CHIRP Maritime – 2019 Causal Analysis

Introduction

In the 2017 Annual Digest, ***CHIRP*** Maritime published a causal analysis of latent failings and human factors for every article that we had published in our quarterly FEEDBACK magazine. The analysis was also posted on the Chirpmaritime.org web site. This article updates the analysis to the end of 2019. We intend to regularly update the analysis both in the Digest and upon the website.

Latent Failings and Human Factors

The analysis of the articles is undertaken in order to identify the root cause(s) behind the reports and is based upon James Reason's research which dates back to 1990 and his book Human Error. The underlying principle is described by the Swiss Cheese model which shows clearly the defences which have been missed in order for an incident to occur.

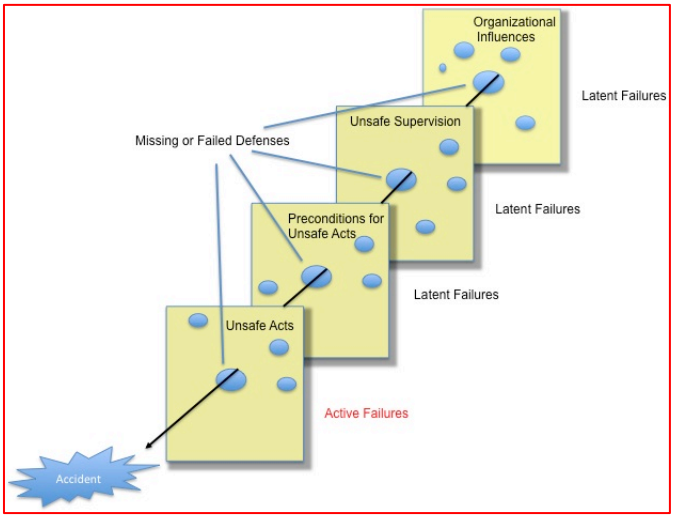


Figure 1 -Swiss Cheese Model

The latent failures are grouped into ten categories; these are Communications, Defences, Design, Error Enforcing Conditions, Hardware, Housekeeping, Incompatible Goals, Maintenance Management, Organisation, Procedures and Training. James Reason further subdivided these "basic" failures based upon causal explanations for the failed defences. There are many of these for each basic category, and ***CHIRP*** Maritime has identified three of the more common failed defences in order to produce the analysis. These are shown on graphs in the following sections, and terminology is further explained.

In addition, we analyse articles in order to identify Human Element issues – this uses the information from the MCA Guidance Notice MGN520 – The Deadly Dozen, and is categorised as follows; Alerting, Capability, Communications, Complacency, Culture, Distractions, Fatigue, Fit for Duty, Local Practices, Pressure, Situational Awareness, and Teamwork.

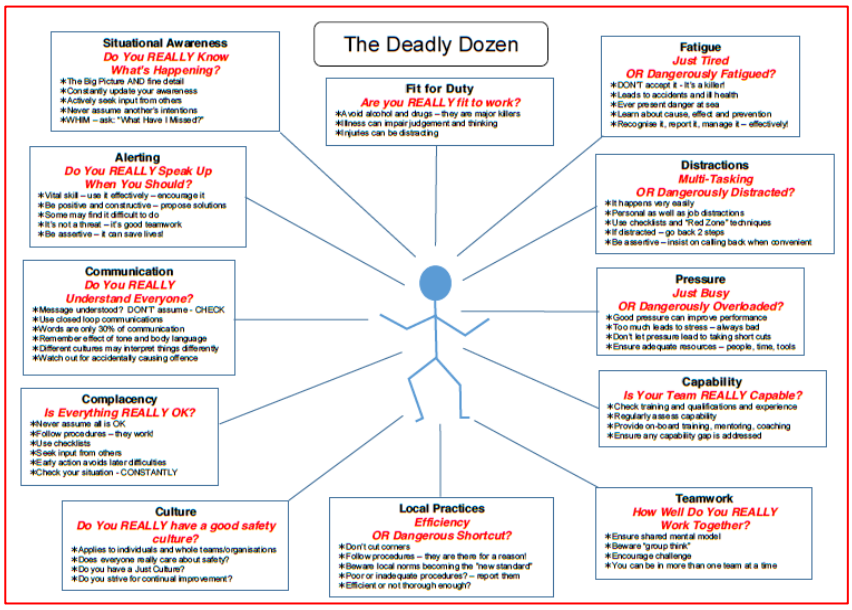


Figure 2 – Human Factors
The Deadly Dozen

Latent Failings – Basic Causal Analysis

The analysis has been produced in the form of a pie diagram and shows the number of incidents for each category where a latent failure has been identified. The number is also shown as an overall percentage.
It should be noted at the outset that the analysis is only based upon the information received. In many cases there is insufficient data to truly identify the root causes behind a near miss, and thus the graph and those that follow, are simply a rough and ready indication of where the maritime sector is today. Also worthy of note is the fact that ***CHIRP*** conducted a similar exercise to that shown, but using only recent reports, (from 2014 onward). The graphs were almost identical, which indicates that the same age-old problems are not being rectified.

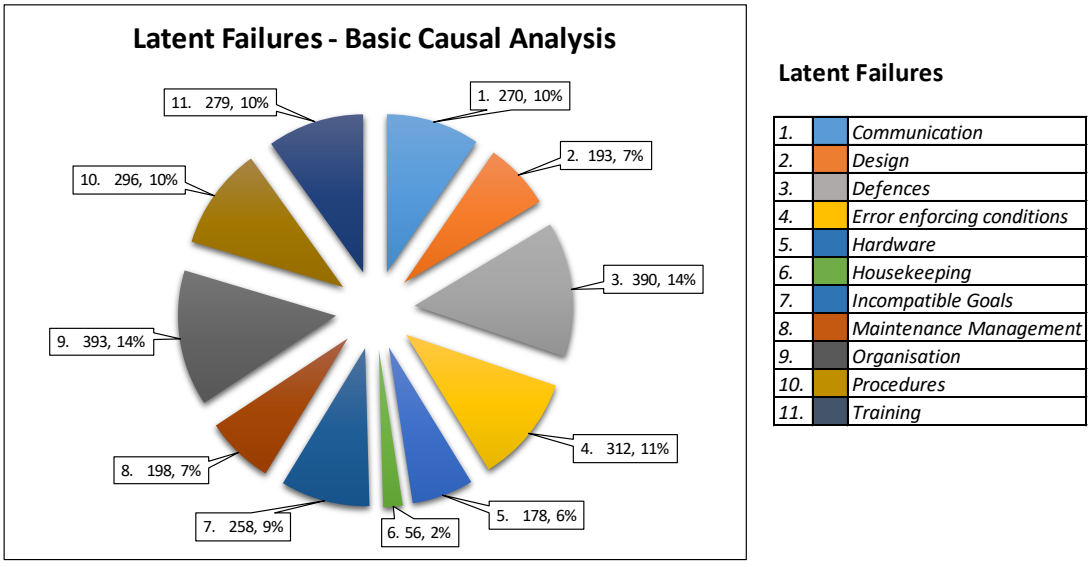


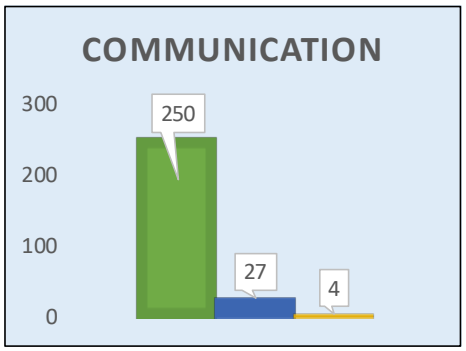
Figure 3 – Latent Failures – Basic Causal Factors

It is perhaps not surprising that *Housekeeping* produces a relatively low score – the maritime sector has concentrated on this for many years as a part of accident prevention. But look at some of the higher scores – *Defences* which have been breached, *Organisational* failings, and *Procedures* not being complied with. We should perhaps ask ourselves why this is so. Just to take organisation as an example, if we are really looking at a root cause the organisation being referred to is generally not shipboard organisation, but often commitment from the Company, and even organisational failings at the ship design and construction stage which might involve classification societies, flag, and naval architects. There is much to reflect upon in order to make permanent improvements in this respect. It should be understood that the analysis is based upon near miss reports – when the same rationale is applied to actual incidents then surely something should be

done by the “powers that be” to address these failings – this includes organisations at company, national and international levels. And yet examination of the vast majority of accident reports worldwide suggests that the root cause is nowhere close to being properly identified. Until this mindset changes, seafarers’ lives will continue to be endangered, accidents will continue, and blame will be laid to rest upon personnel, shipboard procedures or non-compliance with the SMS.

The introduction mentioned that the basic latent failures were broken down into three sub-categories for each latent failure. These are shown on the diagrams that follow and some significant data is shown which is worthy of note. Let’s examine some of these failed defences in a little more detail.

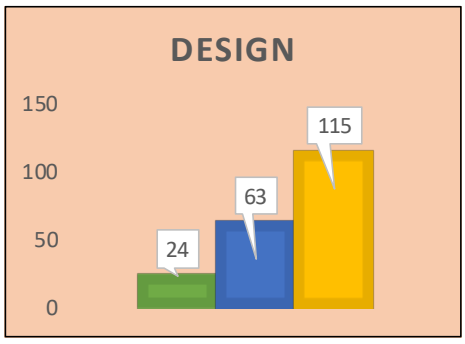
Communications – By far the greatest communications failing has proven to be ambiguous or incorrect communications. In this age where multinational crews are the norm, language problems are not the real issue, and nor is communication overload. It is simple messaging, whether this be verbal or from over-complicated procedures. It shows that closed loop communications where a message is known to be clearly understood requires a lot more attention.



Communication		
1		Incorrect or ambiguous information
2		Language problems
3		Overflow of information

Figure 4 – Communications: causal explanations for failed defences

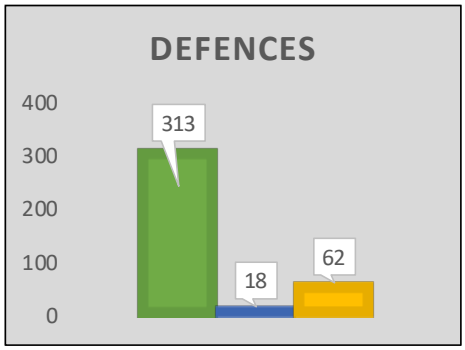
Design – Where design has been identified as a failed defence, it can be seen that there are a high number of latent failings due to a lack of standardisation, followed by a lack of indication of the condition of the equipment. We need look no further than quick release hooks on life saving appliances, and the high number of wire rope failures to show why this is so.



Design		
1		Not ergonomic
2		No indication of condition
3		No Standardisation

Figure 5 – Design: causal explanations for failed defences

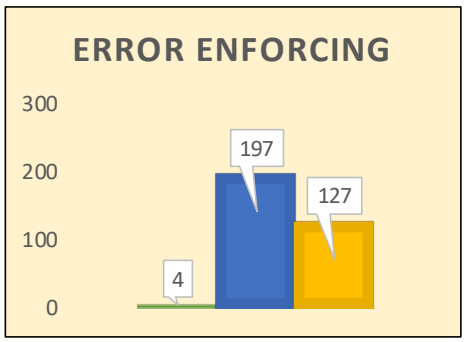
Defences – The following tends to show that we are all experts in writing procedures and instructions – following them is another matter entirely judging by the number of reports received where it was determined that one of the factors was insufficient awareness of risks. This is often attributed to an individual; the true root cause however lies with management, and not necessarily company management. In order for all to become aware, the causes need designing out and procedures need to be put in place which prevent defences from being breached.



Defences		
1		Insufficient awareness of risks
2		No emergency procedures or instructions
3		Unsuitable detection systems

Figure 6 – Breached defences: causal explanations for failed defences

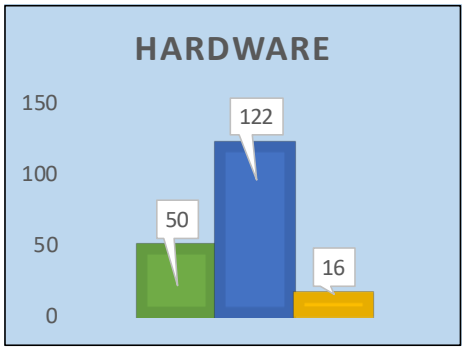
Error Enforcing Conditions – The term "error enforcing conditions" simply means that no matter what the near miss was, it would have happened anyway due to external factors. Abuse or addiction is extremely rare with the near misses that have been reported. However external influences, primarily weather related, and human physical restraints, (it is not possible for a person to do the task without endangering himself), are both frequent root causes. For the former, proper planning and risk assessment can prevent the danger, while for the latter the problems need to be engineered out, preferably at the design stage.



Error Enforcing Conditions		
1		Abuse or addiction
2		External influences
3		Human physical constraints

Figure 7 – Error Enforcing Conditions: causal explanations for failed defences

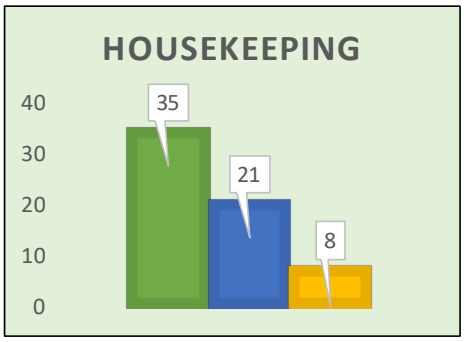
Hardware – The largest number of reports where hardware is an issue result from the hardware not being suitable for purpose. For example, an uninsulated screwdriver is not fit for purpose for any type of electrical work. Another factor has been the condition of the equipment – wear and tear or corrosion. Wire is an obvious example, particularly when it is sheathed – don't use it!



Hardware		
1		Bad condition (wear/corrosion)
2		Not suitable for purpose
3		Procurement and stock management

Figure 8 – Hardware: causal explanations for failed defences

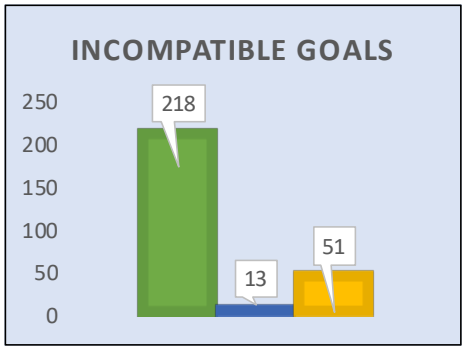
Housekeeping – As previously indicated there have been very few reports received by ***CHIRP*** where housekeeping has been identified as a root cause. In very general terms much of the housekeeping is now addressed by behavioural safety programmes where storage, cleanliness, and personal protective equipment are being effectively monitored. However, from the reports that we have received, the main issue is planning.



Housekeeping		
1		*Bad planning of housekeeping*
2		*Lack of management commitment*
3		*Unclear responsibility*

Figure 9 – Housekeeping: causal explanations for failed defences

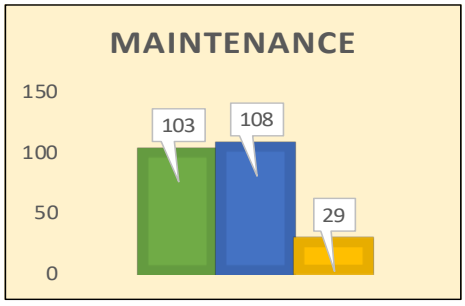
Incompatible Goals – The term "incompatible goals" simply refers to a conflict between two parties – they have different objectives. This might include a task which cannot be performed correctly without disobeying instructions in the Safety Management System. In the graph below, we see a large number of discrepancies between formal procedures (the SMS), and what is actually carried out in practice at the work site. To a lesser extent there may well be financial constraints and time pressure – these are uncommon in near miss reports but would almost certainly be higher for any formal investigations of an incident.



Incompatible Goals		
1		*Discrepancy - formal & informal practices*
2		*Financial constraints*
3		*Time pressure*

Figure 10 – Incompatible Goals: causal explanations for failed defences

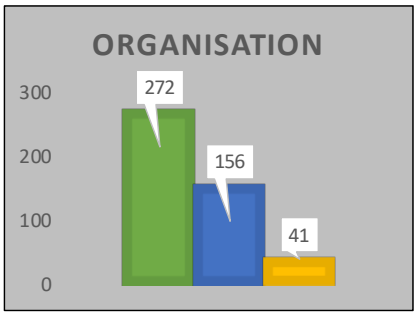
Maintenance – For the near miss reports that ***CHIRP*** has received relating to maintenance, most relate to activities on the deck – more engineering reports would be extremely useful. Nevertheless, it would seem that the documentation (whether this be instructions or procedures) is in place - the main problem is planning and supervision. Once again this is often at a higher level than the on-board management.



Maintenance Management		
1		*Insufficient planning of maintenance*
2		*Insufficient supervision on maintenance*
3		*No relevant documentation*

Figure 11 – Maintenance: causal explanations for failed defences

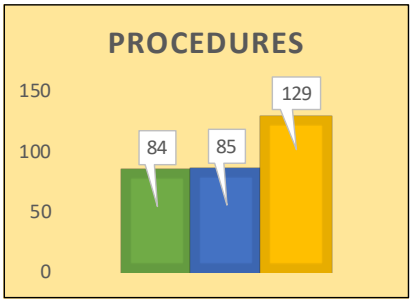
Organisation – The breakdown of defences with organisation once again shows us that tasks are usually properly assigned or have procedures in place. The failings, however, are generally in the planning – this may be on board departmental or shore instruction and has upon occasion been the organisation at a shipyard on new build tonnage. There is also a high level of incidence where the procedures and instructions are fine, but the execution of them is poor, resulting in a near miss.



		Organisation
1		Bad planning or co-ordination
2		Discrepancy between policy and execution
3		No or unclear tasks, authorities and responsibilities

Figure 12 – Organisation: causal explanations for failed defences

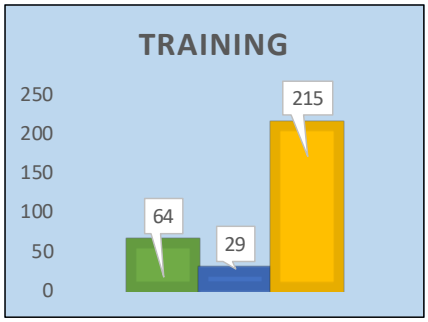
Procedures – With Safety Management Systems having been in place for many years it is somewhat incongruous to find that we have to experience an incident or near miss in order to determine that procedures are difficult to find or are completely missing. There is, to a lesser extent, evidence to show that the scope is unclear – poorly written in other words, and there is often a lack of feedback as to the use of the procedures – i.e. "it is difficult to do this because……."



		Procedures
1		Area of scope unclear
2		Lack of feedback on usability
3		Procedures difficult to find or missing

Figure 13 – Procedures: causal explanations for failed defences

Training – This graph speaks for itself. There is plenty of training available from many sources – fleet instructors, computer-based training, formal courses etc., but it remains a key defence failure that in many cases training was not provided or was ineffective. For the most part the word ineffective is the correct interpretation. For whatever reason, the lessons that were supposed to be learnt from training were not put into practice.



		Training
1		Insufficient management commitment
2		No structured training plan
3		Training not provided or ineffective

Figure 14 – Training: causal explanations for failed defences

There are a lot of lessons in the above graphs and with a little forethought many can easily be adopted in order to reduce the number of near misses and incidents that are currently being experienced in our industry.

The Human Element - Analysis

The introduction mentioned that ***CHIRP*** also analyses articles for human factors. The graph below is a representation of the "Deadly Dozen" – these are the twelve areas where human behaviour impacts upon safety. As referenced in MGN520, the Deadly Dozen has been around since 1993, with origins in the airline industry. If it is considered to be relatively new in the maritime sector, then this is simply evidence that we have a lot of catching up to do. It is also worthy of note that the airline industry does not commence an investigation until all human factors have been identified.

It is often found that near miss reports will contain several of these behavioural factors, since an incident is generally not attributable to a single cause. Just to give a simple example – a cylinder is being replaced on the main engine. The job has been assessed, discussed, and planned. At the critical moment of lifting the cylinder with the main engine crane the operator becomes distracted and fails to check if the lifting clamps are properly secured. They are not, and this is discovered when the unit disengages from the clamps just after the lifting operation commences. There is an almighty thump but fortunately no damage. A human element analysis may well identify situational awareness as an issue, and distractions have already been mentioned. But what about teamwork? What about alerting – did anybody else intervene to stop the operation? In fact, many of the deadly dozen could be factors in this case depending upon the exact circumstances.

As with the causal analysis, ***CHIRP*** can only analyse the articles with the information that is available – we do not conduct full investigations which might lend themselves to a more thorough analysis and so the graphical representation is simply a rough and ready indication of human factors from reports received. Having said that, it is a fair indication of the various safety related behaviours that are impacting upon incidents and near misses.

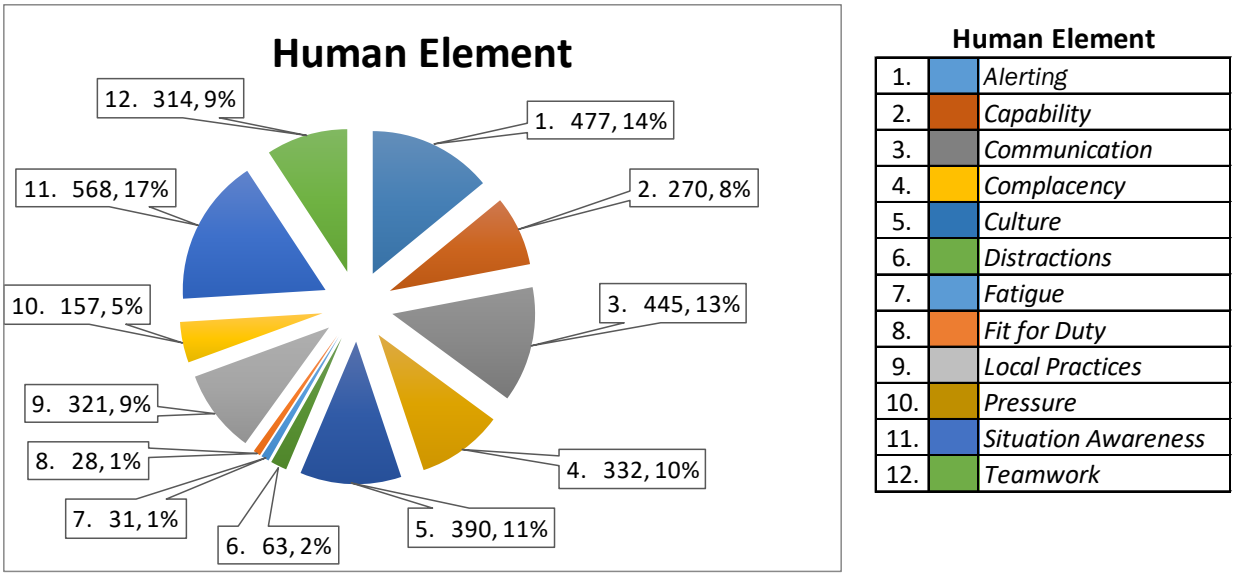


Figure 15 – CHIRP Human Element Analysis

The graph shows some surprising results. The largest failing is a lack of situational awareness and then there is a fairly even spread between alerting, communication and culture, followed by teamwork, local practices and capability. However, there is very little on fatigue, and given the knowledge that fatigue is a very real issue, (see the Project MARTHA findings in ***CHIRP*** publications), it is perhaps surprising that it scores so low. It is entirely possible that, although fatigue would almost certainly be an issue when reporting an accident, it is not really considered for near misses. This is also true for the "fit for duty" and "distractions" categories.

It should be mentioned that, as with the latent failings, ***CHIRP*** compared all reports with those from 2014 onwards. The difference in the graphs was negligible and thus the same conclusions were reached – the maritime sector needs to address these issues to be able to move forward.

Simple Root Cause Analysis

Some of the latent failings may seem to be complex but there is a very simple method that anybody can use to drill down through any event, whether it be a near miss or serious incident, in order to determine the root cause of the event. The method is called “Five Whys”. Quite simply for any incident you take the starting point and ask what happened? To that answer you ask “Why?”. At this point there may be two or more reasons and so a small matrix begins to be built up. For the answer to each “Why” you ask “Why?” again. Some of the matrix may well end up as a dead end with no particular learnings, but the other parts of the matrix should be followed through. When you get to the fifth “Why?” you will be at or very close to the true root cause of the event and be in a position to identify the causal factors and failed defences. Throughout the “Why” questions all aspects of the Deadly Dozen should be incorporated to ensure that all human factors are adequately addressed.

If the above is carried out correctly then it will almost certainly be found that the conclusions are not, “Non-compliance with company instructions or the SMS” or “Human Error”. Human error is not a root cause – the sequence of events that caused the human error will identify the true root cause. The old adage that “an accident on board a vessel has its roots in the company boardroom” is very true.

Conclusions

This paper certainly shows that there are many areas in which improvements can be made, but to do so requires commitment from all sectors of the maritime industry. In very general terms ships and their crews act responsibly but play with the cards that have been dealt to them. Thus, the areas where analysis such as the foregoing reveals a need for improvement starts with commitment in company boardrooms, at Flag State administration level, with classification societies and indeed at the naval architect’s drawing board. The analyses being discussed now can only bear fruit if future decision-making takes note of the findings.