Issue 9

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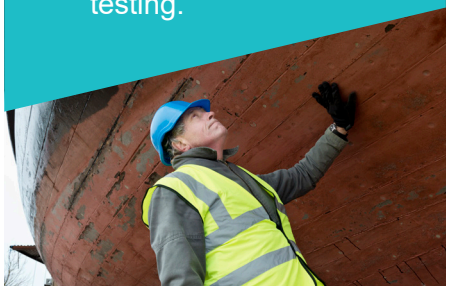
Shaping shipping for people

In this issue we focus on maintenance related incidents:

- the importance of a planned maintenance system
- hazard identification strategies
- regular and thorough inspections
- operational system testing.



Maintenance

Maintenance is essential for the safety of the vessel, its operations and the crew. Identifying, addressing and managing maintenance-related risks as part of your vessel's safety management system is essential.

While a critical safety factor, maintenance-related issues do not always receive the attention they deserve. Maintenance issues are often difficult to detect and not generally linked to safety and therefore are not recorded, reported or addressed as an incident or near miss as part of the organisation's safety management system.

Case study one

Loss of propulsion on a passenger ship

A passenger vessel departed Melbourne on a scheduled cruise to New Zealand. It was operating solely with the starboard propulsion unit as the port propulsion unit was undergoing repair.

During the voyage, the starboard propulsion unit failed and could not be restored. The ship was disabled and tugs were deployed to tow it back to Melbourne.

The investigation[1] found the failure of the starboard propulsion was a result of a recent repair, which included a modification to its configuration.

Monitoring of the repaired unit failed to detect its deterioration prior to failure. While the modified configuration was a proven design, its use on the specific propulsion system was new. Design, installation and trialling of the modified configuration did not detect the error. ►

► *Case studies on maintenance continued from page 1:*

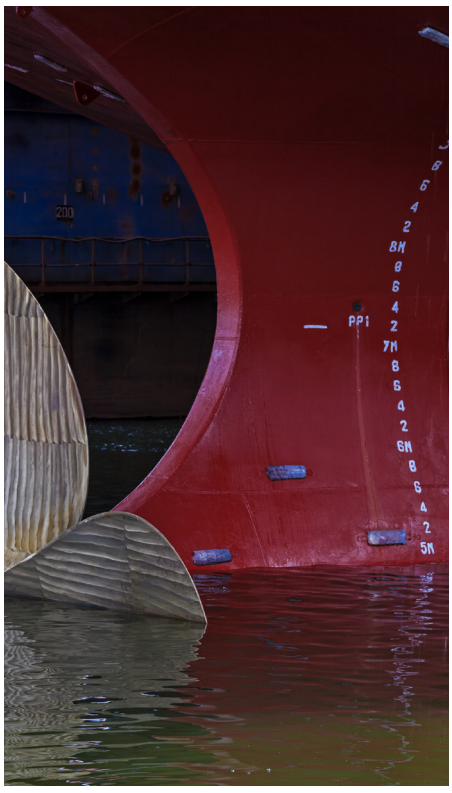
Case study two

Grounding of a tanker

A tanker was bound for the Port of Geelong with a pilot on board. As the vessel neared the eastern end of the South Channel, the rudder ceased responding to helm inputs and remained at 5 degrees to port. The steering was regained and attempts made to prevent the vessel from grounding—without success.

The investigation[2] found the telemotor solenoid controlling the rudder's movement to starboard had stopped responding. The planned maintenance system did not include any maintenance schedules or requirements for the telemotor.

Following the incident, the operator introduced three and six-monthly job entries into their planned maintenance system for the inspection and testing of the steering gear unit. The six monthly schedule included specific requirements for preventative maintenance of the steering gear telemotor solenoid.



The importance of maintenance

Maintenance ensures that a system continues to perform its intended function as per its design in relation to the level of safety and reliability.[3]

As shown in figure 1, there were 2498 technical incidents reported to AMSA in 2017 and 2255 in 2018. Analysis of AMSA's Port State Control data shows there were 896 maintenance-related deficiencies issued in 2017 and 708 in 2018. This represents 13 per cent of the total deficiencies during 2017–18.

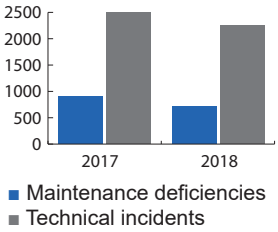


Figure 1: Number of technical incidents reported and maintenance deficiencies issued for 2017–18 (source: AMSA)

During 2017 and 2018, 326 vessels were detained in Australia—165 in 2017 and 161 in 2018. Of these, 149 were due to maintenance issues—87 vessels or 53 per cent in 2017 and 62 vessels or 39 per cent in 2018 (Figure 2).

Technical failures are often considered isolated incidents and therefore do not undergo further investigation.

Examples of issues that could lead to technical failure include:

- unsuitable modification to parts
- omission of maintenance checks
- incomplete installations
- a fault not being isolated
- missing equipment.

While many maintenance-related errors seem inconsequential, they have the potential to remain dormant and can affect the safe operation of a vessel over time.

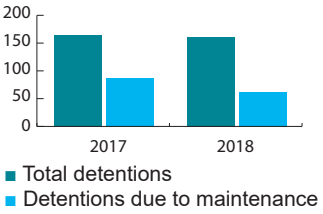


Figure 2: Number of detentions related to maintenance for 2017–18 (source: AMSA)

Insight

The Seafarers International Research Centre (SIRC) at Cardiff University analysed 693 investigation reports published between 2002 and 2016 with the aim of identifying the causes of maritime incidents. For lifeboat related incidents, the most common immediate cause was inappropriate or ineffective maintenance (26.1 per cent) (Figure 3).

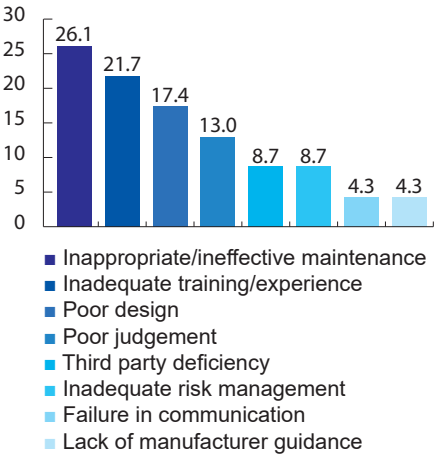


Figure 3: Immediate causes of lifeboat incidents (source: SIRC)

Effective and regular maintenance will result in fewer machinery failures and breakdowns. This in turn will minimise the rate of unforeseen operational delays and serious incidents. There are also the added cost-related benefits of improved productivity and efficiency.

Factors influencing maintenance issues

Due to the complex nature of the maritime working environment, maintenance-related issues are often a result of interactions between organisational factors and latent conditions.[3]

Resource pressures

- A recent study involving 1026 seafarers identified that more than 20 per cent of seafarers reported working more than 69 hours per week with unpredictable working hours.[4]
- Scarce resources mean people and organisations frequently have to make a trade-off between the time and effort taken to prepare for a task, and the time and effort expended doing it.[5]
- Trade-offs involving shortcuts may allow the ship to be operational more quickly, but at the expense of thoroughness and safety. This is identified in phrases such as:

  'It normally works...'
  'It is good enough for now...'
  'Someone else has checked it...'
  'There is no time to do it now...'

- Consider the risks associated with a maintenance related failure and ensure appropriate resources are available to carry out an effective maintenance schedule.

Fatigue

- Fatigue impairs alertness and the performance levels of cognitive and physiological functions, for example decision-making, response-time and hand-eye coordination. When this coincides with other risks in the environment, incidents may occur.
- A range of strategies is available to manage the risk of fatigue.[6]

Maintenance procedures

- Poorly designed procedures that are unclear, out of date, inaccessible, not written for the task or are difficult to follow will likely result in deviation or non-compliance.
- It is important to align procedures with the way tasks are undertaken and to involve seafarers in their development where possible.

Lack of training

- Operators need to ensure training is relevant and up-to-date for the tasks at hand.

Hand-over procedures

- Maintenance tasks may not finish within a single watch. Seafarers frequently accept work in progress or handover incomplete work to an incoming watch.
- Effective and accurate transfer of information is important to avoid assumptions or misunderstanding about the status of work.
- To reduce errors allow adequate time for the watch hand-over.

Group norms

- Norms are the unspoken rules about how work happens in a particular workplace.
- Errors may result if faced with an exception to the rule.
- Informal practices or shortcuts may be deemed as acceptable, if not addressed.
- If an action has succeeded in the past, there can be an expectation it will succeed again without incident.

Poor design

- If the system or equipment is incompatible with the practicalities of the task, seafarers will develop shortcuts and work-around solutions that may have unintended consequences.

Managing maintenance issues within the safety management system

Maintenance requires a systemic approach and should form part of the operator's safety management system.

Planned maintenance systems that include regular and thorough maintenance, visual inspections and operational tests, will reduce the risk of machinery failure.

Equipment and technical systems where sudden operational failures may result in hazardous situations require particular attention.

Specific requirements and instructions should be incorporated into inspection, testing and maintenance plans, including any manufacturer's recommendations.

Good recordkeeping helps evaluate the effectiveness and efficiency of planned maintenance activities.

Key messages

- Plan maintenance to ensure problems are identified early to reduce the risks of system and machinery failure.
- Incorporate the management of maintenance-related risks within the safety management system.
- Introduce specific measures to identify and mitigate hazards to assure the reliability of equipment, machinery and systems.
- Regularly review inspection, monitoring, maintenance action and processes for continued effectiveness.
- Incorporate the manufacturer's recommendations for maintenance frequency where available.
- Investigate technical failures and make improvements to minimise the risk of future occurrences.

References

[1] Australian Transport Safety Bureau 2017, *Investigation number 329-MO-2017-003*, ATSB, Canberra.

[2] Australian Transport Safety Bureau 2016, *Investigation number MO-2016-005*, ATSB, Canberra.

[3] Reason, J & Hobbs, A 2003, *Managing Maintenance Error: A Practical Guide*, CRC Press, London.

[4] Andrei D, Grech M, Crous R, Ho J, McIlroy T, Griffin M & Neal A 2018, *Assessing the determinants and consequences of safety culture in the maritime industry*. Australian Maritime Safety Authority, University of Queensland and University of Western Australia.

[5] Hollnagel, E 2009, 'The ETTO principle: efficiency-thoroughness trade-off—why things that go right sometimes go wrong', *Risk Analysis*, vol. 30,1, pp. 153-154.

[6] Australian Maritime Safety Authority 2017, *Maritime Safety Awareness Bulletin: Fatigue is a safety hazard*, AMSA, Canberra.

Reporting major failures

It is a legal requirement to report any major critical equipment failure to AMSA. You can do this by completing an incident alert (form 18), followed by a detailed incident report (form 19) within 72 hours of occurrence. Forms are available from amsa.gov.au