reason to implement an in-house incident reporting program. Their customers evaluate several attributes in their operator selection process. The operators safety records and safety management is one of the important decision variables. A system of reporting procedures is also required to obtain ISO 9001(Quality Management System) and ISO 14001(Environmental Management System) (Sørenes, 2010; Stuen, 2010). Despite the fact that all the interviewed companies had an in-house scheme for incident reporting, none of them were sharing the information with any flag state.

4.1.3 Ship Owners’ Communication Line to Flag States

Three of the interviewed ship owners (Farstad, Höegh and Wilhelmsen) told that if an accident occurs they would first inform the agent and insurance company. The three also stated that if an accident occurs in an area where the national regulations are unknown, they rely on agent and insurance to help out fulfilling the mandatory reporting procedures (Jørgensen, 2010; Stuen, 2010; Svensson, 2010).

One ship owner (anonymous) emphasize that vessels put on hold due to an investigation is perceived very unfavorable. Customers do often have stakes in cargo, terminals and even the vessel itself. A vessel put on hold for longer periods makes it difficult to trade the ship and may also deteriorate the customer relationship.

Svensson (2010) seek more relevant feedback from flag states, Norway in
particular. In his opinion, safety circulars oriented by branch would be much appreciated for company Wilhelmsen. Statistics and trend developments would be of great interest for the onshore organization. Further Svensson states that memorandums must be constructed in a way that makes it easy for crew members, in each ship department, to identify themselves with hazards pinpointed. Svensson exemplifies case like “what have gone wrong with RORO-vessels ventilation systems?” and “what hazards are identified in the galley?”.

Likewise Jørgensen (2010) states that Høegh receives a very limited amount of feedback from the Norwegian flag state. Jørgensen considers NMD and AIBN as reactive organizations meaning that only serious accidents are investigated and little proactive information provided. Jørgensen believe more resources should be spend on analyzing less serious accidents, thus more proactive information can be shared among the marine industry.

Stuen (2010) request more information for the offshore supply branch of the industry. Higher focus should be given to near misses as this may provide essential learning outcome. On the other side, Stuen experience a small amount of companies willing to share their empirical casualty data. Stuen believe flag state organization of an anonymous presentation of status quo and trend development could have improved the reporting performance.

4.2 Rules and Regulations

4.2.1 IMO Casualty Investigation Code
IMO (2008) recognizes that each flag state has a duty to conduct an investigation to any casualty to its ship when it judges that investigation may assist in developing rules and regulations thus preventing accidents to happen in the future. A marine casualty is in the Casualty Investigation Code (chapter 2.9) defined as: an event or sequence of events that has resulted in any of the following which has occurred directly in connection with operation of a ship:

1. the death of, serious injury to a person;
2. the loss of a person from a ship;
3. the loss, presumed loss or abandonment of a ship;
4. material damage to a ship;
5. the stranding or disabling of a ship, or the involvement of a ship in collision;
6. material damage to marine infrastructure external to a ship that could seriously endanger the safety of the ship, another ship or an individual; or
7. severe damage to the environment, or the potential for severe damage to the environment, brought about by the damage of a ship or ships.

The Casualty Investigation Code (chapter 6.1) also states that “a marine safety investigation shall be conducted into every very serious marine casualty” where a very serious casualty indicates a total loss of the ship, fatality or severe damage to the environment. Also, in chapter 11.1 in the Casualty Investigation Code, it is stated that investigation of an accident shall be impartial, objective and conducted without interference from any other body that may affect its outcome. Chapter 16 in the Code requires investigation to be fully independent from judicial proceedings and all other bodies that in some way or another are involved in the casualty or incident (IMO, 2010).

4.2.2 Norwegian Maritime Reporting Procedures
Norwegian legislation for marine reporting procedures (FOR-744, 2008) is setting requirement to Norwegian flagged vessels
and vessels in Norwegian waters. The legislation defines accident as “when fatality, serious injury or considerable damage is charged to vessel, cargo, environment or external assets due to operation of a vessel; or when an incident in connection with operation of a vessel lead to immediate danger to any consequences mention in the first part.

Chapter 2, §4 in the legislations states that any sea accident, working accident or incidents involving grounding or collision occur, notifications requesting assistance should be directly radioed to one of the coastal radio stations or to JRCC by either the master or the ship owner. A vessel outside the JRCC area of responsibility may instead report to the local RCC.

Chapter 3 in the legislation demands the vessel’s master or the ship owner to report all accidents described in §4 to NMD, using a specified form, within 72 hours from the accident. The legislation do not demand any other actors like JRCC, VTS, coastal radios, insurance company or repair yards to report accidents they may be aware of.

4.2.3 Norwegian Aviation Reporting Procedures
The Norwegian legislation for aviation reporting procedures (FOR-1393, 2006) is valid for all civil aircraft within the Norwegian airspace and to all Norwegian registered aircrafts. However, the aviation legislation is far more complex than its corresponding maritime legislation. First of all, the legislation separates all events into the classes:

1. aviation accident
2. serious aviation incident
3. non serious aviation incident
4. injury
5. technical failure

Secondly the legislation covers a far wider range of actors compared to the maritime legislation. The following list represents all actors covered by the aviation routines:

a. captain
b. flight crew
c. operator (the responsible leader)
d. owner
e. flight control services (ATC, communication, navigation, surveillance, weather services and notice services)
f. ground services (airport administrations, engineers, other that in some way are employed in the ground services)
g. producer of parts and equipment (the technical officer)

Finally it distinguishes between immediate noticing procedures and reporting procedures for all the given events and actors. Noticing is defined as immediate warning of an event (serious or not) by using the quickest means available, while reporting is defined as a written report submitted to the officials. In total the legislation forms extensive notice- and reporting routines for the actors (a-g) in events (1-5). §12-24 in the regulation also forbids all information received form actors a-g to be used in court.

4.2.4 United Kingdom Marine Reporting Routines
In March 2005 MAIB published a Regulatory Impact Assessment on “The Merchant Shipping (Accident Reporting and Investigation) Regulations 2005”. The objective of the assessment was to improve efficiency and efficacy (MAIB, 2005).

As stated in the assessment, MAIB indentified a problem on underreporting of accidents, partially due to foreign ship
owners and masters not knowing to the required reporting routines. Approximately 50 accidents were known through press or other sources, but not reported each year. A proposed chance to the regulations was to include more actors in the maritime industry to be placed under mandatory reporting procedures.

Another identified problem was that results from MAIB investigation were used to determinate liability. A purposed change to the regulations was that information received through inspection should not be available for judicial proceedings without a court order. Declarations from witnesses were also believed to be confined with respect to the fact that witnesses were allowed to have representatives present at all times during the interviews. This regime did not work as intended as lawyers trying to limit the company’s reputation, by hindering the witnesses to speak openly.

Up to 2005 MAIB had addressed over 2000 safety recommendations to ship owners, but the current legislation did not require any of the addressees to respond. Estimates showed that about 1 in 14 recommendations received no response.

On April 18th 2005 the new (post assessment) “Merchant Shipping (accident Reporting and Investigation) Regulations 2005” came into force, presenting a much more extensive and effective regulation than the existing Norwegian regulation. The following sections describe prominent differences A-F between the two flag states:

A. **Actors.** The new regulations cover a wider range of actors by providing representatives from local harbor authorities, Marine and Coastguard Agency and inland waterway authorities to be placed under mandatory reporting routines in addition to the ship’s owner and the ship’s crew (regulation 6).

B. **Self examination.** Regulation 6 §4 states that the ship’s master and/or owner shall, as far as reasonably possible, immediately examine the circumstances for any accident or injury. The findings and the measures taken to prevent reoccurrence shall be reported to the Chief Inspector. The Chief Inspector may decide if further inspection is necessary or not based on preliminary findings provided from ship’s master or owner (regulation 7).

C. **Collection of evidence.** Regulation 9 §1 points out that charts, log books, voyage data recorder and other documents that may be of interest should be preserved upon an accident for investigation purposes. § 9 clearly states that an investigation inspector cannot require a ship to remain longer than is necessary and shall ensure that evidences are collected expeditiously.

D. **Protection of witnesses.** Regulation 5 §2 state that the sole objective is not to determine liability nor, as far as possible, to apportion blame. The statement is also followed by regulation 12 saying that disclosure of records made shall not be made available for purposes other than investigation unless a court orders otherwise. Regulation 10 §5 allows the Chief Inspector to exclude any person (except lawyers acting solely on behalf of the interviewee) to be present at an oral examination of a witness.
E. The closed loop. Regulation 15 states that any recommendation received from the Chief Inspector must be considered and followed up by a case document providing the measures taken or reasoning why no measures are implemented. The regulation also states that the recommendation shall be made public available when the Chief Inspectors judges that the results may be of interest of others than the primary receiver.

F. Penalty. Regulation 18 states that a person who, without reasonable causes, fails to follow the reporting regulations can be given a fine up to level 5 (£ 5000).

4.3 Flag State

Until July 1st 2008 investigation of accidents was conducted by a NMD in a process called “Sjøforklaring”, translated to "maritime declaration". The object of this process was to determine both the question of guilt and the factors causing the accident. This mixture of these tasks was regarded as a problem as actors involved in the declaration process were afraid for prosecution. The statutory declaration process was also criticized for poor efficiency and rarely on-scene inspections. In the light of these factors a new regime was introduced, directing accident investigation to be conducted by AIBN with the sole purpose to develop existing regulations, routines and standards in order to prevent accidents to happen (Ot.prp no 78, 2003-2004).

Despite introducing a new regime, accident investigation in Norway is still criticized among ship owners as presented in section 4.1.3. Brattfoss, one of the eight accident investigators at AIBN states that a significant share of received cases is not investigated due to their limited working capacity. AIBN aims at investigating all serious accidents involving fatality or damage to the environment. For accidents or incidents that are not investigated, the respondent receives a note informing the case is dropped (Brattfoss, 2010).

In the period from the start-up in 2008 to 2009 AIBN received reports on 20 accidents (appendix 4) obligated to investigation according to the Norwegian Maritime Code. On this point, only eleven of the accident investigation reports are published, two investigations are canceled due to limited resources and seven are not yet completed. In the same period 211 accidents, not obligated to investigation, were reported to AIBN where only three investigation reports are made available so far (AIBN, 2010).

The Norwegian Accident Investigation Board has another approach than MAIB when it comes to protection of information provided through investigation for other use than intended. Brattfoss (2010) states that AIBN and the prosecuting authority, represented by the Police, often share the facts and evidences gained through an investigation. Further, Brattfoss states that AIBN intend to keep the interpretation and analysis themselves, inaccessible for others until the investigation report is published. Every AIBN report made public available are given inscription as the following excerpt from the ‘Full City’ investigation report:

"AIBN has compiled this report for the sole purpose of improving safety at sea. The object of a safety investigation is to clarify the sequence of events and root cause factors, study matters of significance for the prevention of maritime accidents and improvement of safety at sea, and to publish a report with eventually safety recommendations. The Board shall not apportion any blame or liability. Use of this report for any other purpose than for improvements of the safety at sea should be avoided.”

Regardless of the effort to protect their findings to be used in determination of guilt or apportion of blame, Brattfoss says
they cannot prevent the investigation report from giving the Police a hint for where to look (Brattfoss, 2010). However, the practices seems to be totally different. In the ‘Full City’ case, the AIBN’s preliminary investigation report was presented as evidence in court and was used to determine whether the captain and 1st Officer should be remand in custody or not. The case was appealed and the report was subsequently also presented as evidence in higher instances. Also the investigation report from the AIB of Antigua and Barbuda was presented as evidence in the court determining the compensation in the aftermath of the ‘Rocknes’ accident in 2004 (Hanevold N., 2009).

According to the recent study on underreporting (Hassel 2010), the situational awareness of the Norwegian flag state seems to be insufficient. Today, AIBN receives most of their information directly from NMD whilst a few numbers of incidents are reported directly from JRCC. Besides that, AIBN does not hold any records on how many accidents that are not reported. Serious accidents or injuries are often intercepted by the press before being reported to AIBN, thus underreporting is therefore not regarded as a major issue (Brattfoss, 2010). In a previous study on databases (Hassel and Hole 2009) NMD was interviewed regarding their way of collecting and receiving information. Results showed that The results showed that nor NMD was aware of the underreporting issue. No actions are taken to try to determine the extent of underreporting other than sporadic check-up with other databases (Bakkevig, 2009).

4.4 Other Contributors
As presented in section 4.2.2 neither the VTS nor JRCC are compulsory reporting contributors with respect to the Norwegian legislation. They may however be useful informants providing complementary information of accident they may be aware of.

In Norway there are four VTS-centers are monitoring respective areas where traffic density is high and where dangerous goods are transported close to shore. In addition one VTS-center (VTS NOR) is given the responsibility to monitor all movements along the coast of Norway, from the boarder to Russia in the north to the Swedish border in the south. The VTS-centers use AIS and VHF radio communication as primary input in their surveillance. Vessels with an indentified suspicious behavior are contacted and diverted using one of the costal radio stations. Incidents leading to a high probability of environmental damage are reported to NMD (Ski, 2010).

In 2007 VTS NOR introduced a new traffic separation scheme (TSS) to reduce probability of collision, but also to make it easier to monitor the ship movement. The TSS is both manually and electronically monitored allowing a filtration of vessels’ AIS-track. The filter will automatically alarm the controllers if the speed of a vessel gets below a certain limit. This meaning ships running aground or exposed to engine failure are detected by the VTS-centre (Sveinungsen, 2010).

As for the VTS-centers, the Joint Rescue Coordination Center (JRCC) possesses a unique position to pass on first hand information about accidents as JRCC often is the first to know about an accident. In 2009 JRCC received a total of 3243 sea related accidents covering both the leisure- and merchant sector (JRCC, 2009). It stands to believe that many of these accidents are not of interest to AIBN, but still mandatory reporting could have improved the situational awareness.
Figure 3 displays the results of the comparative threshold analysis. The most significant difference between the two industries is the amount of reports submitted on in-house problems. Six out of ten reports submitted from the air transport industry are dealing with issues within internal bounds, meaning that a proposed improvement is desired for the reporter itself, the colleagues or the organization managing the company. The equivalent sections for the maritime industry do only make up 21%.

The maritime industry shows a greater tendency to blame other, corresponding external organizations, as exemplified: one ship’s master blaming another for not following “The International Regulations for Preventing Collisions at Sea” (Colregs). More ideally, if the threshold of reporting in own mistakes and colleagues’ mistakes was as low as reporting in others’ mistakes, these parts should have been equivalent big

The aviation industry also submits a relatively larger amount of reports issued on co-operative organizations e.g. a pilot reporting in the conducts of an ATC-service. This fact can probably be explained by the aviation industry being more dependent on co-operative organizations such as ATC, airport authority, and other various ground based workers (de-icing etc.).

Perhaps the most important result of this analysis is the threshold of reporting in personal errors. None of the maritime reports were issued based on self-induced mistakes. The aviation industry comes forward by having a higher degree of reporting in self-induced incidents thus being fairly low, meaning improvements could be done to both parties. The actors in aviation industry also show that they are relatively better to indentify latent causes in their own organization that potentially may lead to an accident. The fact that the amount of reported incidents is much higher for the aviation industry also speaks for itself. The results sorted on the feedback for the air transport industry and the maritime industry can be seen in appendix 5 and 6.
5. Discussion
The findings indicate deficiencies in all of the components in the reporting chain. All the actors have areas where improvement could be done. The Norwegian legislation for marine reporting procedures seems to be somewhat incomplete with respect to its scope and extent and also in the way it separates investigation and question of guilt. Comparison with the United Kingdom’s regulations for marine accident reporting and the Norwegian regulation for aviation accident reporting, show that Norway can develop their maritime legislation even further.

The ship owner findings indicate naïve attitudes by believing reporting of accidents and fulfilling regulations are secured through other parties like shipping agents or insurance companies, which in the best case be defined as a slip or lapse. No evidences form neither NMD nor AIBN indicates this being a part of the today’s practice. The ship owner findings also point out that the regulation in some way can be violated by intentionally not report in accidents in fear of a ship being put on hold.

The comparative threshold analysis points out that the aviation industry is more mature compared to the maritime industry. The actors in the aviation industry show a lower threshold to report individual incidents and keep a higher focus on aspects in their own organization. This may indicate a better understanding of reporting as an effectively tool to improve safety.

The result section is saturated by aspects regarding legislation, motivation to report and cultural challenges. It seems that these also are the aspects that affect the overall underreporting issue. The following sections provide an interpretation of the results and states out some measures to improve reporting performance.

5.1 Legislation efficiency and efficacy
The today’s legal usage seems to be rooted in previous regime’s practices where the maritime declaration was used to determine guilt and causal factors, which is conflicting with IMO’s Casualty Investigation Code. A wrong use of investigation reports may also presumably frighten actors in the maritime industry to report in events, even though reporting is made mandatory. The regulation should be made clearer and forbid evidences found during investigation to be used in court, like the analog regulation for aviation industry.

The regulation may also be changed to involve more actors in the mandatory reporting chain. Some of the intelligence caught by JRCC and the VTS-centers are already relayed as a part of “best practices”, but a change in the regulation would necessitate these practices to be implemented on a regular basis. MAIB estimated in their Regulatory Impact Assessment that an equivalent change in the British regulation would increase reporting performance with up to 3,6 % (MAIB, 2005). If turning to the aviation industry an even more extensive range of actors can be seen. Table 3 is a tempting proposal of mandatory maritime reporting actors based on the Norwegian aviation regulation.

<table>
<thead>
<tr>
<th>Aviation Industry</th>
<th>Maritime Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captain</td>
<td>Master</td>
</tr>
<tr>
<td>Flight Crew</td>
<td>Vessel Crew</td>
</tr>
<tr>
<td>Operator</td>
<td>Ship Manager/ Agent</td>
</tr>
<tr>
<td>Owner</td>
<td>Ship Owner</td>
</tr>
<tr>
<td>Flight Control Services</td>
<td>VTS, RCC, Harbor Authority</td>
</tr>
<tr>
<td>Ground Services</td>
<td>Repair Yard, Classification Society</td>
</tr>
<tr>
<td>Producers of Aircraft and Components</td>
<td>Ship Yards, Component Manufacturers</td>
</tr>
</tbody>
</table>

Table 3 Transfer of mandatory reporting actors
Findings from both AIBN and ship owners indicated that limited resources lead to many less serious cases being dropped. The British MAIB-regulations require a ship’s master or owner to conduct self-examination upon an accident, on which the Chief Inspectors stands freely to decide whether a further investigation is necessary or not. This practice insure that less serious accidents will be treated instead of dropped and that potential “lesson learned” can be received, stored and distributed to other interested parties.

5.2 Motivation
It stands to reason that the answers given from the ship owners where true. On the other hand it is also reasonable to believe that some of their known causes to why the reporting procedures are not followed are not disclosed, especially causes identified as violations or mistakes (section 3.4) However, the ship owners results indicated that absence of reporting can be rooted in all the causes, violation, slip, lapse and mistake resulting in breakages in the link between ship owners and flag state.

The importance of a seemingly immaculate reputation is also brought to the author’s mind. One of the ship owner states that a vessel put on hold due to an investigation is hard to trade. None of the interviewed respondents directly gave up customer relationship as a reason to retain reports. However lost income due to missing contracts or losing ISO-certificates makes it reasonable to believe that protection of reputation may be a reason to withhold mandatory reports.

The answers given form the ship owners also indicate that they look upon obligatory reporting as a “paper-pushing exercise”, giving little results. It is of the author’s opinion that The Norwegian flag state should try to comply with ship owners’ desire of more relevant feedback. This will most likely motivate to a higher level of reporting and assist in hazard identification. As mentioned in a previous study (Hassel and Hole, 2009), membership to the new European Marine Casualty Information Platform (EMCIP) will help sharing information between flag states and making and distributing safety memorandums.

A voluntary confidential reporting scheme like CHIRP appears also to be beneficial. The reports submitted are often useful because the scheme encourage the reporter to give causal factors that presumably otherwise would not be brought to the surface. If the system, in addition, follow up and seek solution to every reported event, the motivation for reporting may grow even higher. Implementing of confidential reporting in the aviation industry has been very successful in the past. In 2001 Denmark’s air traffic services experienced a rise from approximately 15 safety related reports to over 900 reports per year after confidential reporting was introduced (Flight Safety Digest, 2005).

A contrary approach to improve accident reporting routines is to seek information from the actors who are more likely to be informed about accidents (Hassel and Hole, 2009). As stated in ship owner interviews, insurance companies are often the first to be informed if an accident occurs. Today neither NMD nor any other flag state has insight to the insurance companies’ databases (Bakkevig, 2009).

If access was gained to this database it would be easier for the flag state to check whether an accident is properly reported or not. This proposal would eventually require an amendment to the regulation in order to gain access. If introduced, the amendment must be fair and not disadvantageous to competition, meaning it must be affected the same way globally.
5.3 Culture

Culture (or bad culture) is the third, and perhaps the most important aspect to why the reporting procedures are not followed. Reason (1997) defines safety culture as a culture consisting of several other cultures (figure 4). One of the vital components is the reporting culture, defined as a culture where people encouraged reporting their self-induced incidents. In order to function intentionally, the reporting culture must be accommodated by a learning culture. The learning culture is an open minded culture willing to take in findings provided through different sources of information.

Findings from the ship owner interviews also indicated broken links between vessels and the ship owner. Employees seem to be afraid of being fired or punished and therefore avoid reporting accidents or incidents. Still, it is probably not right to just blame the seafarers for the restraint to report events. The fact that there is practically no personally bound between the lower ranked crew and the onshore organization makes it hard to implement faithful connections, meaning that the foundation pillars, in some cases, are too weak to actually claim a safety culture.

A general low overall reporting performance also points out that ship owners have a poor learning culture whilst the flag states have an equivalent poor informed culture. A top view of the reporting performance indicates that the imbalance between accidents and reported events may be rooted in bad follow-ups and low penalties for not report. Again it is tempting to look at the similarities in the aviation industry and see how they deal with the issue. “A just culture” is a phrase introduced to the aviation industry, being a culture that balances thrust, which encourage reporting, but also set strict and fair consequences for unacceptable behavior (SKYbrary, 2010).

When aviation first started, the safety management system (SMS) was little regulating, allowing a reactive “fly-fix-fly” scheme. This regime was allowed to continue until the mid 1970s when a new practice was introduced trying to mitigate and contain human error through training,
and stricter regulations. Learning was provided through investigation of incidents and from experiences from other industries. In the mid 1990s the system developed even further by routinely analyzing safety related data in a proactive perspective (SKYbrary, 2010). During the period from the 1960s to the mid 1970s there has been a remarkable drop in aircraft accidents (Boeing, 2009), meaning safety performance can be changed. Of course this shift was not ensured by change of culture alone, but the constant eager chase for improvement would not be possible without a driving safety oriented culture.

The marine industry is a more deep-rooted industry which traditionally has been allowed to operate free and with little interference from the consumers. Flags of convince have allowed ship owners to escape rules setting boundary conditions to both economy and safety aspects. The maritime industry has showed a relatively poorer willingness to change and to take in new standards if not implemented on a globally basis (through IMO). A code for International Safety Management (ISM) has already been implemented by IMO to ensure that ship owners have a safety management system. However, the ISM code is fairly vague about how the SMS should be conducted (Kristiansen, 2005). The author believes that more precise guidelines may assist ship owners to take essential measures and develop their culture, which consequently also may improve the reporting performance. Follow up and guidance could essentially be assured by classification societies.

Of all the interviewed ship owners, best impression of reporting procedures was given by the company in the offshore supply segment. This company seemed to have implemented reporting procedures way above the standards to the other companies. The motive for the strict procedures was given to be a mixture of self-regulation and customers’ demand for a certain level of safety.

Interference from consumers is apparently an important driving force to catalyze improvements to safety in the aviation industry. The aviation industry is closely related to its customers as the main purpose of flight operations is to transport passengers. Besides, the consequences of an airplane accident are more likely to be fatal compared to a marine accident. However, the environmentally aspects of a marine accident is more likely to be more severe, meaning that a marine accident can broadly harm the existence of life to a wide range of individuals. A shift in today’s marine safety culture is needed to guarantee a better reporting performance, which in turns will help gaining a proper situational awareness and implementation of adequate measures. The driving force will probably not be found among the maritime industry’s consumers, thus the shift in culture is more likely to be rooted in a regulative guidance.
6. Conclusion

This paper has identified some of the deficiencies in the maritime reporting procedures. Different proposals have been pointed out to help gaining a better reporting performance and to avoid broken links. Much can be learned by looking to other industries and other flag states.

Eventually, changes in legislation, motivation and culture are worth next to nothing without a system to intercept and manage submitted reports. Norway has a traditionally been a front-line participator promoting safety and high quality attitudes. The Norwegian flag state should continue its work and, with all its weight, develop a fair and effective framework for meaningful safety reporting.

Preferably, further study should be assigned to receiving more information form ship owners, especially to foreign ship owners’ reporting procedures to the Norwegian flag state. The ship owners interviewed in this study were all Norwegian, resulting in somewhat partial results. The interviewed ship owners showed little knowledge to foreign flag state’s routines and it seems likely to believe that the situation is the same, the other way around.

Further, an assessment of required strategically measures should be evaluated in the light of the maritime industry’s ability to change. This means whether the measures should be implemented by increasing the motivation to report, by force or in a combination of the two.

Acknowledgement

The author would like to thank the Norwegian Research Council for their financial support to the MARRISK and FARGE research projects, in which this study is part of the preliminary research work.

This article is written in parallel with the article "Underreporting of maritime accidents in vessel accident databases" (Hassel, 2010) and is a result of a study on reporting procedures of marine accidents. This work constitutes the author’s master thesis at the Norwegian University of Science and Technology (NTNU), Department of Marine Technology.
Biography


IMO, 2008. Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (MSC/Circ.2).


Norwegian Maritime Directorate, 2009. Sea safety conference- Development of accident rates by Mr. Gåseidnes. Available at (cited April 10th 2010 Norwegian only): http://www.sjofartsdir.no/upload/SJ%C3%B8sikkerhet/Sj%C3%B8sikkerhetskonferansen/2009/Presentasjoner%20Sj%C3%B8sikkerhetskonferansen%20Ulykkesutvikling%20siste%20H%C3%A5vard%20G%C3%A5seidnes.pdf


Olsen T., Commanding Officer 'RS Sundt Flyer', Norwegian Society for Sea Rescue.


Rowse C., 2010. Maritime Director, Confidential Hazardous Incident Reporting Programme.

Ski T., 2010. Senior Advisor VTS- Services, Norwegian Coastal Administration.


Sveinungsen S. 2010. Chief Executive Officer NOR VTS, Norwegian Costal Administration.


Sørenes T., 2010. Vice President Risk Management, Odfjell Tankers.
# Appendix 1 Examples of Aviation Threshold Grouping

<table>
<thead>
<tr>
<th>Group</th>
<th>Example</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong></td>
<td>Pilot doubtful to own decisions during made during landing sequence.</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>1st Officer reports in his unclear communications with Captain.</td>
<td>91</td>
</tr>
<tr>
<td><strong>Group B</strong></td>
<td>Cabin crew reporting Captain's poor crew resource management.</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Cabin crew report Captain forcing crew to over load/ faulty stowage of aircraft.</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Cabin crew report lack of communication with flight crew.</td>
<td>93</td>
</tr>
<tr>
<td><strong>Group C</strong></td>
<td>ATC reports in aerodrome authorities faulty in sorting out a problem with a shooting ground adjacent to a regional airport.</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Pilots reports in on their company’s inappropriate re-fueling procedures.</td>
<td>Repeating</td>
</tr>
<tr>
<td></td>
<td>Pilots and engineers report in on their company’s deficient level of crewing.</td>
<td>Repeating</td>
</tr>
<tr>
<td><strong>Group D</strong></td>
<td>Pilot reports in unclear instructions given by ATC.</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Pilot reports in inappropriate weather forecasting by airport authorities.</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Pilot submits report on faulty on de-icing crew services.</td>
<td>93</td>
</tr>
<tr>
<td><strong>Group E</strong></td>
<td>Pilot submits report on another aircraft taking off without de-icing.</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Pilot submits report on another aircrafts wrong use of transponder.</td>
<td>92</td>
</tr>
<tr>
<td><strong>Group F</strong></td>
<td>Quality Auditor reports in equipment not compatible with other components.</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Pilot reports in vague mayday/pan-pan procedures with no clear description in regulations.</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Pilot reports in his concern on various use of phraseology when assigning flight levels.</td>
<td>96</td>
</tr>
</tbody>
</table>
## Appendix 2 Examples of Marine Threshold Grouping

<table>
<thead>
<tr>
<th>Group</th>
<th>Example</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong></td>
<td>No marine Group A reports in threshold analysis.</td>
<td></td>
</tr>
<tr>
<td><strong>Group B</strong></td>
<td>Engineer report in his supervisors (Chief Engineer and 2(^{nd}) Engineer) inappropriate planning of hot work, resulting in reporter being burned.</td>
<td>12</td>
</tr>
<tr>
<td><strong>Group C</strong></td>
<td>Engineer reports in on his Ship Owners inadequate machinery monitoring equipment. A superintendant report in deficiency in anchoring procedures and maintenance, resulting in an injured crew member.</td>
<td>16 21</td>
</tr>
<tr>
<td><strong>Group D</strong></td>
<td>VTS reporting poor/dangerous performance of navigation. Dredger crewmember reports in too close quarters leading to danger of collision.</td>
<td>Repeating 21</td>
</tr>
<tr>
<td><strong>Group E</strong></td>
<td>Violation of COLREGs. Masters report in on other vessels not following international regulation. Dangerous encounter between leisure yachting and commercial shipping.</td>
<td>Repeating Repeating</td>
</tr>
<tr>
<td><strong>Group F</strong></td>
<td>Manager reports in deficiencies with fire distinguisher equipment. Crewmember reports in vague description of responsibility between a Master and Offshore Installation Manager when vessels are involved in installation operations. A marine Pilot reports in a concern about un-standardized radar equipment may result loss of control.</td>
<td>15 15 16</td>
</tr>
</tbody>
</table>
Appendix 3 Ship Owners Interview Form

Ship owner __________ Flags of registry __________ Type of vessel __________

Reporting routines from vessel to onshore organization:

1. Does the ship owner have preset routines for reporting accidents or incidents ‘ship to shore’?
2. Who is responsible sender?
3. Who is responsible recipient?
4. Are there any changes to the routines with respect to where the vessel is at the time?
5. Do the ship owner have any limits for how quick an accident/incident must be submitted

Reporting from ship owner to flag state:

1. Does the ship owner have preset routines for reporting accidents and incidents to a flag state?
2. Who is responsible sender (onboard/onshore organization)?
3. Is the ship owner known with regulations for mandatory reporting in all countries where operation takes place?
4. How does the ship owner follow up proceedings with flag states?

Ship owner’s consideration of near-misses:

1. What are the ship owner’s procedures for reporting of near-misses?
2. Are near misses reported in the same way as accidents?
3. In what extent are the crew requested to report near-misses?
4. May everybody in the crew report a near miss incident?

Use of reported events for risk analysis:

1. How is collected data used in risk assessment?
2. What feedback does the crew receive from the onshore organization’s risk assessment?
3. Does the ship owner utilize input from other sources like the Sea-Web™ database etc.?

Safety Related Information:

1. Does the ship owner receive any safety related information from its flag state(s)?
2. How is this information transferred to the crew?
3. In what extent do you feel that your accident/incident reports contribute a constructive development in rules and regulations and increased safety for the maritime industry?
4. Is it any type of information you think should be provided to your company in a larger scale than today?
Appendix 4 AIBN- Inspection of Accidents obligated to investigation

<table>
<thead>
<tr>
<th>Date of Occurrence</th>
<th>Vessel Name</th>
<th>Accident Description</th>
<th>Report made available</th>
</tr>
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<tbody>
<tr>
<td>June 10th 2008</td>
<td>Bjørnar</td>
<td>Working Accident</td>
<td>N/A</td>
</tr>
<tr>
<td>August 16th 2008</td>
<td>Lyse Ekspress</td>
<td>Grounding</td>
<td>February 2009</td>
</tr>
<tr>
<td>August 18th 2008</td>
<td>Star Java</td>
<td>Working Accident / Fatality</td>
<td>January 2009</td>
</tr>
<tr>
<td>October 7th 2008</td>
<td>Nord Star</td>
<td>Working Accident</td>
<td>April 2009</td>
</tr>
<tr>
<td>October 24th 2008</td>
<td>Nysand</td>
<td>Working Accident / Fatality</td>
<td>N/A</td>
</tr>
<tr>
<td>November 20th 2008</td>
<td>Nordic Sky</td>
<td>Grounding</td>
<td>June 2010</td>
</tr>
<tr>
<td>December 16th 2008</td>
<td>Star Ismene</td>
<td>Working Accident</td>
<td>N/A</td>
</tr>
<tr>
<td>January 6th 2009</td>
<td>Richard With</td>
<td>Grounding</td>
<td>March 2010</td>
</tr>
<tr>
<td>January 6th 2009</td>
<td>Øyfart</td>
<td>Loss of Vessel</td>
<td>May 2010</td>
</tr>
<tr>
<td>January 6th 2009</td>
<td>Nesbuen</td>
<td>Working Accident / Fatality</td>
<td>February 2010</td>
</tr>
<tr>
<td>March 2nd 2009</td>
<td>Marina</td>
<td>Loss of Vessel/Fatality</td>
<td>May 2010</td>
</tr>
<tr>
<td>March 12th 2009</td>
<td>Lill-Anne</td>
<td>Loss of Vessel/Fatality</td>
<td>Feb 2010 Preliminary</td>
</tr>
<tr>
<td>April 9th 2009</td>
<td>Sanni</td>
<td>Working Accident/Fatality</td>
<td>Investigation closed due to limited resources</td>
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<tr>
<td>June 4th 2009</td>
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<td>Working Accident/Fatality</td>
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<td>July 31st 2009</td>
<td>Langeland</td>
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<tr>
<td>July 31st 2009</td>
<td>Full City</td>
<td>Grounding</td>
<td>March 2009 Preliminary</td>
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<tr>
<td>August 19th 2009</td>
<td>Neptun</td>
<td>Working Accident</td>
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<tr>
<td>September 9th 2009</td>
<td>Monica IV</td>
<td>Capsize/Missing crew</td>
<td>April 2009</td>
</tr>
<tr>
<td>September 16th 2009</td>
<td>Helgeland</td>
<td>Grounding</td>
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<tr>
<td>September 25th 2009</td>
<td>Fredrik Andre</td>
<td>Man Over Board/Fatality</td>
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### Appendix 5 Aviation Threshold Results

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<tr>
<th>Feedback no.</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Air Transport</th>
<th>Group D</th>
<th>Group E</th>
<th>Group F</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Self-induced incident</td>
<td>Colleague's conduct</td>
<td>Own organization</td>
<td>Co-operative organization</td>
<td>Corresponding external employment/organization</td>
<td>Procedures &amp; Equipment</td>
<td>Sum reports</td>
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<tr>
<td>Issue NO 88</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Issue NO 89</td>
<td>1</td>
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<td>4</td>
<td>1</td>
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<td>1</td>
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<td>3</td>
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<td>33</td>
<td>13</td>
<td>3</td>
<td>11</td>
<td>67</td>
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<tr>
<td>Percentage</td>
<td>3,0 %</td>
<td>7,5 %</td>
<td>49,3 %</td>
<td>19,4 %</td>
<td>4,5 %</td>
<td>16,4 %</td>
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## Appendix 6 Maritime Industry Threshold Results

<table>
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<tr>
<th>Feedback no.</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
<th>Group F</th>
<th>Sum reports</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Self-induced incident</td>
<td>Colleague's conduct</td>
<td>Own organization</td>
<td>Co-operative organization</td>
<td>Corresponding external employment/organization</td>
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<td>4</td>
</tr>
<tr>
<td>Issue NO 13</td>
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<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
<td>2</td>
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<td>4</td>
</tr>
<tr>
<td>Issue NO 15</td>
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<td>0</td>
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<td>0</td>
<td>2</td>
<td>4</td>
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<td>3</td>
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<tr>
<td>Total</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>6</td>
<td>38</td>
<td>8</td>
<td>66</td>
</tr>
</tbody>
</table>

| Percentage   | 0,0 %   | 1,5 %   | 19,7 %  | 9,1 %   | 57,6 %  | 12,1 %  |             |

31