

Fatigue Management During Operations:

A Commander's
Guide



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Wendy Sharpe, *Night on HMAS Jerivs Bay*, 2000
Australian War Memorial 91126

Everybody has remarked that increasing fatigue means in general diminished quality and quantity of work. It is also widely recognised that a fatigued group is, as a rule, one in which discontent prevails, and there is apt to be lowered morale. In war there is perhaps no general condition which is more liable to produce a large crop of nervous and mental disorders than a state of prolonged and great fatigue. For these and other reasons the study of fatigue - how it is caused, what are its results and how it may be counteracted - is a matter of very great importance to every military officer.

F.C. Bartlett,
Psychology and the Soldier, 1927



Australian Defence Force Psychology Organisation
and the
Defence Science and Technology Organisation
in association with the
Defence Safety Management Agency

Fatigue Management During Operations: A Commander's Guide
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Overview

Soldiers on operations will usually tell you that the hardest part of soldiering is the continual work over extended periods. Fatigue is the product of intense and prolonged emotional strain, poor and inadequate diet, strenuous physical exertion, unfavourable environmental conditions and sleep loss.

*"How yer goin', mate?"
"Bugged. You?"
"Bugged."
That was the word for all of us.*

Henry 'Blue' Steward
RMO 2/16th Inf Bn, Kokoda Track, Aug-Sep 1942,
Recollections of a Regimental Medical Officer

Unintentionally falling asleep while on operations can have serious consequences - hence the severe sanctions for falling asleep on piquet. Yet the problem persists. Commanders must adopt techniques to manage fatigued soldiers other than threat of punishment. They must also recognise several other costs associated with chronic fatigue, including substandard performance, poor decisions and 'friendly fire' incidents. These costs can be reduced if proper attention is paid to sleep needs and the prevention and management of fatigue. A thorough knowledge of both sleep and the effects of fatigue are essential aspects of fatigue management.

*Exhausted sentries will fall asleep, no matter what.
Commanders need to be frequently aroused to check and
prevent this. But what if the arouser has fallen asleep?
Savage punishment is no remedy. It's a complex problem.
There has to be some sleep.*

Lewis Keeble, MC
Canadian Company Commander during the Normandy Campaign

The effects of fatigue are often insidious. Personnel do not realise, or will not openly acknowledge, that their performance and the performance of those around them is deteriorating. Fatigue from cumulative strain and sleep deprivation leads to, among many outcomes, lowered judgement and initiative, diminished situation awareness and loss of emotional control. Such effects are associated with preventable non-combat casualties, irrational decision-making, fratricide and operational failure. Fatigue can also be a major contributing factor to debilitating combat stress reactions.

Fatigue does not only impact on soldiers. In fact, due to the mental nature of their primary tasks, officers and Senior Non-commissioned Officers (NCOs) are more prone to fatigue and the potential consequences are more serious. Some historians consider the major blunders of General John Monash's military career (for example, 4th Brigade's advance on Hill 917 at Gallipoli in August 1915 and 2nd Division's costly and pointless capture of Montbrehain in October 1918) occurred during, or shortly after, periods of prolonged sleep loss.



His (Monash's) inaction on 8 August might plausibly be explained by his tiredness after the night march (Sari Bar, Gallipoli, 1915) ... His uncharacteristically feeble coordination of an abortive sally towards Sailly-Laurette on 28 March (1918) suggests that he had been exhausted by the effort (during the preceding deployment) ... Tiredness seemed the most plausible explanation of Monash's erratic handling of the battle (capture of Montbrehain, Oct 1918).

P. A. Pederson
General Sir John Monash
in D. M. Horner's *The Commanders*, 1984

The most important steps to take in fatigue management are to prepare an activity/rest/sleep plan to meet the needs of your personnel and to use appropriate techniques and performance aids to detect and compensate for fatigue and sleep loss effects. A prime objective should be to ensure that soldiers are adequately rested before duty and sufficiently free from fatigue so they can operate to satisfactory levels of efficiency. The main effects of sleep deprivation are psychological rather than physical. Commanders must promote awareness and understanding of the effects of sleep loss and fatigue on operational performance.

Continuous high-tempo operations cause great demands on sustainment systems, and severely test the endurance of land forces. Sleep deprivation causes physical and psychological stress, reducing the endurance and resilience of soldiers and their commanders. The requirement to conduct protracted, continuous operations requires the refinement of organisational processes and procedures that enable commanders and their staffs to maintain the tempo of operations while sustaining battle proficiency and high morale.

The Fundamentals of Land Warfare, 1998

This guide concentrates on sleep loss because it is generally the most critical yet often the most misunderstood factor of the fatigue equation. The guide has a historical flavour, predominantly Australian, with quotes and illustrations to demonstrate the relevance of the text to operations, those being predominantly land operations.

Foreword

I am interested in your question whether there is time to consider the 'psychology of our environment.' It is because we do not consider psychology enough that we are taking so long to win the war. Personally, I have always found it pays well to consider closely the psychology not only of the enemy but also of my own troops to study the factors which affect his actions and reactions and how to employ those factors to our advantage, and also to study the methods of keeping up the morale and the fighting spirit of our own soldiers. Indeed, it is psychology all along the line.



Lieutenant General Sir John Monash
letter to Dr Felix Meyer
from the Western Front, April 1918

Australian military commanders have always recognised the importance of psychology to operational effectiveness. The human dimension is, and will continue to be, critical to performance in military operations. At times we are in danger of forgetting this.

In order to be effective, commanders must understand the complexity and diversity of human nature and behaviour. They must be able to anticipate the impact of various events on the morale, cohesion and performance of the personnel under their command and upon opposing forces. They must be familiar with appropriate strategies for dealing with non-military personnel who are increasingly common in field operations. They should be able to accurately gauge levels of confidence and commitment within their unit and understand how humans react to adversity and threat. In short, commanders are applied psychologists.

This document is one in a series focused on psychological aspects of military operations. The series is coordinated by personnel from the Defence Force Psychology Organisation but draws together the expertise and experience of military members throughout the Australian Defence Force, past and present. The results are thought provoking and pragmatic.

I commend the series to you.

During the Yom Kippur war, an Israeli Lieutenant was ordered to hold a critical position with three tanks. In a short time, two of the tanks were destroyed, but he continued to fight using his lone tank, destroying eight Syrian tanks in the next six hours. By this time, he had to replace his driver, who had become a virtual robot, unable to comprehend orders. After another eight hours, the Lieutenant had destroyed another ten tanks and had replaced another driver who had been overcome by the moral effect of combat. After a total of twenty-four hours, and the destruction of twenty-four tanks, he saluted his Brigade Commander and said: "I can do no more." Then he fainted. He was an incredibly brave man who was all used up.

General Richard Cavazos
Leadership on the Future Battlefield
Symposium Keynote Address, May 1983

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Glossary

circadian trough. A period, typically between 0200 and 0600 hours, where body temperature is at its lowest level and mental performance, especially alertness, is at its poorest.

circadian lull. A lesser circadian trough that typically occurs between 1300 and 1600 hours.

continuous operations. Recurring, round-the-clock schedules that last for extended periods. Continuous Operations typically involve intense work levels and use shifts and rotations.

fatigue. A state of weariness caused by physical and/or mental exertion.

fatigue management. A set of guidelines and procedures that attempt to prevent and deal with the deteriorating performance, poor moods and lowered willingness to work that are characteristic of chronic fatigue associated with sleep loss.

insomnia. A sleep disorder characterised by difficulty falling asleep, difficulty remaining asleep and/or waking earlier than intended.

jet lag. The 'mismatch' between local time and physiological cycles, and between physiological cycles themselves, associated with travel to other time zones.

micro-sleeps. Short lapses of sleep that may last a matter of a few seconds to which the sleep deprived are prone.

nap. A sleep of duration less than three hours.

nightmares. Dreams that cause awakening in a state of fright or upset.

shift lag. The time-lag in physiological readjustments, such as sleep onset, waking and energy resources, which can lead to sleep loss and fatigue usually caused by frequent rotation of work schedules.



sleep. An unconscious state regularly and naturally assumed, which is characterised by an almost complete absence of movement and reduced sensory awareness, and during which both mental and physical recuperation take place.

sleep debt. The cumulative loss of sleep over time sometimes expressed as the amount of sleep required to restore performance levels.

sleep inertia. The tendency for people to remain drowsy and be confused and disoriented upon waking from sleep. The effect can last from a few minutes to more than an hour depending on degree of sleep loss and from which sleep stage woken.

sustained operations. Often unplanned, nonstop performance of tasks for unpredictable periods (generally more than 24 hours) until mission completion or until the unit becomes militarily ineffective due to exhaustion.

Introduction

The 38th Battalion (10th Bde) had been fighting or moving continuously, night and day, since August 26th. Its staff, having worked for 71 ½ hours without sleep, had at last settled at Curlu. The intelligence officer and adjutant, lying down to sleep, while the doctor and the scout officer (who was killed a few hours later) proposed 'a swim and a good feed' first. At this moment there had arrived the brigadier, General McNicoll, whom they assumed to be also coming for a long deferred 'nap'. "Get your battalion ready to move in twenty minutes as advanced guard for the brigade," he said. "Cléry is burning, and if possible, your headquarters are to be there tonight".

... some ten German machine-guns, mostly on the hill above Cléry, were pinning the 38th Battalion in the old trenches on the slope west of the village. The company commanders had been trying to probe forward through the old saps but their troops had now been going for 84 hours without rest: they were at the end of their powers and, despite dense shelling of the riverside, they dropped and slept whenever they stopped.

C. E. W. Bean
The A.I.F. in France

Feeling tired has always been a common experience for the fighting soldier. Modern warfare, increasingly characterised by Continuous and Sustained Operations (SusOps), further increases the pressure on commanders to ignore their own sleep needs and those of subordinates. Continuous Operations (ConOps) are recurring, round-the-clock schedules, that last for extended periods. They typically involve consistently high work intensity and are broken into shifts. SusOps are often unplanned and involve nonstop performance for uncertain periods (generally more than 24 hours) until mission completion or until the unit becomes exhausted. During ConOps, there should be regular sleep opportunities, albeit brief and fragmented, while during SusOps there is little opportunity for unit stand down or for soldiers to have more than a few minutes of sleep at any stage. Thus ConOps, which attempt to ensure that sufficient personnel resources are available to allow duty scheduling and adequate rest, are distinct from SusOps, which emphasise mission achievement, possibly at the expense of severe performance degradation. Of course, within ConOps, there are likely to be periods of SusOps.

The Commander (3 BDE) highlighted the issue of his own reduction in rest particularly during the early part of the Operation. He highlighted the need for commanders at all levels to be cognisant of the significant reduction on decision making and performance of staff officers and soldiers alike during continuous operations. He highlighted that, in some cases, his own sleep patterns were extremely disrupted and rarely exceeded three to four hours during the late Sep/early Oct 99 period.

Land Operational Analysis Team,
Lessons and Impressions:
Operation WARDEN/Operation STABILISE, 2000

Technological innovations have allowed many problems related to weather, darkness and equipment reliability to be overcome so that operations are nonstop. The result is that humans are often the weakest link in operational endurance. Fatigue can degrade operational effectiveness within a matter of hours. After 72 hours without sleep, most military personnel will be ineffective at any task. Round-the-clock operations, characterised by limited, disrupted or lack of sleep, and high physical and mental demands, leave soldiers and officers jaded and performing below par. Commanders must consider sleep and fatigue management as critical elements of operational planning. To do so, they must be well-informed about the physical and psychological factors associated with sleep, sleep loss and fatigue.

Skills need to be reinforced to such a level that the individual will act instinctively when stressed or fatigued. The fatigue factor may at times be overlooked during training in Australia. It was a significant contributor to unauthorised discharges of weapons.

Lessons Learned and Confirmed section,
1 RAR Bn Gp Post-operation Report for Operation SOLACE,
Somalia, dated 31 May 1993

Aim

This guide provides commanders with information on how to recognise and reduce the effects of fatigue associated with sleep loss. The use of fatigue management techniques can help reduce or prevent fatigue and thereby maximise work output and performance under demanding operational conditions. It is likely that commanders will be held increasingly accountable for accidents and poor decisions among subordinate staff if preventable fatigue is a factor in these incidents. Basic information is presented on:

- a. the human need for sleep,
- b. the consequences of sleep loss,
- c. causes and signs of fatigue,
- d. the effects of sleep loss and fatigue on performance,
- e. methods for preventing fatigue, and
- f. management techniques for chronic fatigue.

Some of the COs were awfully heartless and brutal. A few had no idea about how to command men or judge a soldier's capabilities. Too often they would order young boys to lug a dead weight for miles, and when the young fellows reached the front they would be too exhausted to fight. I have seen them in tears, too tired to struggle on. They furnished an easy target for enemy gunners. More than one frail, green kid got cut down due to such incompetence in officers' ranks.

PTE Vincent E. Goodwin
World War I Diary

Sleep: Basic Information

You can stay up all night and keep awake provided you keep using some muscles, at least the speaking muscles. You can march all night, fight all night, talk all night. You will be likely to get terribly sleepy somewhere along between 0300 and 0600 hours unless you are doing something exciting or intensely interesting. But you can get through provided you are active. It is very hard to fight sleep if you are quiet and by yourself.

By breakfast time you will be getting less sleepy. You can get through the next day pretty well. You will feel uncomfortable. But other people will not notice anything wrong with you unless you sit down and relax with nothing important or interesting to do. Then, very likely, you'll doze off.

The second night you won't want to stay up but you may have to. Another march may be necessary or the enemy may attack. And the second night is like the first but more difficult. It is harder to keep active under your own power; yet you can, if your officers or the enemy furnish the motivation. You don't want to keep your mind on any topic very long. By this time you are probably getting quite irritable. Little things provoke you and you may talk some nonsense.

The third day is better than the second sleepless night, but you will be irritable, rambling and illogical in speech and thought, inattentive, more than usually sensitive to pain. Your eyes itch. You may begin to see double. You can't sit down and read. You can still be spurred to your full mental powers and manual dexterity if the stimulus is strong enough - if your commander demands your attention, if a shell comes over - but the effect of these things doesn't last as long as it would normally.

With frequent food, how long can you go without sleep? You can manage a third night without sleep and maybe a fourth, with all the symptoms getting worse, with attention harder and harder to command, with more and more activity necessary to keep you awake...

Psychology for the Fighting Man
YANK: *The Army Weekly*, 3 Sep 1943

Sleep is perhaps the major cyclic event in our lives, and it ranks with food and water as crucial to health and survival. Common sense tells us that sleep helps to restore mind and body. It is clear that sleep is essential if soldiers are to maintain operational efficiency.

No human being knows how sweet sleep is but a soldier.

J.S. Mosby
War Reminiscences, 1887

Although sleep is a feature in our lives, there remains a great deal of uncertainty about why we sleep, how sleep occurs and what actually happens during sleep. Sleep is not a state of inactivity as many would think. Rather, sleep is associated with complex and highly organised activities in the body and the brain. In fact, many aspects of our physiology are busier during sleep than when we are awake (for example, the secretion of several hormones) and show remarkably stable patterns of activity. At the same time, sleep inhibits some systems and abilities, inducing a disconnection from the outside world, whereby sensory input is blocked or suppressed to such an extent that we become temporarily blind and deaf.

A definition of sleep. The unconscious state regularly and naturally assumed by man. Sleep is characterised by an almost complete absence of outward movement and reduced sensory awareness. During sleep, both mental and physical recuperation take place. Sleep shows a complex, highly organised pattern of diverse physiological variables.

Stages of Sleep

Recordings of electrical waves in the brains of sleeping humans show five quite distinct stages of sleep, extending from light sleep to progressively deeper sleep. These different stages are associated with brain waves of different characteristics as shown in [Figure 1](#).

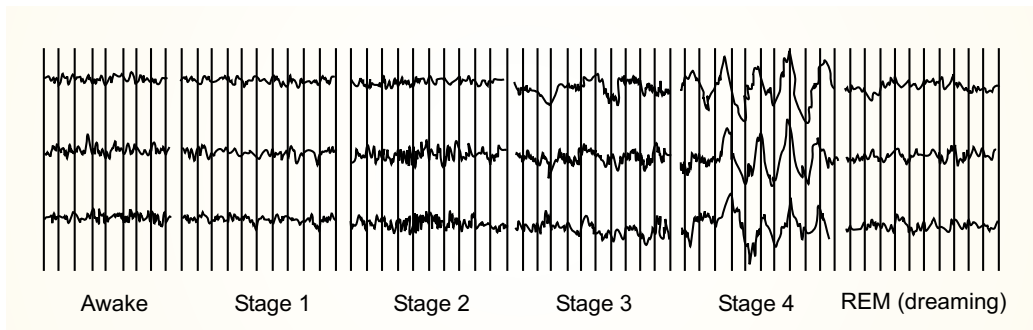


Figure 1. Brain Waves During Sleep

As can be seen in the traces of electrical wave activity in the human brain in Figure 1, the progression from Stage 1 to the Deep Sleep Stages is characterised by slower and larger wave activity. The smallest waves are called Alpha waves (present when a person is relaxed and awake with eyes closed), while the slow, large waves of Stage 4 sleep are called Delta waves.

Stage 1 is a transition state between wakefulness and sleep and is of short duration (about 2-5 per cent of total sleep time). An adult normally spends about 50 per cent of sleep in Stage 2, about 20-25 per cent in the deep sleep of Stages 3 and 4, also called Slow Wave Sleep, and about 20-25 per cent in Rapid Eye Movement (REM) sleep, where dreaming occurs. Typically, a sleep cycle through all the stages lasts between 90 and 110 minutes, starting with Stage 2 (light sleep), proceeding through Stages 3 and 4 (deep sleep) and ending with REM sleep (dreams). Further cycles then occur until waking. It is usually progressively more difficult to awaken people as they pass from Stage 1 to the deep sleep stages. Each person seems to have a unique pattern of transition and duration through the stages.

The Importance of Deep Sleep. There is evidence that Stage 3 and 4 sleep, the most common in the first few hours of sleep, serve the function of physical and mental restoration. The amount of Stage 3 and 4 sleep can increase after strenuous physical activity. Thus, you would expect fighting soldiers to spend a little more than the normal proportion of sleep in deep sleep. Disturbances to sleep, such as a loud noise, tend to interrupt the deeper sleep stages and take the person back to lighter sleep stages. Soldiers sleeping in a noisy battlefield are likely to get less deep sleep than they need to obtain maximum physical and mental restoration.

Three examples of the cyclic variations in the stages of sleep are shown in Figure 2. Numbers on the left of the traces show the stages of sleep. The arrows indicate the end of each sleep cycle and the dark bands show REM sleep. Note that Stage 4 sleep tends to disappear after 2 or 3 sleep cycles while REM sleep becomes longer as sleep progresses.

Sleep loss experiments have shown the body gives the same priority for deep sleep during recovery sleep whether the person is physically or mentally exhausted. Deep sleep is important to both mental and physical recovery.

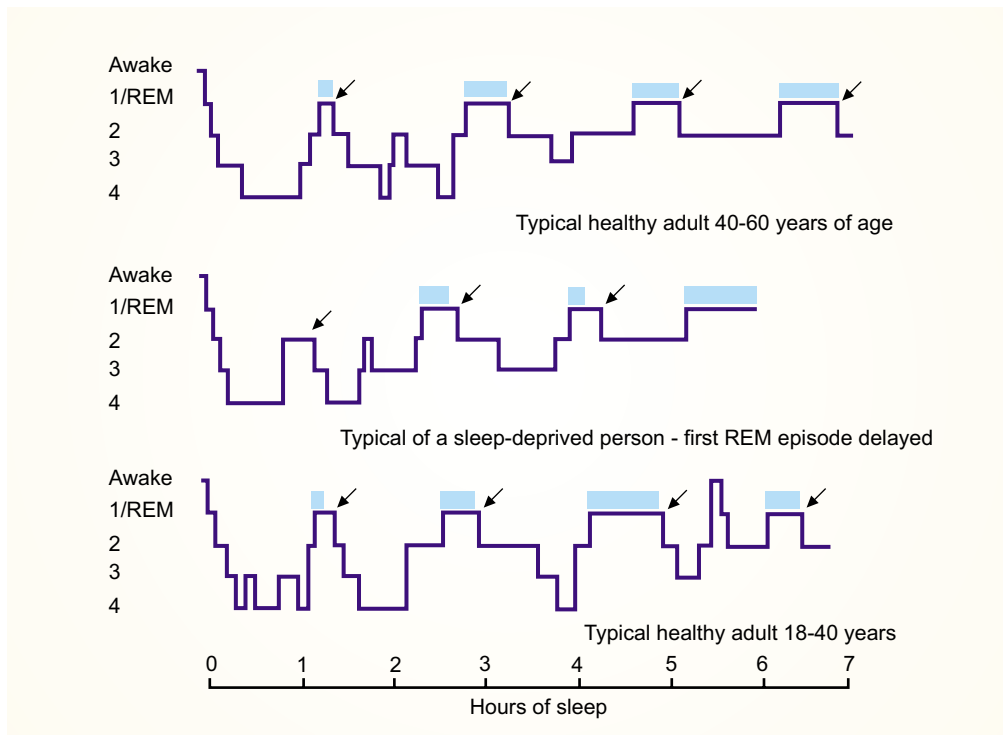


Figure 2. Typical Sleep Cycles

The Importance of Rapid Eye Movement Sleep. REM sleep is so called because of its characteristic eye motions. Dreams most commonly occur during REM sleep. Other physical reactions also occur. Blood pressure, pulse rate and respiration can vary markedly, small body movements and penile erections (which can be unrelated to dream content) are common, and muscle tone is normally at its lowest level. Muscle tone and spinal reflexes are severely suppressed during REM sleep, possibly to prevent the acting out of dream states. It is as if the brain is nearly awake but is somehow disconnected from the body itself. While the deep sleep stages are important to physical and

mental recovery from sleep loss, REM sleep appears critical to mental stability and important to memory and learning. Lack of REM sleep is known to cause irritability, disorientation and attention deficits. When REM debt is extreme, perceptual and mental distortions, such as hallucinations, are common. Following sleep deprivation, Slow Wave Sleep (Stages 3 and 4) is usually recovered completely on the first night at the expense of Stage 2 sleep, while REM sleep recovery is more apparent on the second night.

Case Study. Private J. M., a sniper on Resistance to Interrogation training, had gone 56 hours without sleep and was beginning to lose touch with reality. He was told that the exercise was over and to get some sleep, but convinced that his captors were lying, he ‘escaped.’ He was found 200 metres from the exercise compound, naked and gingerly tiptoeing in circles on a road trying to avoid smashed milk bottles that he imagined were strewn on the ground. He was given a hot drink and placed on a stretcher where he slept 11 hours.

The Effects of Medication and Alcohol on Sleep Patterns. Both the occasional use of sleeping pills and the consumption of alcohol effect sleep patterns by suppressing REM sleep. Overuse of sleeping pills significantly reduces both REM and Stage 4 sleep, the two most critical stages of sleep. Alcohol results in more awakenings during sleep and more frequent shifts in sleep stages. The message is clear: the use of drugs and alcohol should be avoided during sustained and continuous operations. An exception may be caffeine. While caffeine can be useful for improving and maintaining alertness when sleep deprived, its impact is diminished if used constantly. In addition, caffeine increases the time to fall asleep and decreases time spent asleep. The benefits caffeine can provide in enhancing alertness must be carefully weighed against the potential for adverse impact on quality of sleep (and hence recovery). Too much caffeine can have seriously detrimental health and performance consequences.

Caffeine. Many military organisations are studying the value of various drugs and nutritional substances (‘ergogenic aids’) for sustaining physical and mental performance. A common finding is that caffeine is one of the most useful substances available. For example, caffeine can help to delay hypothermia, and some studies report it can increase time to exercise exhaustion by up to 25 per cent. However, dosage must be carefully controlled. Caffeine in coffee provides inconsistent dose levels, hence slow-release caffeine is most beneficial. Of course, adverse side-effects can result if the drug is misused.

Dreams and Nightmares

As mentioned earlier, dreaming most often occurs during REM sleep and takes up about 20-25 percent of total sleep time. Dreaming is essential to mental well-being. Humans who are prevented from dreaming usually develop symptoms of mental disturbance within a matter of days. Individuals who say they do not dream are simply not remembering their dreams. After a period of sleep loss, there may be a perceived increase in the amount of dreaming, especially during morning napping when REM sleep is most prevalent. It is not certain why humans dream, but it is widely accepted that dreams have meaning, though interpretation is often difficult due to their complex and symbolic nature and the fact that dream content quickly fades from waking memory. Some theories that attempt to explain the functions of dreaming are given below.

There are many theories of why we dream:

- to fulfill wishes and desires,
- to express feelings that are deliberately avoided when awake,
- to cope with feelings left over from the waking day,
- to express insights that the conscious mind is not aware of, and
- to 'dump' unnecessary information from the waking day.

Nightmares. Soldiers commonly experience nightmares following a traumatic experience, such as the death of a mate, and in response to bad news from home. Soldiers' nightmares often include elements of combat scenes, hence the common name 'battle dreams'. These dreams are often repetitive. Thirteen percent of Australian soldiers on Operation SOLACE in 1993 in Somalia reported having bad dreams or nightmares while deployed, and 7.5 per cent of Canadian troops reported 'bad dreams or nightmares' 'often or very often' during the last month of their tour in Bosnia in 1997. These dream scenes may or may not have actually been experienced, though some can be almost exact replays of real operational events. A common dream reported by soldiers is encountering one's own death or corpse. This may reflect the phenomenon known as 'survivor guilt', a soldier's remorse over surviving when others have died. It is possible that dreaming about one's own death is the mind's way of alleviating this guilt.

*You go in (the morgue); they unzip the bag and ask, "Do you know who this is?"... I identified a couple of the guys and in my nightmare then - **I identify myself!** At that point I start to run and can't stop running until I wake up.*

Vietnam veteran quoted in
E. Hartman's *The Nightmare*, 1984

Disturbing dreams can persist for months, years and even decades after a highly stressful or traumatic experience. In one study, 59 per cent of American Vietnam combat veterans reported experiencing nightmares at least monthly, and 13 per cent of veterans, without exposure to combat, also had nightmares at least once each month. In a 1997 study, 22 per cent of a sample of personnel who had served in Rwanda reported having frequent nightmares over two years after returning from deployment.



Even now, all these years after the war, my father still has nightmares once or twice a week about his experiences at Changi.

Merrilyn G.
Discussing her father, an Australian prisoner of the
Japanese during the Second World War, 1982

The Soldier's Need for Sleep

The amount of sleep a soldier normally requires varies for a number of reasons such as age, workload and level of fitness. [Table 1](#) shows some comparative information about sleep in soldiers and civilians. The second column in the table shows stated sleep need in a typical civilian adult population. Some people simply require more – or less – sleep than others, with the majority requiring 7-8 hours. As shown in the third and fourth columns, most Australian soldiers tend to get less sleep than their civilian counterparts during predeployment and deployment. This suggests that many soldiers are sleep-deprived during these two stages of deployment. Note that individuals tend to underestimate the amount of sleep they require to function well. It is important to recognise that unusual physical, mental and emotional demands will normally increase the short-term need for sleep. These variations in sleep need mean that different soldiers will require different amounts of sleep to maintain optimal psychological functioning. When operational conditions permit, commanders should attempt to cater for individual sleep needs. Training activities can be used to clarify these needs. Suggested minimum sleep schedules to sustain operational performance are given later in this guide.

On average, adults in Australia sleep 8 hours and 36 minutes on weekdays and 40 minutes longer on weekends.

Source: Australian Bureau of Statistics

For the ADF as a whole, the mean total time spent sleeping on a working day was 7.42 hours, compared to 8.89 hours on a non-working day.

*ADF Activities Survey Standard
Report 1, 1998*

Table 1. Survey of Sleep Need

<i>Hours of Sleep Required/Achieved</i>	<i>General Population (normal sleep requirement)</i>	<i>ARA Infantry Bn Predeployment</i>	<i>ARA Infantry Bn Deployment</i>
3-4	8%	5%	2.9%
5-6	15%	33%	59.2%
7-8	62%	52%	37.9%
9-10	13%	8%	0%
11+	2%	2%	0%

Reducing Sleep Need. Some research indicates that if there is sufficient lead-time (say six months), many soldiers can reduce their sleep need by up to 50 per cent (eg, eight hours down to four to five) without serious detriment. For long periods of chronic sleep loss, however, performance monitoring is advised. Although some people can alter their sleep need for a period, they usually return to a sleep pattern that seems genetically determined.

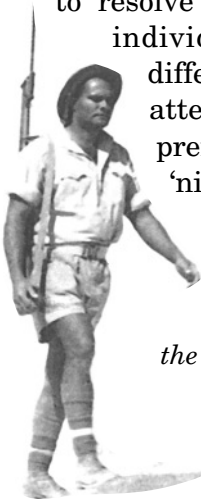
.. we reached open valley and flung ourselves upon a sloping bank, oblivious of the driving rain and biting wind. This was the lowest depth to which my physical powers had ever sunk. I felt that by a slight effort of will I could die and end it all... After lying there for 20 minutes I felt so cold that I determined to push on ... after a quarter of a mile I came down on my knees three times, and recognizing the impossibility of going further without rest, I took shelter behind a shattered log, and ... fell asleep instantly.

Sergeant A. Brunton, A.I.F.
describing the final stages of
a ten hour march in France
October 1916

Individual Differences in Sleep Needs. Similarly, no two soldiers will react exactly the same to the loss of sleep. Greater susceptibility to fatigue and sleep loss in some soldiers has implications for team operations. In some situations it therefore may be useful if a commander has the skills to implement appropriate forms of management for each soldier. Commanders should be aware that individuals differ in the following:

- a. amount of sleep required to maintain adequate performance;
- b. depth of sleep and degree of sleep inertia;
- c. preferences for timing of sleep and activity (morning versus evening active types - 'larks' and 'owls' - are well established circadian patterns);
- d. ability to fall asleep; and
- e. ability and motivation to remain awake when fatigued (tolerance for sleep loss).

The issue of whether soldiers should be treated differently on operations, according to their different sleep needs, is one for individual commanders to resolve in light of relevant circumstances. However, if optimum individual performance is mission essential, then individual differences should be catered for. For example, during ConOps, attempt to roster duties based on a person's observed or stated preference for morning or evening activity ('early birds' versus 'night owls').



It was then that the soldiers with (Staff Sergeant) Jim Cowey realised just what the previous days had taken from that brave man. He was so exhausted that the physical effort of eating was almost beyond him.

Lex McAulay
*Blood & Iron: The Battle for
Kokoda 1942, 1991*

Age and Sleep

With increasing age, the following general sleep and performance patterns have been observed:

- a. duration of sleep decreases (eg, someone who sleeps eight hours at age 18 may sleep six to seven hours at age 40);
- b. shortfalls in usual sleep duration will be more disruptive to general functioning;

-
- c. reduction in the restorative value of sleep;
 - d. sleep becomes more fragmented and is more susceptible to disruption by noise;
 - e. increased difficulty adjusting to changes in sleep and work schedules;
 - f. a tendency to perform best in the morning hours; and
 - g. a gradual decline in the relative duration of sleep Stages 3 and 4 (both crucial to physical restoration).

Unless they were exceptionally fit, older men, those over 35 were no match for the climate and terrain.

Michael O'Connor
Kokoda - The Lessons Remain Valid,
Australian Defence Force Journal,
Jan/Feb 1993

The general rule is that aging is associated with progressive intolerance to sleep disturbance and irregular working schedules. Once again, however, individual differences will ensure exceptions to the above trends. For example, level of fitness may act as a moderator of both sleep need and adaptability to disrupted or deprived sleep (although better health and sleep schedules in those who exercise may account for the apparent link between fitness and lowered sleep). Note that both the youngest and oldest appear most prone to fatigue on operations. Lack of mental and physical hardiness and inexperience may explain a commonly observed lack of stamina in younger troops. Apparently, many older personnel compensate for mental fatigue by 'pacing' themselves effectively.

It was during the Tessel phase that exhaustion began to bite. The oldest and the youngest were worst affected; I formed the view that most under 23 and over 35 were too young or too old.

Lewis Keeble, MC
Company Commander
Normandy Campaign 1944

Gender and Sleep

There do not appear to be significant differences between men and women in sleep patterns or sleep need. In surveys of sleep duration in the general population, women as a group tend to get less sleep than men. (In Australia, this difference amounts to between 30 and 60 minutes each day). This lower amount of sleep obtained by women should not be considered an indication that women as a group require less sleep; rather, it indicates the impact of sociocultural factors, such as greater responsibility for child care and other domestic duties. There is considerable evidence that chronic sleep disruption and sleep loss appear to cause increased, and more specific, adverse health effects in women, particularly in relation to their menstrual cycle and its hormonal activity.



This does not necessarily indicate that Servicewomen will be more prone to ill-health during deployment as presumably commitments to domestic responsibilities will be set aside or at least lessened.

Sleep Loss and Disruption

In spite of the mountain cold all slept like logs on the stony ground. The rarefied air, though bracing in effect, probably added to the perpetual fatigue which weighs down the infantryman between battles. In battle, weariness slips away, but when the main need is over, dragging fatigue, the protest of the body against

will-power, begins again. Mental and nervous reaction coupled with physical overstrain take their toll. In addition, many nights' sleep are lost altogether while the remainder are broken by sentry-go and patrolling ...



It fills the infanteer's veins with mud and covers his brain with a fog through which he can see only the words "I must keep going!"

... The infanteer drops in the mud or among the rocks, to be roused an hour or so later by an N.C.O. saying, "Your turn as sentry," or an officer saying, "We've got to go out on a patrol."

W. B. Russell
The Second Fourteenth Battalion, 1948

The Body Clock. Many bodily functions (eg, temperature, blood pressure, urine and hormone production, blood composition, heart rate and metabolism) fluctuate in a systematic way throughout a period that is close to 24 hours per cycle, each peaking and waning at certain times. These cyclical patterns form a kind of biological clock - the 'circadian rhythm' (from circa meaning 'approximately' and dies meaning 'day'). [Figure 3](#) demonstrates the

circadian rhythm, in relation to body temperature, in a 24 hour period. Sleep and wakefulness are perhaps the most noticeable components of the human circadian rhythm.

Yes, there in the front line we were cheerful. But there are the wee sma' hours just abune the twal, when the vital tides are at their teeniest, weeniest ebb. Then the sentries, staring across the dripping wire, waiting for the dismal dawn, as the chill creeps into their bones, are apt to let their thoughts wander ...

Herbert Rae
World War One veteran
Dawn, cited in *A Terrible Beauty*, 1977

Times of Worst Performance. Mental performance, especially alertness, is poorest when body temperature is at its lowest level. This is typically between 0200 and 0600 hours and is known as the 'circadian trough.' Perhaps this is why Napoleon found 'two o'clock in the morning courage' very rare and valued it highly. Another, less pronounced, circadian trough, called the 'circadian lull' in this guide, occurs between 1400 and 1800 hours. Best mental performance is usually mid-morning to early afternoon (0700-1400) and in some tasks (those involving vigilance or quick responses) in the evening between 1900 and 2100. Late night/early morning work is a problem for most people because it requires an overriding of their circadian trough. Moods and willingness to work are also detrimentally effected during the circadian troughs.

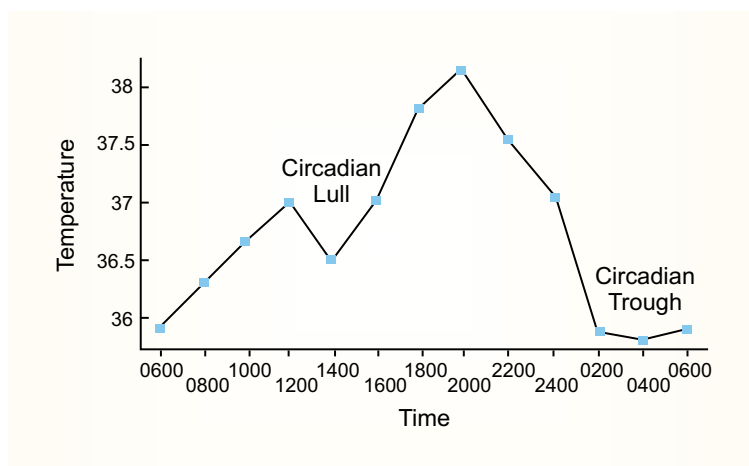


Figure 3. Circadian Rhythm

I have rarely met with the two o'clock in the morning courage, I mean unprepared courage.

Napoleon



Sleep Inertia. After any period of sleep, there is a tendency to feel drowsy and disoriented, and mental abilities may be unreliable. This 'hangover' effect is called 'sleep inertia' and can last from a few minutes to a few hours in cases of extreme sleep loss. During a period of sleep inertia, a soldier may forget instructions, be liable to panic at false alarms and involuntarily fall back to sleep. To prevent sleep inertia affecting operations, soldiers should be woken about 20 minutes before their scheduled period of duty, given a hot drink and a meal and supervised until it is clear they are properly awake. A word of caution: care should be taken when waking soldiers as they may startle and become momentarily violent. Note also that it may be extremely difficult to wake exhausted soldiers when they are in Stage 3 and 4 (deep) sleep.

The proceedings were further enlivened by an agitated British sergeant suddenly dashing into our midst, staggering up ... and gasping out, 'The battery's overrun. They're all dead and the guns lost.' He then fainted gracefully but heavily into the brigadier's arms. Of course the battery was all right. The sergeant had been wakened from an exhausted sleep by a bang as someone threw a grenade or firework, and, still asleep, had panicked.

Field Marshal Sir William Slim
Defeat into Victory, 1956

Micro-sleeps. Sleep-deprived soldiers are prone to drift into short lapses of sleep that may last a matter of a few seconds. These micro-sleeps do little or nothing to overcome the effects of fatigue. Micro-sleeps are unavoidable when sleep loss is extreme and are a major contributor to degraded performance and lowered safety due to lapses in vigilance and memory. Only a few moments of sleep will prevent the transfer of memory from short-term working memory to long-term storage. Hence, a soldier may miss part of a radio transmission without realising it and may unconsciously fill in memory gaps with distorted or fabricated information. If not aroused from micro-sleep, soldiers will progress into deep sleep. Micro-sleeps are most prevalent during the circadian trough and circadian lull. Apart from drugs, only sleep itself can remedy the occurrence of micro-sleeps.

Irritability increased; there was a tendency for people to fall asleep at O Groups when not being directly addressed.

Lewis Keeble, MC
Company Commander
during the Normandy Campaign

Sleep Disruptions

Many causes of disruption to sleep are obvious: loud noise, pain, bright light, extremes of temperature and the need to urinate. Others are less obvious and disrupt sleep without causing awakening; for example, both infection and extremes of temperature tend to reduce REM sleep. Any disruption to sleep, or to the sleep cycle, can degrade the recuperative quality of sleep and hence contribute to fatigue. The inability to fall or stay asleep (insomnia) is one of the most common sleep disruptions.

I was remorseful, shaken up, wet as a shag, and couldn't relax. Maybe I caught twenty minutes or an hour's sleep, then it was daylight.

Private K. Branch
on the morning of 19 Aug 1966
quoted in Lex McAuley's
The Battle of Long Tan, 1986

Insomnia. A common belief is that fighting soldiers rarely complain of insomnia because they are so exhausted; it is presumed that involuntary falling asleep is a much more likely problem. This is not the case. Insomnia is common on operations. Insomnia can be characterised by difficulty falling asleep, staying asleep and/or waking earlier than intended. Soldiers often have to snatch sleep when they can so that opportunities for sleep become very precious and an inability to use them very distressing. Being unable to fall asleep, even on occasions when the military situation allows it, is a highly frustrating experience. High arousal in response to the stressors of combat (typically fear and concern for mates/subordinates) environmental factors, worry about home and family, and being out of sync with one's normal sleep cycle, are major contributing factors to sleep-onset insomnia. Difficulties in staying asleep are also common because of operational noise, sudden involuntary startle movements and disturbing dreams of battle or other distressing events.

Insomnia also occurs frequently during predeployment and deployment phases causing an unwanted sleep debt immediately prior to operations. Commanders, whose main task is mental as opposed to physical, are especially prone to insomnia as it is often caused by intense concentration, worry and the fact that the prevalence of insomnia increases with age.

At night I lie with my eyes open wide, unable to sleep for the load that is on my shoulders.



Field Marshal Erwin Rommel
in a letter to his wife on day 6
of the battle of El Alamein

He was a first class commander; you couldn't go to sleep when he was about.

Field Marshal Sir Auchinleck
referring to Field Marshal Rommel

Overcoming Insomnia. People experiencing persistent insomnia sometimes 'medicate' themselves with alcohol or drugs. This is unwise as there is a risk of dependency on such aids and their effect may continue into work time. Furthermore, medication does not solve insomnia as it may only alleviate symptoms in the short term. There are proven methods for dealing with insomnia. Some can be applied in operational settings, for example:

- a. Use your field notebook to record thoughts on decisions, ideas or tasks that occur while you are trying to sleep in order to reduce worry that you may forget them during sleep.
- b. Avoid caffeine (coffee, tea, chocolate) for at least four hours prior to anticipated sleep. Some people develop a sensitivity to caffeine that interferes with sleep. There is evidence that this sensitivity can be triggered by high levels of stress.
- c. Progressively relax your body, breath slowly and deeply, and count your breaths. Try not to focus too closely on sleep itself; you cannot force yourself to go to sleep. Try to imagine relaxing images or pleasant memories to entice sleep.
- d. Use common sense in preparing for sleep and in deciding on a place to sleep.

I wake up 15, 20, 25 times in the middle of the night and my brain is just in turmoil over some of these agonizingly difficult decisions ... I get enough sleep, but I don't get very much rest.

General Norman Schwarzkopf
quoted February 1991 during
Operation Desert Storm

In some cases, insomnia is related to a medical condition, but normally it is a problem of anxiety or poor sleeping habits. The condition is quite common post-deployment. If insomnia persists, seek specialist advice.

I found that on operations [in East Timor] if I woke in the early hours - some aspect would hold me awake for up to two hours. Then in the cold light of day the same issue seemed of little consequence.

Brigadier Mark Evans
Commander 3rd Brigade
Regarding Operations in East Timor
Personal Communication, 2000

Jet Lag and Adaptation to New Environs

‘Jet lag’ usually refers to the mismatch between the body’s various physiological systems and the external cues (day/light cycle, meal-times) of the new environment, which occurs when flying quickly to a different time zone. Flight from east to west results in the hours in the day being extended; flight from west to east results in shortened days. Jet lag is more severe and persistent with eastwards travel. In either case, the circadian cycle will be ‘out of sync’ with the new time zone. Depending on the time difference, the main circadian trough may now occur during the day, causing extreme drowsiness, with the circadian peak at night, causing restless sleep. The second component of jet lag, which is often overlooked, is the mismatch between the various body rhythms themselves. Each rhythm has a unique pattern of readjustment in a new time zone, and the body takes considerable time to return to normal (resynchronisation). Most physiological processes will adjust within two weeks, with body temperature and melatonin release patterns being among the slowest to change. Melatonin is a hormone that has a strong impact on regulation of the circadian cycle; however, its production is influenced by light, not sleep. As a guide, allow one day of adjustment for each hour of difference between the new and old time zones before performance, and mood will be back to predeployment levels. Jet lag can have serious effects

on rapid deployment forces. Indeed, research has found unit effectiveness can be reduced by as much as 15 per cent when a unit deplanes in a new time zone.

*We left the plane and had our first taste of equatorial heat.
The air was almost solid! After only a few paces from the
air-conditioned comfort of the Boeing, we were all soaked
in sweat.*

Robin Harris, 6RAR, arriving in
South Vietnam, *The New Breed* in
K. Maddock's *Memories of Vietnam*, 1991

*I was hot, uncomfortably hot. My sweat-stained shirt
clung to my inflamed and prickling chest. This discomfort,
I knew, would pass in a couple of weeks, as soon as my body
adjusted to the heat and the intense humidity of South
Vietnam.*

Graham Walker, 8RAR
Like a Card House in the Wind in
K. Maddock's *Memories of Vietnam*, 1991

Preventing and Reducing the Effects of Jet Lag. One solution to the problem of jet lag is to attempt to change to the new time zone before deploying to the area of operations so as to allow the body to make the necessary adjustments before arrival. This would entail shifting sleep and work patterns to the new time zone prior to deployment. For example, troops may sleep in the early afternoon and work through the night for one to two weeks prior to deployment. Another solution is to establish a forward staging area and program time for adaptation. Another tip is upon arrival, stay up until the local normal sleep time, so as to promote, more rapid adjustment. Research with shift workers and long-haul pilots suggests people can reduce the time taken to adapt to a new shift by using exposure to bright light. Such interventions require specialist advice.

*After four weeks in Baidoa, diaries kept by members of the
1 RAR Group and interviews conducted in May by Army
psychologists debriefing troops before returning to
Australia suggested that close living conditions and the
paucity of amenities for the combat elements contributed to
a buildup of frustration, resentment and fatigue.*

Bob Breen
A Little Bit of Hope:
Australia Force - Somalia, 1998

Adaptation. The time taken to deploy, and variations in climate in the new location, can contribute to both fatigue and sleep disruption. Differences in temperature and humidity can impact significantly on physiological processes and require quite lengthy acclimatisation (up to three or four weeks) before predeployment levels of performance are regained. Short-notice deployments, characteristic of operations other than war, often lack amenities and basic living conditions (in the initial stages at least). The resulting discomfort will add further to the challenges of adaptation.

Lessons Learned from Somalia: A forward staging base should be considered for long deployments. Troops could arrive, rest and then complete a last short leg by C-130 or similar aircraft into the theatre.

*ABCA Lessons Learned Newsletter
Vol 1, July 1994*

Drugs. Prescribed drugs, although not recommended, have enabled some troops to function effectively immediately after deplaning. In particular, it is claimed that melatonin may allow some individuals to more quickly 'reset' their internal clocks. Other medications, especially sleeping pills, are probably best avoided, as they may cause sleeplessness when opportunity sleep arises, impair performance by slowing response time, impede natural recovery from stress, retard circadian readjustment, interact negatively with other substances and impact adversely on mood.

Accidents and Fatigue

Humans, if sufficiently sleep deprived, will sleep even if it means putting their life at great risk. Countless transport accidents attest to this compelling need to sleep even in the face of death. Fatigue also reduces judgement especially the ability to sense the stealthy transformation of sleepiness into sleep itself. Fatigue, associated with the circadian disruption of night-shift, has been implicated in the Chernobyl nuclear disaster (started 0125 hours), the accidents at the Three Mile Island nuclear power plant (0400 hours) and the Bophal chemical plant (0057 hours), and the ill-fated decision to launch the Challenger space shuttle. Research has shown that night-shift workers are almost twice as likely as day workers to have traffic accidents, while travelling home from work, presumably due to the effects of chronic sleep deprivation and circadian influences.

Front-line soldiering could be as much a battle against fatigue as against the enemy. This was almost literally true at Sanananda where, in order to combat the powerful desire to sleep, some men on watch in perilously forward positions pulled pins from grenades and held down the levers, knowing that sleep, and the release of their grip, would bring death.

Mark Johnston
*At the Front Line: Experiences of
Australian Soldiers in World War II, 1996*

There was a lot of activity on our left flank around Maryang San, with many enemy probes. It seemed that they were building up to another counter-attack on us. 'Lofty', exhausted by frequent 'stand-tos', rolled over in his pit onto his Owen gun and discharged a burst, destroying his leg.



Maurie Pears
Recollections of War
In M. Pears and F. Kirkland's
Korea Remembered, 1998

Fatigue induced by the sustained and continuous nature of training exercises has been identified as a major contributing factor in many serious accidents among ADF personnel. Two brief, illustrative case studies are presented.

Case Study One. A SNCO was driving home from work at 1600 hrs. He had been on duty the evening before, after working all day as an instructor, during which time he had slept about two hours. After dismounting from duty, he had worked another full day without rest. During the 15 minute trip on a country road, the driver fell asleep at the wheel. His vehicle veered onto the opposite side of the road and crashed into an oncoming vehicle. The soldier was killed instantly.

Case Study Two. At 0115 hrs on the 11th day of a major training activity, an APC struck a rock causing the vehicle to veer. The driver over-corrected the movement causing the vehicle to turn violently and suddenly in the opposite direction. At this stage, concerned about his ability to control the vehicle, the driver carried out an emergency halt procedure causing the vehicle to stop suddenly. Each of these movements caused the passengers to be thrown about in the rear of the vehicle. One passenger hit his head on the vehicle's fittings and hull more than once and sustained fatal head injuries. Driver fatigue, due to successive days of 14 hours of driving without significant breaks, was identified as a major factor in the accident. Common fatigue-induced impairments in driving performance include reduced awareness, lowered response time and loss of fine motor control. Such deficiencies can combine to cause overcompensation in corrective steering.

It is clear that fatigue can, and does, disrupt operational effectiveness and jeopardise safety in the military. Some recent research into fatigue has adopted a fatigue-related performance impairment index similar to the blood-alcohol concentration guidelines widely used in traffic regulations. For example, after 17 hours of sustained wakefulness, performance on cognitive and psychomotor tasks (such as hand-eye coordination) decreases to a level similar to performance with a 0.05 per cent blood alcohol content, while 24 hours of wakefulness compares with a 0.10 per cent level. Equating the impact of fatigue with the effects of alcohol intoxication appears to be a useful technique for both predicting performance impairment and guiding commanders, policy-makers and workplace managers about the development of fatigue management programs.

17 hours of sustained wakefulness leads to a decrease in performance equivalent to a blood alcohol content (BAC) of 0.05 per cent. The decrease in performance after staying awake for 24 hours is equivalent to a BAC of 0.1 per cent. A person with a BAC of 0.05 per cent is twice as likely to have an accident as a person with zero BAC, while a person with a BAC of 0.1 per cent is seven times more likely to have an accident.

Beyond the Midnight Oil: An Inquiry into Managing Fatigue in Transport, 2000

Fatigue in the Military

Preceded by fourteen stretcher cases, the extended column made slow progress along the escape route. Men at the rear sent messages forward, saying, "Keep moving. The Japs will be on to us." They halted at dusk. The stretchers could go no further in the darkness. No information percolated along the column until, as PTE J.J. Mannion relates, "an order or a 'mulga' or something came along, saying that we were to wait till morning." Platoons clung together, preparing a scratch meal from each man's meagre contribution. Where the men sat, there they slept beside the track ...



CPL C.S. Edwards, describing the evening halt on the ridge, declared that "the entire battalion lay down, posted no sentry, and the enemy perhaps half a mile away didn't molest us. It was truly a miracle."

Raymond Paul

Retreat from Kokoda: The Australian Campaign in New Guinea 1942, 1958



Another embarrassing moment occurred early in our tour when I was on sentry duty for my section. At that time, information was scarce about friendly troops in the area. We thought at the time that we were in the front line. 0200 hours came around; another half-hour before I was to wake the next relief. Suddenly, to my left I saw about thirty lanterns slowly

coming down the far hills and heading for our position. I thought it strange that the enemy would use light at night.

I woke our platoon commander, Lieutenant Robin Morrison, and informed him that the Chinese were coming. I managed to convince him and we all stood to. In actual fact, it was the first time that we had observed parachute flares being dropped in front of an American unit to our front by a plane. Rather embarrassing, but the mind plays funny tricks in the early hours of the morning and I had convinced myself that the flares were hurricane lamps in the hands of the Chinese! 'The King has no clothes' said some wit in the platoon ... I slunk back to my hole in the ground.

Joe Vezgoff (3 RAR)
The Great Adventure 1950-1951
In M. Pears and F. Kirkland's
Korea Remembered, 1998

Causes of Fatigue

Fatigue on the battlefield is generally the product of one or more of these:

- a. intense emotional strain and mental workload;
- b. strenuous and/or prolonged physical exertion;
- c. inadequate food and water intake and/or food lacking nutrition;
- d. adverse environmental conditions, including low light levels;
- e. periods of monotonous, boring activities; and
- f. disrupted and lost sleep.

Thinking back on those days of mindless exhaustion, I believe that the dreadful diet was largely to blame for our condition... proper food is needed to support any exertion, but how much more to sustain the day-in-day-out slog of climbing up and down some of the steepest mountains in the world, heavily burdened by gear and weapons, often for days without shelter of any kind?

Henry D. Steward
Kokoda Trail, 1942
Recollections of a Regimental
Medical Officer, 1983

Signs of Fatigue

Effective fatigue management requires a sound knowledge of the signs, symptoms and effects of sleep loss and fatigue.

Their faces were drawn and pallid, their eyes had the fixed stare common in men who had endured heavy bombardments, and they had the jerky mannerisms of human beings whose nervous systems had been shocked to an alarming degree.

H. R. Williams, describing troops
on the Western Front, 1916
Comrades of the Great Adventure, 1935

Physical Signs. Extreme fatigue leads to physical deterioration. Major physical signs of fatigue and chronic sleep loss are:

- a. vacant stare with sunken, bloodshot eyes;
- b. eye strain, sore or 'heavy' eyes, dim and blurred vision;
- c. droning and humming in the ears;
- d. paleness of skin;
- e. slurred speech;
- f. headaches;
- g. slowed responsiveness;
- h. lowered body temperature;
- i. lowered, variable heart rate;
- j. faintness and dizziness;
- k. lack of energy or vitality, drowsiness;
- l. unstable posture/swaying, dropping chin, nodding head;
- m. intermittent loss of muscular strength, stiffness, cramps; and
- n. loss of manual dexterity/difficulty making fine movements.

I was tired. Dear God, how tired I was; we all were. We had been on duty for three days and nights. My limbs felt like aching cotton wool, my eyes smarted and I sat for a moment on the firestep. It was a real physical effort to keep awake. I felt I would barter my soul for a few hours of uninterrupted slumber.

Private Saunders, quoted in
Denis Winter's *Death's Men:
Soldiers of the Great War*, 1978

They were sallow and drawn, different men from the smooth, brown-cheeked, fit soldiers of a few weeks ago in Queensland. Sleepless, bloodshot eyes and stubbled faces told the story.

Henry D. Steward
Kokoda Trail, 1942
*Recollections of a Regimental
Medical Officer*, 1983

Functional Signs. The combined effects of physical and mental fatigue will impact in many areas important to operational functioning. This impact will be evident in a range of performance effects and behaviours including:

- a. *Degraded Mental Processes.* Fatigue disrupts mental processes through confusion, poor concentration, narrowed perception, general cognitive slowness and forgetfulness. For example, the deterioration in working memory, sensory acuity and motor speed, characteristic of fatigue, may combine to cause degraded vigilance and slowed responsiveness and prevent reactions demanded by a change in situation. The impact of these, and other cognitive processes on performance, are described in more detail in the next section.

[Major] Blumer was also concerned that his men were losing their concentration and motivation ... Operation SOLACE was much longer than annual large-scale exercises in Australia. The living conditions at the airfield were endurable for a couple of weeks when the adrenalin was high and everything was new and exciting. After six weeks, the close living, and lack of privacy, sleep deprivation and the hot, dry, dusty conditions began to wear personnel down.

Bob Breen,
*A Little Bit of Hope:
Australia Force - Somalia*, 1998

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- b. *Group Processes.* Chronic fatigue leads to decreased interaction with team members and degraded communication due to lowered sensitivity to the usual cues and elements of social interaction. Soldiers may lose their sense of humour and become uncharacteristically moody, irritable, argumentative or socially withdrawn, all of which can degrade group dynamics.

They hardly knew where they were marching. Some had peculiar dreams or hallucinations. Others actually dropped into a doze, shuffling along in the line of march by holding on to the bayonet frog of the man in front. When a few minutes rest was called, some men sank to the ground in such crumpled weariness that they had to be stirred forcibly to their feet. Left beside the track they would soon have fallen captive to the pursuing Japanese.

Henry Steward
*Recollections of a Regimental
Medical Officer, 1983*

- c. *Impaired Command.* Situation awareness, battlespace visualisation, and other higher-order cognitive elements of tactical decision-making are affected by mental fatigue. This will result in slowed decisionmaking in some commanders. In others there may be no change in the rate of performance in decision-making; however the quality of their decisions will decline. Furthermore, this decline in effectiveness is usually not apparent to the individual. Fatigue can also lead to the uncritical acceptance of irrational, erroneous or illegal orders. Due to confusion, fatigue may also cause decreased willingness to initiate action (decision paralysis). Decreasing performance standards in others may go unnoticed.
- d. *Morale Effects.* Fatigue impacts not only on the ability to fight and command but also on the will to fight and command. Fatigue is strongly associated with decreases in satisfaction, motivation and interest in the prescribed tasks and activities of the group. At the individual level, fatigue may foster a sense of pessimism or fatalism, generate a tendency to think the worst and induce a proneness to reject the group, take offence easily and magnify grievances.
- e. *Diminished Personal Safety.* As fatigue is detrimental to both self-awareness and situation awareness, it leads to apathy, decreased attention to personal hygiene, neglect of normal safety precautions and procedures, and greater acceptance of risk. Sleep may be regarded as a welcome escape, irrespective of the potential dangers.

I asked him (an officer) to let us bivouac, which he did, so we just fell down and slept, rain and all, and shells falling all about us, but we were too exhausted to bother, we didn't mind if we were killed, it was terrible.

CPL A. Thomas
A.I.F., France, October 1916


- f. **Odd behaviours.** These may include talking 'gibberish', neglect of routine tasks, stupid accidents, hallucinations and inconsistent work and behaviour.

Operational effectiveness increasingly relies on complex mental processes that are highly susceptible to the impact of fatigue.

Some Effects of Fatigue on Performance

Reduced Attention. Soldiers are slow to notice occurrences in their environment such as the approach of an enemy.

Communication Difficulties. Increasingly, it is difficult to decide what needs to be said, how to say it or what someone else said; for example, soldiers cannot formulate coherent messages and may omit important information in orders or reports. Speech may become unintelligible.

Performance Deterioration: Rule of Thumb 

A 25 % decline in mental performance for each successive 24 hrs without sleep

Mood Changes. Significant changes in mood normally accompany performance degradation. These almost always include increased irritability and can entail depression and apathy.

Inability to Concentrate. Maintaining attention to the task at hand, for even a few seconds, is difficult. Soldiers cannot follow complex directions or perform numerical calculations and are easily confused.

Increasing Omissions and Carelessness. Soldiers begin to skip tasks, miss events and make mistakes, for example, failure to perform weapons checks or remember the action state of weapons. A common and dangerous sign of chronic fatigue is unauthorised discharges.

The battle had raged all night and was still raging ... Kennedy (Battalion CO) looked up at me from deeply sunken eyes. His voice sounded inexpressibly weary, lacking the bark and bite with which I was so familiar.

Farley Mowat
And No Birds Sang, 1979

Decreased Vigilance. Soldiers become less alert. They may fail to detect targets, especially during monotonous tasks or in tedious environments. Operation of surveillance devices is especially effected. Tasks requiring sustained attention are the most adversely affected by sleep deprivation.

Slowed Comprehension and Learning. It takes longer to understand any form of information; for example, it may take an excessive amount of time to comprehend a message or to find a location on a map.

Encoding/Decoding Difficulties. It becomes more difficult to transform data or to process information; for example, map coordinates are decoded slowly, and mistakes are made while doing it.

Hallucinations. Sometimes when fatigue is very severe and stimulation is low, the tired brain starts to see and hear things that are not there. As these illusions can be very real, the soldier may respond inappropriately.

Muddled Thinking. Reasoning becomes slow and confused. Even simple tactical situations may 'stump' the soldier. This can deteriorate to irrational thoughts, poor logic and false beliefs (delusions).



By now the company had been on patrol for just on six weeks. I could feel that we were losing our zip as I was having to correct faults and kick backsides more than ever before. The hard yakka of patrolling in the wet and living on hard rations was taking its toll. It was our first really long stint on operations and the strain of remaining constantly alert and watching your arcs all the time, coupled with the physical effort of scrub bashing and interrupted sleep for gun piquet, had worn us out. We were jaded.

Lieutenant Gary McKay
Vietnam, July 1971
In Good Company, 1987

Faulty Short-term Memory. Recall of recent events is faulty. The content of a radio message may be immediately forgotten or recalled incorrectly. The ability to assimilate new information is badly degraded.

Slowness in Perception. Soldiers are slow to understand things seen or heard, especially patterns; for example, the significance of changes in fire patterns or aircraft movements may be missed.

Slow and Uneven Responsiveness. Soldiers are generally slower to respond to events, but some reactions degrade more quickly than others.

Task Complexity. Uninteresting and complex tasks, as opposed to those that are interesting and simple, are more seriously effected by sleep loss.

L *eadership Issues*

By then Sharon's men had been moving and fighting for 39 hours since leaving Ein-Hotsev ... At last the thought struck him forcefully: "My brigade is physically spent." Still, he felt fairly good, though he hadn't closed his eyes in 70 hours ... At 2300 hours ... he called a conference of all commanders to issue orders ... He intended to tell the others that the brigade would again carry on, starting at 0400 hrs ... He reckoned that 5 hours' sleep would be more than enough to freshen men in these circumstances. But he couldn't get the words out. As he opened his mouth to speak, he looked at his officers who sat facing him. Every one of them was sound asleep. The sight narcotized him. His tongue thickened, the sounds choked in his throat, he fell flat and was almost instantly asleep. Nature had taken over because Sharon, an acute judge of the physical powers of other men, had for once pushed himself beyond sensible limits. Many a general has been stripped of his battle command for making the same error. In Sharon's case it wasn't fatal. He slept for 4 hours and 15 minutes. It might have been longer had not an airdrop come in ... and landed one 600-pound bundle within 3 feet of Sharon's head. That wakened him and reconvened the conference.

regarding Colonel Ariel Sharon
in S.L.A. Marshall's
Sinai Victory, 1958

Fatigue confronts the commander with many challenges. Despite their experience and other abilities, commanders are generally more prone to fatigue than their troops. There is normally great reluctance on the part of commanders to admit to the detrimental effects of fatigue on their own performance. Add the deceptive nature of chronic fatigue to this tendency of denial and the likelihood of serious failure in individual commanders is amplified. Serious failures in individual commanders are likely to lead to sudden, catastrophic failure in units. It is therefore imperative that commanders practise self-care in order to ensure proficient functioning. Unfortunately, military culture and tradition raise powerful impediments to the notion of commander self-care. Another challenge posed by fatigue for the commander is the need for finely-tuned judgement in determining the limits

of operational effectiveness in subordinate units, commanders and troops. Hence, the commander is required to monitor and prevent the impact of fatigue on all personnel, in order to avoid operational failure, fratricide (friendly fire incidents) and other preventable accidents, serious breakdown in cohesion and morale, and high rates of combat stress casualties.

There are more tired corps and division commanders than there are tired corps and divisions.

General George S. Patton
War As I Knew It, 1947

The only time a soldier becomes so exhausted as to feel incapable of further action is when the officer in charge succumbs to fatigue.

Report by 16 Bde, cited in
Gavin Long, *The Final Campaigns*

The Added Burden of Command. Commanders at all levels are generally more prone to fatigue than their troops for a variety of reasons. One dimension of this susceptibility to fatigue is the increased responsibilities and stressors that are characteristic of command, such as decision-making, fear of one's own incompetence or misjudgement and loneliness due to a relative lack of support. Commanders are often faced with tasks and ethical dilemmas for which they may have no specific training or experience. As noted previously, tasks that require mental effort are generally more tiring than purely physical work. Many command responsibilities involve complex mental processes such as tactical and operational planning, battlespace visualisation and coordination of operational duties. All these challenges, responsibilities and task characteristics exacerbate fatigue in the commander through increased effort and stress and by competing for time that should be devoted to sleep.

For the officer and N.C.O. there are in addition the long reconnaissance, the difficult patrol, the conference at someone else's headquarters and the effort of looking cheerful and confident in the face of almost impossible tasks.

W. B. Russell
The Second Fourteenth Battalion, 1948

My company commanders in Korea were young men, two were about 30, one younger and one was older but he was outstandingly fit. Thirty is the upper age limit for regimental officers in wars as fast-moving and physically demanding as the Korean War, particularly in its earlier phases.

General Sir Francis Hackett
The Military Team
In M. Pears and F. Kirkland's
Korea Remembered, 1998

Age. Another important dimension to fatigue susceptibility in commanders is age. Increasing age is associated with greater proneness to insomnia as a result of the normal developmental course of sleep (prevalence of insomnia increases from about 25 per cent of the general population at age 30 to about 50 per cent by age 60). Older age is also generally associated with lower levels of physical fitness, increased adverse impact on performance by disruptions to routine sleep and reduced capacity for recuperation from sleep loss, physical exertion and mental strain. Age has always been identified as a critical factor in command ability in combat. For example, Lieutenant General Bennett, GOC 8th Australian Division in Malaya, 1941, stipulated age limitations within his command during World War Two: Lieutenants were to be 26 years or younger (compared with an upper limit of 30 years in prior formations); with Captains 'correspondingly youthful'. Of course, there were inevitable exceptions to these rules; however, subsequent experience in New Guinea and Korea tended to confirm the importance of age to effectiveness in field command.

In the first four weeks of deployment [on Operation WARDEN] I lived much the same as any soldier in my Brigade. Despite the fact that I was relatively fit for my age (47), I felt that physically it was beginning to take its toll on me by week three. I got my second wind in week four.

Brigadier Mark Evans
Commander 3rd Brigade
Regarding Operations in East Timor
Personal Communication, 2000

Rank. Rank is another factor related to differences in fatigue. A US Army National Training Centre study of sleep during a 14 day exercise involving battalion-sized task forces showed that the higher the rank, the greater the sleep deprivation. Lieutenant Colonels and Colonels, in force-on-force echelons averaged, as a group, barely four hours of sleep each 24 hours

compared with close to five hours for the Captains and Majors group, nearly six hours for Lieutenants and Senior NCOs, nearly seven hours for Junior NCOs, and over eight hours for Privates. The generalisability of these findings to the Australian Defence Force are of course suspect due to a host of national and organisational differences. Nonetheless, the findings suggest potentially important implications for training effectiveness and possibly for operational effectiveness. Senior-ranking participants are more likely to show progressive performance degradation as an exercise or operation progresses; whereas, junior members are more likely to improve their performance over the duration due to adequate sleep and the benefits of experience.

Nor is it fair to assume that sleep, like pay, is distributed according to rank. Sometimes middle-rank officers, majors and lieutenant-colonels, find the burden hardest to bear. They are no longer in the first flush of youth, the contrast between peace and war strikes them hard, and the unremitting pressure of staff work may remind them that they have become more worriers than warriors.

Richard Holmes
*Battle: The Experience of
Modern Combat, 1997*

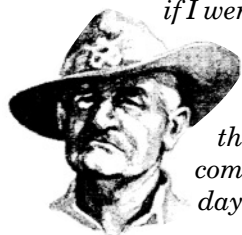
Staff Officers. Staff officers also deserve mention. It is not just commanders who are prone to fatigue among the officer ranks. Although the modern battlefield is now capable of continuous operations, including night fighting, the 24 hour schedule has always been a characteristic of the various headquarters and their staff. Yet despite this long body of experience, staff officers are often the worst offenders in terms of ‘self-inflicted’ or preventable fatigue. Just as many young officers learn the importance of proper sleep hygiene the hard way, for example, by being sent to rest by their platoon sergeant, many staff officers allow themselves to reach a mental state where their performance adds no value to the decision processes of the headquarters. Improper sleep may even adversely impact on operational effectiveness (such as making errors in targeting coordinates). All officers must learn to balance the competing priorities and demands placed on them and recognise that sleep must be given due consideration. Fatigue should never be considered an inevitable byproduct of operations or a constant of warfare that is excusable and therefore easily dismissed. Unfortunately, the reality often stands in stark contrast to this advice. One of the main findings from a review of the Gulf conflict was that many commanders paid lip service to sleep need during conventional operations.

In spite of stress and difficulty, unremitting toil and wasted effort, weary days and sleepless nights, fresh task piling upon the task but just begun, labouring even harder during periods of so-called rest than when their troops were actually in the line, this gallant group... Remained steadfast...

Lieutenant-General Sir John Monash,
describing the staff officers of the Australian Corps
The Australian Victories in France
in 1918, 1920

The Myth of Immunity to Sleep Loss. Commanders often regard themselves as being the least vulnerable to fatigue. We have seen that this is not the case. Leaders in the field must have both physical and mental endurance, accentuating their need for sleep, thus making them prone to performance deficits when deprived of sleep. Command tasks typically require complex reasoning, detailed planning, prolonged concentration and quick or difficult decision-making. These cognitive tasks are generally more tiring than even strenuous physical exercise and are often associated with sleep disturbances.

Commanders must cope with the effects of fatigue and sleep loss on their own performance as well as monitor these effects in subordinates. The fact that leaders usually need more sleep than troops may pose a dilemma to commanders who desire to lead by example. Perhaps Field Marshal Slim's comments may ease such concerns. Slim normally went to bed at 2200 hours, and if any of his staff woke him for any reasons short of crisis, they did so at considerable peril.



I had seen too many of my colleagues crack under the immense strain of command in the field not to realise that, if I were to continue, I must have ample leisure in which to think, and unbroken sleep ... Generals (read commanders) who are terribly busy all day and half the night ... wear out not only their subordinates but themselves. Nor have they, when the real emergency comes, the reserve of vigour that will enable them, for days if necessary, to do with little rest or sleep.

Field Marshal Sir William Slim
Defeat into Victory, 1956

The belief that sleep-denial is a way of displaying self-control and hardiness is common in modern-day commanders. For example, analysis of the 1992 ADF Activities Survey reveals that in a sample of 490 Australian Army personnel on exercise or operations, 17 (3.5 per cent) reported having no sleep during the 24 hour survey period. Most of these respondents were officers. The practise of sleep-denial, however, is usually counterproductive. As sleep debt increases, so too do the physical, psychological and behavioural consequences of sleep loss. No-one is immune. If sleep loss is unavoidable, it would be wise for leaders to have nominated staff or subordinates observe them for signs of degradation and to report any concerns objectively.

So while it was difficult to rest while the soldiers were still fighting out there, I knew I had to. ... the troops did not need a tired, fuzzy-thinking corps commander the next day when we made our final move. ... The best I could do was get some rest.

General Fred Franks
during Desert Storm
Into the Storm: A Study of Command, 1997

Trust in Subordinate Commanders. An associated issue for some commanders is the desire to oversee all activities. The root of this issue may well be trusting subordinates to command the unit while commanders sleep. Trust is a largely unsung element of directive control. Subordinate commanders should be trained in higher command roles to instil confidence in their ability to take over when required. Commanders should delegate and take sleep. They should not rely on the performance capability of a few key individuals; this is impractical and dangerous. Furthermore, sleep deprivation should not be used in training deliberately to find 'weak links' in the staff or to break them. Rather, subordinates should be openly exposed to sleep loss so they learn from the experience of fatigue (to know their limitations and the performance effects of exhaustion) and understand the importance of sleep and fatigue management.

Meanwhile Brigadier Taylor (22 Aust Bde), dazed with fatigue but unable to sleep, sent for Lieut-Colonel Varley, who had been with his 2 / 18th Battalion in reserve during the night, and asked him to take over, temporarily, command of the brigade. "I realised," Taylor recorded, "that I would have to get a few hours' rest in a quiet spot; my brain refused to work and I was afraid that if I carried on without rest the brigade would suffer." Having given the order, he collapsed ...

During the defence of Singapore,
February 1942,
in Lionel Wigmore's
The Japanese Thrust, 1957

Self-care as an Ethical Imperative of Military Leadership. Despite the evidence that fatigue does degrade operational outcomes, and in spite of available information on how to prevent or reduce debilitating fatigue, some commanders will ignore the potential consequences of fatigue when confronted with the demands of an operational environment. One recent approach to overcoming this neglect of fatigue is to foster self-care in relation to sleep need as an 'ethical imperative'. Just as soldiers are taught to care for their feet by routinely changing their socks and keeping feet dry as much as possible, all personnel should understand the critical importance of gaining adequate sleep, know their own sleep tolerances and be practised in techniques for improving the quality of sleep during operations. Commanders are responsible for their own sleep needs. By practising good 'sleep hygiene', commanders will set an example for subordinates. Commanders should also enforce appropriate sleep management as a matter of routine. Proper sleep contributes to individual and unit effectiveness. If given appropriate emphasis, a philosophy of self-care, at all levels in relation to sleep need, has the potential to foster effective sleep habits and fatigue prevention behaviours. Sleep cannot be delegated; the individual must take responsibility for their own sleep need.

Towards dusk, when it was usual to change into slacks and roll down shirt sleeves, a group of us gathered round the tailboard of a truck to swap yarns and discuss prospects for tomorrow. We were to move off before midnight and none but the most phlegmatic considered it worthwhile to sleep.

A.I.F. soldier, cited in Gavin Long's
Greece, Crete and Syria, 1953

The Perils of Sustained Operations. Sleep need should be a component of the operational planning process, featuring in time and mission analyses. Typically, however, once an operation begins, sleep plans, job rotation and rest periods are neglected or appear impossible to implement. In SusOps, commanders are often faced with the dilemma of choosing between exhausting the unit in attempting to accomplish the mission, or allowing less than peak performance, for extended periods, by ensuring minimum sleep needs are met. There is no right or wrong answer to this dilemma, but decisions must be made with an accurate awareness of human performance capabilities and tendencies in extended operations, including sleep inertia effects, accidents and decreased risk management, lowered morale and mounting grievances, and the increasing need for rest breaks and associated problems of ‘getting the troops going again’. Some analysts believe the increasing proportion of ‘friendly fire’ casualties among coalition forces in the closing stages of Desert Storm (a 100 hour SusOp) were largely due to fatigue. Commanders must balance such costs against the mission and presumed benefits of sustained operations.

The battalion crossed the steep Wadi Daqoun in fading light and in the darkness the pace became slower and slower. At each halt men would fall asleep, and it took much time to make sure they were all awake when the march had to be resumed.

Gavin Long
Greece, Crete and Syria, 1953

A painstaking investigation revealed that at least 35 out of 148 American fighting men and women killed and 72 out of 467 Americans wounded in the Gulf War were the result of 28 friendly fire incidents.

Colonel David Hackworth
‘Friendly Fire’ Casualties
Marine Corps Gazette, March 1992

Fatigue: A Deceptive Enemy. One of the most important points in this guide is that the debilitating effects of fatigue described may not be apparent to the sleep-deprived, especially during the latter stages of exhaustion. Each soldier will have a unique pattern of symptoms to chronic fatigue. The symptoms usually appear gradually and there tends to be an overestimation of task performance by the individual. Sometimes the first indication of severe fatigue is waking up after falling asleep. This lack of awareness is one of the most dangerous aspects of sleep loss. It is particularly common in

commanders and staff officers who are fixated on operational matters to the exclusion of all else. Therefore, the effects of fatigue and sleep loss must be continually monitored in subordinates, colleagues and superiors. Advice for monitoring and gauging the effects of fatigue are given on pages 76-77.

Emphasized above all is the firepower in the human spirit when it is both daringly exploited and intelligently conserved. To push men to the limit - but to understand the limit - in this lies the touchstone of success in the fighting life or any other.

S.L.A. Marshall
Sinai Victory, 1958

Judging the Limits of Endurance. Perhaps there is no more critical function of command than using all available human resources as closely as possible to the limits of endurance without overstepping the mark. Such judgement is a complex skill, and its cultivation is problematic as many of the issues already discussed; misconceptions about immunity to fatigue, competing priorities, and a culture of toughness and self-denial, can interfere with relevant learning opportunities during training. The ability to accurately assess the capabilities of personnel can be compromised by several aspects of organisational culture and human nature. For example, it is a common feature of organisations that leaders are shielded from bad news. In addition, commanders are often preoccupied with other matters and may simply assume that their own morale is reflected in their subordinates, rather than actively and objectively attempting to gauge the psychological status of personnel. A classic study in the Swedish Army showed that the higher the rank level, the less accurate commanders' judgements were about their own unit climate issues (such as morale and cohesion) yet the more confident they were in their judgements. This 'double jeopardy' is another obstacle to sound command judgement.

But, as often occurs in an exhausting withdrawal, alarm increased in proportion to the distance from the front line. Commanders are older and less resilient than the men in the battalions; they and their staffs see much of the wounded and non-combatant troops and are apt to judge the condition of the front-line troops, perhaps still holding firmly, by the condition of the shaken men seen in the rear areas.

Gavin Long
Greece, Crete and Syria, 1953

If commanders are to consider, and attempt to predict, when peak performance may be required of their force, and how long this can be sustained, then they should utilise reliable and objective measures of human performance such as morale and the ongoing impact of fatigue. Operational judgement is based on a complex equation of factors, many considered largely intangible, and often based on unreliable information, distorted intuitions and inadequate experience. To help counter these components of the ‘fog of war’, commanders should be aware that quite robust techniques for measuring unit climate factors are available. The resulting information can enhance the judgement required in operational planning and decision-making.

Morale and Fatigue

Fatigue impacts not only upon the ability to fight and command but also the will to fight and command. If significantly sleep deprived, military personnel will begin to show behaviours that will jeopardise the desire to support the mission and even their team. Fatigue will induce lack of judgement, loss of aggressiveness and offensive spirit, loss of control, impulsive decision making and other behaviours that are out of character, such as quickness to take offence and a tendency to magnify grievances. Other operational environment stressors (eg, concerns about leadership, family, rations) will amplify these behaviours. The end results are diminished effectiveness and lowered morale.

An incident occurred which showed just how tired the men were. Attacking on either flank, the 3rd and 9th Corps failed to reach the Outpost Line. When the 1st Brigade (1st Division) was ordered, on leaving the trenches, to assist the renewal of the 3rd Corps’ assault on 21 September, 119 men mutinied, walking to the rear in protest.

P.A. Pederson
General Sir John Monash in
D. Horner’s *The Commanders*, 1984

The troops started out tired and unshaven and unwashed. They seemed to be abandoning an ideal position for a stand and running away once more - contrary to everyone's wish to "have a go" at the enemy. They piled into overcrowded vehicles amid rifles, Bren guns and gear and equipment where no position offered comfort yet no move was possible. The sleep they needed was unattainable.

Diarist, reference troops of 2/48th Bn, A.I.F. during the withdrawal across Cyrenaica, April 1941, in B. Maughan's *Tobruk and El Alamein*, 1966

There is general recognition that the maintenance of morale is the most important single factor in war. Military history has shown, and field research has confirmed, that morale (the enthusiasm and persistence with which a member or members of a group engages in the group, supports its leadership and commits to its goals and activities) is a powerful factor in helping to alleviate fatigue, temporarily at least. There are other examples where lack of motivation and morale may explain why soldiers and commanders failed to endure severe fatigue.

Strong and effective leadership, which fosters morale, is another powerful antidote to fatigue. Skilful leaders know the endurance capabilities of their team, understand and respect how precious sleep is to the tired soldier, identify early the symptoms of fatigue and rest their troops before exhaustion. If necessary, however, they can spur exhausted soldiers to make the extra effort, particularly in physical tasks. It must be noted, however, that the impact of leadership on motivation will not last, and if rest is not available, each leadership intervention will foster briefer and briefer periods of response. For tasks that are primarily mental in nature, leadership is unlikely to counter the effects of chronic fatigue.

It was apparent that all commanders and officers present were nearing exhaustion and on two occasions a senior officer dropped off to sleep through sheer fatigue. The conference lacked a definite spirit and I can recall saying to the C.O. that in my present condition, having only had four hour's (approx.) sleep since Thursday, 29 January (it was then 8 p.m. on Monday) it was difficult to think along offensive lines.

Captain C. F. Newnham
Coy Commander, 2/21 Bn, during the Japanese attack on Ambon, Jan-Feb 1942, cited in Lionel Wigmore's *The Japanese Thrust*, 1957

Commanders at all levels should actively use motivational techniques to alleviate extreme tiredness. Themes such as unit pride, mateship, group loyalty, toughness, the meaning or importance of the mission/tasks, and a sense of sportsmanship or friendly rivalry amongst unit members can be useful. Incentives such as the promise of a nap, a rotation or some leave are other 'motivational tools'. 'Diggers' are renowned for working long and hard, but they do not appreciate unnecessary or unfair workloads or toiling for what they perceive are the wrong reasons. Recent research into the human dimension of peace support operations reveals that it is increasingly important for leaders to constantly 'manage the meaning' of why troops are involved. Compared with the usual 'black and white', 'us versus them' and the simplicity of conventional operations, peace support operations entail politically complex situations, a great deal of contact with local inhabitants, exposure to civilian suffering and other disturbing incidents, all of which can challenge the belief and value systems of Australian troops. In these circumstances, many soldiers require regular encouragement in order to stay committed and to feel that their presence is worthwhile. Effective leadership, strong cohesion, operational success and command competence are among the best motivators for soldiers, irrespective of their degree of fatigue. Nevertheless, remember that if all other motivations have faded or are lost, soldiers fight for their mates. Commanders should never allow soldiers to become isolated on the battlefield.

We were all edgy, tired and rundown from the earlier Commando operations and the subsequent loss of 317, and not in the mood to take much more. We were looking for excuses to go home. Self-inflicted wounds and battle trauma were around the corner, but were held off by the guts of the men and our need for each other. There was a little bother with lawful commands within the platoon (but what is a lawful command in those perilous circumstances?). We dealt with this as a platoon problem and still held together, all 15 (?) of us (those remaining).... We were without a Platoon Sergeant and would remain so for the remainder of operations.

Maurie Pears, *Recollections of War*
In M. Pears and F. Kirkland's
Korea Remembered, 1998

Combat Stress

Major Brown, Colonel Owen's right-hand man in the 3rd battalion, an old Australian soldier of iron nerve, twice hit and his face scarred by shrapnel after a dash to McDonald's outpost, vowed he could see a Turkish sniper beside him in the same trench. On Wednesday General Bridges had Brown to a quiet tea on the beach and sent him back, after a few hour's sleep, restored.

C. E. W. Bean
The Story of Anzac: The First Phase, 1935

Combat Stress Reaction (CSR) is a temporary response to the stressors of the combat zone. While fear and anxiety usually make up the core feature of CSR, there are a variety of physical, emotional, mental and behavioural signs that range in functional impairment from mild (such as irritability, jumpiness, various physical complaints) to debilitating (such as loss of self-control, disordered thinking and deliberate self-injury). When combat stress reactions are severe enough, they can impede the ability to function as an effective combatant. Such dysfunctional personnel are referred to as combat stress casualties.

The US Army concluded during WWII that almost every soldier, if he escaped death or wounds, would break down after 200 to 240 'combat days'; the British agreed breakdown was inevitable. The reason that only about one sixth of casualties were psychiatric was that most combat troops did not survive long enough to go to pieces.

Gwynne Dyer, *War*, 1986

It can be difficult to distinguish CSR from exhaustion as the two conditions often interact and share many symptoms such as headaches, trembling, confusion and forgetfulness. Fatigue is not a necessary condition for the occurrence of disabling combat stress, but fatigue is often a major contributing factor. During the Second World War, CSR was referred to as 'battle fatigue' in some forces. Indeed, during the drawn-out campaigns of the European and North African theatres of the Second World War, most soldiers who had served for more than six months at the front eventually became psychological casualties. This form of combat stress casualty was referred to as the 'Old Sergeant Syndrome'. Conversely, combat stress reactions can also contribute to fatigue by interfering with sleep through symptoms of insomnia, sudden involuntary flinching or jumping about during sleep, disturbing dreams, and hypersensitivity to noise, sudden movement or unexpected light.

A commander should not forget that too much battle stress, for too long, will render soldiers incapable of efficient performance. The signs are there when good officers and soldiers begin to do the wrong thing or fail to react effectively. Sometimes troops have to be driven beyond this point, but the commander must know there is a price to pay.

General Sir Francis Hackett
The Military Team
In M. Pears and F. Kirkland's
Korea Remembered, 1998

The significant influence of fatigue on the incidence of combat stress reactions is also recognised in the prevailing techniques for managing combat stress casualties. While the key principles of management are immediacy (starting the intervention as soon as possible), proximity (to the member's unit or duty location), and expectancy (fostering the goal of full recovery to previous duties), the underlying procedures for recovering combat stress casualties are rest and replenishment. When operational circumstances permit, rest and replenishment entails providing meals, fluids and a sense of personal security so as to allow extended sleep. In this way, some military forces have returned up to 90 per cent of stress casualties to their units within three days.

In October 1967, the RMO of 2 RAR ... reported an increase of 'emotional worries' in one rifle company that had spent 40 days without a break on operations; two soldiers had had to be evacuated with combat fatigue. The episode, in showing that an increase in psychological disturbances followed a heavy operational schedule, mirrored the experiences of earlier battalions.

Brendan O'Keefe
Medicine at War: Medical Aspects
of Australia's Involvement in
Southeast Asia 1950-1972, 1994

A commander may be confused as to whether a dysfunctional soldier is primarily a stress casualty or chronically fatigued. Diagnosis is probably not the immediate issue in most cases, rather, the focus should be on how to return the soldier to effectiveness as a combatant. Fortunately, for both psychological casualties and fatigue cases, initial management can, and should, be undertaken in the unit. Of course, in some cases, stress casualties will require more than simple interventions of replenishment, rest and a chance to get their experiences into perspective. However, all genuine fatigue cases should return to functional status after appropriate periods of rest and sleep. Clearly, the prevention of both combat stress reactions and fatigue are key command responsibilities.

Fatigue on Operations

The lack of sleep I feel now, at eleven o'clock in the morning, is a grain of sand compared to the mountain that will tower over me when dawn breaks tomorrow. Past dawns I've flown through come forward in memory to warn me what torture the desire for sleep can be... How wonderful it would be if this really were a dream, and I could lie down on a cloud's soft, fluffy quilt and sleep. I've never wanted anything so much ... I'd pay any price - except life itself. But life itself is the price.



You can't stay switched on for that period of time. If you're not having contact, you're not finding regular sign of the enemy and everyone starts getting blasé. You start getting a bit too casual. You start making a little bit more noise at night. When you're patrolling you're not as alert. A patrol of three weeks means you can keep your mind on the job the whole time. Six weeks - with the exhaustion, when you're patrolling in jungle all day, it's very debilitating. You're sweating, it's a lot of physical work; you're not having your sleep. You're not having what you would call a first-class menu with green vegetables and all the stuff you need for stamina. During nights, you're laying awake a lot. Operating in the rain - the rain

keeps you awake and you're out on sentry and you have got to come back and try to get sleep. You're operating on exhaustion a fair bit and trying to go that long on six weeks, means that you do start to lose your sharp edge. And when you start to lose your sharp edge, then you can start losing blokes.

Private Wally Burford
quoted in Gary McKay's
Delta Four: Australian Riflemen in Vietnam, 1996

Fatigue in Nuclear, Biological, Chemical Conditions

Operating in a contaminated battlefield requires great stamina. Fatigue tends to be magnified by the range of difficulties and threats associated with nuclear, biological, chemical (NBC) environments such as thermal burden, decreased quality of communication, distorted and reduced visual field (eg, fogged masks), diminished manual dexterity, resistance by mask filters to breathing, restricted body movement, complications in eating and drinking and the unfamiliar, persistent and invisible nature of the threat. Select findings from field studies of simulated chemically contaminated operational environments suggest:

- a. Any task taking three times longer to complete when wearing protective clothing is likely to be modified by the soldier or simply not done.
- b. During a 12-hr NBC scenario in a 72-hr exercise, time to complete a mechanised infantry attack increased almost 100 per cent from baseline, and engagement proficiency decreased with all weapon types.
- c. Due to difficulties in communicating, the number and duration of radio calls typically increases, eg, there was a 28 per cent increase in the number of repetitions and clarifications of messages in one trail.
- d. Most pilots could not safely fly a single standard mission (one fuel load or two hr) in Chemical Protective Clothing (CPC) in ambient temperature conditions of 41°C.
- e. Endurance of armour crews ranged from just 3.3 to 36 hours in a 49-hr NBC scenario. Self-propelled artillery crews could sustain firing missions for only 1.5 to four hours, depending on workload and ambient temperature (those lasting four hours operated in 23-27°C conditions).
- f. Reduced field of vision and recognition problems, due to the wearing of masks, contributed to a 20 per cent fratricide rate (simulated) from small arms fire, compared to 4 per cent with normal field dress.
- g. During a 72-hr exercise, tank company teams, in simulated NBC conditions, destroyed 74 per cent fewer targets in attack mode than control teams in non-NBC conditions.

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- h. During a 96-hr operation in simulated NBC conditions, a battalion task force took 96 per cent longer to move to alternate battle positions than a similar control unit in non-NBC conditions¹.

Many of the physical, behavioral and psychological reactions to working and living in CPC are similar to those caused by fatigue and sleep loss, for instance, greater error rates, less delegation, reduced responsiveness to orders, increased irritation, reduced attention span, less accurate performance monitoring, disorientation and slower work rate. Furthermore, sleep quality is generally degraded by wearing protective clothing, especially if a mask must be worn. People in full CPC usually take longer to fall asleep and their sleep is considerably more disturbed.

Two apparently incongruent conclusions appear to dominate field research on military performance in NBC environments. One general finding is that most standard military tasks can be performed satisfactorily, but that extra time is required to perform in CPC. The other main conclusion is that there is significant impairment in the performance of most military tasks while wearing full protective ensemble. This guide concludes that personnel performing continuous, highly physical workloads in CPC are likely to perform in a militarily effective manner for no more than six hours; effectiveness could be less than two hours if ambient temperature is high. In addition, command and control is generally degraded by wearing CPC due to increased exhaustion in leaders, adverse changes in leader temperament (eg, increased frustration) and the physical barriers to routine communication.

Measures to prevent fatigue in NBC conditions must be incorporated into standard operating procedures. Research suggests several techniques and factors which can contribute to the prevention and regulation of fatigue and other adverse performance effects associated with working in CPC. These include: fostering high levels of physical fitness, practising sleeping in full CPC, ensuring heat acclimatisation, managing subordinate workloads with an understanding of the impact of CPC on performance and endurance, training in stress management techniques and allowing flexible work/rest ratios that are linked to ambient temperature and individual physiological differences (rest breaks of 5-15 minutes should occur at least hourly). Other techniques include enforcing drinking water discipline, using unconventional techniques for reducing fatigue, such as crew rotations, (which may require cross-training) working in the shade and when ambient temperature is at its lowest, and finally, extended training in CPC to both enhance habituation to

1. *Military Psychology, Volume 9 (4)*, Special issue on the Effects of Chemical Protective Clothing on Military Performance, 1997

this form of dress and development of the confidence and skills required to increase endurance and improve performance.

Fatigue in Air Operations

... Here it's well into midday and my mind's still shirking, still refusing to meet problems it undertook so willingly in planning for this flight ... No; I must, I will become alert, and concentrate, and make decisions ... I shake my head and body harshly. I flex arms and legs, compress muscles of chest and stomach, stamp feet on floor boards, bounce up and down, jam the stick forward to throw my weight against the belt, jerk it back to press myself tightly to the seat and floor. I'll break this spider web of sleep! But, but ... the instrument board is vague- like evening twilight - my brain swims ...

Charles Lindbergh
The Spirit of St. Louis, 1953

Flying demands the highest performance and safety standards. These standards depend on crew being alert and functioning at full potential. However, flying is characterised by constantly rotating work schedules, intense and sustained workloads and precise and rapid cognitive demands. Thus, the potential for fatigue, and consequent performance impairment, is significant. It is, therefore, no surprise that aviation has attracted more research interest regarding the impact of fatigue on performance than perhaps any other human endeavour.

Pilot Fatigue Linked to SAS Chopper Crash

... In June 1996, during the two weeks before the accident, an intensive build-up period to the mission may have left senior pilots exhausted and under additional stress.

Sydney Morning Herald
22 October, 1996

Note: In fact the Black Hawk Board of Inquiry Report in 1996 identified 16 'directly causative' factors and 26 'contributory' factors to the accident consistent with contemporary accident investigation philosophy which adopts a systems approach to analysis.

In terms of workload, a brief look at the helicopter pilot's duties is illustrative. These duties include: set-up memorisation; constant switching of visual attention between inside and outside the cockpit; assimilating various multi-function displays; listening to multiple radio nets; listening to auditory cues from the aircraft; constant assimilation of information to produce and maintain situation awareness of space, time, movement, system status, message traffic, threat status and mission status; error checking and recovery; communicating with copilot and crew; and other general 'housekeeping' duties.

When given the ability to work aircrew for 16 hours in any 24 hour period, the tendency may be to do so, particularly for squadron key appointments. For short periods this is sustainable; however, over the medium-long term, fatigue becomes evident in the aircrew ... Currently the aircrew have a planned two month rotation out of theatre to prevent the onset of fatigue.

Land Operational Analysis Team,
*Lessons and Impressions:
Operation WARDEN/Operation STABILISE, 2000*



Many of the abilities most affected by fatigue, often without recognition, are essential to flight performance and safety. Even subtle performance decrements, that are characteristic of fatigue, can have serious consequences. New technologies are constantly introduced in the cockpit, often with limited consideration of the resulting human factors issues. For example, there is clearly a pressing need for research into human performance using night vision goggles, particularly in relation to fatigue effects.

Potential Impacts of Fatigue on Aircrew Performance. The potential impacts of fatigue on aircrew performance include:

- a. diminished crew coordination, vigilance and psychomotor performance (although there are conflicting findings on the latter);

-
- b. a tendency to rely on others to make decisions or to shoulder group tasks is induced;
 - c. failure to make comprehensive instrument scans;
 - d. a tendency to abbreviate or skip routine checks;
 - e. increasing frequency of errors of omission (failing to detect and/or correct undesirable system performance or behaviour),
 - f. larger deviations allowed to occur before corrections are made, and corrections tend to overcompensate;
 - g. more passive flight control strategies;
 - h. lower performance standards being accepted without realisation;
 - i. peripheral activities overlooked; and
 - j. micro-sleeps.

During Operation Desert Storm, the United States Air Force observed that cumulative fatigue in C-5 air transport flight crews resulted in the fumbling of radio frequency changes, slowed reaction times, impaired judgement, diminished checklist discipline, decreased aircrew coordination and increased irritability.

Beyond the Midnight Oil: An Inquiry into Managing Fatigue in Transport, 2000

Key Predictors of Inflight Fatigue. The key predictors of inflight fatigue include:

- a. preflight fatigue,
- b. landing times after 0230,
- c. landing times more than 14 hours after waking,
- d. landing times 10 hours after commencing work,
- e. flying four or more days in a row,
- f. flying a second sortie, and
- g. working during the circadian trough periods.

The Contribution of Group Processes.

Aviation human factors research has shown the importance of group processes in the cockpit (eg, cohesion, communication flow, role definition, workload management and leadership style) in moderating the impact of fatigue. In a landmark investigation of the operational significance of fatigue, a surprising finding was that many tired crews were rated as performing significantly better, and making fewer serious operational errors, than rested, pre-duty crews. The fatigued crews had completed three days of operations as a team in a complex simulation, whereas the pre-duty crews did not have the benefit of recent experience with each other. It was concluded that group processes in established teams have a powerful effect on performance and may, up to a point, moderate some of the debilitating consequences of fatigue. This finding has clear implications for crew scheduling/composition both in aviation and in other defence teams involved in highly complex tasks.



It was concluded that group processes in established teams have a powerful effect on performance and may, up to a point, moderate some of the debilitating consequences of fatigue. This finding has clear implications for crew scheduling/composition both in aviation and in other defence teams involved in highly complex tasks.

During Operation ALLIANCE, a month long airlift (January 1996) in support of Canadian troops in Bosnia, 18 Transport Group CC-130 Hercules carried out 86 missions, from Trenton to Split, with aircraft landing in theatre every four hours. Most crews attained the 120 hour maximum allowable flying time per 30 day period in as little as two weeks. There were several reports of aircrew falling asleep at the controls.

M. Paul, R. Pigeau & H. Weinburg
Fatigue in long-haul re-supply missions, 1998

Preventing Fatigue in Air Operations. Strategies for the prevention of fatigue in air operations include:

- a. supervision and review of mission planning;
- b. awareness of circadian rhythms;
- c. rotation of cockpit duties (where feasible);
- d. regular inflight feedback on performance;

-
- e. routine breaks;
 - f. physical activity and light exercise;
 - g. napping (carefully timed, last less than two hours and occur outside or during the latter phase of trough periods to reduce sleep inertia); and
 - h. adequate hydration and nutrition (small, hot, nutritious, high protein meals during flight are best - avoid legumes, nuts and grains).

On long-haul flights, it is not advisable to 'circadian shift' if you will be returning to your home time zone within three days. Furthermore, bright sunlight, during 'home' night hours should be avoided while at the destination, as this can trigger the release of the hormone melatonin (a key factor in the regulation of the sleep/wake cycle) and thereby induce an unwanted circadian shift.

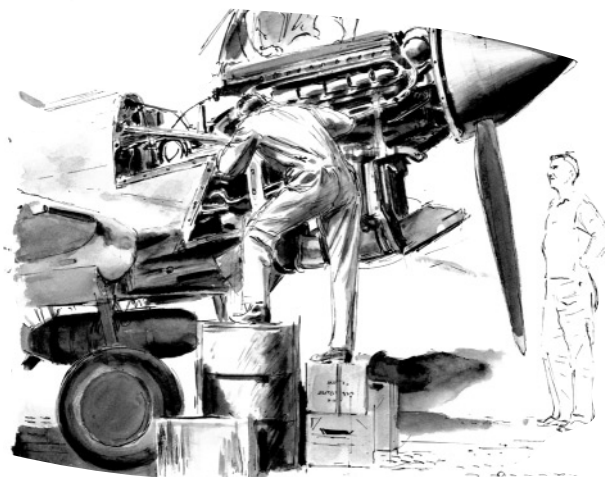
I knew three crews during the Battle of Berlin who obviously were in bad shape because of fatigue and should have been rested ... One of the crews had several close calls and the pilot was a nervous wreck. On one trip, they were hit by flak and the navigator and wireless operator were injured. On another trip, they were sprayed with shells from a night fighter. One shell came through the windshield right in front of the pilot - the shoulder of his jacket was sliced through ... It was obvious that this crew had had its nine lives and was so shattered by fatigue and tension that there was little chance of them surviving if they continued to operate. They were not rested and they perished.

Pilot Officer Joe Sheriff
cited in M. Middlebrook,
The Berlin Raids, 1988

Maintenance Personnel

Depending on manning and operational tempo, the various ground crew that support air operations may be even more vulnerable to fatigue than flight crew. Maintenance and inspection personnel generally do not have the regulated duty/rest schedules that govern aircrew. Shifts are routinely extended; night shift is commonplace. Maintenance and inspection are technical, labor-intensive and highly regulated tasks. Time pressures, heavy workloads and restrictive workspaces can also lead to significant stress and fatigue. Much maintenance work involves higher order cognitive abilities

which are prone to fatigue, for example, diagnosis and safety-related decision making.



Common fatigue induced problems in maintenance work include:

- a. reduced communication;
- b. misinterpretation of instructions;
- c. complacency;
- d. distraction; and
- e. loss of 'system awareness', eg, noticing progress in tasks.

In a recent BASI (Bureau of Air Safety Investigation) study of regional aircraft maintenance personnel, 29 per cent of respondents reported that they were sometimes so tired at the end of a long shift "that they could not perform their tasks properly."

Beyond the Midnight Oil: An Inquiry into Managing Fatigue in Transport, 2000

Extreme fatigue can impair visual perception which is a key component of search functions and fault detection. As expected, research has shown the circadian trough hours to be associated with increased error rates in the complex socio-technical systems of maintenance and inspection. The various fatigue countermeasures discussed in this guide are relevant for maintenance personnel. Additional, specific fatigue prevention strategies for maintainers also include:

- a. determining points within existing aviation support systems where there is potential for operator error;

-
- b. moving decision-making as close as possible to the work point;
 - c. team coordination training and enhanced communication;
 - d. hangar floor redesign from a human factors perspective (matching systems with human capabilities/tendencies); and
 - e. improved lighting and access equipment to reduce the discomfort and fatigue posed by restricted workspaces and inadequate illumination.

Sustaining the Black Hawk squadron in East Timor requires the resources of the entire regiment. The Black Hawk squadron in East Timor is currently expending 25 flight hours per day and returning one aircraft per week to Darwin for deep maintenance in exchange for a serviceable aircraft flown into theatre from Darwin. Aircrew have suffered from fatigue, particularly in the first weeks of the operation; however, careful management by commanders has proven effective in managing fatigue levels.

Land Operational Analysis Team,
Lessons and Impressions:
Operation WARDEN / Operation STABILISE, 2000

Night Vision Goggles and Fatigue

Night Vision Goggles (NVG) are a cumbersome device. While advances in technology have reduced the overall weight and made them more user friendly, most users still find them uncomfortable and awkward. They do, of course, allow operations to be conducted in conditions that previously would have been considered prohibitive. Research into NVG is relatively recent. The issue of fatigue is prominent in research studies into the impact of NVG. Within the ADF, various aspects of NVG are being studied by several agencies:

- a. Defence Science and Technology Organisation;
- b. Insitute of Aviation Medicine; and
- c. Directorate of Strategic Personnel Planning and Research.

Australian and Somali lives were probably saved by NVGs and thermal imagers used at Baidoa Airfield ... Word soon got around that the Australians could see at night ...

Bob Breen,
*A Little Bit of Hope:
Australia Force - Somalia, 1998*

Listed below are some general points relating to NVG and fatigue:

- a. Using NVG is tiring. For example, Army Aviation Crew Duty Limits work on the basis that one hour flying with NVG is equivalent to two and a third normal flying hours (1:2.3). Typical fatigue symptoms will include neck and eye strain, increased reaction times, deterioration in psychomotor skills and reduced decision-making capabilities.
- b. There is some evidence to suggest that experience with NVG is a factor that reduces the adverse effects of NVG. Pilots with many hundreds of hours goggle time appear to be less susceptible to the fatigue effects of NVG. One reason for this may be an enhanced ability to minimise disparity in focusing in binocular (two tube) setups.
- c. As with other sources of fatigue, mental skills tend to deteriorate more rapidly than physical ones. The few studies that have been conducted in this area reveal that experienced pilots at very high levels of fatigue (48 - 72 hours of sleep deprivation) can still handle an aircraft quite well; however, what they cannot do nearly as well, at these high levels of fatigue, is make the decisions and judgements, and maintain the situation awareness, crucial to safe flight in the operational environment.
- d. What is sometimes overlooked in studies of fatigue is that NVG are usually used during the body's circadian trough. Thus circadian aspects of fatigue are at work. It is not clear, at this stage, whether fatigue associated with the use of the device itself and circadian factors are additive or whether there is some interactive effect. It is possible that the fatigue effects are stronger than we expect.
- e. The nature of the task may affect the relationship between fatigue and NVG use. The higher arousal level, associated with more complex tasks, may mitigate some fatigue effects (eg, decision-making and judgement) up to a point, however, may exacerbate what we know as skill fatigue (eg, reaction times, psychomotor skills).
- f. Anecdotal evidence from experienced NVG users suggests that prevailing light conditions can significantly affect NVG-related fatigue. Under good ambient light conditions, the workload associated with a particular task can be similar to that of performing the task during daylight without NVG. However, under low light levels, that same task can be exponentially more difficult and tiring.

-
- g. An understanding of NVG-related fatigue might help in the management of fatigue. For example, identifying the different components of NVG fatigue may suggest prevention techniques for each aspect. The alleviation of visual fatigue may require only short periods of rest (say 20 minutes), whereas for general mental and physical fatigue, longer periods may be required.

To alleviate problems of fatigue, eye strain and strain on muscles in the neck, it was reported that some sections employed NVG in the hand-held mode. Other solutions to address these problems included decreasing the work to rest ratio of one hour of work to 10 minutes of rest, as is the ratio suggested in training. It was reported that this was reduced by some Platoons to as little as 25 minutes on and 25 minutes off in rotation or 20 minutes of work to 10 minutes of rest.

Captain Alison Skate
*Confidence in NVG Following
Extended Operational Use, 2000*



Fatigue on Operations in Somalia: A Case Study

The intensity of ADF operations in Somalia in early 1993 was extremely high for the first eight weeks, with soldiers receiving little rest. Most soldiers worked seven days a week. The tempo of both patrolling and armoured operations was higher than expected. Fatigue was commonplace.

Diggers Thrown in Stockade for Rifle Accidents

BAIDOA -- Australian soldiers are lucky not to have been killed or wounded by their own weapons after some nine or 10 "unauthorised discharges", 1st Battalion commanding officer Lieutenant Colonel Dave Hurley said yesterday.

The number of incidents since the deployment of troops some three weeks ago has lead to the construction of detention cells for some offenders and new measures throughout the 900-strong force.

Townsville Bulletin

Research conducted with 823 soldiers on Operation SOLACE in Somalia provides insight into the prevalence and effects of fatigue. While all of the signs given in Table 2 can be attributed to or associated with fatigue, the reader should note that there may be other causes of many of these symptoms besides fatigue and sleep loss.

... a number of factors are involved in the incidents - tiredness, carelessness and stupidity. There are guys who are working at a very high pace and they have done a lot of work in a very short time and I think that is contributing to it; that tiredness drifts into carelessness at times and that's what can cause it.

Lieutenant Colonel Dave Hurley, CO 1 RAR
 referring to the high number of unauthorised
 discharges during Operation SOLACE;
 quoted in the *Townsville Bulletin*, 10 February, 1993

Table 2. Signs of Fatigue in Personnel on Operation SOLACE

<i>Symptom Experienced During Operation Solace</i>	<i>Per cent of Sample (823 soldiers)</i>
Feeling emotionally flat or drained	48
Feeling low in energy or slowed down	48
Extreme fatigue/tiredness	47
Temper outbursts to minor events	45
Easily annoyed/cranky	44
Having no interest in things	35
Headaches	31
Difficulty falling asleep	28
Nausea or upset stomach	26
Difficulty staying asleep	21
Forgetfulness	19
Trouble concentrating	16
Difficulty relating to others	15
Bad dreams or nightmares	13

<i>Symptom Experienced During Operation Solace</i>	<i>Per cent of Sample (823 soldiers)</i>
Mental confusion	10
Carelessness	10
Frequent minor accidents	8
Difficulty making decisions	7
Faintness or dizziness	6

Arguably, the major deficiency of Operation SOLACE, from a performance effectiveness viewpoint, was the failure of many commanders to anticipate, assess and attempt to address the impact of fatigue. Post-operation reports from several units in Somalia identified fatigue as a major concern. Implications were drawn for crew rest and rotation schedules, rest and recreation practices, and the need to directly address fatigue in training in Australia. The precipitating role of fatigue, in the high rate of unauthorised discharges of weapons, was emphasised.

To sleep after a patrol was near impossible. A company of men [over 100] was crammed into a roofless building in sweltering conditions. After returning from patrol, there was a compulsory debrief, then a briefing for the next patrol which had to be passed on to the section as formal orders. In reality, the men were lucky to get three or four hour's sleep between patrols. The effects were noticeable after a day and blatant after two.

Lieutenant R. J. Worswick
Urban patrolling - A Coy perspective
 cited in Bob Breen's,
A Little Bit of Hope:
Australia Force - Somalia, 1998

Fatigue on Operations in Bosnia: A Case Study

The intensity of peace operations is often high, especially during the first month. Research conducted with three Canadian Forces contingents, in the Former Yugoslavia, provides insight into the prevalence and effects of fatigue. While the signs outlined in [Table 2](#) can be attributed to or associated with fatigue, it is emphasised that there may be additional contributing factors to these symptoms besides fatigue and sleep loss.

After their arrival in southern Croatia from Chilliwack, B.C., 1 Combat Engineer Regiment worked 21 days straight. Now, to reduce fatigue, the sappers rotate two days in the minefield with one in camp.

John Howse
*On Deadly Duty, in
 Canada at War, 1995*

Table 3 suggests a remarkable consistency of symptom patterns across contingents in Bosnia. Signs of fatigue are quite common. In one contingent, nearly 14 per cent of respondents reported being ‘overly tired’ either ‘often’ or ‘very often’.

Table 3. Signs of Fatigue in Three Canadian Force Contingents in Bosnia

<i>Sign of fatigue</i>	<i>Percentage of sample</i>		
	<i>Contingent A n = 512</i>	<i>Contingent B n = 168</i>	<i>Contingent C n = 420</i>
1. Headaches	54.6	63.1	52.5
2. Trouble sleeping	50.8	45.4	48
3. Being cranky/easily annoyed	46.7	48.8	40.3
4. Overly tired/lack of energy	41.7	51.5	37.9
5. Loss of interest in things	30.8	25.1	23.9
6. Difficulty concentrating	30.1	31.5	27.9
7. Minor accidents	14.8	18.5	16
8. Mental confusion	14.1	10.7	10
9. Difficulty making decisions	12.2	14.4	11.7
10. Taking medication to sleep or calm down	8.8	6.6	4.8

To measure signs of strain, respondents were asked to indicate how often they had experienced each of 36 items in a "list of troubles or complaints people sometimes have ... over the last few weeks" on a four point scale from ‘never’ through ‘sometimes’ and ‘often’ to ‘very often’.

I'm so exhausted I could use something to keep me going some days. There's too much work and not enough time to get it all done. Sometimes I'm up until two in the morning and then back at it at eight.

Sergeant, Canadian Contingent
Stabilization Force (CCSFOR),
Bosnia, 1998

Table 4 suggests that this particular contingent experienced its greatest level of fatigue at mid-tour. Interestingly, this peak in fatigue was associated with a relative decline in morale, as measured by another research instrument.

Table 4. Signs of Fatigue at Three Stages of Deployment in One Contingent

<i>Symptom</i>	<i>Percentage of sample</i>		
	<i>Early Tour n = 398</i>	<i>Mid Tour n = 200</i>	<i>Late Tour n = 512</i>
1. Headaches	52.8	57	54.6
2. Trouble sleeping	52.5	55.5	50.8
3. Being cranky/easily annoyed	47.7	57.5	46.7
4. Overly tired/lack of energy	51.5	48.5	41.7
5. Loss of interest in things	29.4	36.7	30.8
6. Difficulty concentrating	29.9	39.5	30.1
7. Minor accidents	17.8	26.5	14.8
8. Mental confusion	12.2	20	14.1
9. Difficulty making decisions	22	25	12.2
10. Taking medication to sleep or calm down	5.3	9	8.8

I've been going for a couple of months without a break. I'm past my limit and really need a 96er (96 hour R&R pass) to recharge my batteries.

Combat Arms officer
CCSFOR, 1998

The routine really gets to you after a while. Everyone is always tired. You can tell because we're all a bit more ready to snap at each other.

Corporal
Royal Canadian Regiment
CCSFOR, 1998

Fatigue in East Timor

Perusal of the Land Operations Analysis Team database, on the lessons learned during Operation STABILISE/WARDEN in East Timor, indicates a high profile and a general awareness of various issues related to fatigue. Research conducted by the Defence Safety Management Agency, among supporting units back in Australia, particularly in Darwin, also revealed that fatigue was one of the major problems facing many support personnel during the operation. Much of this evidence is anecdotal. One of the more tangible means of analysing the impact of fatigue on operational effectiveness is information on unauthorised discharges (UDs). Due to the seriousness of this breach of safety, accurate figures are maintained. Figure 4 below provides a profile of the incidence of UD's over time. Note that the figures for UD's represent the percentage of total UD's for the initial five month period of the deployment.

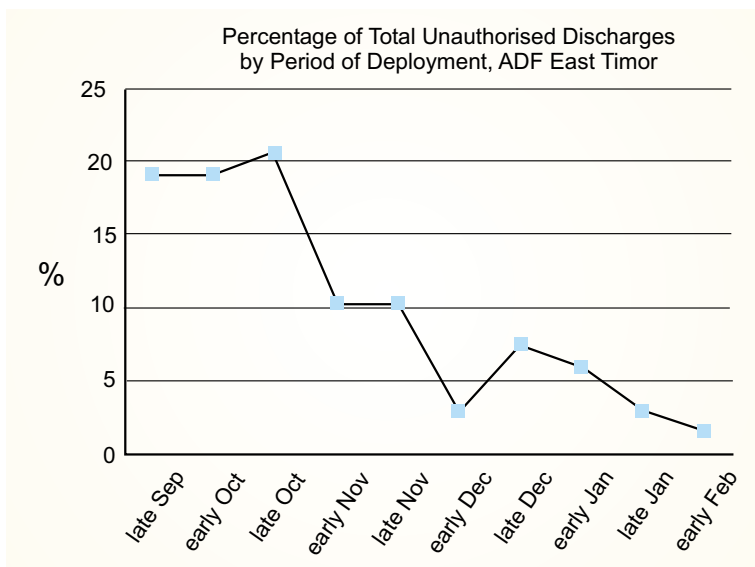


Figure 4. Percentage of Total Unauthorised Discharge by Period of Deployment, Australian Defence Force East Timor

B Sqn 5 Avn Regt achieved 1000 operational flying hours on 28 Oct 99. This indicates an ROE of about 700 hrs per month. The operational tempo is still high and mental fatigue is of some concern. Although people are getting sufficient rest, there is some indication that two months (including Tindal) of deployment, tasking and maintaining is taking its toll.

5 Avn Regt, East Timor,
War Diary Entry, 1999

The trend clearly represented in [Figure 1](#) is consistent with a general view that the first six weeks of the deployment in East Timor was characterised by extremely heavy workloads and a consequent high level of sleep deprivation. After the six week period, there was a notable decrease in operational tempo for many personnel as units became familiar with the area of operations and routines were established. Other factors also contributed to initial high levels of fatigue including the strain of uncertainty (particularly about the actual level of threat), the reliance of many troops on hard rations and the need for many to acclimatise to the heat and humidity. Of course, level of training and experience with weapon handling are likely to have been factors in the relatively high initial incidence of UDs.

Sub-units have indicated that soldiers can only sustain patrolling with NFE goggles for approximately two hours due to the onset of fatigue. Accordingly, night patrols also include periods of static observation tasks to provide individuals with eye relief. At platoon level a patrol tasking rate of $\frac{2}{3}$ operating and $\frac{1}{3}$ resting was employed to ensure an extended day and night operational presence in the AO could be sustained ... Individuals and commanders should also be cognisant of fatigue and other side effects associated with the use of NFE when planning operations.

Land Operational Analysis Team,
Lessons and Impressions:
Operation WARDEN/Operation STABILISE, 2000

There has been a flood of comment, opinion and reasons put forward for the number of UDs within the force. Despite attempts to rationalise the number by seeking comparison with other operations, the fact remains that even one UD is unacceptable and endangers life. The reasons offered for the vast majority of the incidents are incorrect drills used on the weapon and tiredness / fatigue.

Land Operational Analysis Team
*Lessons and Impressions:
 Operation WARDEN / Operation STABILISE, 2000*

Examination of the relationship between rank and the incidence of UDs shows a remarkable coincidence; the proportion of UDs by rank closely reflects the rank composition of the deployed force. While it is difficult to draw conclusions from such broad findings, it is plausible to postulate that the impact of fatigue may have neutralised differences in weapons training and operational role that may be presumed to exist between the broad rank groupings represented in Table 5. These preliminary findings (shown in Table 5) are consistent with a central thesis of this guide that no-one and no rank level is immune to fatigue.

**Table 5. Rank and Unauthorised Discharges, ADF East Timor
 Late September 1999 to Early February 2000**

<i>Rank</i>	<i>Proportion of Force</i>	<i>Proportion of UDs</i>
PRIVATE (E)	48.6 per cent	44 per cent
JUNIOR NON-COMMISSED OFFICER	25.9 per cent	30.9 per cent
SENIOR NON-COMMISSIONED OFFICER	12.8 per cent	13.2 per cent
OFFICER	12.8 per cent	11.8 per cent

The unit has two terminal sections. These people had been working 18 hours a day for 45 days, unloading ship after ship, to the point where there was at least one instance where a soldier literally fell asleep operating (a crane with a 20 tonne connex on board). The safe conduct of terminal operations of this scale would be improved if the unit had an increased terminal asset ... at present there is no ability to rotate terminal operators for sustained operations.

Land Operational Analysis Team,
*Lessons and Impressions:
 Operation WARDEN / Operation STABILISE, 2000*

Clearly, however, more detailed research is required to validly draw out the factors involved in unauthorised discharges and to differentiate the effects of the two main presumed culprits: poor handling drills and fatigue. Such research would be facilitated by adding information fields to current UD reporting procedures. These fields should include time of day (to account for circadian trough influences); hours of continuous wakefulness prior to the incident; time on task at the time of the incident; amount of sleep during the previous 24, 48 and 72 hour periods (to determine if a sleep debt existed) and time in theatre (to account for acclimatisation and experience).

Personnel were working extremely long hours and were heavily fatigued ... This was at a time when the FST (Heavy) was peaking at 62 patients, resulting in 12 to 14 hour shifts and security duties ... Fatigue was considered to be the primary cause of one of the FST (Heavy)'s two Unauthorised Discharges.

Land Operational Analysis Team,
Lessons and Impressions:
Operation WARDEN / Operation STABILISE, 2000

The selection of quotes in this chapter attests to the wide impact of fatigue across units and roles. Other information about the human dimension of service in East Timor has been collected (albeit retrospectively) from several units. A sampling of survey response information from three units (two Infantry and one Air Field Defence Squadron) is presented here to illustrate fatigue relevant data. Stressors of deployment were assessed using a 36 item scale that covers a spectrum of issues including operational, organisational, environmental and family factors. 'Mental or physical fatigue' itself was a trouble or a concern to some degree for 55, 59 and 71 per cent of the three response samples. In one unit, fatigue was rated as causing 'much' or 'very much' trouble or concern in 27 per cent of respondents. Workload ('the amount of work you were expected to undertake or achieve') is presumably a major predictor of fatigue. It was a trouble or concern for 69, 61 and 64 per cent of the response samples. Signs of stress were also assessed using a standard 35 item stress reactions scale. Boredom (experienced often or very often by as many as 43 per cent of sample), being overly tired (27 per cent often or very often), crankiness (18 per cent), headaches (18 per cent), and sleeping problems (18 per cent) were among the most commonly reported signs. 'Minor accidents' occurred at least sometimes for 32 per cent of the respondents from two units. 'Bad dreams/nightmares' were reported at least sometimes for 19 per cent of respondents in one unit. Collectively, such symptoms suggest less than optimal operational performance in East Timor.

Reports were transmitted at the end of each day ... A problem with reporting requirements was due to the tempo of the ops most reporting was written between 2200 hrs and 0200 hrs. At times the quality of the report suffered due to fatigue.

regarding Field Intelligence Operations
in East Timor,
Lessons and Impressions:
Operation WARDEN/Operation STABILISE, 2000

My feeling about UDs is that the more tired a soldier becomes, the more necessary it is to revert to drills. Over time we have begun to pay lip service to the necessity of familiarity through drills. The bottom line was our weapon handling skills were not good enough to override fatigue.

Brigadier Mark Evans
Commander 3rd Brigade
Personal communication, 2000

Preventing Fatigue

At 0200 hrs, we were reacted to the CARE compound in NGO road ... Once again it took me ages to find the silly bloody place and then about fifteen minutes for the guards to open the door and get an Australian CARE worker to talk to us ...

At 0500 hrs, I was woken again and told to get the platoon ready. Two 'squads' of 'enemy' had just passed a sniper pair on a track north of town; spaced, no noise, track discipline, sense of purpose and armed. This was very scary - we'd never seen anything like this before and I was preparing to deal with this group at night ...

When I handed over at 0800 hrs to Todd Everett, I was a wreck. I had had very little sleep, been on reaction most of the day and night (normally you spend most of the time waiting to be reacted) or writing lengthy incident reports and doing debriefs and seeing the IO. Above all, the adrenalin had totally exhausted me. The highs were followed by lows requiring deep sleep (which wasn't available!).

LT P. J. Connolly
Diary entry 22 Jan 93, Somalia
quoted in Bob Breen's
A Little Bit of Hope, 1998



The main ingredients in the prevention of fatigue are:

- a. imposing sensible work demands and schedules;
- b. maintaining an appropriate diet;
- c. fostering morale, and whenever possible;
- d. avoiding or reducing sleep debt.

The latter is best achieved by establishing regular schedules for work, rest and sleep, using napping when sleep schedules are disrupted by operations, and ensuring that you and your soldiers know their tolerance to sleep loss and their minimum sleep requirements by experiencing sleep loss in training.

Sometimes when situations were desperate for manning, platoons would adopt a very low profile and seek very thick scrub or thorny bamboo to back up against and man a half-moon perimeter with only two guns manned to allow the soldiers to get some rest. There is not much advantage in stopping for a night and only having three hours sleep after a hard day's patrol. Tired Diggers will be the end result and ones that are not alert usually are the first to become casualties - or their immediate neighbours.

Gary McKay
*Delta Four: Australian Riflemen
in Vietnam, 1996*

Sustained Work Limits and Minimum Sleep Schedules

Sleep loss may not seriously degrade gross motor physical performance (eg, trench digging, marching) for 18-40 hours. Beyond 40 hours, however, even physical performance will rapidly degrade. Mental abilities and fine motor coordination (as used in operating equipment and technical maintenance work) are more sensitive to sleep loss and usually deteriorating to unacceptable levels after only 18 hours of sustained work. After 36 hours of continuous wakefulness, most tasks involving perceptual, mental or fine motor skills degrade sharply, for example, sustained attention to brief, irregular signals and complex planning can erode by up to 50 per cent from baseline performance levels. After 72 hours of sustained operations, almost all soldiers will exhibit significant and persistent symptoms of fatigue that

Minimum Sleep:
Rules of Thumb



Mainly Physical work:
3 hours of uninterrupted
sleep per 24 hour period
for up to 9 - 14 days

Mainly Mental work:
4 hours of uninterrupted
sleep per 24 hour period
for up to 4 - 6 days

Note: There will be individual
differences among personnel -
some will require more sleep in
order to remain effective

preclude effective combat performance. For instance, a soldier may be able to fire at a fixed target but will not shoot effectively if targets appear randomly.

As a guide, general combat effectiveness can be maintained on three hours of sleep per 24 hour period. Most soldiers can maintain an acceptable level of physical performance for 9 - 14 days on such a schedule. However, extended rest (at least three days) would then be necessary. Tasks that are mainly mental in nature require more sleep. Table 6 gives guidance on the absolute minimum amount of sleep required to maintain acceptable performance levels in sustained operations where time is critical. This data is drawn from British Army research. Remember that individuals will differ in their ability to cope with sleep deprivation. Note that in NBC conditions, additional rest periods are essential. (See pages 84-85 for further advice on recuperative sleep.)

Table 6. Minimum Operational Sleep Requirements

<i>Mainly Physical Tasks</i>			<i>Mainly Mental Tasks</i>		
Acceptable performance (days)	Sleep required (uninterrupted)	Suggested recovery period	Acceptable performance (days)	Sleep required (uninterrupted)	Suggested recovery period
3	0	24 hrs	1	0	8-12 hrs
6	1.5 hrs per day	2 days	2	1.5 hrs per day	12-24 hrs
9	3 hrs per day	3 days	3	3 hrs per day	24 hrs

Work/Rest Schedules

The scheduling of work and sleep/rest periods is a key aspect of fatigue prevention. Many work shifts used in the military appear to be adopted without reference to the human dimension of operational performance. Matters such as sleep need, the circadian cycle and the detrimental impact of fatigue on performance are not considered when shift schedules are devised. It appears that traditional shift schedules are rarely examined or questioned in the military, and the performance detriments that some shifts generate either go unnoticed, are ignored, or are accepted as unavoidable by-products of continuous operations.

The most dangerous shift practice I've experienced was in Cyprus where, as a Line Sergeant, I was required to do 24 hours on, 24 hours off for six months. The job required constant driving from one OP to the next, along the line, resupplying and checking and so on. It was very dangerous driving the last six hours of every shift. Many vehicle accidents occurred.

Serving Major
regarding his experience during
peacekeeping in Cyprus in 1983

Several commonly adopted shift schedules lead to fatigue and performance degradation. For example, the four hour on/four hour off cycle does not allow a sufficient rest period for restorative sleep to occur. Perhaps the worst schedule is the rotating shift, where personnel are exposed to new hours of work each day. This shift does not allow physiological adaptation to the changing times for sleep onset, waking and use of energy resources. This constant desynchronisation of the circadian cycle results in daily sleep loss and chronic fatigue, a condition often referred to as 'shift lag'.

Yet the rotating shift schedule is surprisingly common within the military. It is sometimes justified by notions of sharing hardship. Admittedly, perceptions of equity are an important component of morale; however, a daily shift rotation could generally be replaced by a weekly or, better yet, a two-week or monthly shift rotation which is still equitable. A longer rotation cycle allows personnel some period of stability to adapt to a shift change (each shift adaptation generally requires 48-72 hours) and to develop a personal routine. In this way, performance deficits associated with work during late night or early morning shifts should be minimised following a period of adaptation.

The new staffing structure of the Bde S2 staff saw the addition of an extra officer and SGT. The extra SGT came along at a time when the two existing SGTs had been working on 12 hour shifts for several weeks and were becoming fatigued. The extra SGT meant that the SGTs could go to eight hour shifts, which was clearly more sustainable in the longer term.

HQ WESTFOR, East Timor
Lessons and Impressions:
Operation WARDEN / Operation STABILISE, 2000

There is no 'optimal' shift schedule. There is also a great deal of disagreement in the relevant scientific literature, based mainly on civilian sector research, about the timing and duration of shifts, speed and direction of shift rotation, and flexibility of shift systems. The following guidelines for developing a shift schedule for continuous military operations are given:

- a. Avoid any schedule that is not tied to the 24 hour circadian cycle.
- b. Allow a major rest/sleep period every 24 hours (for example, a 24-hour-on/24-hour-off schedule effectively means that personnel will sleep only once every 48 hours).
- c. Attempt to provide at least a six hour rest/non-work period each 24 hour period (this generally allows for a four hour period for sleeping). An eight hour rest period is better (should allow six hours of sleep).
- d. Schedule the main rest period for the same time each 24 hour period.
- e. Attempt to allow at least a week on each shift before a rotation (though individuals who appear 'night shift intolerant' are best given only one or two consecutive night shifts).
- f. Avoid daily or continuously rotating schedules (those who advocate rapidly rotating shifts in the civil sector tend to do so mainly for social considerations).
- g. Forward or clockwise shift rotation (morning - afternoon - night) is favoured as it allows longer rest intervals and parallels the body's natural tendency to extend past a 24 hour cycle.
- h. Do not commence morning shift before 0700 hours so as to avoid beginning work during the circadian trough and to maximise REM sleep.
- i. Shift length should be determined by the physical and mental features of likely duties. Hours should be reduced for highly complex and demanding tasks.
- j. When possible, program short nap periods into shifts.

Shift Intolerance. About 10 - 20 per cent of personnel will be 'shift intolerant'. This means that, even with well-designed shift systems, and with the best intentions, some individuals do not adapt to shift work. Rather than gradually adjusting to a new phase of shift work, their circadian rhythm remains in a state of permanent flux and disruption. Night shift is particularly problematic for these people. The result is chronic sleep deprivation and its associated adverse effects on health, mood, and work efficiency.

Napping

It is better for sleep to be taken in one continuous block, but operational constraints may allow only brief periods of sleep. Napping, defined in this guide as any sleep of less than three hours, is not a time-wasting luxury but a mandatory technique for maintaining performance during SusOps. Commanders must emphasise that every opportunity to have short sleeps be used.

It was 1900 hours when he arrived at base and assembled his commanders for their orders conference. Everyone was weary. Facing them, Ben-Ari fell asleep before he could start talking. Thereby the conference was automatically suspended. All present lay down and went to sleep for forty-five minutes. On awakening, they got their tasks.



S.L.A. Marshall
Sinai Victory, 1958

The longer a nap, the greater the benefits in improving mood, performance and alertness. Short naps (even 10 to 30 minutes), although not ideal, are better than nothing. A 30 minute nap will decrease the rate of decline in performance by improving performance for a period. If possible,

naps should be taken before a period of continuous activity or expected sleep loss, rather than after. A two-hour 'prophylactic' nap before a night operation can help to maintain performance levels.

I found cat napping to be extremely beneficial - I would often feel better from a catnap than from six hours of sleep at night.

Brigadier Mark Evans
Commander 3rd Brigade
Regarding Operations in East Timor
Personal Communication, 2000

The benefits of naps can be offset by lengthy periods of drowsiness due to sleep inertia. However, these post-nap ‘hangover’ effects can be minimised by timing naps to coincide with the peaks in the circadian cycle. Avoid napping during the circadian trough or circadian lull if you may need to be quickly alert. Naps are usually more effective in the late afternoon or late evening; although, daylight morning naps are of benefit, particularly after a night without sleep. One-hour naps are useful for reducing the frequency and duration of microsleeps.

Some research indicates that during periods of chronic sleep loss, naps taken late at night (2200 to 2400 hours) help to maintain performance, while naps taken in the early morning (0400 to 0600 hours) help to recover performance (but the latter are likely to cause significant sleep inertia). Afternoon naps tend to contain proportionally more Stage four sleep. If possible, naps should be taken in quiet surrounds. A nap in the corner of a busy command post, or alongside a supply route, is likely to reduce the recuperative value of sleep because sleep will be disrupted by noise and activity. Even if the soldier does not momentarily awaken, research has shown that noise and surrounding activity will cause cortical arousals in the subconscious brain that fragment the wave patterns and stages of the sleep cycle. The result is disturbed and, hence, ineffectual sleep.

... to experience all the unusual forms of sleep, one has to join the Army. We have slept on the ground, with a rock for a pillow and the stars for blankets. We have also slept in mud with torrential rain for eiderdown. ... I am blessed in a very special way - I can sleep under any circumstances. I have slept under the one blanket and a couple of inches of snow. I have also slept in the back of a three-ton truck, driven at twenty miles per hour across country at night, with the lights out.

X61400, ‘On Sleep’,
Khaki and Green, 1943

Fatigue Management

It was about two in the afternoon when we finally got anchored and managed to eat a bit and get clean. The crew were so tired by now that I only closed up the short-range weapons, and let everybody else sleep. Of course at 3.30 the raid came. I was in such a deep sleep that it must have taken quite a few bombs to wake me and I remember fighting to get my shoes on with the whistle and roar of bombs going on above me; and, still with a mind half conscious I got up on deck to see a whopper go up about a 100 yards astern ... The most amazing thing of all was the fact that some of our sailors slept through the whole fiendish din of ack-ack barrage and shaking of near bombs without turning an eyelid, which all shows how tired they were.

1st Lieutenant
H.M.A.S. Hotspur
Suda Bay, Greek Campaign, World War II
in H. Hodgkinson's *Before the Tide Turned*

Fatigue management is a collection of guidelines and procedures that attempt to prevent, evaluate and deal with the degrading effects of fatigue and sleep loss on performance, mood and willingness to work. Fatigue management also includes a knowledge of sleep and the sleep needs of personnel who work in the demanding environments, especially those with sustained and continuous schedules.



Fatigue management in military operations requires compliance to a work/rest schedule. It should be as much a part of military logistics as how to move, feed and clothe soldiers. During operations, all military personnel must have sufficient periods of quality sleep. They must be able to recuperate from the fatigue

and the stress of continuous work in order to maintain performance effectiveness.

This section includes suggestions for improving both wakefulness and quality of sleep, specific sleep management tips for commanders and advice on how to monitor performance and mental deterioration under trying conditions. The two most important steps in fatigue management are:

- a. preparing a work/sleep plan to meet the needs of your soldiers for the operational conditions expected, and
- b. using appropriate techniques and performance aids to detect and compensate for the effects of weariness and sleep loss.

Simple methods of performance evaluation are discussed below.



One night while on sentry duty ... I came pretty damn close to shooting myself in the foot - by accident, of course. It happened during the last half hour of my midnight-to-dawn shift. My eyes were getting heavy with sleep as I sat ... not with my rifle as usual, but with a revolver... I remember the revolver hanging rather loosely in my hand, pointed to the ground between my feet, my head drooping, when all of a sudden a loud bang shattered the stillness of the night, snapping me to full alert...

Stanley Scislowksi
Not All of Us Were Brave, 1997

Detecting Mental Performance Deterioration

A relatively easy and effective method of detecting early degradation in mental task performance is to have unit members do an easily learned task of a tedious nature. The 'Plus 7' task is often used as it tests short-term memory (particularly affected by sleep loss) and reliably detects mental lapses. The 'Plus 7' task is a continuous addition exercise. Begin by choosing a random starting number from five to nine. Add seven to it to get the sum. Continue to add seven to the sum. These additions are all done in the head, remembering the sum, and calculating the new sum. If soldiers can continue this task for at least one minute, without long pauses or mistakes, they are probably not

experiencing severe sleep loss effects. The most important thing to look for is an ability to do repeated additions without any long pauses. A substantial decrease in the total number of additions completed in a given time frame, as well as long pauses and errors, indicates deterioration. Obviously, numerous variations to this task are possible. The goal is to get soldiers to demonstrate working memory. More difficult tasks can be used for brighter or mentally quicker soldiers, such as continuous subtraction (start with a three digit number above 300 and choose a single digit number between five and nine to be subtracted). Alternatively, more militarily relevant tasks can be used such as encoding, decoding or map plotting. Whatever the task, it is useful to establish baseline performance scores for each soldier prior to the commencement of SusOps in order to take account of individual differences in the abilities involved.

Because of the strain, they [the 8th Army field engineers] worked in half-hour shifts: 'any longer than that and we lost our concentration and became careless.' Montgomery's assumption that the Engineers would be able to clear a narrow corridor of eight feet through the minefield at a rate of 100 yards per three minutes proved completely unrealistic: 'for hour after hour the work went on. The teams were relieved at half-hourly intervals and many of the mentally exhausted Engineers lay where they were and fell instantly asleep, oblivious to the gunfire, the bombs and the bullets.'

Ben Sheppard
regarding the Battle of Alamein
A War of Nerves, 2000

Improving Wakefulness

In order to improve wakefulness:

- a. Allow frequent breaks to alleviate strain, boredom and complacency.
- b. Increase social support; ensure soldiers are paired up to provide companionship, support and checks/double-checks for one another. Use teams rather than individuals to do tasks whenever possible.
- c. When fatigue is due to sleep loss (rather than physical effort), use periods of mild exercise or short bursts of strenuous activity.
- d. Identify the purpose of tasks to increase incentive.

-
- e. If possible, change routines and rotate tasks. To facilitate this option, cross-train personnel in a variety of tasks and skills.
 - f. Exposure to sunlight or bright light can stimulate mental activity.
 - g. Where appropriate, introduce novel background noises (such as a radio) for personnel completing mundane or repetitive work.

Enhancing Quality of Sleep

Personnel can optimise their sleep time by adopting the recommendations below (where operational conditions permit):

- a. Make every effort to create conditions conducive to quality sleep: cots, darkened and quiet sleep areas, adequate security and so on.
- b. Minimise alcohol use. Alcohol may assist in falling asleep, but it disturbs the sleep cycle and can cause early awakening. Alcohol also exacerbates fatigue's impairment of mental processes.
- c. If you are eating before taking sleep, eat carbohydrates (bread, milk, cheese, potato). These take longer to break down and provide 'slow-release' energy the next day. If eating quite close to sleep time, food should be snack-sized. Further details, concerning food as a fatigue management tool, are found in [Table 7](#).
- d. Upon waking, eat protein (meat, eggs). Proteins promote tissue growth and regeneration and are digested best in the mornings.
- e. Avoid stimulants like nicotine and caffeine prior to sleep.
- f. If possible, prepare for sleep gradually, for example, slow down, go through a prepare-for-sleep routine (some light exercise, reading, letter writing or a wash may help some personnel).
- g. Take the time to prepare for sleep in order to avoid disturbances to self and others (for example, prior ablutions, handy water bottle, effective insect netting or repellent).

A powerful source of insomnia during the fighting in Papua were the mites that caused 'scrub itch', which consisted of intensely irritating bites scattered over the body ...

Mark Johnston
*At the Front Line: Experiences of
Australian Soldiers in World War II, 1996*

- h. Ensure all personnel understand the high priority of sleep. For example, exhausted personnel normally should not be wakened for a meal or to shave. Short of critical operational demands, sleep should not be interrupted.

Table 7. Food as a Fatigue Management Tool

1.	Meals made up largely of carbohydrates are known to facilitate better sleep.
2.	Meals made up largely of protein are considered to assist wakefulness and work activity.
3.	Regular meal timings help to regulate the circadian cycle.
4.	During the night shift, main meals should be eaten before 0100 hrs.
5.	In the morning after night shift, a light snack of carbohydrates should be taken no later than two hours before expected sleep time.

One grievance was Monash's policy of not normally issuing rum: he provided soup, Oxo and coffee to exhausted and cold men coming out of the line, but his experience with the 4th Brigade lead him to believe, on purely medical grounds, that rum did more harm than good.



Geoffrey Serle
John Monash: A Biography, 1982

Fatigue Management: What the Commander Can Do

The commander can assist in the management of fatigue by implementing the following measures:

- a. Use training to ensure all personnel know their tolerance to sleep loss and to develop the ability to nap, regardless of the situation.
- b. Include sleep requirements in operational planning and sacrifice sleep plans only in dire circumstances. Different sleep plans may need to be prepared for each potential operational scenario.
- c. Allow adequate sleep before an operation. Sleep cannot be stored, but avoid sleep debt (that is, the amount of sleep required to restore normal performance levels) in yourself and your personnel.
- d. Monitor sleep periods in yourself, your subordinates and superiors during operations. Use a formal sleep/activity diary or set aside space in your field notebook. Be aware that during deployment many inexperienced soldiers are too excited or nervous to sleep.

The factor of tiredness of unseasoned troops was a very pressing one and it was found that most reinforcements were, after 48 hours without sleep, completely exhausted, though a number of the officers and more experienced men were still comparatively fresh after four or five days with only three or four hours' rest in the whole period. In other words, untrained troops must be nursed until they are used to the demands being made on them, and to the noise and uncertainty of warfare ...

LTCOL S. Pond, CO 2/29 Bn
cited in Lionel Wigmore's
The Japanese Thrust, 1957

- e. Similarly, check performance levels during SusOps; for example, use the 'Plus 7' test to confirm mental alertness.
- f. Aim to allow each soldier at least four to five hours of unbroken sleep each 24 hour period, preferably at about the same time each day.
- g. When appropriate, adopt a more relaxed leadership style. Tired soldiers normally respond better to this approach. Reassure rather than pressure. Be sensitive to mood changes in your soldiers and don't overreact to uncharacteristic outbursts that are a likely reaction to stress and fatigue.
- h. You may need to modify your leadership behaviours as fatigue increases, for example, give simple directions, deliver orders and directions slowly, ensure orders are complete and unambiguous, repeat all orders and directions and confirm they are understood, and be tolerant of errors.
- i. Know the effects of sleep loss. Such awareness should enable you to accurately gauge the limits of human endurance, predict when units and personnel will need rest or replacement, identify and anticipate behaviours, such as sleep inertia, distinguish between fatigue and combat stress reaction, anticipate and avoid accidents, and so on. [Figure 5](#) provides an example of the Performance, Signs and Management of fatigue for a three day SusOp.

For a rifleman, service in a combat zone can be likened to running a car and, if the car is not serviced, checked for wear and tear, greased, had the oil changed and the tyres rotated, then things will start to go wrong. Soldiers in a war zone who face mortal danger through contact and fire fights with the enemy on a daily basis will be like the neglected and under-serviced car if they are not themselves taken out and given rest and recuperation.

Gary McKay
*Delta Four: Australian Riflemen
in Vietnam, 1996*

- j. Attempt to provide environments that facilitate sleep. Restrict social interactions during time nominated for sleep.
- k. Use strategies to compensate for the effects of sleep loss (see page 66), such as using every opportunity to sleep or nap to help maintain performance, or cross-training soldiers, to give you the option of rotating tasks and routines, to increase motivation and alleviate boredom.
- l. Field studies show that fitness correlates with endurance and recuperation from fatigue. Thus, promote high levels of physical fitness before operations begin, but do not overtrain once in the field.
- m. Accept that you have an ethical and operational obligation of self-care. You must take adequate sleep to remain effective. While this is common sense, young and inexperienced leaders often find it difficult to accept.

My single most important piece of advice to combat leaders ... is to become superbly fit! During combat operations ... the physical and mental strain is extremely high, draining the strength and endurance from all at alarming rates ... fatigue saps their will to act at all, and seriously impairs battle judgement. Without superbly fit junior leaders, successful combat operations are impossible.

Lieutenant-General S. C. Waters
Former Company Commander
1st Canadian Parachute Bn in World War II
The Past Serving the Future

Fatigue Checklist

Table 8 contains a list comprised of easily observable behaviours that may indicate fatigue in soldiers. It is clearly a simplified assessment tool but may prove useful for commanders wishing to effectively manage work and rest/sleep schedules. During training, the checklist would also be useful, in conjunction with a sleep/activity log, in helping to determine each person's tolerance for sleep loss.

Directions: For each of the behaviours listed below, circle the number to the right that most closely corresponds to the observed or reported frequency of that behaviour in a unit member. Add up the 12 circled numbers to obtain a total fatigue score. Guidelines for different score bands are given below.

Table 8 : Observable Behaviours Indicating Fatigue

<i>Serial</i>	<i>Behaviour or Sign</i>	<i>Absent</i>	<i>Occasional</i>	<i>Frequent</i>
1.	Unsatisfactory attention to personal hygiene (eg. not shaving or dressing wounds regularly)	0	1	2
2.	Poor work output (eg. many errors in message transmissions)	0	1	2
3.	Slowed / slurred speech	0	1	2
4.	Slowed responsiveness (to conversation, noises, any stimulus)	0	1	2
5.	Unstable posture (eg. swaying, hunched shoulders, drooping head)	0	1	2
6.	Micro-sleeps (momentary lapses from consciousness)	0	1	2
7.	Hallucinations (eg. seeing 'walking bushes' or imaginary snipers)	0	1	2
8.	Obvious forgetfulness	0	1	2
9.	Irritability (eg. uncharacteristic complaining or bickering)	0	1	2
10.	Confusion / disorientation (eg. uncertain of pit location or current task)	0	1	2
11.	Headaches (revealed by cradling the head, furrowed brows)	0	1	2
12.	Blurred vision (eg. squinting / rubbing the eyes, difficulty reading)	0	1	2

Subtotals

Total

Total Score

0 - 8

9 - 16

17 - 24

Suggested response

No immediate action required

Nap required

Extended sleep required

Note:

Each soldier is different. Differences in characteristics such as sense of humour, maturity, experience and leadership will effect how the Fatigue Check List score is interpreted. **Similar scores do not necessarily mean that soldiers are similarly fatigued and require the same management.**

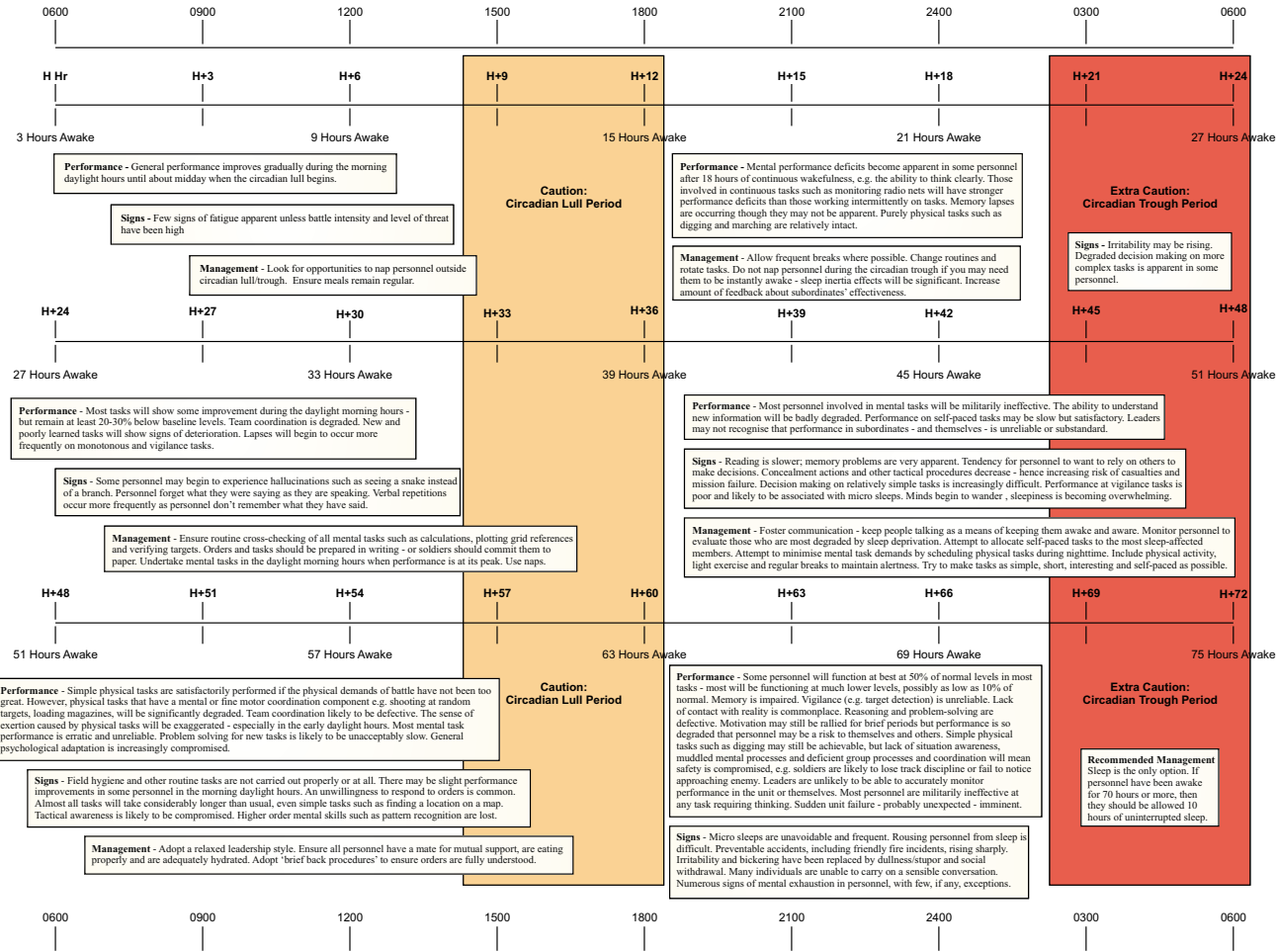


Figure 5. Performance, Signs and Management for a Three Day Sustained Operation

Compensating for the Effects of Lost and Disrupted Sleep

When signs of degradation begin to appear, the following may alleviate the impact (methods for improving wakefulness may also apply):

- a. Promote or enforce the ‘mateship’ system where soldiers team up to do tasks, check and double check each other and permit napping.
- b. Let members most affected by sleep loss do tasks which are self-paced. Sleep loss has less impact on these types of tasks as opposed to tasks that are work-paced.
- c. Encourage soldiers to write down tasks or messages received and have others check that it has been written down clearly and legibly.
- d. Adopt a ‘brief back’ procedure to confirm understanding.
- e. Cross check calculations and decision processes and verify targets.
- f. Organise the daily workload after a period of sleep to allow for mainly ‘mental’ tasks to be completed before ‘physical’ tasks.
- g. Develop written checklists for Standing Operating Procedures for use when levels of fatigue are likely to degrade memory and performance.
- h. Give priority of sleep to personnel who have critical tasks, whose role or tasks make them more vulnerable to sleep loss, or who are showing that they are more severely affected by fatigue.
- i. Evaluate the feasibility of establishing separate day and night fighting/operations teams.

After battle, sleep is best.

Roden B. Wriothesley Noel,
The Old, circa 1880

Post-combat Recuperation

Recovery:
Rules of Thumb



Hours of SusOps	Hours of Sleep
24 - 36	4
36 - 48	6
48+	10

The aim of fatigue management, in this phase, is to regain combat effectiveness as quickly as possible. The best way to deal with fatigue is to allow time to rest, and most importantly, sleep. Without this time, physical and mental recovery will not fully occur.

Resting or lying down is not enough; sleep must be taken. Sleep is the only effective remedy for sleep loss.

The men are, of course, very sleepy... but every hour that we are left unmolested is improving their condition.

Lieutenant-General Sir John Monash
noting the condition of A.I.F. Troops
cited in Geoffrey Serle's
John Monash: A Biography, 1982



Fortunately, small amounts of sleep, compared to actual sleep loss, can dramatically improve performance. After 24 hours of SusOps, four hours of uninterrupted sleep should promote adequate recovery. This time may be insufficient if subsequent mental performance, as opposed to physical performance, is required. Following 36 to 48 hours of SusOps, a block of at least six hours of sleep should be allowed for recovery. After 48 hours or more of sustained operations, personnel should be allowed to sleep until 'spontaneous' awakening or for up to 10 hours. Longer periods of sleep are not recommended as sleep 'drunkenness' and disruption to circadian rhythm may occur. For similar reasons, further sleep periods should not occur for at least 12 hours. If exhaustion is severe, watch for unsafe sleeping practices. Soldiers may fall asleep in potentially dangerous locations. Attempt to provide supervision especially if vehicles are in the area.

Next morning I woke in quiet calm, restored by the miracle of sleep. We had reached Menari before the Japanese, and my fears had been the creatures of exhaustion.

Henry Steward
*Recollections of a Regimental
Medical Officer*, 1983

Conclusion

*The sentry reefs his belt another hole, and, yawning, stares
into the gulf of night and whets his eyes, whose edge is
blunt with sleep that spreads like rust along the blade of
sight.*

*Minute to minute adds its pebble weight upon his stooping
head and harnessed shoulders, and in the riddled brazier
of his skull thoughts burn to ash, and settles low, and
smoulders*

into half-dreams ...

Sentry-Go
Kenneth Mackenzie
POW Camp guard
Cowra

Fatigue and sleep are recurring themes in military writing, reflecting their importance to both soldiers and commanders throughout the ages. Sleep management is no less important to the contemporary commander especially due to the continuous nature of modern warfare. Both military performance and morale are closely tied to fatigue. There exist many conflicting views about sleep and sleep loss, many of them outdated, born in a bygone era of warfare. Modern day commanders need a factual understanding of sleep. They should be aware of individual differences in sleep need and the effects of sleep deprivation on their subordinates. In addition, commanders must be sensitive to their own susceptibility to the effects of sleep loss. These effects are often insidious and can also be particularly disruptive to the mental tasks that are the commander's 'bread and butter'. Contrary to Napoleon's advice that 'commanders are not expected to sleep', commanders must sleep to remain effective.

We have been amusing ourselves by trying to discover the longest period of absolute quiet. We have been fighting now continuously for twenty-two days, all day and all night, and most of us think that absolutely the longest period during which there was absolutely no sound of gun, or rifle, fire, throughout the whole time was ten seconds ... We are all of us certain that we shall no longer be able to sleep amid perfect quiet, and that the only way to induce sleep will be to get someone to rattle an empty tin outside one's bedroom door.

(then) Brigadier John Monash
Letter home from Anzac Cove
20 May 1915

The most debilitating effects of sleep deprivation are psychological rather than physical. It is a command responsibility to promote an awareness of sleep loss and fatigue. All personnel should get adequate sleep before deployment and, during operations, try to sleep at least four to five hours in a single unbroken period each 24 hours (adequate to keep going indefinitely on a sustained operation). In critical situations, however, three hours of sleep per 24 hours will suffice for most soldiers to remain effective for up to nine days. Commanders and personnel who undertake primarily mental work (eg, technicians) and tasks requiring sustained attention (eg, radio operators) need more sleep due to both the wearying nature of mental tasks and the added impact of fatigue on mental activities. Soldiers should use every opportunity to have short sleeps. Napping is usually beneficial; however, soldiers need to be aware that waking from naps may be accompanied by a state of confusion and sluggishness (sleep inertia). Performance evaluation is necessary to obtain a realistic idea of the severity of the effects of fatigue and sleep deprivation. These guidelines should be practised during training so that all personnel learn how to effectively sustain performance.

Before, during and after battle, sleep is the only excuse for not thinking.

Major General D.C. Spry
Commander 3rd Canadian Infantry
Division, 1944-45

... the fundamentals of war - that soldiers must be trained before they can fight, fed before they can march, and relieved before they are worn out.

Field Marshal Sir William Slim
Defeat into Victory, 1956

Recognition of the adverse effects of sleep deprivation permeates offensive military history. Deliberate prevention of sleep has often been a tactic against the enemy, for example, constant and harassing artillery fire, gas attacks (often in WWI a major aim of using gas was to prevent enemy soldiers sleeping in their trenches) and blaring loudspeakers as part of a psyops campaign. It is ironic then that commanders often contribute to sleep loss in themselves and their own troops by ignoring good sleep practice and management and promoting a culture where self-denial and presumed immunity to sleep loss are regarded as virtues. The reality is that such attitudes and behaviours are analogous to self-inflicted wounding; furthermore, they are dangerous and reflect a serious lack of professionalism. Leaders must have realistic expectations about performance levels during extended operations. They must know what aspects of performance are most vulnerable to degradation and understand how to manage the detrimental effects of fatigue so that military performance can be optimised in the face of the frictions of war.

The enemy should never be given a complete rest by day or by night, but be gradually and relentlessly worn down by exhaustion and loss until his defence collapses.

Field Marshal Earl Haig
quoted in Edmonds,
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Distrust yourself, and sleep before you fight.

John Armstrong, c. 1770

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