Measuring and Monitoring the Effectiveness of ISM Code Compliance

a Ulysses Systems whitepaper
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To obtain meaningful statistical analysis of the success of ISM, the following issues need to be considered:

- The number of accidents that have occurred on a large sample of ships over a reasonably long period, before the enactment of ISM.
- The number of accidents that have occurred under the same conditions after the enactment of ISM.
- The actual cause of all the recorded accidents, which often differs greatly from the reported cause, if such cause is actually reported.
- Elimination of statistical distortions. (Conclusions drawn from statistics are susceptible to circumstantial distortions, which cause long periods of analysis.)

Needless to say, the statistical approach requires a lot of hard work and patience.

Much effort is needed with statistical analysis to provide us with indications of what to do, whereas our own intuitive understanding as ship managers provides far quicker enactment of positive change. In other words, in shipping we can easily see where we need to improve so that there is no need for statistical analysis yet. Also, implementing the solutions to known safety and efficiency shortcomings is very time consuming, so by the time we implement the management changes, more statistics will be available. So, statistical analysis should come after you have identified all likely problem areas and made all possible efforts to eliminate them.
Your top management, if they are from a maritime background, can assess the weak points to a greater extent than analysis of statistics. After all this work has been completed, it is then possible to gain some data mining benefits from statistical analysis. However, if you are in urgent need of comparative data before and after enactment of quality management systems, the best way is to ask 3rd party managers or their insurers what they observed as the differences between their safety record before and after they implemented ISMA.

**IS IT REALISTIC TO ASK OUR SHAREHOLDERS FOR MORE MONEY TO SPEND ON SAFETY CULTURE?**

Senior management may often say that safety is most important, but at a shareholder or creditor meeting this may not be the best slogan. Since safety and efficiency are very closely related, why is it that we cannot say we want to spend money to increase efficiency?

You may ask how safety and efficiency are related? Safety requires awareness and clear thinking. It also requires a few hardware items, like ‘hard hats’ to name one of the least expensive ones. Efficiency requires clear thinking and awareness, but with more emphasis on other tools.

You may ask how do we increase efficiency? Well, there are many ways, most of which are common knowledge. e.g. Knowing ones job, anticipating events, knowing ones available resources and other
pointers that you already know, or may obtain in a book or training course.

You also know that confusion and efficiency do not go hand in hand, and that randomness, which is similar to confusion, is something that as a species we need to fight continuously in our environment. In other words, confusion exists almost everywhere unless we take measures to avoid it. Confusion makes things unpredictable and this causes safety and efficiency problems. For example:

- It is confusion that causes mariners to be unaware of priorities.
- It is confusion that wastes people’s time in the office or on board trying to find information, because it was not recorded in the most appropriate place.

Such unawareness of priorities, and lack of information can be critical in the diagnosis of a problem in a crisis. Confusion is also a result as we all know, when we multi-task and we do not take painstaking measures to organise and co ordinate such multi-task activities.

**Examples of Information-related Activities**

So, it may be easier to talk management into spending money to increase efficiency, which in itself saves money and increases safety. How can efficiency save money? It saves time and mental preoccupation with banal and unnecessary tasks like filing. For example, e-mail for a travelling businessman saves communication costs but more importantly it saves the time that the businessperson and his secretary must spend throwing out or filing the faxes that he has collected on the trip. This is a minor example
of the subtle improvements to efficiency that can be achieved through judicious use of contemporary information technology, but it is nevertheless, one of many examples.

ARE NATURAL ABILITIES IMPORTANT IN ACHIEVING SAFETY AND EFFICIENCY?

Some commanding officers have a natural aptitude towards problem solving, others have aptitude in analysis and explanation, some have aptitude in discipline and consistency.

Safety is achieved by awareness, clear thinking, and clear priorities. To improve safety culture you have to know your particular human resources and where they might be weak. Visiting vessels to assess the abilities of the crews is time better spent than pre audit audits or pre-vetting vetting aimed at finding non-conformities.

You may ask why? Ships are insufficiently fitted out with instrumentation to allow them to operate unmanned, so human intervention is essential. Human intervention is much more expeditiously assessed by highly focussed, highly motivated ship managers observing the crew at work, than by spot check on vessels condition and paperwork which divulges much less useful information about the human resource on board. Therefore, assessment of the shortcomings of your human resources and the quest to reduce their confusion are the most expeditious ways of increasing safety and efficiency.
DOES ANYBODY READ SAFETY MANAGEMENT SYSTEM MANUALS?

Some do some do not; the ones that do should be rewarded with medals. Manuals are so contrary to the natural comprehension of humans, that any crewmember that reads them should be awarded the gold medal for arduous labour.

Why you may ask? Manuals are written for too many diverse reasons to be of much use to an operator as a guide for performing tasks. They are written to comply with the law, to give some instructions and they are written to allow defence against management negligence claims, etc. Also, the actual acts of reading, index searching or information retrieval inhibit the degree of concentration, so the final attention paid to the desired text is seriously diminished.

As ship operators our experience with regard to management and policy manuals is limited. Most of our experience is with machinery operating manuals, which is actually rather different. The ideal people to ask about procedures manuals are military experts, for in the armed forces such manuals play a very important and critical role. Therefore, the experience from the deployment of these is best obtained from military experts.

HOW MUCH DOES FORGETTING CONTRIBUTE TO ACCIDENTS?

Forgetting probably causes more unwanted incidents than anything else. No Nobel prizes will be awarded for this revelation. However,
there are a number of ways to avoid it. The two most relevant to our discussion are training and reminding.

Training people so that they don’t forget is essential. The result of good training is a sub-conscious checklist in the mariner’s mind. Such training is, of course, best achieved by on the job experience, and the time-tested apprenticeship system. Even though training is a major issue related to what we are discussing, it is too long to include in this paper.

The other method to ensure that people do not forget is to provide **timely** reminders. For example, suppose that there is a rise in the lube oil sump tank level in an auxiliary diesel engine. The Oiler checking the level may enter the new level in the logbook and may even notice that it is higher than the previous level. At this point he needs to be warned of the seriousness of the situation in the event that the rise in level is not due to replenishment by a previous watch, but instead, is due to sea water or fresh water ingress from the various seals, cooler tubes etc.

Most companies, having anticipated such dangers, may have written a warning procedure in the SMS manual, which is in the engineer’s office and is highly inefficient in divulging warnings when one is looking to warn the Oiler at the time of measuring, or recording the sump measurement. Some companies may provide Oilers with their own simpler manuals, but even if the Oiler had his own copy of an extract of the SMS manual for personal use, would he notice the abnormality and then read the manual? No, it is most likely that he would neither notice nor read the manual. Even if the Oiler was an avid reader of SMS manuals, he would most likely not remember
the warnings, and remember to check for previous replenishing action.

Consider how much easier it would be to have an electronic engine log, similar to a paper log, but in spreadsheet form on a computer in the control room, that connects the action of replenishing oil to the recording of increased sump levels. Therefore, unless someone had previously recorded the action of replenishing oil, the spreadsheet would go into an alarm mode if the level was sensed, or recorded, as having risen. This electronic log could then warn the Oiler of the danger of a rise in level, without a proximate recording of replenishment, and provide him with a convincing video recount of a similar situation and the damage that resulted.

One may say that a simple warning sign on the sump gauge may be sufficient, however, this is not so. Constant warnings without special reason become customary expectation and are ignored by most humans. Human attention is stimulated by a violation of expectations. Constant out of context warnings become expected if seen more than once and are normally ignored after the first time.

You may say that such interactivity involving electronic logs is far in the future. On the contrary, software is far cheaper than one or two extra alarm instruments and almost an inconsiderable cost to each vessel. It could warn against a large number of situations that alarms cannot address. And since the spreadsheet would be a generic product, one programming effort could be shared by thousands of users while also providing framework for education and corporate memory.
There are two ways of warning people efficiently. Let’s use an example to illustrate efficient and inefficient ways to remind humans of warnings. As mentioned in the previous example, one way is to provide the warning at a time when it is **highly relevant**, (e.g. when recording the two different sump levels but at a time when no oil replenishing took place). The other is to warn them in the context of what they are about to do and while they are focused on the issue.

By organising your company-wide information system properly, you can provide education and warnings at the correct instance so as to efficiently influence the critical issues to which operators pay attention. To achieve this, a company must have a computerised information system that combines as many on board functions as possible, so as to provide the user with information at the point of need. It makes no sense having stacks of information that the user is not used to referring to, because doing so is outside the operator’s series of actions for the task at hand and will be ignored.

The question arises as to the need for computerisation. Well, it is the only way to relate large quanta of information instantaneously to the item of concentration. Paper information takes far too long to retrieve and cannot be automatically linked to the action of preparing for job at hand, without the user consciously looking for it. For example, a warning about the high fluid level in the sump tank cannot be presented to the user at the point of that level being recorded unless a computer is used.

Supposing that a master has been given instructions to load at a loading buoy, when last year a vessel from the same company fleet
was involved in an incident where there was a minor collision with a buoy. The company has analysed the cause of the accident and determined that it could have been avoided had the standby tugboat line not been dangerously close to the vessel's propeller at the time that the vessel needed to manoeuvre astern to avoid a wind driven collision. The company issues an amendment to the SMS manual and all the masters and officers of the fleet are meant to read it.

However, what guarantee do we have that the present Master of that vessel, one year later, remembers the suggested precaution if he was on leave at the time the incident happened? Surely, we do not expect him to memorise the SMS manual or its amendments upon his return to the vessel. As we all know, SMS manual changes are read by the officers and crew, but are not read in the context of preparing for a job and are not read just before taking preparatory action.

As an isolated precaution, such a warning would be seen as one of thousands of issues to bear in mind by the reader when he reads the manuals or the amendments all at one time. However, should the warning come just before arrival at a mooring buoy the Master may find the information very relevant.

Furthermore, important warnings and amendments of procedures must stand out and must appeal to the logic of the reader. For example, the reader may also remark that in any manoeuvring situation it is advisable to keep tug lines away from the propeller, and if he is not convinced that this is a valid warning, he will not take it into proper consideration. However, if the warning is given
at the right time and with sufficient explanation as to the context, he may well realise that it is during prolonged loading at the buoy, while attention is no longer paid to manoeuvring, that tug lines may be inadvertently allowed in the vicinity of the propeller.

**If confusion and forgetfulness are two fundamental sources of errors and inefficiency, what can we do to assist in these areas?**

Computers do certain things like store and retrieve information much more efficiently than any other means. Therefore, insofar as providing reminders, computerisation is by far the best tool. Computers can today do things that humans are appallingly bad at doing -- for example, filing, retrieval, calculation, accounting and even advising.

How does a computer advise? It can give consistent advice without the possibility of forgetting to mention something. **The trick is to get the computer to know when to give the advice.** Sometimes computers know when to give advice, and when they do, they are far better tools than people.

In our company we have had a software system built that addresses these very issues. Despite the absence of infallible statistics to prove that we have in this way helped with the solutions to confusion and reminders, we have convinced our shareholders. We achieved this by appealing to our shareholders’ own reasoning, that we are improving efficiency and safety.

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