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Seaways

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Automation on the bridge

The Nautical Institute

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Focus

Cooperation amongst professionals

"Cooperation is often a difficult process, although generally the common bond that exists between seafarers of whatever nationality will help to find solutions"

The maritime world is a fascinating mixture of straightforward tasks in a complex environment. The task in the commercial world is essentially simple – the transportation of cargo or people from one place to another in a cost efficient and profitable venture. In the naval service the tasks may be more diverse but usually amount to defence of the realm and protection of its trade in one form or another. The complexity in which these tasks must be performed stems from the natural environment, which is potentially far more powerful and unforgiving than mere man-made objects, as well as the vast array of regulations, competition, and rapid technological change amongst many other factors. Added to all this are human frailties which need to be taken into account and guarded against. These complexities were explored in the London Branch mini-seminar (see p32) in relation to the Safety Management System (SMS), where it was clear that environmental regulations are adding increasingly complex layers to the SMS and may therefore be detracting from the fundamental purpose and focus of the SMS which is safety. What the seminar did demonstrate was that a good SMS is only achieved through cooperation between the sea and shore staff based on professional knowledge and experience and a thorough grasp of the regulatory environment as well.

BRM

The same is true of Bridge Resource Management (BRM) which features in a number of articles this month as well as being the theme for the latest issue of *The Navigator*. Captain Butalia, Master of a livestock carrier, addresses improvements needed in this training to really take into account the human element leadership and management (HELM) aspects (see p4). The commercial industry has a lot of catching up to do in this type of training as the Institute highlighted with its work in 2001/2002 when course structures were devised in cooperation with various stakeholders. Since then the inclusion of HELM in the STCW 2010 Amendments is a step in the right direction, but a great many existing seafarers are still in need of this training to help them manage the complexities on board. Mentoring can play a part in this process of developing such skills and is certainly essential in building on the learning outcomes of the BRM course as identified by Professor Torskiy and colleagues from the Ukraine (see p21-22). Captain Sam Pecota from the USA also looks at the advantages and disadvantages of sea phase training in dedicated training ships versus service in commercial vessels which should also include building on BRM courses ashore (see pp 11-12).

A different take on BRM is contributed by Cdre Chris Rynd of Cunard who looks at the automated systems in some detail and encourages that they be integrated as part of the bridge team (pp 6-10). In some cases they will indeed take the place of a human seafarer eg a helmsman – hopefully to release that person to more useful tasks rather than reducing the number of crew on board – but should be interacted with in essentially the same way as one would with a person. In particular it is important that the limitations and frailties of the system are equally well understood and guarded against as human frailties should be.

Benefits and Challenges

Cooperation is often a difficult process, although generally the common bond that exists between seafarers of whatever nationality will help to find solutions. A number of examples of this were given to the joint seminar in Mumbai which brought the Indian Navy and Coastguard together with the merchant shipping community (see pp 23-24 and 29). Another fine example was the response to the *Exxon Valdez* oil spill in Alaska which quite rightly demanded a rapid reassessment by the oil industry of risk assessments and response capability (see pp 14-15). It shows that when the right professionals are brought together with a clear remit and empowerment to get things done rapid solutions are achievable. Similarly, this process can be and is used to learn lessons from military exercises for both operational improvement and to ensure that the next exercise is more effective. Lt Cdr Fedoruk explains the process for a multi-national exercise and it is good to see that he incorporated our MARS principles into the military sphere (see p 25 and MARS pp 17-20). More reports to MARS are always welcome, and a responsibility for all maritime professionals as we are all involved in near misses from time to time.

p6

p11

p14

p25

Mariners' Alerting and Reporting Scheme

MARS Report No. 264 October 2014

MARS 201450

Liquid propane spill gives cold comfort

➔ A LPG vessel was outbound under pilotage. On deck, preparations were being made for the changeover from the last butane/propane cargo to the upcoming full propane cargo. The cargo discharge valve of cargo tank 3S had stuck during the previous discharge and could only be used with a limited rate. The chief officer (C/O) decided to remove the valve spindle assembly as soon as possible because bad weather was forecast before the next loading operation. This job had been done several times in the past, so the C/O considered it a routine operation; as such, a risk assessment was not performed. The Master was unaware of the maintenance operation at the time.

As on previous occasions, the plan was as follows:

1. Lower the tank pressure to <40 mBar.
2. Drain the lines and isolate the cargo system.
3. Slack all bolts except four.
4. Controlled release of the four bolts to release the vapours.
5. Joggle the spindle assembly to release more vapours.
6. Completely release the last bolts.
7. Take off the assembly and replace it with a blind flange.
8. Have E/R personnel repair the spindle assembly and then re-install.

With the bosun and one AB, the C/O completed steps 1-4. Then, with the cadet and another AB joining them, the C/O started to joggle the valve assembly. As soon as the spindle assembly was lifted off, liquid propane streamed out and was blown by the strong wind to the starboard side. The AB received a significant amount on his upper legs while the cadet received somewhat less on his upper leg and ankle, as did the C/O. He immediately managed to reposition the assembly on the valve body, which stopped the outflow. The AB and the cadet exited the area and received first aid. The vessel was still heading towards the pilot station but as the injuries appeared superficial it was decided not to return for a medical evacuation. Mediport was informed for assistance.

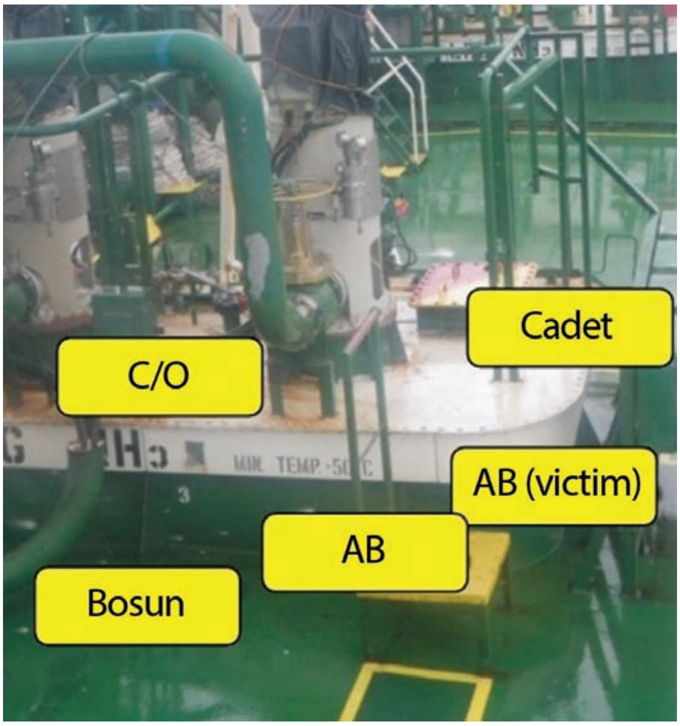
About 48 hours later, while near the arrival port, one victim was heliported to the hospital. He was found to have second degree burns and blisters which required medical care for several days before he was repatriated home.

The excellent company report found, among others, the following:

Contributing factors

- Chronic repairs: The company had recognised the chronic nature of the valve/spindle assembly problem, as breakdown reports had been already issued and spare parts had been delivered on several occasions. Alternatives to this valve type were being sought, with the intention to replace all six at the next dry docking.
- Management of change: On at least six previous occasions similar repairs were covered by a Permit to Work, but not on this occasion. It is likely a Permit to Work would have prevented this accident from happening as it would have been discussed with the Master, who had noticed liquid in the condensate line earlier.
- Time and commercial pressure: The oncoming foul weather was the decisive factor in starting the repair soon after leaving port, in order to remove the valve and make use of the time at sea to repair the valve in the engine room (with a blind flange on the cargo line) and to replace it shortly before loading.

Spindle valve assembly



Layout of the accident site

- Situational awareness: There was no shared mental model on how to proceed. The bosun and one AB were initially involved at the valve with the C/O when another AB and the cadet were called in. At that point, nobody was clearly briefed on what was about to happen. There was no check on whether all participants were clear on their individual tasks and whether the full process and risks were understood (no toolbox meeting). The C/O wrongly assumed that the cargo in the line had evaporated based on previous experiences with this job. He did not realise that on those occasions the repairs were started eight to ten hours after completing cargo operations, whereas on the day of the accident repairs were started only about two hours later. His preoccupation with completing the job, combined with the fact that he had done the same task a few times before (although with another team) led to risk acceptance and complacency. It also created a mind-set in which the C/O judged it acceptable to bypass standard procedures (ie No Permit to Work).
- PPE: The PPE used was not adapted to the risk of frostbite; crew used standard cotton boiler suits over their personal clothing (jeans).

MARS 201451

Self-induced fatigue contributes to grounding

Edited from official report 10-202 of the New Zealand Transport Accident Investigation Commission

➔ During the morning it was found that maintenance work would not be complete until approximately 1600. The Master set the vessel's departure time to midnight that same day. The maintenance work was completed by 1600 and the Master elected to stay on board to allow the OOW to go ashore, which he did around 1800. While ashore, the OOW had a few pints of beer then went for a walk, returning to the vessel at about 2045 and turning in to bed at about 2115. The mate had also been ashore and had four or five pints of beer before returning to the vessel at about 2130 and turning in for rest. By 2230 the Master and crew were up and about doing their normal pre departure routines. At about 2350, the vessel sailed with the mate on the helm and the Master having the con.

At about 0015, the OOW arrived on the bridge and took the con of the vessel from the Master. The mate was still on the bridge when the OOW arrived, but left the bridge about five minutes later. The OOW maintained the vessel on its designated track, regularly plotting the vessel's position on the chart. At 0350, as the OOW altered course off a prominent point, he called the mate for the 0400-0800 watch. The mate arrived on the bridge at about 0403 and after reading and signing the Master's night orders, took over the watch. At about 0408 a course alteration to about 253° was performed. At about 0506 the vessel grounded while still on a heading of 253°.

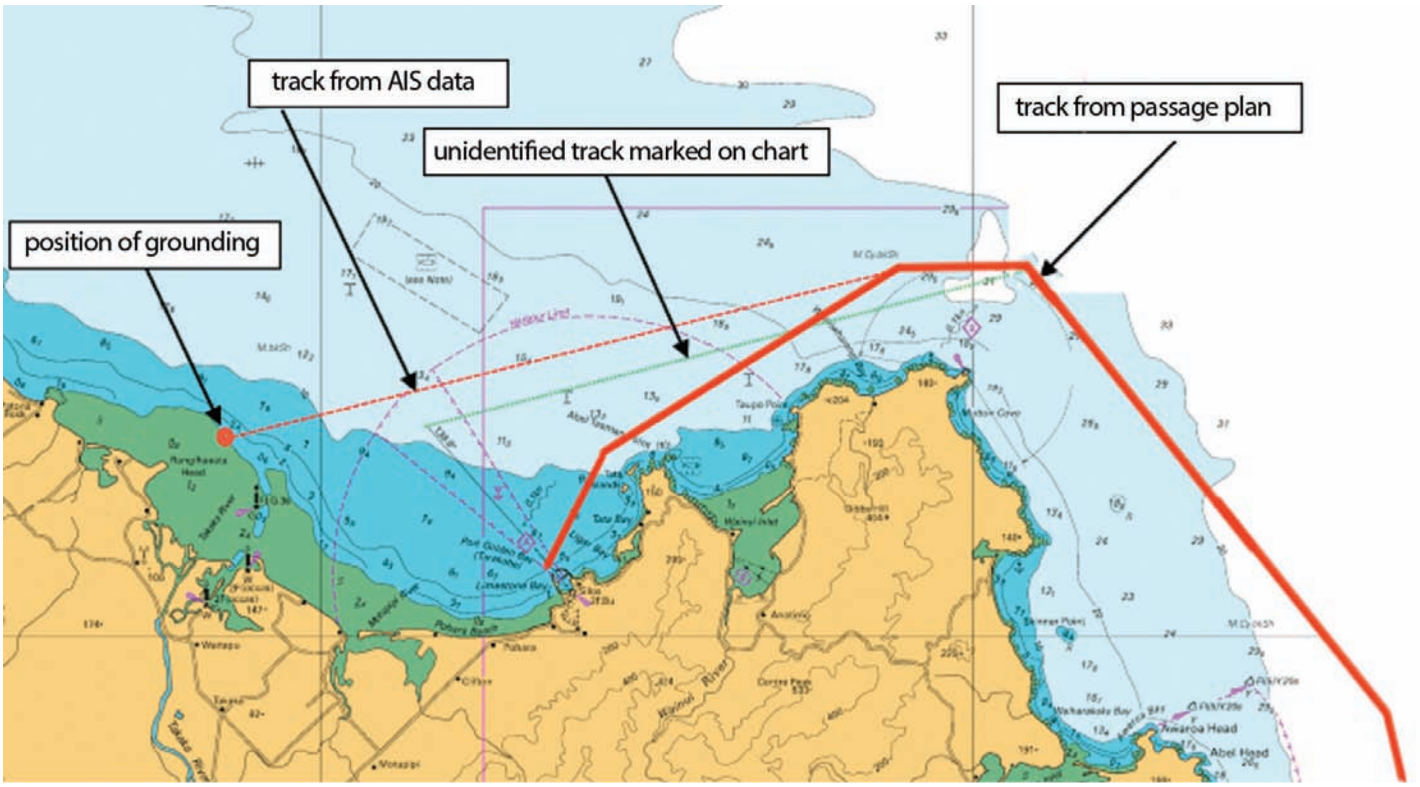
During the course of the investigation, the mate was adamant that he had not fallen asleep after altering the vessel's course to 253°. Yet, the sequence of events (see photo) show this as a strong possibility. If not asleep, he must have been doing something other than monitoring the progress of the vessel.

Some of the findings of the official report were:

The mate went ashore where he consumed 'four to five pints of beer' before returning to the vessel. Even when considering that alcohol affects individuals in different ways, the mate's performance would likely have been impaired when he was steering the vessel out of port under the Master's command.

Research has shown that even consuming a small amount of alcohol prior to sleep can affect the quality of sleep leading to daytime fatigue and sleepiness. The mate had only had 3.5 hours' sleep in the previous 21 hours by the time he went on watch at 0400. The mate did not take enough of the ample opportunity he had to rest before being required for watchkeeping duties.

■ **Editor's note:** In many instances today, commercial pressure and unrealistic vessel manning practices conspire to trap mariners and set them up for fatigue while watchkeeping. This appears not to be the case for this grounding. In this instance, the mariner set himself up for fatigue.



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MARS 201452

EEBD not primed? It's not ready to save your life

Edited from USCG official safety alert 06-14

➔ During recent inspections, it has been discovered that numerous SABRE Emergency Escape Breath Devices (EEBD) / Emergency Life Support Apparatus (ELSA) were in an unprepared status. The 'Quick Fire' functionality that puts the EEBD into operation when the bag is opened up and hood is worn was not in its 'primed' state. This can have fatal consequences when time is of the essence to escape a hazardous atmosphere.

When purchased or returned from servicing, this equipment will have a small removable label viewable through a window on the bag that states 'QUICK-FIRE NOT PRIMED ANTI-TAMPER DEVICE AND FITTING INSTRUCTIONS INSIDE' This means the unit is not ready. Once received on the vessel, the EEBD should be prepared for use by opening the bottom left corner flap, attaching the 'Quick Fire' cord and removing the label.

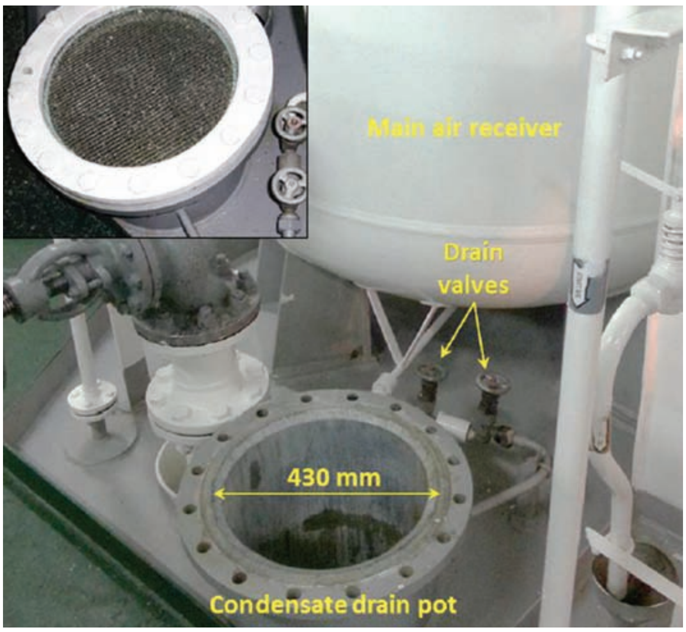
■ **Editor's note:** Although this safety alert concerns SABRE brand, you should check all EEBDs carefully for their proper functionality.

MARS 201453

Ad hoc modifications cause fatality

Edited from official ATSB Transport Safety Report MO-2013-005

➔ The fourth engineer started his engine room checks, which included draining accumulated water (condensate) from the main and auxiliary air receivers. He opened each of the two inline drain valves of the forward main air receiver about one turn and stood by, watching the flow of condensate through the observation glass of the drainage pot. Shortly afterwards, and without warning, the observation glass exploded.



Drainage pot arrangement. Inset shows observation glass in place.

The fourth engineer was found seriously injured, breathing but unconscious. After shutting the two air receiver drain valves to stop the flow of escaping air, first aid was administered to the victim. About 30 minutes later the victim stopped breathing. Cardio-pulmonary resuscitation was immediately performed by crew members. Shortly thereafter paramedics arrived by helicopter and assessed the situation, but it was too late; the victim was confirmed dead.

An analysis of the accident showed it was likely that condensate had accumulated in the air receiver overnight. When the drain valves from the main air receiver were opened, the condensate flowed into the drainage pot in sufficient quantity to cover the bottom of the pot and the discharge hole. This flow of liquid was probably followed by a marked increase in pressure due to the inrush of pressurised air (about 30 bar) from the receiver. The pressure increase in the drainage pot was sufficient to fracture the observation glass, leading to its catastrophic failure. The positioning of the drain valves behind the observation pot meant that the fourth engineer's upper body was positioned directly over the observation glass and therefore in the path of the explosive force and debris from the pot.

The condensate drain pots fitted on the vessel were not of a design normally fitted by the builder, or commonly encountered on board ships. They were a modification that was implemented at the request of the shipowner's representative to eliminate splashing of condensate. He had provided notes outlining the fitting of glass observation windows. Although the design of the drainage pots suggests that some consideration was given to the likelihood of pressure accumulation, no quantitative engineering analysis of the design was undertaken. When considering the working conditions and component deterioration over time, failure of the observation glass at some time in the future was almost inevitable. Importantly, any failure would probably occur while the operator was positioned over the observation glass to operate the valves or to look into the pot, as in this case.

Compressed air systems are a vital service on board a ship and as such are subjected to class scrutiny. However, the drainage systems and their components, particularly open ended piping, are not regarded as being under pressure and are not normally considered to be classed items. The information and drawings available on board the vessel at the time included the final (approved) drawing for the compressed air system but did not mention the modified drainage pots or the closed drain system. The modified drainage pots and the enclosed drain system should have been brought to the attention of class by the shipyard and subject to design scrutiny prior to being installed and used, as this was both a modification and exposure to pressures in excess of 7 bar.

Official report findings

- The drainage pot observation glass failed catastrophically when the pot was subjected to significant air pressure from the pressurised air receiver. Pressure accumulated in the drainage pot when liquid condensate from the air receiver restricted the flow of air and liquid out of the pot into the drain piping and to the bilge.
- The shipyard did not follow its own procedure for fitting a modification required by the ship owner's representative. Consequently, the shipyard did not conduct appropriate engineering analysis or testing of the condensate drain system prior to fitting it. They were, therefore, unable to establish the extent or impact of pressure accumulation and operating conditions on the system.
- Both the shipyard and the owner's representative considered the drain system to be open and therefore not prone to pressure accumulation. They did not appropriately consider the significance of any possible pressure build-up in the drainage pot.
- The condensate drainage pots fitted to vessel's main air receivers were not fit for purpose as they were not capable of withstanding the internal pressures that were likely to accumulate in service.

■ **Editor's note:** When in doubt, or for any ad hoc modifications to vital machinery, consult class.

MARS 201454 –

DP mishap: Human + error = total loss of power

Edited from official USCG Safety Alert 08-14

➔ Crew on a DP vessel were performing maintenance on the main power distribution bus circuit breakers; maintenance which was several years overdue. Additionally, the maintenance was conducted during a critical Outer Continental Shelf activity. In support of the circuit breaker maintenance, the vessel was transitioning from a 'closed bus' operation to an 'open bus' configuration with 50% of the vessel's thrusters operating on each bus.

After opening the bus tie, a generator protection circuit failed to function properly, and this combined with a design flaw in a power transformer protection circuit causing half of the vessel's thrusters to stop. The vessel's engineer attempted to restore power to these thrusters by closing the bus tie without synchronising two live buses (crash sync). Design features and operational procedures to prevent such an action and consequences were not sufficiently in place. The design deficiency allowed a power transient to cause a total loss of thrust and therefore loss of position.

Lessons Learned

1. The vessel did not have a defined Critical Activity Mode of Operation (CAMO). Ensure a vessel has a defined CAMO and is operating in its CAMO during critical OCS activities.
2. Ensure the DP operations manual and SMS both appropriately address DP equipment inspection, repair and maintenance requirements. A vessel should not perform maintenance that may cause a loss of position during a critical OCS activity.
3. An equipment failure, an operational error and multiple failure modes not identified in the vessel's Failure Modes and Effects Analysis (FMEA) combined to produce the loss of position.
4. Ensure a structured competence assurance program is applied to all key DP personnel. At a minimum, DP personnel should be required to demonstrate proficiency in understanding the redundancy concept and emergency procedures in intervening for failed redundancy. Intervention proficiency in restoring power and thrust should be demonstrated during drills and annual trials.

MARS: You can make a difference.

You can save a life, prevent injury and contribute to a more effective shipping community.

Everyone makes mistakes or has – or sees – near misses. By contributing reports to MARS, you can help others learn from your experiences. Reports concerning navigation, cargo, engineering, ISM management, mooring, leadership, design, training or any other aspect of operations are welcome, as are alerts and reports even when there has been no incident. The freely accessible database (http://www.nautinst.org/mars/) is fully searchable and can be used by the entire shipping community as a very effective risk assessment, loss prevention and work planning tool and also as a training aid.

Reports will be carefully edited to preserve confidentiality or will remain unpublished if this is not possible.

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