DOES WORK KEEP YOU AWAKE AT NIGHT?

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SUMMARY

In the maritime sector, the IMO has stated that “fatigue is now widely perceived as the cause of numerous marine casualties.” In the UK, there have been 60 reported groundings due to bridge watchkeepers’ incapacitation or absence in the 10 years between 1993 and 2003. The MAIB has stated that despite recommendations on manning and alarms “…both merchant and fishing vessels are still finding themselves aground, having overshot their waypoints because the sole bridge watchkeeper has fallen asleep.”

This paper will discuss fatigue and present some of the results from a major research programme designed to investigate seafarer fatigue. Common sense, as well as fatigue research, tells us that we need enough sleep to feel well rested and alert. Yet fatigue is a key issue challenging performance and safety in the maritime industry. The problem is best addressed using an approach that seeks to identify those areas where the problem is greatest and targets solutions accordingly, allowing us to achieve “alertness when required and sleep when desired”.

1. INTRODUCTION

Working unusual hours, or some form of shift work, have been necessary to meet a part of many business expectations around the world for a long time. In fact as far back as ancient Rome, traffic congestion was lessened by ensuring deliveries were restricted to the night time hours [1]. In today’s world, estimates vary, but approximately one quarter of the work force is involved in shift work [2, 3].

However, it has also been suggested that the many and varied schedules we work are not always the “best” ones both in terms of health of the workers and with respect to the impact upon business. A recent survey by the Wall Street Journal reported that poorly designed schedules in 24-hour businesses cost the United States $75 billion a year in lower productivity and accidents. Similarly a number of companies are exhorting that not all schedules are suitable and that there are ways to determine the better ones [4]:

“Don’t let a schedule you didn’t design determine how you run your business. Figure out your business needs; then design your schedule.”

This redesign of schedules can incorporate not only the needs of the business but also the physiological needs, and indeed even the preferences, of the shiftworkers. Our physical limitations should always be treated as an important consideration when considering patterns of work; however studies in many businesses, over many years have indicated a link between working around the clock and the build up of fatigue.

Fatigue is often described as a generic term encompassing a wide variety of experiences, predominantly impaired alertness, and can often be described by words such as “sleepy”, “tired”, “exhausted” or even “knackered”. For a more formal definition, the IMO have defined fatigue [5] as:

“A reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including: strength; speed; reaction time; coordination; decision making; or balance.”

In order to further explore the issue of working patterns and fatigue we should firstly examine two major phenomena that have been demonstrated to cause fatigue, which are sleep loss and circadian rhythm disruption.

2. SO WHY IS THERE A PROBLEM?

“How much sleep do you need?” is the question that involved years of research at many different locations in the 1970’s to answer. In the United States, after spending hundreds of thousands of dollars of government money the conclusion was that you need “enough sleep to be alert the next day” [4].

Sleep can be defined as a “periodic state of physiological rest when consciousness is suspended” [6]. It is a basic physiological need and the average adult exists on around 7½ hours of sleep per day [7]. This figure is not necessarily the standard amount we either need or desire and furthermore, since sleep loss results from the brain getting less sleep than is needed this has a cumulative effect leading to an increasing sleep debt over successive sleep opportunities. In simple terms this means that if an individual normally requires 8 hours of sleep to feel well rested and completely alert and only achieves 6 hours of sleep then a 2 hour sleep debt has been incurred. If this situation continues for four nights then an 8 hour sleep debt has been accumulated. This sleep debt can only be paid back by getting some good quality sleep periods of suitable duration, typically this is not paid back on an hour-for-hour basis but by ensuring a couple of good sleeps on successive nights.
However, another factor affecting the build up of fatigue is the quality of the sleep we get which is also dependent upon the time of day we are trying to sleep. Our natural sleep cycle is rhythmical due to the influence of the circadian (Latin, circa-diem: about a day) rhythms which are generated by a biological clock in the brain. The rhythms maintain a physiological and behavioural periodicity of around 24 hours to coincide with the solar day [8] and control sleeping/waking, cyclical changes in body temperature, hormone secretion etc. It should also be noted that the rhythm of our sleep/wake cycle has a periodicity of around 24 hours to coincide with the solar day [8] and control sleeping/waking, cyclical changes in body temperature, hormone secretion etc. It should also be noted that the rhythm of our sleep/wake cycle has two distinctive peaks (one in the morning and one in the early evening) and two troughs (nadir in the middle of the afternoon and in the small hours of the morning). Furthermore, we rely on time cues, called zeitgebers, to keep the biological circadian clock “set” to the time of day.

However, there is a problem if we are not getting sufficient sleep and studies of prolonged partial sleep deprivation show there is a cost to the individual, and often the organisation, in terms of mood, well being, and also in the ability to perform, particularly in tasks that are inherently boring and monotonous (e.g. watchkeeping, driving) [9].

In fact, over the past 20 years there have been a large number of studies [10] that have looked at the effects of sleep debt upon mental performance where a clear pattern of results have shown:

- Slowing of mental processes and reaction time;
- Reduced vigilance and ability to fix attention on a task;
- Memory;
- Logical reasoning;
- Slower to recover from stress; and
- More vulnerable to infections and other illnesses.

Now we have “scratched the surface” about the problems, let us address the issues in the marine sector.

3. FATIGUE IN THE MARINE SECTOR

In the United Kingdom (UK), Marine Accident Investigation Branch (MAIB) investigations [11] have identified a link between small dry cargo ships operating in the short sea trade, manned by just 2 deck officers, and the number of groundings caused by fatigue. The MAIB suggest that the many factors which contribute to the link probably include:

- Voyage cycle time;
- Disrupted watch patterns;
- Working hours;
- Ship’s type and size;
- Sleep problems;
- Stress and work pressures;
- On board relationships; and
- Type of cargo carried.

Looking at the MAIB data [11] on bridge watchkeeping, the number of incidents occurring by time shows a spike between 04:00 and 05:00, particularly for grounding. In the study, fatigue was considered to be a factor in 82% of the groundings which occurred between 00:00 and 06:00. The study identified that alertness and performance tend to be at their lowest during the early hours of morning which reflects the normal circadian pattern of performance previously discussed.

This is not the first time the MAIB has highlighted the issue and in the 2002 MAIB Annual Report [12] it was stated that:

“Fatigue, and the effect this has on being able to keep a proper watch was a recurrent theme for another year. Recommendations are still being made on the installation and proper use of bridge watch alarms, but both merchant and fishing vessels are still finding themselves aground, having overshot their waypoints because the sole bridge watchkeeper has fallen asleep.”

This is despite the fact that being alone on the bridge between 00:00 and 06:00 hours is contrary to many of the guidance documents and standards promulgated throughout the industry [13, 14]. The matter has also been incorporated into the Maritime & Coastguard Agency’s (MCA) Marine Guidance Note (MGN) 84(F) [14] which deals with keeping a safe navigational watch:

“Both the skipper and watchkeepers should take full account of the quality and quantity of rest taken when determining fitness for duty. Particular dangers exist when the watchkeeper is alone. It is all too easy to fall asleep especially when sitting down in an enclosed wheelhouse. Watchkeepers should ensure they remain alert by moving around frequently, and ensuring good ventilation.”

Similarly the Protection and Indemnity (P&I) clubs are aware of the importance of this matter and the UK P&I Club’s most recent Major Claim Analysis [15] stated that 59% of major claims (>US$100,000) were caused by human error. Further they estimated that since 1987 the cost of fatigue related accidents has been US$1.5 billion with a steady US$1.5m per day to the industry as a whole.

In a separate review [16] of the UK P&I Club’s data and based on 123 collision claims between 1987 and 1991 the likelihood is greatest during the early morning hours with the peak between 06:00 and 07:00. This early morning peak of marine related incidents has also been borne out by other research [17].

In 2005, an Australian Maritime Safety review of the work practices of Marine Pilots [18] states that “the incidence of fatigue as a causal or contributing factor to past accidents has more than likely been under-reported.” The report suggests that around 30% of shipping casualties occurring in Australian waters are fatigue-related.
In a UK study [19] looking at fatigue at sea and assessing it against legislation and management guidelines it was recently stated that nearly a third of respondents’ working hours violate the requirements regarding hours of rest set out in the Working Time Directive. In conclusion the research states that excessive working hours and inadequate periods of rest are still problematic onboard a range of vessels. This conclusion is also supported by the MAIB [20] who found that:

“...fatigue, brought on by minimal manning and arduous watchkeeping and operational routines, is endemic at sea, especially in the short sea trade.”

4. SO WHAT ARE THE SOLUTIONS?

Fatigue levels are not solely due to minimum manning levels and working hours but are also influenced by other factors. In normal 24/7 industrial shift-work it is possible to educate the shift-worker and to provide advice about personal fatigue management strategies including environmental considerations. These would cover such things as eating strategies, sleeping environments, lighting, air conditioning, provision of a suitable sleeping area etc.

However, on board a ship the seafarer is “a captive of the work environment” [5] and there is often little opportunity for the seafarer to control how noisy their cabin is, whether the bed is comfortable or how much light enters their sleeping environment. Instead a focus on the operational aspects is required to effectively tackle fatigue which may consider watch patterns, or tasks undertaken when on certain watches or even off-watch. Furthermore, the possibility for cultural change may be required to allow the seafarer to begin to manage their fatigue. Some of these factors can be influenced by training and environmental considerations. Training is often seen as an important step in order to achieve awareness and possible change of a safety culture.

With fatigue having been identified as a contributing factor for accidents in the commercial maritime industry, a number of bodies have introduced guidelines or training about the fatigue issue [5, 21]. It should be borne in mind that some of the shore-based training programmes have useful elements but that the additional aspects of seafaring, such as ship motion, require additional considerations. The US Coast Guard has developed a training course [21], Crew Endurance Management System, which aims to improve the endurance of crewmembers to cope with operational risk factors such as:

- Erratic work schedules;
- Extreme temperatures;
- Frequent separation from loved ones; and
- Heavy workloads.

The focus, at the moment is on voluntary guidance rather than mandatory requirements. Rumours circulate that something more robust may be required for vessels entering certain territorial waters at some unspecified date yet there is no requirement for any form of crew fatigue management programme. However, before we implement such a programme, the fundamental question exists as to what levels of fatigue are present across the different shipping sectors. Is it the same in short-sea and fishing for example?

5. CONTINUING RESEARCH

The good news is that a research project funded by the Health & Safety Executive (HSE) and the MCA has been running from the University of Cardiff for the past three years. The aim of the seafarers’ fatigue research project is to investigate the issue of seafarers’ fatigue across the broadest range of commercial ship types possible [22]. The project has been broken into three phases:

- Phase 1- offshore oil industry;
- Phase 2- short sea and coastal trade; and
- Phase 3- deep sea and bulk sector.

The initial phases have shown that fatigue levels are greater in the coastal sea-sector, than for those involved with support shipping for the offshore oil industry. Primarily this is due to a combination of factors including working hours, sleep problems, tour length, shift schedule, job demands, stress at work and standing watch. The third phase of the project is currently underway looking at short-haul bunkers, containerships, reefer, tankers and cruise ships. Early results seem to indicate that the type of ship may not be the crucial determinant but rather the many factors that characterise the ship on a practical level (e.g. particular work / leave schedules).

6. CONCLUSION

Common sense, as well as fatigue research, tells us that we need enough sleep to feel well rested and alert. Yet fatigue is a key issue challenging performance and safety in the maritime industry. If we consider the commonly used phrase I often hear about people “being our most important asset” then perhaps it is true that “if people are our most valuable asset, alert employees are even more valuable.” [4].

The problem is best addressed using an approach that seeks to identify those areas where the problem is greatest and targets solutions accordingly, allowing us to achieve “alertness when required and sleep when desired”.

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8. REFERENCES


9. AUTHORS BIOGRAPHY

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