ACCIDENT AND INCIDENT DATA

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Abstract

Although it is often suggested that accidents at sea have reduced over the last decade, there is no doubt that they still occur, both to vessels and those that work on them. One potential contribution to the reduction of such accidents is the collection of accurate data on accident and incidents as this may be used to suggest improvements to safety systems, and to inform changes in practice and policy. Although there are a number of sources from which such data may be obtained, when these are examined they are generally found to be localised, poor in coverage, and/or to contain only very basic data. Therefore, this paper outlines an attempt to collect and combine available sources of accident and incident data, both for vessels and personnel, discusses the format, nature and limitations of this data, and considers whether there is any common core of available information in the public domain. Information from a number of sources will be examined, including maritime administrations, P&I clubs, and shipping companies. Finally, recommendations are made to consider what information could valuably be recorded, and how it could helpfully be classified, so that these sources are more comparable and compatible for research purposes.

Introduction

Although the number of shipping accidents occurring at sea has been said to have reduced over the last decade (Transport Safety Board of Canada, 2001) accidents and incidents still occur, both to vessels and those who work on them. The impact of these accidents can be far reaching. Not only can they entail physical damage to, or loss of, a vessel with considerable financial losses, all too frequently they also involve loss of life or disabling injury. For shipping in general, such accidents cause a loss of confidence about the safety of the industry (Iarossi, 2003), and may produce strong demands for tougher regulation and control over the sector.

One way to try and reduce accidents and suggest ways in which safety may be improved, is to collect accurate information about the accidents and incidents that occur (McCafferty and Baker, 2006; Nielsen, 2001; European Transport Safety Council, 2001). The benefits of such information are well recognised. The European

Transport Safety Council (2001) in a report on road, air, rail, and water transport suggested that 'accident and casualty databases are an indispensable tool to allow for objective assessment of transport safety problems, the identification of priority areas for action and for monitoring the effectiveness of countermeasures' (p1).

There are also a number of benefits of such information which are specific to the maritime industry. For example, classification societies could use such information to guide and support their planning of rule making (Baker and McCafferty, 2005). Shipping companies may also use this data to develop better informed and targeted policies for their safety management systems, whereas Port State Control could use it to identify ship types that are more at risk of incidents in order to better target vessels for inspection. More generally such data may help to facilitate research into health and safety within the industry (Baker and McCafferty, 2005), which at present is very limited.

Ashore, information about accidents and incidents in most transport sectors is well recorded and is readily available. For example, a European wide database of road transport accidents was set up in 1993, and all member states provide data to feed into this on a yearly basis. Similar schemes have also been set up in the aviation industry (European Transport Safety Council, 2001). However, in the maritime industry, although administrations are legally required to collect data on accidents and incidents occurring to their flagged vessels, or to vessels in their waters under SOLAS regulation I/21 and MARPOL 73/78, articles 8 and 12 (see MSC/Circ.953-MEPC/Circ.372 for more detail), this data is sometimes poorly kept, and often not always publicly available. This makes it of limited use.

In an attempt to try and examine the types of accidents and incidents that are occurring at sea, some researchers have simply looked at single datasets (Philips and Daltry, 2006, Roberts, 2006). However, due to their nature such studies are generally very limited, as the data even when collected from several sources is often related to a single geographical location (e.g. Hansen *et al.,* 2007), or focuses on specific vessel types. Thus, robust generalised statements about the type of accidents and incidents that are occurring worldwide cannot confidently be made from such studies.

Other researchers have attempted to collect data from multiple sources and aggregate this data (Baker and McCafferty, 2005). However, in practice these have only used data from a small number of sources which the researcher has access to, and thus cannot be seen as global in their coverage, suffering from many of the limitations similar to those of the single source studies. A similar conclusion is drawn by the European Transport Safety Council (2001) report on accidents and casualties occurring in waterborne transport.

A major recognised source of accident and incident information is maritime administrations. Administrations are not only obliged to conduct accident investigations and record their outcomes, but they must also supply the International Maritime Organization (IMO) with information regarding their findings[1]. However, they are only legally required to provide these when 'it [the maritime administration concerned] judges that such an investigation may assist in determining what changes in the present regulations may be desirable' (Graveson, 2006), and thus a large majority of the accidents and incidents that occur are not reported. This is supported by our own analysis of the IMO database and corresponding data from a sample of maritime administrations which indicated that only a very few of the incidents recorded on national databases are reported to the IMO[2]. A similar conclusion is drawn by Graveson (2006).

Many other sources of accident and incident data are also available. For example, the World Casualty Statistics is published yearly by Lloyd's Register Fairplay, and lists losses and disposals of sea-going merchant ships. Confidential reporting schemes such as the Marine Accident Reporting Scheme (MARS), and the Confidential Hazardous Incident Reporting Programme (CHIRP) collect and publish accident information reported confidentially by seafarers. However, these sources generally provide limited data with very partial coverage, and cannot be used to determine robust calculations of numbers of accidents and incidents globally.

[1] Under the SOLAS regulation I/21 and MARPOL 73/78, articles 8 and 12 legislation (see MSC/Circ.953-MEPC/Circ.372 for more detail).
[2] It should be noted that administrations are only legally required to report ship casualties which are considered to be 'serious' and 'very serious'.

Thus, whilst there are a number of available sources of information about maritime accidents and incidents internationally, these are either very localised, or those which are more global contain very limited data. The European Transport Safety Council (2001) suggested that where such situations arise 'a co-ordinated approach offers the best means to gain maximum value out of each separate system' (p7). However, to date in the maritime industry such a combined approach has not been undertaken on a large scale.

This paper describes the progress made to date with a project dedicated to the identification and collation of accident and incident data kept by different sources worldwide, such as maritime administrations, Protection & Indemnity (P&I) clubs, and shipping companies, as well as other available sources of information. The format and nature of these data will be documented, as well as whether there is a common core of information that is collected across sources. The public availability of relevant data will be also discussed.

Within the study we have looked at two levels of accident and incident data: vessel level incidents and personal injuries/fatalities and in describing these have approached and collated data from maritime administrations, P&I clubs, and shipping companies.

Vessel Level Incidents

In order to collect vessel level incident data, maritime administrations were contacted and asked for their co-operation. Maritime administrations are legally obliged to collect accident and incident data, so between them they should be in a position to supply comprehensive data on numbers of accidents/incidents worldwide, all things being equal.

However, shipping is a major global industry, and worldwide there are over 180 maritime administrations. Contacting all of these would be very time consuming. Therefore using the Lloyd's Register Fairplay World Fleet Statistics 2005 report, we identified the top 30 countries of registration by gross tonnage and contacted them for

further information and details. This was seen as acceptable as the top 30 represented 87.5% of the world gross tonnage.

Contact details for these maritime administrations were obtained from three sources. Firstly, the Marine Accident Investigators International Forum (MAIIF) (http://www.maiif.net/Contacts.htm) which is an organisation that aims to provide a forum to promote and improve marine accident investigation, and to foster co-operation and communication between marine accident investigators. Secondly, the International Maritime Organization (IMO) website (http://www.imo.org/includes/blastDataOnly.asp/data_id%3D17408/6-circ.2Annex1NationalcontactpointsJan07.pdf), and thirdly, if no contact details were listed for a particular maritime administration, internet search engines or personal contacts were used to try and identify relevant personnel[3].

Using these contact details a combination of faxes and emails were sent to the listed contact persons/organisations explaining the aims of the project, and asking them to identify the most appropriate person to contact in their administration about accident and incident records and their potential access. To make it easier and quicker to respond a pre-designed pro-forma was provided (see Appendix 1) asking for the following information: organisation, name, the person's position within the organisation, their address, email, telephone number, and fax number. The sheet could be either sent back by email or by fax. If no response was received to this after approximately 2-3 weeks, a follow up fax or email was sent, again asking for the same information. If no responses were received after the two attempts, the maritime administrations were contacted by telephone (where listed), and the contact details of the appropriate person were asked for.

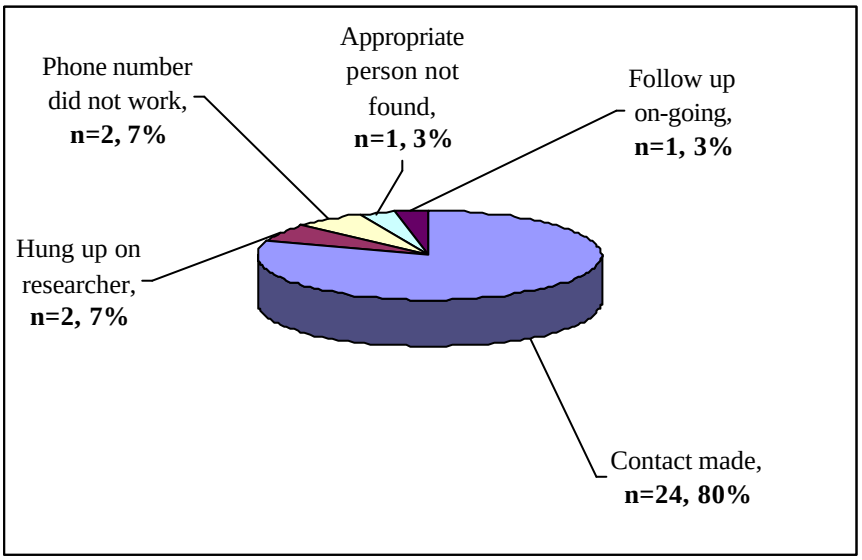
Although for many of the contacts the same organisation and individuals were listed on both the IMO and MAIIF list, in some instances different people/organisations were provided. In these cases, if no response was received from the initial and follow

[3] In some cases no contacts details could be found for some maritime administrations either on the lists or the internet, and thus, where possible personal contacts of staff in SIRC were used to either directly contact the maritime administration, or to identify contacts.

up requests, an alternative contact person was identified from the list, and was contacted.

Following this lengthy process we managed to get a response from 80.0% (24 of the 30) of the maritime administrations initially contacted. Of the 6 maritime administrations we could not contact at all despite numerous efforts, two put the phone down on the researcher, which was mainly attributed to language difficulties, and the phone number listed in two other cases did not work. For one maritime administration, the contact details were for an inappropriate person in the administration, and despite being passed from department to department, the appropriate person was never found, and in one further case the follow-up process remains incomplete.

Figure 1: Pie chart showing contact made, and reasons for contact not being made

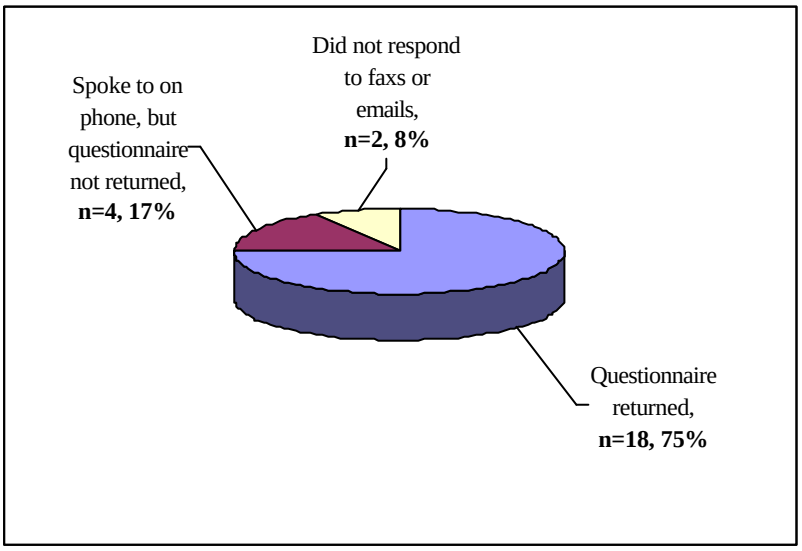


Once we had established the appropriate individuals with whom to further liaise, we sent a short questionnaire (see Appendix 2) to them by fax or email. The questionnaire asked about the sort of information that was maintained by the maritime administration (e.g. written accident reports, statistics on accidents, tabulated data, etc), the format (i.e. electronic or paper), whether it was publicly available, whether it could be accessed online, and importantly if they would be willing to share this data for academic research purposes.

If no response was obtained a second follow up fax/email was sent after a period of 2-3 weeks. After a further 2-3 weeks, if we still hadn't received a response, the identified person was contacted by phone, and asked if they would be willing to complete and return the questionnaire.

As a result of this concerted effort, 18 completed questionnaires (75.0%) were returned from the 24 administrations for which we had contact details. In four of the six cases where questionnaires were not returned, this was despite discussions with individuals on the phone and agreement with regard to the re-sending and return of the questionnaire. Two contacts, simply did not respond to any fax or emails sent to them.

Figure 2: Pie chart showing the number and frequency accident database questions returned, and reasons for no - responses



Looking at the 18 questionnaires that were completed and returned, 94.4% (n=17) of the maritime administrations indicated that they kept basic records of accidents and incidents that occurred on their national flagged vessels and in their national waters, with only one maritime administration indicating that it did not keep any records at all. However, when asked more specifically about the types of records kept, all 18 maritime administrations indicated keeping records of accidents/incident reports, with 88.8% (n=16) keeping paper records, and 72.2% (n=13) keeping electronic records. Similarly, all 18 maritime administrations kept records of accidents/incident

investigations, with 94.4% (n=17) keeping paper records, and 66.7% (n=12) keeping electronic records. However, not all maritime administrations kept statistics on accidents, with one indicating that it did not keep records in either a paper and electronic format. Of the remaining 17 that did, 76.6% (n=13) kept paper records, and 70.6% (n=12) kept electronic records. Four (22.2%) of the maritime administrations indicated that they kept other sorts of records, including website data, faxes and the International Maritime Organization Global Integrated Shipping Information System (IMO GISIS). The frequency and type of records kept can be seen in Table 1.

Table 1: The frequency and percentage of record types kept

Records kept			**Type of record**		
	Frequency	*Percent*		*Frequency*	*Percent*
Accident/incident reports	18	100.0%	*Paper*	16	88.8%
			Electronic	13	72.2%
Accident/incident investigations	18	100.0%	*Paper*	17	94.4%
			Electronic	12	66.7%
Statistics on accidents	17	94.4%	*Paper*	13	76.6%
			Electronic	12	70.6%
Other	4	22.2%	n/a		

For the accident and incident records that were kept, just under half the maritime administrations (44.4%, n=8) indicated that these were publicly available, and in 87.5% of cases (n=7) these were available online. In 6 of the 7 cases (85.7%) web addresses were listed. However, for one of these the website was maintained in the national language, and thus the researcher could do no further analysis of its content. Of the remaining 5 websites, two gave access to accident reports only, one offered tables of accident statistics, and the remaining two websites maintained both sources of data.

When asked if they investigated all accidents that occur on their national flagged vessels or in their national waters 66.6% (n=12) of the maritime administrations indicated that they investigated all accidents. The majority of these investigations were done by the maritime administration itself with only 33.3% (n=6) suggesting that the investigations were done by another agency.

Twelve maritime administrations (66.7% of those who returned the questionnaire) indicated that they might be willing to share the information that they maintained on accidents and incidents for academic purposes. These maritime administrations were contacted by email and asked if they could provide us with access to/or copies of the accident and incident databases/records (ideally in an electronic format) for the period of 2000-2005. The email emphasised that the information would only be used for research, and that we were interested in general trends, and not individual cases. It was also made clear that all data would be treated as strictly confidential and that any reporting of it would not identify any sources of data, vessels or seafarers.

If no response was obtained, a follow-up email was sent after a period of 2-3 weeks. If there was still no response after an additional 2-3 weeks, the maritime administrations were contacted by phone, and asked if they would be willing to let SIRC have access to the data for academic research purposes. In a number of cases the person contacted had to seek further permission to share the data which took additional time.

In addition to those that agreed to share data when they completed a questionnaire, a further maritime administration subsequently agreed, via email correspondence, to share accident and incident data with us for the study, making a total of 13 maritime administrations that agreed to share their data with us.

However, after extensive follow-up, of these 13 maritime administrations only 7 (53.8%) actually provided data. Even though they indicated that they were willing to share data, two of the maritime administrations simply did not respond to requests to provide this. A further two despite repeated emails and phone conversations have yet to actually provide the data, although they still seem willing to do so. Reasons for not providing data ranged from difficulties with extraction, to needing to seek permission from a higher authority. In one case, although the maritime administration had data, it could not provide it as it had only recently been computerised, and said it needed to check the system before it could extract such data, saying this would take around 12 months. In another case, a database was actually sent, although this was blank. Despite follow-ups about this no complete database was received. In three cases, data was obtained (in some cases additional data to that sent) from the maritime administrations' websites, as this was publicly available online.

Table 2 summaries the data that was sent to us by maritime administrations. The actual source of the data has been excluded to protect confidentiality and the alphabetical letters labelling datasets were assigned randomly. In most cases the datasets cover a period from 2000-2005, although in one case, only a single year of data (2004) is given, and in two other cases, data is available from 1984 and 1982, respectively.

Table 2: Content of the datasets provided by the maritime administrations

	Country										**% keeping Information**	
	Datasets							***Offline***				
Information Kept	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**A**	**D**	**H**	***Datasets***	***Offline***
VESSEL LEVEL												
Reference number			✓	✓	✓						42.9%	-------
Occurrence date/date incident occurred	✓	✓	✓	✓	✓	✓	✓				100.0%	-------
Location		✓		✓	✓	✓					57.1%	-------
Incident type	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100.0%	100.0%
Vessel name			✓	✓		✓	✓				57.1%	-------
Flag		✓		✓		✓	✓				57.1%	-------
Ship type	✓	✓	✓	✓		✓	✓				85.7%	-------
Damage to vessel				✓	✓						28.6%	-------
Gross tonnage		✓		✓		✓	✓				57.1%	-------
Age of vessel when accident occurred				✓			✓				28.6%	-------
Was there any pollution						✓	✓				28.6%	-------
Remark	✓	✓	✓		✓						57.1%	-------
Cause		✓		✓							28.6%	-------
CREW LEVEL												
Total crew number							✓				14.3%	-------
Number of seafarers dead	✓	✓	✓	✓	✓	✓	✓	✓			100.0%	-------
Number of seafarers rescued							✓				14.3%	-------
Number of seafarers injured	✓	✓	✓	✓[4]	✓	✓	✓	✓			100.0%	-------
Number of seafarers missing	✓	✓		✓			✓	✓			57.1%	-------
Crew injury level					✓						14.3%	-------
Details of crew injury	✓				✓						28.6%	-------

[4] Injuries are actually broken down into serious and minor injuries.

From Table 2 it can be seen that there is considerable variation in what information is recorded about accidents and incidents. Some countries, such as country 'D', store detailed information, whereas others store much less, for example countries 'A' and 'C'. All keep information on the type of incident, the dates of incidents, and the number of seafarer deaths or injuries. The majority (85.7%) also keep information on ship type. However, important information about the vessels and the incident seem not to be recorded in many cases, with less than half (28.6%) of maritime administrations recording information about the age of the vessel, damage occurring, and surprisingly the cause of the incident. Information about the nature of injuries to personnel is also often not recorded, with only one of the current datasets including such data.

Although Table 2 includes information about what accident and incident data and statistics are available online, it is difficult to draw conclusions about such data, as they often only represent a small amount of the information held by the maritime administrations, i.e. what they chose to publish. Therefore these online data sources will not be discussed any further. However, it should be noted that only 3 maritime administrations actually published such data.

Looking at the format of the data, a number of problems can be seen when making comparisons between the different sources. Firstly, as discussed above, different information is recorded by each of the maritime administrations. Although there is a basic core of information, in reality only a very limited number of variables can be compared, such as incident type, ship type, and the number of seafarers deaths or injuries. Thus only a very basic picture of the type and nature of accidents and incidents occurring worldwide can be obtained.

How the data is recorded is also an issue. For example, some maritime administrations code fire and explosion as separate events, whereas others group them together. In fact, even within maritime administrations classification may change year by year as databases grow and develop. Such inconsistencies, make it very difficult to compare datasets, and often result in the loss of detailed data as incidents have to be grouped together in order to compare them meaningfully. This standardisation not only applies to factors such as accident types, but also to others such as recording of

personal accidents. For example some maritime administrations simply record numbers of seafarers injured, whereas others record more detailed information such as whether these injuries were minor, serious, or fatal.

There is also large variation in respect to the years for which data is available. Some maritime administrations keep data as far back as 1982, whereas others have only recently begun to collect data. For example, country 'E' only has accident and incident data from 2000. It is important to note that it is not only tabulated data that is not kept in some cases prior to these dates, but that accident and incident data per se is not available at all before this. However, it must be noted that in some cases we were only provided with data for a certain range of years (usually 2000-2005), even if accident and incident information was available for years prior to this.

In this paper we have only discussed tabulated data, and this ignores the vast number of accident reports that the maritime administrations maintain, which take the form of narrative reports, many of which are published online. In fact all maritime administrations indicated they kept such records. However, this type of data is very problematic from an analytic point of view as data needs to be extracted, classified, and standardised which, as a process, is very open to error, such as variability in coding and difference in interpretation of the data, even if it is done by one researcher. Therefore, although narrative accounts may be a rich source of information about what happened during accidents and incidents, they present a number of challenges in terms of the extraction of reliable statistical data.

Despite these difficulties, we were able to create a limited accident and incident database using combined data from the maritime administrations, containing the following factors: ship type, incident type, flag, the number of fatalities and injuries. It is these data that will be presented by Dr Bailey in the next paper in a comparison of perceptions of risk and 'reality' as far as we can ascertain it.[5] . Table 3 gives a flavour of the sort of information which is contained in the database, showing the percentage of incident types occurring.

[5] See Bailey, N., Ellis, N., Sampson, H., 2006 '*Perceptions of Risk in the Maritime Industry: Ship Casualty*', SIRC: Cardiff University for more information about the perceptions data which this comparison is based on.

Table 3: The percentage of incidents that occurred - all maritime administration databases

Incident type	Percent
Collision with Another Ship	34.9%
Damage to Vessel	12.8%
Personal Injury/Death	9.4%
Grounding	8.5%
Sinking	8.3%
Fire	5.4%
Natural Death	4.4%
Damage to Equipment/mechanical failure	2.8%
Regulation Infringement	2.2%
Missing Data	1.8%
Contact with a fixed structure	1.8%
Fire/explosion	1.5%
Explosion	0.2%
Other	6.1%

Personal Injuries

Although maritime administrations keep fairly detailed information about accidents and incidents that occur to their vessels, records of accidents and incidents occurring to crew are much less detailed, especially if these did not involve the vessel at all in terms of damage (see Table 2).

Looking at the data which is kept, in all cases maritime administrations retained information about the number of seafarers who were injured and fatalities that occurred in any recorded incident. In one case these injuries were further broken down into 'serious' or 'minor' injuries. Nearly two thirds (57.1%) kept information about the number of seafarers missing. However, only a small number kept more detailed information about injuries, with just 2 (28.6%) recording the activity that was being undertaken when the incident occurred.

This lack of detailed information has a number of drawbacks. Firstly, it does not allow a reliable picture of the most frequent accidents occurring to be obtained, and thus little can be said about the risk of certain accidents and incidents occurring. This lack

of information, such as the task being undertaken, means that no conclusions about casual factors can be drawn from aggregated data, or recommendations as to how procedures can be improved in order to try and reduce the risk of accidents.

Even when information is available about the type of accidents occurring, as with the vessel level data, there is often little consistency across sources as to how this is classified, again reflecting the differing nature of what is recorded by the maritime administrations. Thus it is difficult to make robust comparisons across the datasets.

There may also be under-reporting of injuries that occur to personnel, as these often only seem to be recorded when they are linked to accidents associated with the vessel. The severity of an injury may also influence whether it is reported, and Philips and Daltry (2006) suggest that only a fraction of the incidents that occur are reported if they do not involve a fatality or serious injury. Thus the level of accidents and incidents occurring to personnel is likely to be dramatically under-represented as a result of considerable under-reporting.

Given these limitations, we decided to see if more robust information could be collected from other sources. Two possible alternative sources of data relating to personal injuries were identified: P&I club claims data, and company 'in-house' data.

P& I Club Claims Databases

Given the sensitive nature of this data, the previous approach - obtaining access through 'cold calling' - was seen as inappropriate, and therefore a face to face method of negotiating access was employed. Using established personal contacts within SIRC, we approached a number of P&I clubs within the UK, one within Scandinavia and in addition a claims handler based in a major labour supply country with whom we had worked in the past[6].

[6] We are very grateful to all these individuals for their kind assistance and time consuming efforts to help us.

We managed to obtain the cooperation of 3 P&I clubs and one claims handler, who agreed to provide us with data. To date information has been provided by 2 of the P&I clubs, and the overseas claims handler. With respect to the final P&I club, researchers have visited the office and looked at the data maintained, and it is hoped that in the near future they will return with a strategy for collation and collection.

The type of data obtained from the P&I clubs was for the most part in the form of aggregate statistics presented as frequencies and percentages in relation to the different types of claims received (most of the clubs did not feel they could allow us to have full access to the raw claim reports due to their sensitive nature and potential legal repercussions). Having examined the data, we concluded that there is little congruence in claims classification across clubs. Indeed it was only in relation to burns that incidents appeared to be classified in the same way. This makes it difficult to compare data from one club with data from another, as there is no standard format to the stored information. Table 4 shows the injury claims for two of the P&I clubs, and illustrates the different nature and format of the data kept by the two clubs, with only 'burn' being similar across the sources.

Table 4: The types of injury claims received by each P&I club

Club A		**Club B**	
Injury type	*Percentage*	*Injury type*	*Percentage*
Burn	2.7%	Burn	8.4%
Strain	7.4%	Dental	0.6%
Suffocation	0.8%	Fracture	46.0%
Drowning	0.8%	Wound	26.6%
Cause of injury	47.3%	---------	---------
Under investigation	34.2%	---------	---------
Other	6.8%	Other	18.4%
Total	100.0%	*Total*	100.0%

Another limitation on the use of P&I claims data in establishing levels of incidents/accidents to vessels and to seafarers is that they may only be collected when claims are sufficiently large to justify recording/documentation. For example, some clubs only collate data relating to claims over 100,000 US dollars, which means that many accidents and incidents where costs have been relatively minor are not included.

For larger claims, records are generally kept, but this is often only in a very basic form. It seems that only in the cases of very large claims, amounting to several hundreds of thousands of US dollars, are detailed records kept.

The format of the records maintained by the P&I clubs is also problematic from a research perspective. Claims generally take the form of a file (or files) of information about the claim, which include accident and investigation reports, port state control reports, witness testimonials, solicitors' letters, invoices, emails and other correspondence. Within these files there may be little organisation and order, and what is included often varies greatly from claim to claim, depending on the nature of the individual case. From a researcher's point of view this is very difficult to analyse, as it may be necessary to trawl through hundreds of documents in order to arrive at standardised data which can be aggregated into accident/incident statistics. This process has its own problems as, during such coding of cases, researchers are necessarily required to exercise a degree of judgement as to what injuries to record, how to classify accidents (for example, where multiple injuries may be present) and so forth. However, notwithstanding this difficulty, it is simply the case that in many claims files the residing documents simply do not include enough detail about the incident to allow for such classification into usable standardised data[7].

Even when P&I clubs do aggregate their data, due to the changing nature of how claims are classified, groupings are often inconsistent from year to year making comparisons over time highly problematic. It is also the case that many claims records have also only been recently computerised, and thus the analysis and classification of earlier, paper-based records requires considerable effort and time.

Some clubs publicly report some of their findings from their claims databases. However, caution must be taken when examining these, as they may reflect the particular club priorities - for example, which claims are the most costly, rather than which incidents are the most frequent. When looking at such reports, it is therefore

[7] Through examining the records at the P&I club it is estimated that only 1 in 10 of the claims have sufficient information to be aggregated effectively into an accident and incident database format.

crucial to remember that these represent claims, and not accidents and incidents, which are very different in nature.

Due to the many limitations of the claims data, and the vastly differing nature of the information kept by different clubs, it was not possible to attempt to combine them together into one dataset, and thus only very limited conclusions can be drawn from each comparison made. No meaningful aggregated statistics for the P&I clubs can be presented.

Company Injury Data

The introduction of the International Safety Management Code in 2002 made it a legal requirement for shipping companies to set in place and follow documented Safety Management Systems (SMS). As part of this process, companies are also required to record and maintain accident and incident data for their fleet, and this information is usually very detailed. However, it is generally not publicly available and kept within the company due to its sensitive nature.

Therefore, in order to try and address the limitations of the data kept by the P&I clubs we decided to approach a number of shipping companies which had helped us with the Lloyd's Register Educational Trust Research Unit (LRETRU)[8] *Safety and Perceptions of Risk* study, and asked if we could have access to their injury records. Five companies were approached and of these three provided accident and incident information and two are still in discussion with us. Of the three that did provide data, one simply provided their raw accident and incident data, one provided a internal report which consisted of brief summaries of each incident that had occurred within the company between 1999-2005, and the final company provided its 'in house' software package which was used to produce accident/incident reports, as well as examining more detailed information about specific incidents and reporting new incidents. Each of these sources of information will now be examined in order to see

[8] Formerly known as the Lloyd's Register Research Unit (LRRU)

the format of the data, what it can be used for, and its compatibility to other sources of data.

Company A

Company A provided its accident and incident data in a raw electronic format for a period of 2003-2005, which included just over 1,600 reports. These datasets included information such as the date of the incident, reference number, a description, information about the cause, and classification of the incident type.

When comparing this data to that of the maritime administration and P&I clubs a number of differences can be seen, relating to the classification of accidents and incidents. For example, Company A classifies accidents in terms of major and minor injurious, near misses, pollution incidents, and mechanical incidents, where as maritime administrations classifications included fire, explosions and collisions, etc. Therefore this makes comparisons between the different sources very difficult.

However, the description field in the data does give fairly detailed information (in the form of a narrative) about what happened, and this was available for approximately two thirds of the accidents and incidents that occurred. Analysis of this showed however that many of the incidents refer to mechanical and electrical failures, dealing with functionality problems of machinery and equipment rather than the types of occurrences traditionally termed as accidents and incidents.

However an important factor listed on company A's data is cause. This was listed at multiple levels, and is classified in terms of the main cause, and then broken down into three subsequent causes. No other data sources provide such important information, and this may be very useful in the development of subsequent interventions or attempts to develop safety measures.

Company B

Access to Company B's accident data took the form of access to a software package which could be used to produce customisable accident/incident reports, as well as to

examine more detailed information about specific incidents. Data could be manipulated and queries run according, for example, to particular years, incident types, locations of work, etc. Outputs could take a variety of forms such as tabulated data, bar graphs and pie charts.

However, there were a number of difficulties with the software package. For example, although the software package could produce varied outputs, many of which use similar categorisation to those used by the maritime administrations, data could not be re-coded or re-classified and therefore it was not possible to produce a single output to match the maritime administrations data. Raw data was not available and this considerably reduced the capacity for the data to be used comparatively.

As a single data source, Company B's data provided a good model for the collation of personal injury data, providing breakdowns of the types of injury, the area of the body where injury occurred, the severity of injury, treatment received, and the location of the incident which resulted in the injury. However these details are provided as separate outputs, and information cannot be matched across individual cases limiting the conclusions which can be drawn from the study of the information. For example, conclusions about the most frequent types of accidents in certain locations onboard vessels cannot be made.

The personal injury data is however detailed enough and similar enough to that maintained by other companies, such as Company C, to compare for example the types of injury and the location of injury on the body, with some standardisation of coding between the two. This analysis is ongoing.

Company C

Company C's accident and incident data takes the form of a report which includes brief summaries of each incident, which are further grouped into basic incident types, as well as graphs summarising these data, for example, bar graphs and pie charts showing the number of incidents by month. The reports cover accidents and incidents over the period 1999 to 2005.

The data is fairly comprehensive giving a brief overview of the accidents and incidents that occurred, and containing more detail than in many of the maritime administrations accident and incident reports referring to personnel. The nature of this data is different from that contained in maritime administrations datasets, including more detail about the incident, not just the number of seafarers injured or fatalities. Its more detailed nature would make it easily adaptable to be comparable to other available data.

Although this report was printed it was fairly easy to transfer the brief summaries to a database in order to aggregate them, using categories of injury causes similar to those used on the LRETRU's 'Study of Safety and Perceptions of risk' Questionnaire Survey. This allowed us not only to examine the frequencies of injury types occurring, but also to compare these to the perceptions of risk for each (as defined by the questionnaire survey results). This analysis is currently ongoing.

Other Data Sources

Although we have looked at three sources of data within this paper, there are many other sources of accident and incident data that are publicly available, such as reports, papers, and annual publications. These stem from a range of institutions and organisations within the maritime industry, as well as governments and academia. Therefore this section will consider a select few of these data sources, looking at the format of these, as well as their compatibility to other sources of data.

Lloyd's Register Fairplay - World Casualty Statistics

The *World Casualty Statistics* are published yearly by Lloyd's Register Fairplay, and list frequencies of total losses[9] and disposals[10] of sea-going merchant ships. These figures are additionally further broken down by nationality of registration, nationality

[9] The term total 'losses' refers to 'propelled merchant ships of not less than 100 GT which, as a result of being a marine causality, have ceased to exist, either by the virtue of the fact the ships are irrecoverable, or have been subsequently broken up'. Ships that have been declared as total losses, but which have, or are in the process of being repaired are not included.

[10] The term 'disposals' refers to ships which are broken up for reasons other than casualty. These will not be considered within this paper.

of owner, incident type, ship type, GT and DW ranges, as well as many combinations of these. The most up to date report is for 2005, although data is available back to 1994. The *World Casualty Statistics* mainly deals with losses and disposals for cargo carrying ships, although data for other types of vessels are included, but generally only for serious incidents. The data does however exclude pleasure crafts, naval vessels, and ships restricted to harbour services, or river/canal services. This information is compiled from a variety of sources, including data from insurance claims handlers, classification societies, registration authorities, reports form the web, owners, and government departments. This is usually collected in a raw format, and then coded, with new sources constantly being added.

The information which is presented by the *World Causality Statistics* is very similar in many instances to the format of the data recorded by maritime administrations and some of the companies. This makes it easy to compare basic information, such as, accident types, and vessel types to other sources. More in depth analysis is also possible, for example, such as the number of losses by flag and ship type, due to the extensive breakdown table provided, although this would take in some cases extensive manual manipulation.

However, there are a number of problems, from the point of view of this type of research, with the use of the *World Casualty Statistics*. Crucially data is limited to cases involving total loss of vessels excluding the many cases where vessels are repaired or relatively undamaged after accidents and incidents. The data also focuses on cargo vessels over 100 GT excluding many other smaller vessels, for example those that work within harbours. Therefore although the *World Casualty Statistics* may be based upon information received from a wide range of sources, its scope in terms of the provision of a comprehensive dataset relating to marine accidents and incidents is very limited.

To illustrate the under-reporting inherent in the database a comparison was made between the frequency of incident types as listed in the *World Casualty Statistics* publication for a period of 2005-2000 to data provided to LRETRU by five maritime administrations for the same period (Table 5).

Table 5: The frequency of different type of incidents for the period of 2000-2005 reported in the World Casualty Statistics, and from 5 maritime administrations

Incident Type	World Casualty Statistics	Maritime administrations combined datasets	Percentage differences
Collision	112	2631	2249.1%
Contact	20	135	575.0%
Fire/Explosion	126	539	327.8%
Foundering	423	623	47.3%
Hull/Machinery	9	Not included in dataset	n/a
Missing	4	Not included in dataset	n/a
Other	20	Not included in dataset	n/a
Wrecked/Stranded	208	638	206.7%
Total	922	4566	395.2%

From this comparison it can be seen that even when accident types from the *World Casualty Statistics* are compared to those from only five maritime administrations, there is a massive difference between the numbers of incidents recorded. In general, despite only coming from five maritime administrations, there is much more data recorded in this combined database. For example, in the case of collision the maritime administrations show a 2249.1% increase in the number of cases recorded. For other incident types the difference is less extreme, for example, foundering (taken as sinking) only showed a 47.3% increase. For our purposes such under-reporting makes the dataset unsuitable for use in analysis.

The Australian Transport Safety Bureau (ATSB) - Online Database

Although this source is in essence the Australian Maritime Administration's accident and incident database, Australia was not included in the top 30 maritime administrations, and thus given the accessibility of its data it will be discussed briefly here.

The Australian Transport Safety Bureau (ATSB) is an operationally independent body within the Australian Government Department of Transport and Regional Services and is Australia's prime agency for transport safety investigations. Its aim is to

maintain and improve transport safety and public confidence through independent accident investigation, safety data analysis recording and research, and through raising awareness and knowledge. The ATSB investigates accidents in the aviation, marine, rail and road sectors and keeps records on all of these.

In reference to marine accidents, it investigates all accidents and serious incidents involving Australian registered ships anywhere in the world, as well as foreign flag ships within Australian waters. These reports are then published in a tabulated format on the ATSB website which is publicly available (http://www.atsb.gov.au/publications/investigation_reports/index.aspx?mode=mar).

The data includes information relating to occurrence date, location, basic categorisation, and brief descriptive accounts. Some personal injury data is also presented, although this is very limited being classified and presented as either 'none', 'minor', 'serious', or 'fatal'. With some recoding this could be compared to the information stored by other maritime administrations.

Confidential Reporting Schemes

Confidential Reporting Schemes, unlike many schemes linked to maritime organisations and shipping companies are voluntary and confidential, and allow seafarers to report accidents or near misses without fear of reprisal or blame. The aim of these schemes is to 'create an environment where human element incident reporting is facilitated, resolution promoted and information disseminated without risk of negative personal consequences' (Powell, 2006). There is strong support for such schemes, as many suggest that they encourage seafarers to submit reports where they would not necessarily do so in other ways (Beedle, 2006).

One such scheme is the Marine Accident Reporting Scheme (MARS) run by the Nautical Institute, which was started in 1992. Accident reports are received from seafarers worldwide who can report accidents (and near misses) without fear or prosecution. The sole purpose of MARS is to pass on lessons learned to other seafarers through making public these anonymous reports. To date over 700 reports have been received and published by MARS (Beedle, 2006). Other schemes also

exist, such as the Confidential Hazardous Incident Reporting Programme (CHIRP), originally introduced in 1982 within the aviation industry, but extended to the maritime industry in July 2003 to allow seafarers to report potentially hazardous incidents confidentially. Both of these schemes are based online, and have searchable databases of reports, in which specific years can be examined or keywords searched for. The reports take the form of a narrative about the incident written by the seafarer.

However such confidential reporting schemes cannot be used to provide statistical data on seafarers' accidents and injuries as their coverage is so limited and partial. Few seafarers report to such schemes lacking either the requisite interest, motivation, means, or information to do so.

Some Ways Forward

In this paper a number of sources of data have been examined relating to vessel accidents and personal accidents and injuries in the merchant shipping sector. At the current time none of these sources of data can be easily combined to allow for the production of a robust analysis of accidents and injuries across the sector which is a major deficiency giving rise to problems in relation to planning and policy making for ship operators, regulators, insurers, classification societies and so forth. The sector is in urgent need of robust data relating to marine accidents and injuries and it would be possible for such data to be produced given greater consistency in recording practices.

Maritime Administrations

Although the majority of maritime administrations store accident and incident data, the nature of this varies widely from administration to administration. Therefore there is a need to standardise the data collected so that a 'core' of comparable information can be recorded by all. This should include information on incident type, ship name, location of vessel, flag, vessel age, reference number, ship type, ship size. Core information about personal injury/mortality also needs to be recorded, for example, the number of fatalities and injuries, location of incident (e.g. whole ship/engine room, bridge, etc) type of injuries, area of injury, level of injury, age of those injured,

nationality of those injured, rank of those injured. Standardising this information would allow it to be compared and compiled much more easily. However this is not to say that maritime administrations should not be encouraged to collect additional data, as they may wish to record information specific to their administration.

Not only does the type of information that is collected need to be standardised, so too does the method of accident/incident classification. For example, as discussed previously, it is not uncommon, even within single maritime administrations, for fire and explosion to be grouped together in some cases, but not in others. Therefore standard classification systems for the data that is collected need to be outlined so that all maritime administrations may use this to guide their classification.

Although the majority of maritime administrations maintain computerised records, this research has shown that there are still some that do not. Therefore it is recommended that all should be encouraged to record accidents and incidents electronically, as this has a number of benefits. For example, the format of what and how this is recorded could be easily standardised, especially if a universal software package was developed for use by all maritime administrations and an electronic format would also make it much easier to analyse and compare the data.

However, in order for such data to be of any wider use, it is of course necessary for maritime administrations to be willing to make data available for research purposes. At present it remains rather difficult to secure access and this hampers efforts to effectively assess accident and injury data in meaningful ways to the benefit of the sector.

P&I Clubs

P&I clubs could play an important role in the collation and analysis of injury and accident data and indeed some already provide partial data which is of benefit to the industry. To take such efforts forward and allow for more robust conclusions to be arrived at, there is a need for the standardisation of information that is collated by P&I clubs for statistical purposes. The recording of 'core' data about claims, similar to the core information outlined in relation to maritime administrations would be beneficial.

This would allow for comparative analyses which would provide the basis for more robust conclusions.

One way to facilitate the standardisation of data collected by the P&I clubs is through the design and use of pro formas (either electronic or paper), which could be used by all clubs, for all types of claims, regardless of their financial value. This may go some way to addressing the current situation in which lower value claims are not being recorded.

Companies

Although companies are generally good at keeping accident and incident data within their fleet, this information is usually kept solely within the company, and is recorded using their own methods of classification, making it very difficult to compare to that of other companies. Therefore it is suggested that, as with the maritime administrations and the P&I clubs there is a need to standardise how data is recorded and its format, perhaps through the development of a universal scheme which companies could voluntarily adhere to.

It would also be a benefit if companies encouraged seafarers to report accidents and incidents, as at present practices such as including targets for the reduction of lost time incidents (LTIs) in Key Performance Indicators (which may be linked to bonuses) serve to encourage non-reporting of more minor incidents. This masks the real levels of accidents and injuries that may be occurring and casts considerable doubt on available data. It may also give the impression to seafarers that companies are not genuinely interested in their safety, only in the *appearance of safety,* which may cause not only low morale, but also produce poor adherence by seafarers to company policies and practices reflecting a two-way lack of commitment.

As with the maritime administrations and the P&I Clubs, it would also be helpful if companies could be persuaded to make their data available on a confidential basis to researchers. Sharing this information could promote the development of more effective safety procedures as a more comprehensive and thorough understanding of accidents and injuries is achieved.

Conclusion

Within the maritime industry there are many different agencies that keep information about accidents and incidents, such as maritime administrations, shipping companies, P&I clubs, and regulatory organisations. However, when the type and nature of these data are compared, it can be seen that what is recorded varies greatly, even within the same types of organisation. For example, the levels of detail recorded about the incidents and the definitions used for accident type classifications. Such findings are not new nor are they industry specific; The European Transport Safety Council drew a similar conclusion in its review of road traffic accident databases in 2001. However, they do suggest that although the problem is recognised within industries, currently little has been done to address it.

The consequence of this is that it is currently impossible to present comprehensive and robust globalised accident and incident data, making it very hard to identify trends in accidents and incidents and suggest measures in order to address these. Therefore, there is an urgent need to standardise what is recorded, and how data is stored, in order to facilitate research, analysis, and subsequent decision making, across the sector.

It is our intention in the future to attempt to develop a recommended pro forma for the categorisation, recording, and storage of data for use across the industry. We will be looking to key stakeholders within the sector for assistance and support in this endeavour. We thank them in advance for their assistance.

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Appendix 1

Contact Person Details for the Maritime Accident and Incidents Review Project

Organisation: _____

Name: _____

Position within the organisation: _____

Address:

_____

_____

_____

_____

_____

_____

Email: _____

Telephone number: _____

Fax number: _____

Thank you for your cooperation. Please return this completed page by email to EllisN@cf.ac.uk or by fax to +44(0)29 2087 4619.

All contact details will be held in the strictest confidence and in compliance with the Data Protection Act.

Appendix 2

Accident Database Questionnaire

1. Do you maintain records of accidents/ incidents that occur on/ to your national flagged vessels, or in your national waters?

   Yes ☐ No ☐

2. What sort of accident/ incident records are kept? (please tick as many boxes as necessary)

   Records of accident/ incident/ reports

   Paper ……. ☐
   Electronic (if so please state software utilised e.g. Excel) …… ☐

   _____

   Records of accident incident investigations

   Paper ……. ☐
   Electronic (if so please state software utilised e.g. Excel) …… ☐

   _____

   Records of statistics on accidents (i.e. the number/ type of incidents)

   Paper ……. ☐
   Electronic (if so please state software utilised e.g. Excel) …… ☐

   _____

   Other (please specify below) ……. ☐

   _____
   _____
   _____

3. Are these record's publicly available? (If no, please go to question 5)

   Yes ☐ No ☐

4. Can these records be accessed on line? (If yes, please go to question 6)

   Yes ☐ No ☐

   If so. please give the web address:

   http://_____

Accident Database Questionnaire

5. Would you be willing to make your data available for academic research purposes (subject to normal protocols about confidentiality etc)?

   Yes ☐ No ☐

6. Do you investigate all accidents that occur on/ to your national flagged vessels or in your national waters?

   Yes ☐ No ☐

7. Is this done by yourself?, or by some other agency? (if this is done by another agency, please give contact details)

   Name _____

   Address _____

   _____

   _____

   Telephone number _____

   Fax number _____

Thank you for your cooperation. Please return this completed page by email to EllisN@cf.ac.uk or by fax to +44(0)29 2087 4619.

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