

# Fatigue at sea: Looking beyond rest hours

Rest-hour requirements and other established approaches to managing fatigue are important, but they do not necessarily tell the whole story. Could wearables and other monitoring technology help identify and ultimately reduce the risk of fatigue-related incidents at sea?

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The safety risk on board does not always lie in the job itself. The condition of the person carrying it out matters too, particularly when fatigue affects performance. Gard's Crew Claims Report 2026 found that most injuries occurred during routine work and often involved experienced crew members performing familiar tasks. The report also identified recurring patterns linked to time onboard and time of day.

These findings do not mean that fatigue is always behind such injuries. But they underline an important point: no one is immune to the factors that can affect human performance. Sleep, workload, stress, time of day and the demands of life and work at sea can all influence seafarers' performance, regardless of experience, training or familiarity with the task.

# Recording rest is not enough

Seafarer fatigue has long been recognised as an important occupational health and maritime safety concern, with fatigue-related errors contributing to maritime accidents. The IMO defines fatigue as "*a state of physical and/or mental impairment resulting from factors such as inadequate sleep, extended wakefulness, work/rest requirements out of sync with circadian rhythms and physical, mental or emotional exertion that can impair alertness and the ability to safely operate a ship or perform safety-related duties.*"

International regulations seek to manage this risk in several ways, including through the ISM Code, safe manning requirements, limits on working and resting hours, and the IMO's guidelines on fatigue. In practice, however, compliance with work and rest-hour requirements under the STCW Convention and MLC 2006 remains a central measure. Yet compliant records do not necessarily mean that a seafarer is well rested or alert, nor do they always tell the full story. Research by the World Maritime University has identified widespread adjustment of work and rest-hour records, raising questions about how accurately they reflect actual working patterns onboard.

The challenge therefore goes beyond knowing how many hours someone has worked or rested. As reflected in the IMO definition, fatigue can result from a combination of factors and is therefore difficult to capture through working and resting hours alone.

**Case example: A master's dilemma**

n the early hours, a general cargo vessel engaged in coastal trade missed a turning way point and ran aground. The master, alone on the bridge, had just set the autopilot on a new heading when he sat down in a chair and fell asleep. The bridge navigational watch alarm system (BNWAS), which should have been in operation, had been deactivated. As a result, the deviation went unnoticed by the entire crew and the grounding could not be prevented.

The master acknowledged that operational demands had prevented meaningful rest in the days leading up to the grounding. Although his hours of rest records were in compliance with regulatory requirements, effective rest was not achieved in practice. Preparations for port inspections and cargo operations had continued to interrupt and occupy his rest periods. His decision not to post an additional lookout during the night watch was based on benign environmental

conditions, light traffic, and the need for the crew to rest after working intensively during the previous unloading operation and ahead of the next loading operation.

The case illustrates an important distinction between recorded and effective rest, and how operational demands and manning arrangements can affect the ability to achieve meaningful rest in practice. And even when rest appears sufficient on paper, the person making a safety-critical decision may not always recognise when fatigue is beginning to affect their performance.




## Can technology help?

The difficulty of reliably measuring fatigue has increased interest in whether technology could provide additional insight. New approaches combine physiological and behavioural data with increasingly sophisticated analysis to identify patterns associated with fatigue. While their use in the maritime industry is still developing, research and trials are beginning to explore their potential in operational settings. They cannot replace effective strategies for ensuring adequate rest, appropriate manning and seafarer health and wellbeing, but they may add another piece to the picture.

The US Navy provides an interesting example. Following two serious mishaps in which fatigue was identified as a contributing factor, the Navy explored monitoring approaches that could complement traditional working-hour controls. A 2024 study found that consumer wearables could collect reliable sleep-wake data at scale during operations at sea, supporting their potential role in operational fatigue management while also highlighting challenges around participation and data privacy.

Beyond sleep tracking, physiological indicators such as heart rate variability (HRV) are also attracting attention. Now measured by many consumer wearables, HRV can provide insight into how the body responds to stress and recovery. Generally, a higher HRV relative to your normal baseline is associated with better recovery, while a declining HRV over time may indicate accumulating physiological strain. HRV is widely studied in medical research and has been linked to a range of chronic conditions. It is also being investigated in demanding operational environments, including military settings, as a potential indicator of fatigue and physiological readiness. Maritime evidence is more limited, but a recent review found HRV monitoring feasible under real shipboard conditions.

Other approaches aim to assess fatigue or workload in real time using devices that measure brain activity (EEG), facial thermography, eye-tracking technology or monitoring of OOW activity levels. A 2025 study of vessel traffic service operators found that changes in facial and nasal temperature correlated with mental workload, pointing to the potential for non-invasive monitoring. Another 2025 study examined the relationship between fatigue and changes in pupil diameter, including the potential of eye-movement measurements as an objective indicator of fatigue among officers of the watch.

# Technology is only part of the answer

Technology is developing quickly, but fatigue will never be captured by a single number on a watch, ring or monitor. Nor can technology compensate for inadequate manning, excessive workloads or rest repeatedly interrupted by operational demands.

Work and rest records, self-assessment and emerging technologies each offer a different part of the fatigue picture. Records show when someone should have had the opportunity to rest; self-assessment indicates how they feel; and technology may add information about sleep, recovery and physiological signs associated with fatigue. Together, these sources could help identify developing fatigue earlier and support better-informed decisions.

With this in mind, some practical considerations for operators are:

• Do not confuse compliance with recovery. Rest-hour records remain important, but they do not necessarily show whether meaningful rest was achieved.
• Look beyond the records.Fatigue is influenced by more than working hours. Interrupted rest, quality of sleep, individual and psychosocial factors, and the work actually carried out rather than simply the planned schedule can all affect fatigue risk.
• Plan operations with fatigue in mind.Manning, watch arrangements, workload and operational schedules should provide sufficient opportunity for sleep and recovery, including when dealing with demanding tasks, overtime, and unexpected operational demands.
• Encourage self-monitoring and self-assessment.Seafarers should be trained and supported in recognising the signs of fatigue and understanding how it may affect their performance and ability to work safely. TheIMO Guidelines on Fatigue also provide examples of sleep and fatigue monitoring tools that can support such self-monitoring.
• Foster a speak-up culture.Seafarers should feel comfortable raising concerns about their own fatigue or that of a colleague, and questioning decisions or intervening when they believe fatigue may compromise safe operations. This should apply to everyone onboard, regardless of rank, role, or experience.
• Do not let professional status discourage intervention.The same principle should apply when working with pilots and other external service providers. Although ship operators are not responsible for managing their working hours and rest arrangements, the crew should remain vigilant and be prepared to question decisions if concerns arise.
• Explore technology as an additional tool.Wearables and other monitoring methods may provide insight into an individual's sleep, recovery, and alertness, but should be used alongside other indicators of fatigue and with an understanding of their limitations.
• Do not underestimate the value of personal data.Seeing HRV trends from wearables may help individuals understand how lifestyle choices affect their recovery and encourage healthier habits.
• Build in privacy and trust from the start.When introducing monitoring technology, seafarers should understand what information is collected, who can access it and how it will be used.
• Keep responsibility where it belongs.Technology should not shift responsibility for managing fatigue onto the individual seafarer.

Nevertheless, the case of the master's dilemma described above illustrates a broader challenge. Whether fatigue is recognised by the individual, noticed by a colleague or flagged by technology, identifying it only helps if there is a realistic way to respond. Recognition alone cannot create rest, reduce workload or provide another well-rested watchkeeper on the bridge when one is needed.

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