

AMSA Ref: 21837

Your Ref: MF2.2

Ms Meg Crooks
Committee Secretary
House of Representatives Standing Committee
on Communications, Transport and the Arts
Parliament House
Canberra ACT 2600

Dear Ms Crooks

Thank you for your letter of 5 May 1999 inviting us to make a submission to the inquiry into managing fatigue in transport. Clive Davidson is currently overseas and has asked me to respond on his behalf.

Please find attached our submission which has also be forwarded by email.

Please contact me or David Harrod (6279 5656) if you require any further information.

Yours sincerely

A handwritten signature in black ink, appearing to read 'P. Quirk', with a stylized flourish at the end.

Patrick Quirk
General Manager
Ship & Personnel Safety Services

17 June 1999

Fatigue and the Mariner

Introduction

This paper describes strategies addressing the issue of fatigue in maritime transport, both within Australia and internationally. It covers that aspect of the shipping industry that falls within the jurisdiction of the Australian Maritime Safety Authority (AMSA) and considers only those safety / operational factors that might be directly influenced by AMSA actions. It does not attempt to discuss the technical nature of fatigue, or the associated physiology.

Background

Historically, seafarers have always been subjected to fatigue. The nature of the job at sea is different to other jobs because the mariner is a captive of the environment, it is not possible after work to go home and rest and re-charge for the next day's duties.

In the days of sailing ships, crews worked a four hour on, four hour off routine at sea, frequently interrupted by the need for all hands to turn out to deal with problems brought about by changing weather. Ships were small, cramped, wet and subject to violent motions. The crews were small in number, and poorly fed and provided for, and voyages lasted up to two years.

The advent of mechanical propulsion changed things only marginally, crews became larger and because it was possible to provide refrigeration, nutrition improved, but voyages were still long, the work was hard and isolated and there was no means of escaping from the environment during the voyage.

Modern Australian ships are fast, well found, and provide high quality living standards. Voyages are generally short in duration and modern communications means that mariners are easily able to contact family and friends ashore. Most Australian ships make extensive use of technology, reducing the need for extensive amounts of physical labour.

However, the nature of shipping has also changed substantially, and with it so have the physical and mental pressures on ship's crews. Modern shipping is much more closely integrated into the industrial supply chain than ever before. The advent of just-in-time inventory management and the need to ensure the rapid, reliable delivery of goods and raw materials has resulted in the development of highly specialised ships, many of which are purpose-built for the trade. Trading patterns have changed as well, and as the capital cost of a ship rises, so does the need to ensure that the ship operates to keep costs to a minimum. For the shipowner, the most expensive period of the voyage is that spent in port loading or discharging, the least expensive is at sea.

Ship design and cargo handling systems and port infrastructure have evolved to the point where the majority of ships now spend less than 24 hours in port at any one time¹. Many ships now spend in excess of 90% of their operational

life at sea or in pilotage. Ships are also bigger and the volume and value of cargo handled is much greater than ever before.

There are also many more ships now, so that traffic density and complexity has increased, increasing the workload on watchkeepers during the coastal and deep-sea phases of the voyage. Modern navigation systems have also increased the operating envelope for ships, allowing them to operate in conditions of weather, tide and traffic that previously were not possible. Modern machinery is also complex, expensive and high performance, requiring high professional skills to operate and maintain.

The nature of materials transported has changed as well as their mode of transportation, the carriage of goods in open stow has been replaced by containerisation, providing better protection for the cargo and speeding up handling times. The IMO lists over 600 chemicals regularly carried in bulk by sea². In addition to unprocessed raw materials such as grain and ores, ships now carry liquefied gases, wine, orange juice, livestock, chilled and frozen foodstuffs, fruit and vegetables as well as manufactured goods. Many of these cargoes require meticulous preparation for carriage, a high degree of care during the voyage and sophisticated handling equipment for loading and discharging.

Ships systems are computerised and automated to a high degree, but the nature of the marine environment is such that these systems must be carefully monitored and maintained on a 24-hr basis. Thus, to a great extent, the nature of seafaring tasks has changed from one of physically operating machinery and systems to one of monitoring and analysing outputs from the computers that run the ships systems. However given the nature of their operations ocean going vessels will always require the capability of performing normal and breakdown maintenance. Manning levels, and more importantly work practices and crewing arrangements, need to address that requirement if fatigue and safety problems are to appropriately managed.

Nature of the environment

Today's mariner works in an environment that can be loosely described as coastal, offshore or blue-water, each with its own individual characteristics as well as similarities.

Coastal shipping is usually short-haul, fast turn-around shipping that operates constantly in and out of port, trades such as passenger ferries, feeder container ships, oil products, gas and chemical tankers and small bulk carriers form the bulk of this sector. The coastal trade forms the majority of Australia's fleet. Most of the work is done by the crew, including pilotage and berthing and cargo lashing and many of the ships operate to fixed schedules.

Offshore shipping comprises vessels engaged principally in support and exploration programs for the offshore oil industry and similar activities. The work is heavy, difficult, dangerous at times and demanding. The ships are small, with few crew members and the hours are often long.

Blue-water shipping is the long haul side of the maritime industry; some ships spend over 90% of their time at sea and may be at sea for many weeks between ports. Bulk ore carriers, crude oil tankers, car carriers, and main line container ships form most of the trade. The crews are small in number.

Time spent in port and at sea by liquid bulk carriers in 1998

	Mean time in port (Hh/mm)	Mean time at sea from previous port	Mean time at sea to next port	Mean % time in port
All ships	17.07	93	54	11.66
Coastal	16.11	37	40	20.92
Blue water	51.10	382	131	9.96

Source: Kahveci, E; We saw the sea, SIRC 1999)

There are other industry sectors, the most notable of which is the passenger cruise industry.

Work onboard modern ships usually falls into three patterns; watchkeeping, day work with call-outs and day work.

Watchkeeping usually involves some form of split shift; traditionally 4 hours on and 8 hours off, but in the offshore and coastal sectors this might be changed to a 4 on/4 off or 6 on/6 off rotation. In some coastal sectors, watches are never broken, the roster continues irrespective of whether the ship is at sea or in port. The watches are fixed, and the same officers do the same watches on all ships: Chief officer does the 4-8-watch morning and evening, the 3rd officer is on duty from 8-12 daily while the 2nd officer has the 12-4 shift. It is worth noting that each officer normally has other duties that occupy time outside of the watch hours.

The ship's master and engineers usually work day work with the master and the chief engineer on constant call, other engineers are rostered on call for a 24-hr period in addition to their normal day duties.

The balance of the crew is generally on day work, but some are rostered for night lookout duties to accompany the permanent watchkeepers.

The workload aboard is subject to substantial fluctuations and ranges from a stable, routine environment on a long passage to extreme peaks in coastal phase when the ship is constantly in and out of port and working cargo round the clock. All crewmembers work hours outside of the norm, ships operate on a 24-hr basis and are subject to delays and disruptions due to weather, tides, traffic, cargo readiness or the availability of a berth or pilot.

The crew lives aboard the ship and is thus captive to it and to each other, with little or no opportunity in the course of a voyage to seek a break ashore. Studies conducted in the UK at the University of Loughborough on seafarers in passenger ferries show a distinct pattern of sleep disturbance caused by

noise and vibration from the ship's operations³. The problem is exacerbated by bad weather; with the ship moving violently at times, proper rest, sleep or meal breaks are often impossible.

In this environment, recognition and effective management of fatigue are critically important, the potential for substantial damage to sensitive marine environments and risk to life and property is great.

Fatigue management is not a large part of the structure of safety or competency courses in Australia and work needs to be done to bring the issue within the framework of contemporary OH&S awareness systems.

It needs to be said that management of fatigue is not a task that can be delegated and forgotten, as a safety issue, it requires active participation both onboard and ashore. Companies must develop dynamic fatigue management programs and provide the necessary resources and encouragement to make them work.

There is a concern with overseas shipping that masters who engage in contemporary fatigue management practices (changing watch rosters, time ashore, enforcing hours of rest) may not be well supported by their managements. AMSA, through its ship inspection programs, works to ensure that the crews of ships visiting Australian ports comply with internationally required rest periods.

The nature of fatigue

It is not the purpose of this paper to conduct a discourse on the nature of fatigue. The International Maritime Organisation (IMO), in a Circular on fatigue⁴, has provided a definition suitable for use in developing management strategies.

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; co-ordination; decision making; or balance.

A common thread in all definitions is the degradation of human performance. This aspect has been recognised at IMO and forms the basis for work within that organisation to address the problem.

International situation

Much work is being done internationally to address fatigue problems within shipping. The IMO has established a major working group under the joint auspices of the Maritime Safety Committee (MSC) and the Marine Environmental Protection Committee (MEPC) to develop a plan and Australia has taken a leading role in the work. The main thrust of the work is to develop a set of guidance notes for the use of all sectors of the industry. The notes are being designed to provide a comprehensive and integrated approach to the

problem. They will include consideration of design, ergonomic and habitability issues as well as job task analyses, manning scales and compliance with the requirements of the various international conventions.

The terms of reference for the work are:

- .1 Considering the definition of fatigue in MSC/Circ.813/MEPC/Circ.330, List of Human Element Common Terms, assess the need for expanding or further clarifying this definition;***
- .2 Review concepts contained in annex 1 of MSC 70/13 and consider how they might be applied in addressing issues of crew fatigue;***
- .3 Taking into account on-going efforts to address fatigue, consider the need for additional practical guidance to address factors identified in Resolution A.772 (18); and***
- .4 Recognising that research in the field of crew fatigue is on-going, consider how the most valuable and practical results can be consolidated as international guidance and communicated to shipboard personnel***

Additionally the IMO has been very active in publishing other material and has an extensive list of documents providing guidance to shipowners and administrations. The list is at Attachment 1. The current work within the IMO should be completed by 2002.

Fatigue is addressed in the International Conventions; the IMO Convention on the Standards of Training and Certification of Watchkeepers (STCW) has a section dealing with fatigue whereby it stipulates the hours of rest a seafarer must have.⁵ Essentially, the Convention requires that watch systems be arranged so as watchkeeping is not impaired by fatigue and that each watchkeeper has a minimum of 10 hours of rest in any 24 hour period. This rest period may be split, with at least one period of at least 6 hours. The Convention recognises that, from time to time, circumstances may dictate longer work hours and makes provision for the management of this.

The International Labour Office (ILO)⁶ has taken a somewhat different approach, primarily preferring to stipulate hours of work in the convention on seafarer's hours of work, although there is an alternative that reflects the STCW convention arrangement. Australia has not ratified Convention 180. Given that Australia has adopted the STCW Convention and that the normal hours of work are agreed through workplace and industrial agreements, there is little apparent need domestically to ratify this convention.

The Seafarer's International Research Centre (SIRC) at the University of Wales in Cardiff, UK, is currently developing a proposal for a wide-ranging study into the impacts of fatigue on the performance of the mariner. AMSA officers have a long-standing professional involvement with SIRC and are providing technical advice and assistance where applicable. The SIRC study is scheduled to run for three years and is estimated to cost about £500,000.

SIRC has also developed and recently released a training package on fatigue management aimed at masters and owners.

Australian situation

In 1994, AMSA recognised the need to develop an understanding of the presence and extent of fatigue amongst Australian mariners. By early 1994, the Australian maritime industry had experienced ten years of major change. In that time, crew sizes had been reduced from about 36 to about 18 and the industry had completed a program which saw seafarers in the system undertake a number of retraining modules in a nine week intensive course at the Australian Maritime College. Considerable emphasis in the retraining was given to OH&S matters as well as vocational skills enhancement and refresher training.

The nature of the social, cultural and professional environment aboard the ship must also be considered when arriving at appropriate manning levels. On Australian vessels it might be possible to reduce manning levels further without adverse impacts on fatigue and overall workloads. However for this further reduction to be successful would require substantial cultural and technical change to be implemented which focussed on the operation of the ship as a single transport system. The success of any further crew reduction would also be a function of the recognition by all involved, owners, masters and crews that each has a role to play in dealing with fatigue and other workplace issues.

It must also be recognised however, that the current round of manning reductions has created the potential on some ships in some trades, for groups to work excessive hours. This is similar to an earlier situation involving coastal tankers where the work generated was such that an additional deck officer was added to the ship's complement. This situation must be carefully managed.

Also in 1994, discussions between industry and AMSA took place with a view to refining the Australian Seafarer's Code of Conduct and introducing an Australia wide Drug and Alcohol policy for mariners.

Earlier, in the spring of 1993, the Australian Parliament passed a landmark piece of legislation for Australian seafarers, the Occupational Health and Safety (Maritime Industry) Act. This Robens style Act had the effect of creating for Australian seafarers, the same regulatory environment for OH&S as that enjoyed by the land based workforce. Hitherto, personnel safety matters were dealt with under the Australian Navigation Act 1912, an approach inconsistent with OH&S management in other Australian industry.

It was recognised that these structural changes would have a significant impact on the health and well being of the seafarers involved and that the

issues would need to be carefully managed. Although there was anecdotal material, there was no reliable, industry wide data, available on the existence of fatigue and stress related problems. Equally there were only rudimentary data available within Australia on the general health of seafarers or the suitability of existing levels of fitness for the tasks required during a voyage.

In the light of this AMSA, in consultation with industry, determined that it was necessary to establish some base line information on the health and fitness of the seafaring population to provide a sound basis for future effective OH&S management. It was decided to establish a study that would effectively do three things:

- Look at the linkage between stress, fatigue and health of crews on vessels with the new manning levels;
- Draw on existing research worldwide to make recommendations to manage fatigue, stress and health related safety problems and;
- Provide objective benchmarks to address fatigue, stress and health issues and measure the effectiveness of interventions.

The study was conducted for AMSA by a team of researchers from the Queensland University of Technology and was published in 1997 as the FASTOH report⁷. A copy of the report accompanies this submission.

The report surveyed the whole industry and broke new ground in that it was the first study into matters of occupational health in seafarers to be conducted on an industry wide basis anywhere in the world. Subsequently, the same research team has conducted a similar but more tightly focused study into fatigue in Coastal Pilots. This study has been published in electronic form and is available from AMSA's Internet site⁸.

In early 1998, AMSA sponsored and took an active role in an international conference on fatigue in transportation⁹. AMSA conducted a workshop on maritime fatigue at that conference and has continued an active follow-up program. It is intended to conduct another maritime workshop at the next conference in Fremantle in March 2000 and AMSA will be fully involved.

FASTOH

The FASTOH report determined that the industry was stable (over 50% in industry for more than 20 years), ageing (median age 44, higher than the international mark of 38.7), 98% male, well-educated (60% with some form of 80,000).

The study also found that Australian seafarers smoke and drank more, ate more sugar and fat and exercised less than the Australian population at large. The seafarers also reported poor quality of sleep at sea and 80% reported occasional to frequent stress on the job, but an overall high degree of job satisfaction.

The FASTOH study made two sets of recommendations. The primary recommendations seek to address occupational stress at sea and involve examination of issues such as work scheduling, the home/work interface and habitability. The secondary recommendations are aimed at producing lifestyle changes with a view to increasing awareness of the benefits to overall health of better nutrition, exercise and reduced alcohol and nicotine consumption.

The report was accepted by AMSA and tabled in the IMO where it was well received. The IMO working group on fatigue has recommended that the FASTOH report be given high profile consideration in future consideration of fatigue by IMO¹⁰.

Within Australia, work to fully adopt the FASTOH recommendations has been slow, due mainly to the need to implement another round of industry structural changes. In June 1998, the Government abolished the Seafarer's Engagement System and introduced company employment. Companies were understandably reluctant to divert major resources into the FASTOH issues until they had bedded down their new employment arrangements.

Since the release of the FASTOH report, access to the Seafarer's Assistance Service (a free, confidential, professional counselling service for mariners and their families) has increased, with a large majority of self-initiated referrals. Pleasingly, in the 1998 reporting period, alcohol and drug problems reached an all-time low¹¹.

With each ship involved in a different trading pattern, it is difficult for industry to quantify sleep and stress matters, but programs are underway to address the problems. AMSA has given effect to the hours of rest provisions of the STCW convention and is closely observing industry practices, principally through its program of OH&S audits. Some companies are examining the use of voyage plans to determine and monitor times of duty and rest. It must be said however that, in the Australian context with a growing awareness of OH&S and general safety issues, hours of work and rest are not as significant a safety problem as for other flag states.

Companies are also examining their policies on nutrition and exercise and several have commenced lifestyle awareness programs for staff. Overall fitness is an important tool in the fight against fatigue and it is important to encourage seafarers to keep fit.

Habitability issues are more complex and need to be examined globally with a view to producing changes to the conventions governing ship construction and fitout. In this regard, the work of the IMO working group on fatigue is important, as it is to consider these matters in the course of the development of the IMO fatigue management guidelines.

ISM Code and Port State Control

It must also be recognised that the advent of the International Safety Management (ISM) Code for ships provides, through its requirement for a

documented and auditable safety management system, a framework for effective fatigue management. AMSA is currently developing an audit program for ISM Code compliance for Australian ships and an element of this will examine fatigue management.

In its Port State role, AMSA works within the framework of the STCW convention and the ISM Code where applicable (ISM will not apply to all ships until 2002, at present it applies to tankers, bulk carriers, passenger ships and high-speed craft). In consultation with other Port States, AMSA is examining ways for Port State Control inspectors to determine compliance with the hours of rest provisions of STCW.

Coastal Pilots

The second Australian study into fatigue involved the Coastal Pilots. While they were considered in the FASTOH study, the small numbers and the sensitivity of the areas in which they work warranted a study in its own right.

AMSA has accepted the results of the study and has moved to make interventions in the operations of coastal pilots. In addition to a comprehensive monitoring program of pilot workloads, AMSA has recently introduced new requirements for rest periods for pilots that directly address fatigue management. The major measure recognises that sleep quality is affected by the time of day in which it is taken and requires that a proportion of the rest period be spent in hours of darkness.

To provide a basis for further interventions, AMSA commissioned a risk analysis of coastal pilot operations and is currently studying the results.

AMSA is in regular consultation with the pilotage management groups and fatigue is an item for continuous discussion and review.

Conclusion

AMSA has an acute awareness of fatigue in maritime transport and has introduced some major programs to manage the issue; it has conducted leading edge research into the problem (the FASTOH and Coast Pilot's studies). It is an active participant in the development of fatigue management criteria internationally (the IMO working group and the SIRC research) and actively fosters research and discussion.

AMSA will continue to refine and develop its approach to fatigue management commensurate with its overall safety management charter. However, it recognises that proper management of the issue is the responsibility of all in the industry. The AMSA approach is towards raising awareness and encouraging owners, operators and crews to manage the risk through the development of fatigue management programs, recognition and education campaigns and proper attention to crew levels, workloads and lifestyle matters.

Attachment 1

The following IMO instruments have some applicability to crew fatigue:

Conventions and codes

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended

1995 Seafarers' Training, Certification and Watchkeeping (STCW) Code

SOLAS, Chapter V (Regulation V/13)

International Code of Safety for High Speed Craft (HSC Code)

Assembly resolutions

A.481(XII) Principles of Safe Manning

A.680(17) IMO Guidelines on Management for the Safe Operation of Ships and for Pollution Prevention

A.772(18) Fatigue Factors in Manning and Safety

A.792(19) Safety Culture In and Around Passenger Ships

A.849(20) Code for the Investigation of Marine Casualties and Incidents

A.850(20) Human Element Vision, Principles and Goals for the Organization

MSC circulars

MSC/Circ.493 Recommendation Related to the Fatigue Factor in Manning and Safety

MSC/Circ.565 Fatigue as a Contributory Factor in Maritime Accidents

MSC/Circ.621 Guidelines for the Investigation of Accidents where Fatigue may be a Contributing Factor

MSC/Circ.675 Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas

MSC/Circ.747 Ship/Port Interface

**MSC/Circ.813/
MEPC/Circ.330** List of Human Element Common Terms

MSC/Circ.827 Reports on Marine Casualties and Incidents

References

- ¹ Kahveci, E (1999) (in press):
We saw the sea: quality of life in fast turnaround ships.
SIRC, University of Wales, Cardiff
- ² IMO International Bulk Chemicals Code (IBC Code)
- ³ Reyner, LA and SD Baulk: (1977) Fatigue in Ferry Crews – A Pilot Study.
SIRC University of Wales, Cardiff
- ⁴ MSC/Circ.813/MEPC/Circ.330, List of Human Element Common Terms
- ⁵ STCW 95 Regulation VIII/1; Chapter VIII, Section A-VIII/1 *Fitness for duty*.
- ⁶ ILO (1996) Convention 180 – Seafarer’s hours of work and the manning of ships convention.
- ⁷ QUT (1997): FASTOH: A Survey of the Health, Stress and Fatigue of Australian Seafarers.
- ⁸ <http://www.amsa.gov.au>
- ⁹ Murdoch University: Fatigue and the 24hr Society, 3rd International Conference. Fremantle WA, March 1998
- ¹⁰ IMO (1999) Report of the Joint MSC/MEPC correspondence group on fatigue to MSC71.
- ¹¹ Seafarer’s Assistance Service, Report for 1998 (Confidential).