

# Shaping Shipping for People

Fatigue is a safety hazard:  
It needs to be managed

## Introduction

Fatigue is a safety hazard that impairs individual performance, wellbeing and can lead to accidents. The nature of vessel operations means seafarers are exposed to conditions which lead to fatigue. Insufficient sleep, night work, irregular and long working hours, monotonous tasks, high work demands are all frequently present in seafaring jobs. These are the primary factors that lead to fatigue. The need to manage the risk of fatigue - both at the individual and management level - is critical.

In this bulletin we'll look at fatigue, the causes and consequences, and strategies to help reduce the associated risks.

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Figure 1: Accidents at sea<sup>[1 and 2]</sup>

## Fatigue and safety

Accidents can occur when fatigue coincides with operational hazards.

### Accident 1:

A New Zealand-based fishing trawler with one crewmember and a skipper were 3 days into a five to six day fishing trip. At around 8:00 pm, the vessel started preparing to anchor with the crewmember on deck and the skipper navigating. When the vessel was about 2 nautical miles from anchorage the skipper fell asleep. The crewmember on deck noticed breakers close by and alerted the skipper. The skipper attempted to go astern, but it was too late - the stabiliser arm had struck the sea bed. The investigation<sup>[1]</sup> found that the skipper:

**worked for 18 to 19 hours** for each of the previous three days  
developed a toothache which **affected his sleep**  
**did not consider** he was unduly **tired** and this was reflected in the depth sounder alarm which was set on low volume.



Figure 2: Fishing vessel grounding<sup>[1]</sup>

### Accident 2:

At 3:22 am in June 2013, a cargo vessel ran aground while on passage from Scotland to Sweden. The second officer who was on watch at the time fell asleep. The vessel was making around 10.5 knots when it overshot a course alteration waypoint by 2.5 miles before the second officer woke. He attempted to alter the vessel's course but it was too late and the vessel ran aground.

The second officer's work and rest pattern complied with the International Convention on Standards of Training, Certification and Watchkeeping hours of rest requirements. However, this was not enough to prevent the onset of fatigue with the second officer falling asleep while on duty.

The investigation<sup>[3]</sup> identified the following factors contributing to this accident:

**lack of sleep** due to disruption to the second officer's body clock. This may have contributed to the second officer only sleeping for around 30 minutes prior to being woken to prepare for the vessel's departure

the **bridge design** layout enabled the second officer to use electronic navigational aids while seated which may have increased the potential of falling asleep

the bold **routine absence of a lookout** on watch at night without incident would have **strengthened the false belief** that it was safe to continue to operate in this manner

the vessel's **safety management system** did not provide **guidance on fatigue management** and the effective use of crew resources.

In both these accidents fatigue risk factors such as long working hours, lack of sleep, disturbed sleep, night work, and high work demands were present

## Causes and consequences

The nature of seafaring means long and irregular work hours are common. Seafarers also spend an extended period of time working and living away from home with few or no rest days.

Fatigue is caused by a range of factors including:

- inadequate sleep (most people need 7 to 9 hours of night sleep in a 24 hour period, any less can be an issue)
- long working hours (working more than 12 hours in a 24 hour period increases risk)
- working irregular hours at unusual times for our normal body clock (night work means working at times when our body would usually want to sleep, and sleeping during the day when our body wants to be awake)
- work demands
- other factors which affect sleep quantity and quality such as sleep disorders, medical issues, ship motion and stress. These are all strongly linked to disturbed sleep and impaired performance.

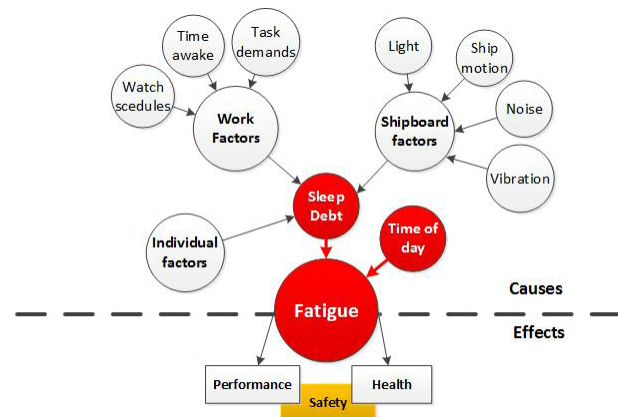


Figure 3: Fatigue causes and effects (adapted from<sup>[4]</sup>)

The shipboard environment and working conditions affect sleep quality and quantity. Fatigue associated with sleep debt is cumulative which means losing even an hour of sleep every other night over the course of a week will negatively affect performance. It also leads to delayed response and reaction time, impaired reasoning, reduced alertness, increased risk taking and impaired hand eye co-ordination.

Research shows that the effect of fatigue is similar to alcohol impairment

Fatigue is also associated with longer term health effects which include heart disease, diabetes, high blood pressure, anxiety and depression.

## Port State control data

AMSA's port State control deficiency and detention data over the last 4 years shows an increasing trend in vessel detentions related to work and rest hours.

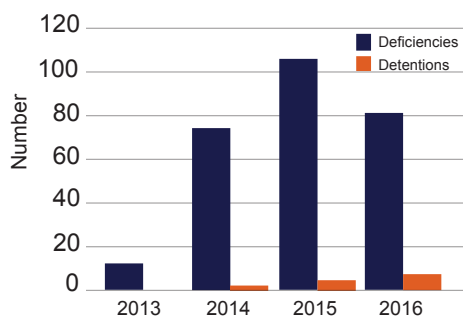


Figure 4: Port State Control Data 2013-2016 (source: AMSA)

Meeting prescribed hours of rest requirements (those identified in international conventions and national regulations) does not necessarily guarantee a seafarer will not become fatigued. The hours of rest requirements are a minimum and do not take into account key aspects of work patterns that affect fatigue, including night work and different types of operational schedules.

Evidence also exists that the shipping industry under reports work and rest hours. Research shows seafarers who under report their work hours are significantly more fatigued and less healthy than those seafarers who do not<sup>[6]</sup>.

A recent study by the University of Queensland, the University of Western Australia and the Australian Maritime Safety Authority (AMSA) which included responses from 1026 seafarers working on international commercial vessels, found that:

- seafarers reported working an average of just over 61 hours per week; and
- over 35% of seafarers reported working more than 70 hours per week.

Job related injuries, increased health problems, lost productivity and employee turnover are some of the risks associated with long working hours (that is working more than 60 hours per week)<sup>[5]</sup>.

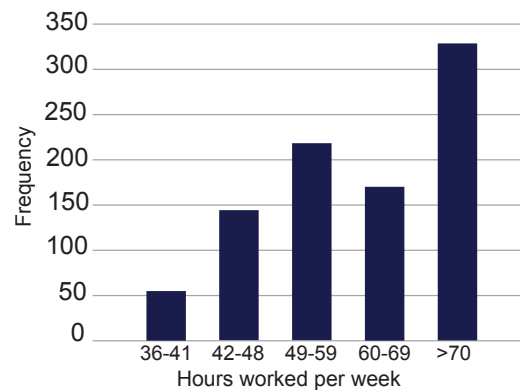


Figure 5: Hours worked per week

## Maritime research projects

A number of research studies on fatigue in maritime workplaces show that seafarers are often exposed to the risk of fatigue.

A recent study, Project MARTHA<sup>1</sup> (led by Warsash Maritime Academy and partners from Sweden, Denmark, China and the UK) found that masters feel stressed and fatigued at the end of their tours of duty; night watch keepers get significantly less sleep than others on board; and long tours of duty (more than 6 months) may lead to increased sleepiness, loss of sleep quality and reduced motivation.

The Australian Maritime College and AMSA are continuing to undertake studies on fatigue. A study on mitigating fatigue through vessel design has collected data from around 33 seafarers on sleep behaviours. The findings focused on proposing design changes to reduce noise, light and improve bunk design, and ensuring that fatigue is considered early on in the vessel design process. A second study will be conducted to design and trial a fatigue risk management approach which considers the findings of the previous study.

## Investigating fatigue

Based on fatigue risk management principles, the Australian Transport Safety Bureau have developed investigation analysis tools to examine fatigue. These investigations do not apportion blame but provide an understanding of safety issues so that industry can implement effective interventions. Investigators will firstly examine fatigue related errors. If human performance impairment is found to be consistent with fatigue, investigators will continue to examine:

- alertness while on duty;
- quantity, quality and timing of sleep obtained; and
- the sleep opportunity provided.

This will further assist in providing organisational support for managing fatigue risks.

<sup>1</sup> A copy of the MARTHA report can be accessed at [www.intermanager.org/2017/01/martha-fatigue-report-is-launched-at-the-imo/](http://www.intermanager.org/2017/01/martha-fatigue-report-is-launched-at-the-imo/)

## Managing the risk of fatigue

Work patterns and life on board can vary greatly - this depends on the time spent at sea, the number of port visits, vessel movement, vessel size, the number of crew, the type of vessel trade and the operator. Generally fatigue is not effectively considered. However, the need to manage fatigue applies equally to all vessels and all seafarers.

The International Maritime Organization is currently updating the guidelines on fatigue mitigation and management and this supports the adoption of a risk based approach to manage fatigue at sea. It encourages joint responsibility by operators and seafarers to manage the risk of fatigue as is embodied in workplace health and safety legislation in most countries.

Whether hours of work and rest are regulated or not, the need to implement supporting controls to manage the risk of fatigue at sea is vital <sup>[7]</sup>.

The International Safety Management Code (widely known as the ISM Code) states that the company should assess all identified risks to vessels, personnel and the environment and establish appropriate safeguards.

Similarly the National Standard for Commercial Vessels (NSCV Part E) outlines that the operation of a vessel must be conducted as safely to the extent that is reasonably practicable, including carrying out risk assessments to identify all risks including fatigue.

The management of fatigue should form part of a vessel's safety management system to ensure that hazards and any associated risks are identified, managed and mitigated, and risk control measures are continuously monitored.

In managing the risks of fatigue the following should be considered:

- ensuring adequate resources (including manning) are available to conduct all tasks safely and effectively;
- ensuring safe work scheduling which include working hours, adequate rest periods and the provision of adequate sleep opportunity. There are a number of practical tools that can be used for assessing safe work scheduling decisions with figure 6 providing some guidance;
- providing fatigue awareness and training to seafarers and other personnel whose decisions may impact the management of fatigue;
- napping strategies to use when exposed to restricted sleep (note that while naps are a powerful boost to alertness they do not eliminate the need for sleep);
- sleep disorders - fatigue may be a consequence of an underlying medical condition such as insomnia or sleep apnoea. In these situations, medical attention should be sought.

### Risk of fatigue increases when.....

Work hours per week	are more than 60 hours
Work hours per day	are more than 12 hours
Rest hours between work periods	are less than 7 hours
Night work per 7 days (between 2100-0900)	are 4 or more
Short breaks within work period (10 mins)	there are no breaks
Recovery days (per 7 days)	is less than 1 day

Figure 6: Risk times for fatigue

While the above measures are the most effective in reducing the risk of fatigue, it is not possible to entirely eliminate fatigue in a shipboard environment. Other measures can be adopted to identify and lessen the risks such as:

- monitoring and assessing sleep (e.g. through subjective or objective self-assessment);
- monitoring alertness while on duty (can be done during hand-over);
- taking short breaks when possible;
- task rotation to break up job monotony;
- exercising regularly and eating regular, well - balanced meals;
- periodically re-assessing hours of work and rest;
- planning, altering and/or designing the vessel's work and sleep areas to support alertness when working and sleep when resting;
- establishing an open communication between seafarers and management on fatigue related issues; and
- encouraging reporting of fatigue-related incidents.

## Take-away message

A dangerous aspect that is clearly present in many accidents is that the individuals involved did not recognise that their own performance was impaired.

It is a fact that fatigued individuals suffer poor judgement and make bad decisions

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