NAVAL HEALTH RESEARCH CENTER

SLEEP MANAGEMENT MANUAL

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SLEEP MANAGEMENT MANUAL

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I. BASICS OF SLEEP

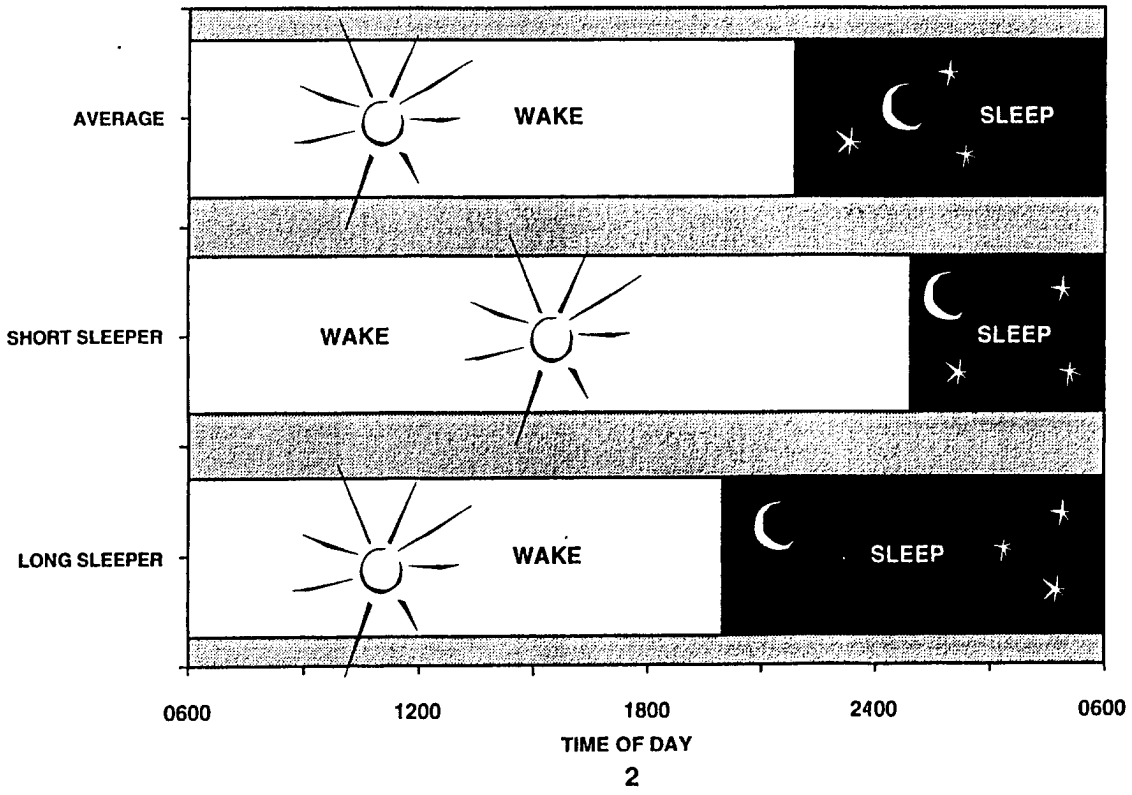
A. Introduction

Sleep is an essential physical need, like food, air, and water. You can skimp on it only to a point and still function. You will only perform and feel your best if you get an optimum amount of sleep. When operational requirements make this impossible, it is critical that you obtain the maximum amount of sleep possible within operational limitations. Also, it important that you know the effects of sleep deprivation so that countermeasures can be used to compensate. The purpose of this manual is to provide naval personnel with the basic facts about sleep and to teach them specific sleep management techniques.

B. Sleep Need

The average person needs about 8 hours of sleep to feel well rested and alert throughout the day. However, you may need more or less than this amount (Figure 1). Persons who need more sleep than average will be hit harder when operational requirements limit sleep. This is not a sign of weakness, laziness, or lack of motivation. The amount of sleep you need and your response to sleep loss is a biological characteristic. It is important to know your own sleep need and those of personnel under your command to plan effectively for operations that will limit sleep.

FIGURE 1: INDIVIDUAL DIFFERENCES IN SLEEP NEED



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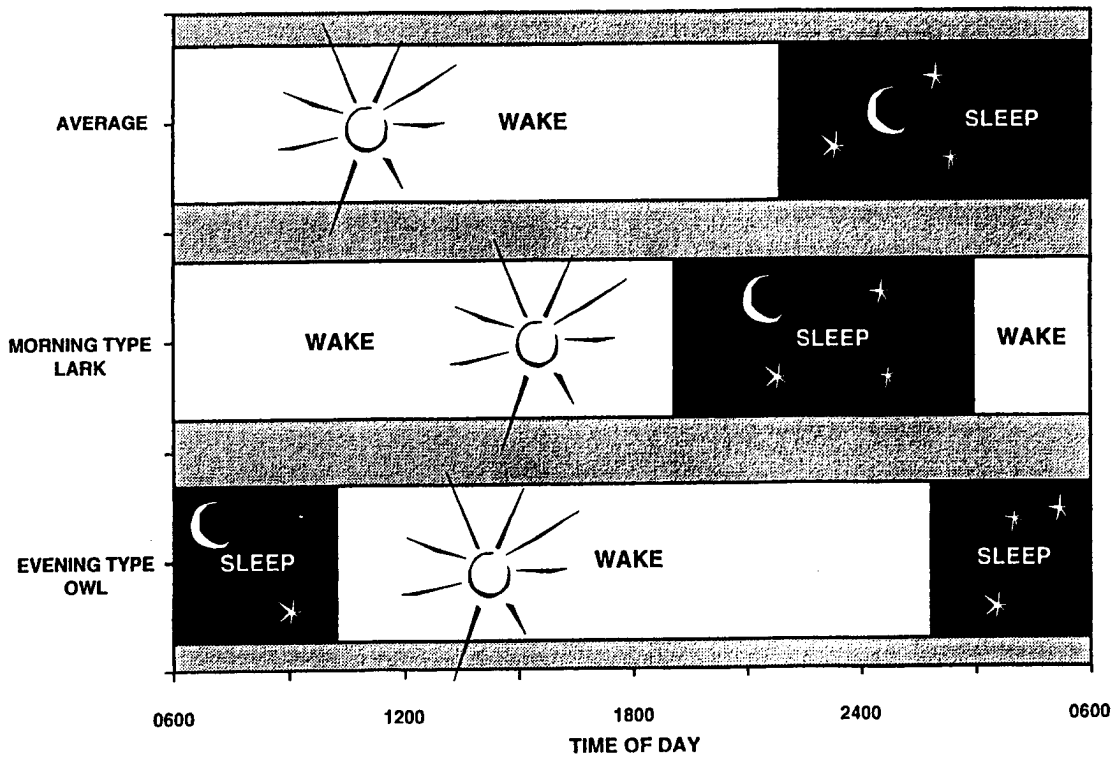
C. Sleep Timing

Almost everyone sleeps better if they sleep at night than during the day. However, the optimal timing of the sleep period can vary. Some people are ready for bed early ("Morning" types or "Larks"), others find it difficult to get to sleep until the early morning hours ("Evening" types or "Owls"). Sleep timing variations are diagramed in Figure 2. Unlike the amount of sleep you need, timing of sleep can be adjusted. Techniques for doing this are discussed under Countermeasures.

FIGURE 2: INDIVIDUAL DIFFERENCES IN SLEEP TIMING



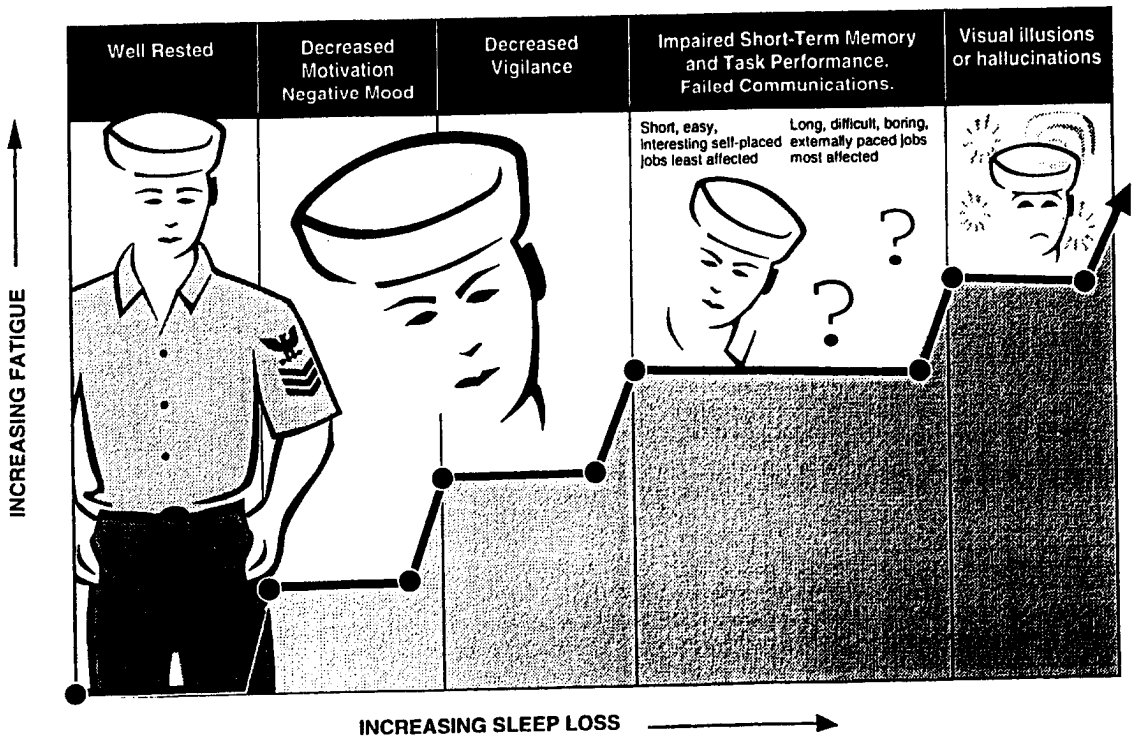
D. Effects of Sleep Loss

Operational requirements can prevent you from getting optimal amounts of sleep. Five hours of sleep per day can maintain performance (but not mood) in most people for at least a week, sometimes two. With less than 5 hours of sleep, performance can suffer significantly. It is critical that you be aware of the consequences of sleep deprivation and that you have a plan to compensate. Sleep-deprived people are often unaware of the extent of their impairment. This is important in operational settings when an individual reports no problem though performance and alertness may be degraded.

Effects of sleep deprivation are outlined in Figure 3. All aspects of human capability can be affected. Usually, the first thing affected is **mood**. You will tend to feel irritable and too fatigued to do your work. As sleep deprivation progresses, you are likely to experience impaired **vigilance**, making it difficult to focus your attention, and faulty short term **memory**. Poor attention and faulty memory can cause problems in **communication**, with failure to comprehend or failure to remember what has been communicated. After 2 days without sleep, **illusions** or **hallucinations** may occur.

Long, boring tasks are more affected by sleep loss than short and/or interesting tasks. Complex decision-making is more affected than simple, well-learned tasks. You may have more difficulties maintaining your alertness when you are sleep-deprived if you must work in a poorly lit area. Sleep loss accumulates over time. If you start an operation already short on sleep that will multiply the effects of restricted sleep during the operation. Interaction of sleep deprivation with circadian rhythms is discussed under Basics of Circadian Rhythms.

FIGURE 3: EFFECTS OF SLEEP LOSS



E. Getting Good Sleep

Good sleep is a matter of habit. Teach yourself to be a good sleeper under a regular daytime work schedule, and you also will sleep better under operational conditions. The following guidelines and information in Figure 4 provide strategies for getting good sleep.

Keep your sleep/wake schedule as regular as possible. If you sleep from 2200 to 0600 on workdays, avoid altering this by more than a couple of hours on weekends. An irregular schedule can detract from the quality and quantity of your sleep both on weekdays and weekends.

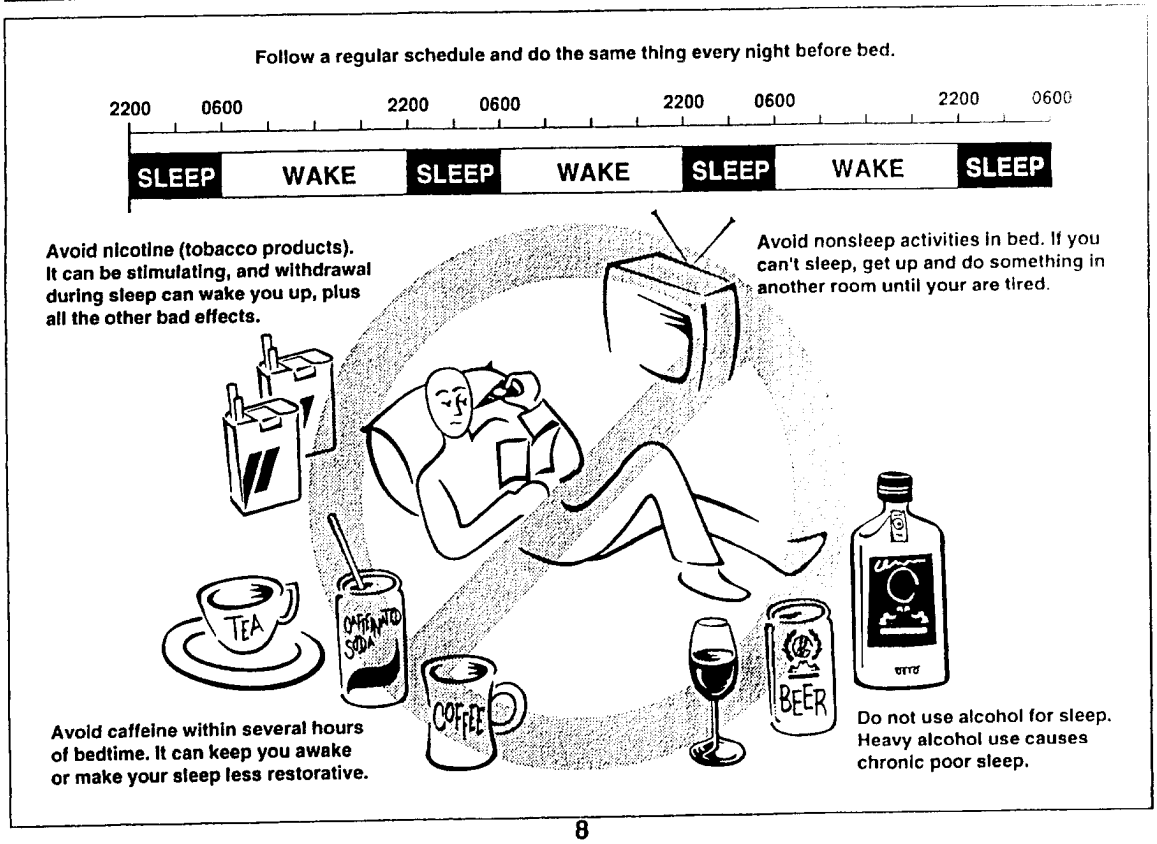
Avoid wake-promoting activities in bed. You want your mind and body to be ready for sleep when you are in bed. If you work, study, or eat in bed, you promote being awake and may be unable to sleep when you would like to.

Do not consume caffeine near your sleep period. Caffeine is a stimulant that will decrease the quality of sleep even in people who feel it has no effect. Caffeine is present in coffee, tea, many soft drinks, some over-the-counter (OTC) pain relievers, and other products.

Nicotine in tobacco products also can hurt your sleep, along with your health. During sleep the tobacco user goes into nicotine withdrawal. This may trigger awakenings and disrupt sleep quality and quantity.

While drinking alcohol may make it easier for you to fall asleep, overall, you will have poorer quality sleep. After alcohol you will tend to have awakenings and disturbed sleep the last half of the night.

FIGURE 4: OPTIMIZING SLEEP



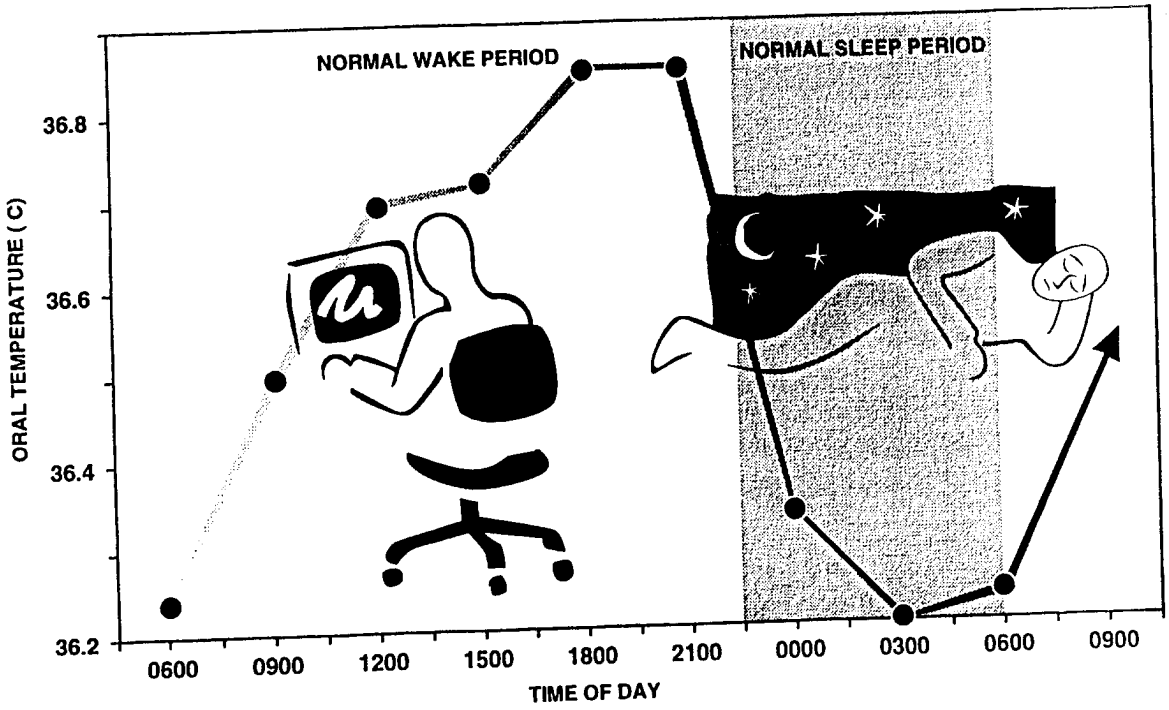
II. BASICS OF CIRCADIAN RHYTHMS

A. Introduction

Your body and mind are programmed to follow a daily rhythm. A circadian (circa = around, dies = day) clock in the brain controls the 24-hour rhythmic pattern of these functions. Humans have evolved to be awake and performing best during the day and to sleep at night. During the circadian low period (0200 to 0600) it is difficult to maintain wakefulness and performance. During the circadian peak (late morning to early evening) it is difficult to remain asleep. Vehicular and industrial accidents occur more frequently during the circadian low period. Several recent major disasters--Chernobyl, Bhopal, Three Mile Island, and Exxon Valdez--all occurred during this period. The circadian rhythm of body temperature (Figure 5) roughly parallels the rhythms of most performance measures.

Our circadian clocks run a little slow. Your natural tendency, if you had no time cues at all, would be to live closer to a 25-hour than a 24-hour day (lengthening the day). This is why it is easier to stay up later than to go to sleep earlier. It is also why it is easier to adjust after flying west than flying east (see Jet Lag).

FIGURE 5: CIRCADIAN RYTHMS



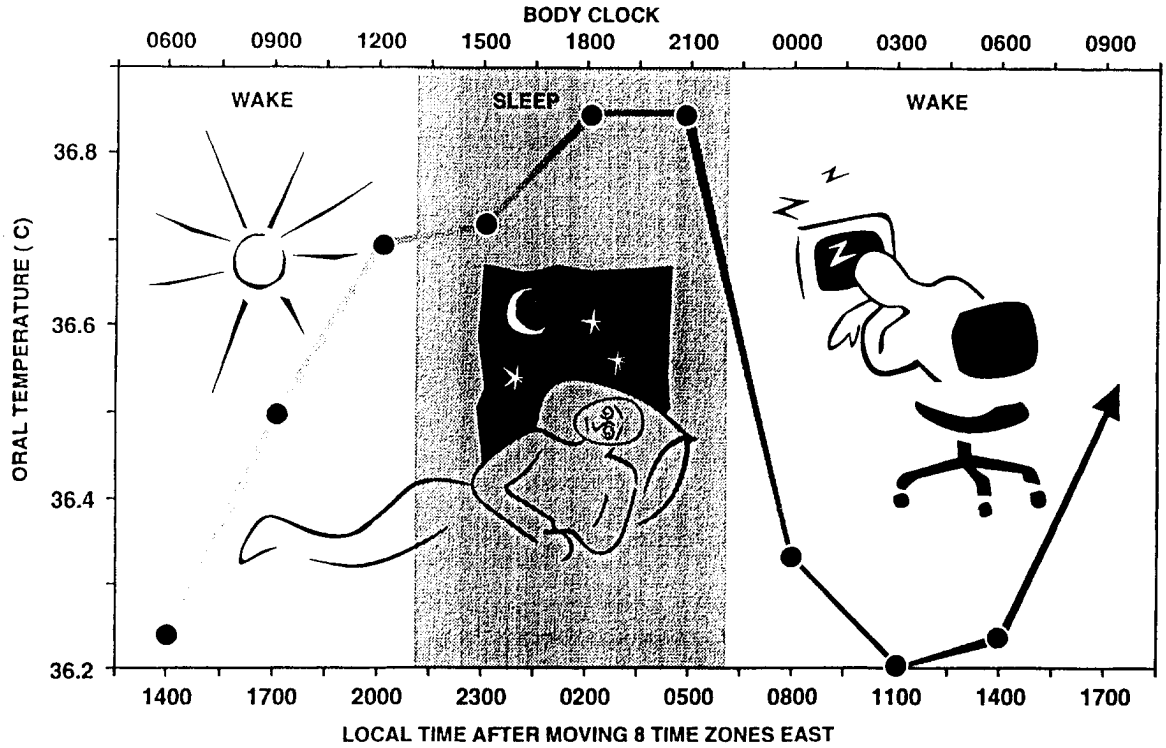
B. Jet Lag

Jet lag results from conflict between the body's internal clock and local time. The circadian clock cannot adjust immediately after rapid travel across multiple time zones. Initially, after jet travel over long distances, you are working and sleeping at the wrong times in relation to your internal clock (Figure 6). Subsequently, physiological disruption occurs as body rhythms adjust to the new time zone.

A variety of strategies can promote circadian adaptation to a new time zone. On the plane while you are traveling to the new location, eat and sleep at times appropriate to the destination clock. If you arrive in the morning after a long flight, take no more than a short nap. Wait until local nighttime for a longer sleep. It is especially important that you control the timing of your exposure to bright light before, during, and after transport, because bright light is the main signal that adjusts your internal clock. See the Bright Light section under Countermeasures for specifics on how to use bright light to reset your circadian clock.

However, if you must engage in nighttime operations soon after transport across 8 to 12 time zones, you may wish to stay on your home time schedule and prevent your rhythms from shifting. This way your time of peak performance falls during the time of the operations. To do this, maintain your home base schedule (i.e., by local time, sleep in the day and work at night), and avoid being out in the sunlight during the day. Another situation where you would not wish to adjust your circadian rhythms is on very short trips, when you will return to home base time within a few days. Under these circumstances, avoid bright light exposure.

FIGURE 6: JET LAG



After traveling to a new time zone it can take over a week for the body clock to shift to local time. This can cause difficulties both with performance during wakefulness and with sleep at night. Disturbed sleep can cause further performance inpairment.

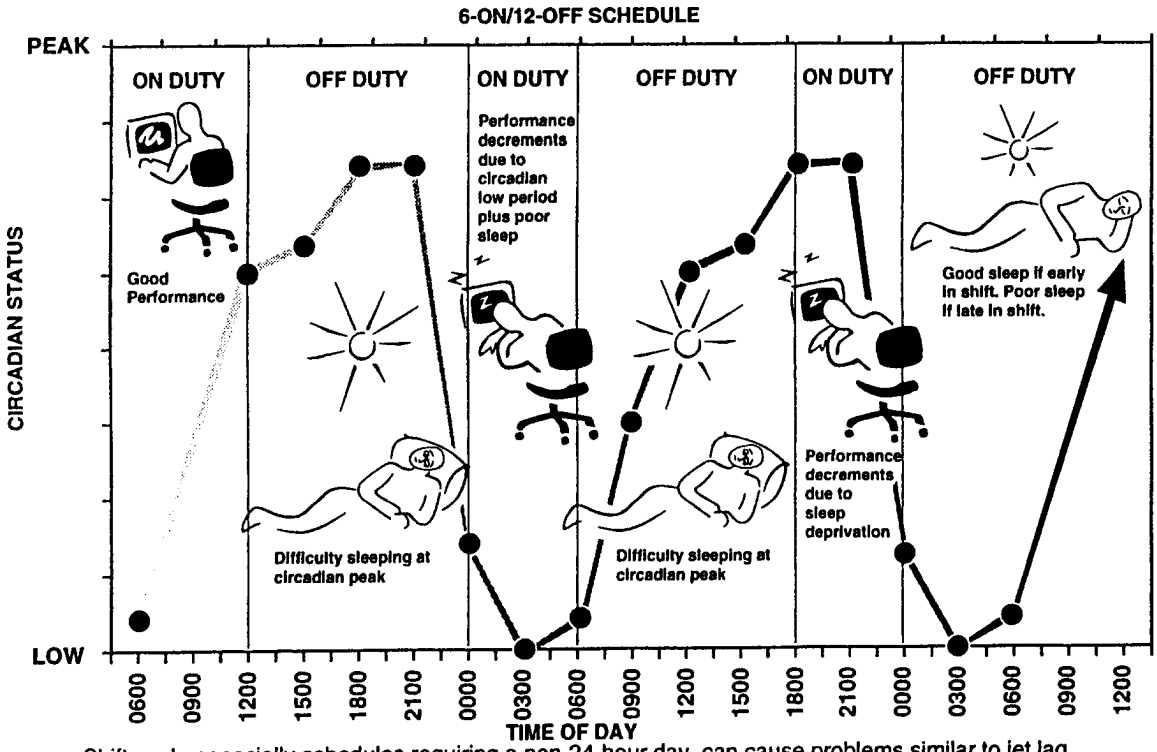
C. Shift work

Shift work schedules cause problems similar to jet lag. When you work the nightshift, both your work and your sleep suffer from circadian displacement. It is impossible to synchronize the body clock to a night-work schedule, unless the workday sleep/wake schedule is maintained during off-days as well. Careful control of the timing of sunlight exposure also would be required. If your work shift changes frequently, as with rotating shifts or non-24-hour schedules (see Figure 7), adjustment is not possible.

If you cannot adjust your body clock to your shift work schedule, it is particularly important to optimize your sleep. Otherwise, insufficient sleep combined with circadian misplacement of the work period can significantly impair your performance and alertness. This can increase your risk of incidents and accidents. Optimizing sleep is discussed in the Getting Good Sleep section in Basics of Sleep. Additional important factors when sleep must occur during the day include:

(1) Make the environment as comfortable, dark, and quiet as possible (e.g., blackout curtains and a fan to mask noise).
(2) Schedule a sleep period and respect it as you do a nighttime sleep period. You must be able to receive emergency commands, but avoid being awakened for nonemergencies.
(3) Avoid any caffeine close to the scheduled sleep period (preferably more than 6 hours before).

FIGURE 7: SHIFT WORK

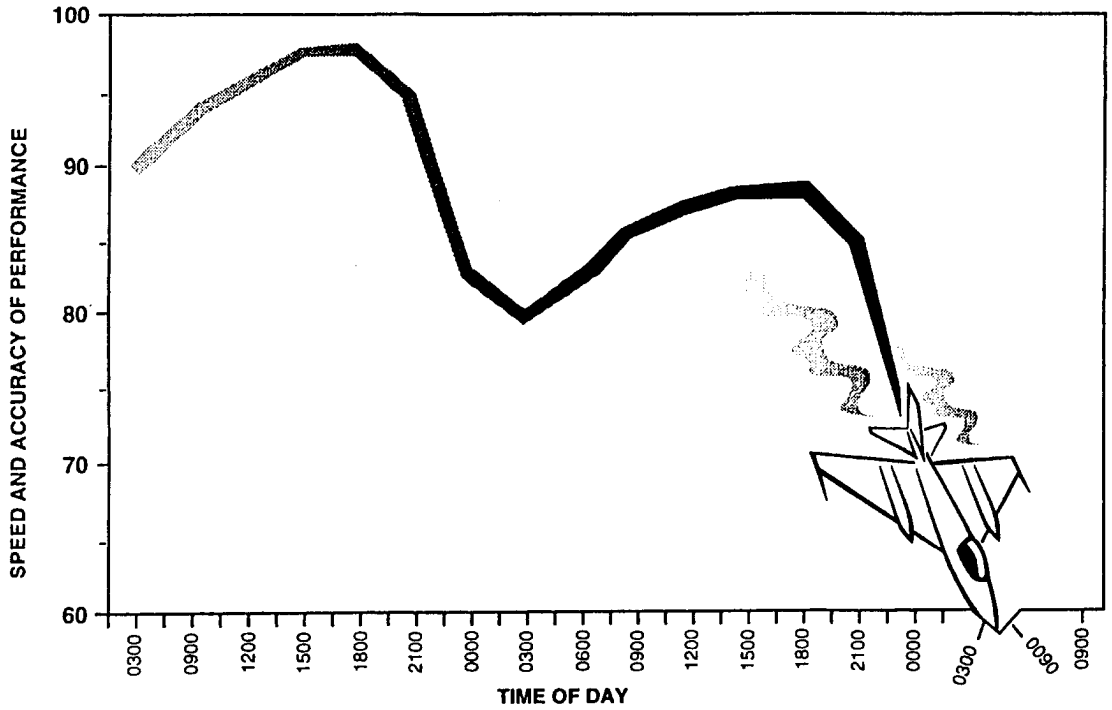


Shift work, especially schedules requiring a non-24-hour day, can cause problems similar to jet lag.

D. Interaction of Circadian Rhythms With Sleep Loss

The effects of any amount of sleep deprivation on performance will be worse during the circadian low period. For example, you may do better at 0900 after 24 hours without sleep than you would at 0400 with less sleep loss (Figure 8). Remember, if you have shifted time zones then the time when sleep deprivation will affect your performance the most is defined by your body clock, not by local time.

FIGURE 8: CIRCADIAN INTERACTION WITH SLEEP LOSS



Sleep deprivation adds to the effects of the circadian low point. The risk of errors and accidents is highest with late night/ early morning work during sleep deprivation. Naps should be used to minimize sleep deprivation during SUSOPS or other sleep restricting operations when possible. You should ALWAYS start such an operation well rested.

III. COUNTERMEASURES

A. Bright Light

When you move to a new time zone you must reset your internal clock as well as your watch. The main factor that resets your internal clock is bright light, like sunlight. Most artificial light found indoors is ineffective. Bright light also may have a direct alerting effect, so that you are more alert working in a very brightly lit area than in a dimly lit area.

The basic rule is that light late in the day shifts you later and light early in the day shifts you earlier (Figure 9). The tricky part is that "late" and "early" are defined by your internal clock, not by local time. For example, if you travel 6 time zones eastward your clock is behind local time. To shift your internal clock earlier you need bright light around 0500 to 0900 internal time, 1100 to 1500 local time. Light at 0500 to 0900 local time (2300 to 0300 internal time) would shift you in the wrong direction.

Instructions for when to get and avoid light to help your clock adjust are shown in Table 1. Be outside without sunglasses as much as possible when Table 1 says to be in sunlight. Try to stay indoors when Table 1 says to avoid sunlight. If you must be outside or in a brightly lit area, wear dark, reddish-brown sunglasses. Blue or gray glasses are ineffective for this purpose. (It also is possible to shift your clock over several days before transport. However, this requires the use of special bright light devices.)

FIGURE 9: EFFECTS OF BRIGHT LIGHT

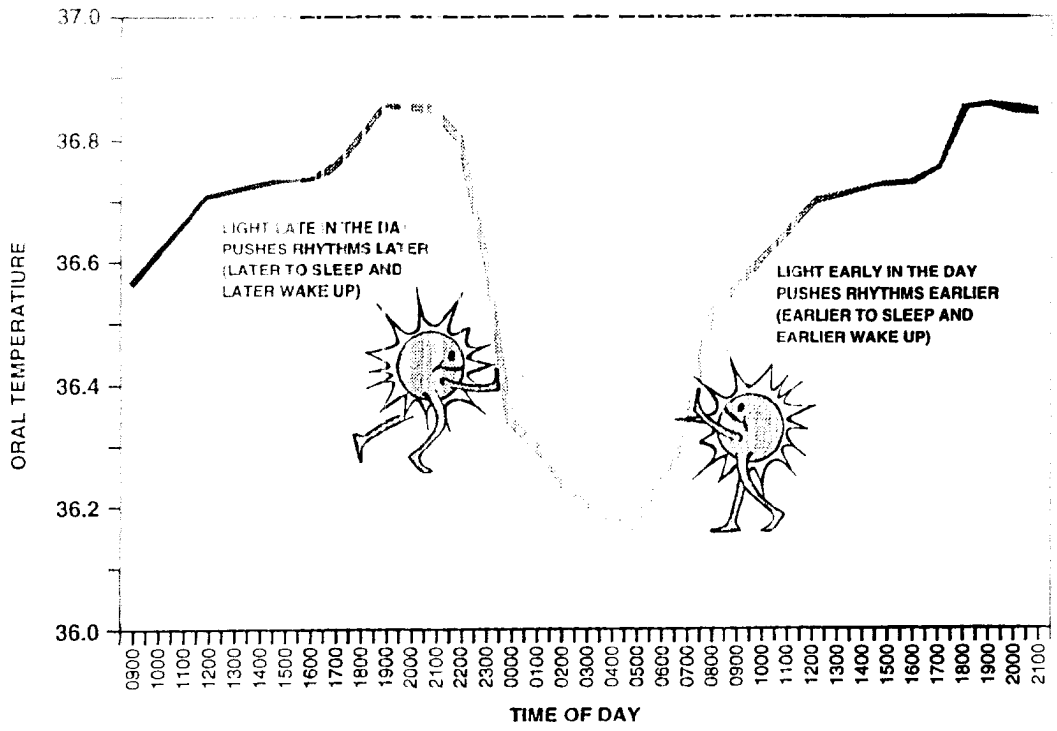


TABLE 1: LIGHT EXPOSURE GUIDELINES TO ADJUST INTERNAL CLOCK

# TIME ZONES CROSSED	DAYS AFTER TRANSPORT	GET BRIGHT LIGHT	AVOID BRIGHT LIGHT
WESTWARD			
3 - 6	1 - 3	late evening	early morning
7 - 9	1	late afternoon and early evening	late evening
	2 - 4	late evening	early morning
10 - 11	1 - 2	afternoon	late afternoon and evening
	3 - 5	evening	early morning
12	1	early afternoon	late afternoon and evening
	2	late afternoon and early evening	late evening
	3 - 5	evening	early morning

EASTWARD			
3 - 5	1 - 2	late morning	early morning
6 - 8	1	early afternoon	morning
	2	midday	early and midmorning
	3 - 4	midmorning	early morning
9	1	mid- to late-afternoon	morning and early afternoon
	2	midday	early and midmorning
	3 - 4	late morning	early morning
10-12	same as listed for 12 time zones westward travel.		

B. Naps

Military operations may not allow a 7- to 8-hour nocturnal sleep period. Training yourself to be a good sleeper will help you to nap under operational conditions (see Getting Good Sleep). Naps are a useful preventive measure (e.g., an evening nap prior to a night shift). They also can be important for recovery from sleep loss.

In general, longer naps are more effective than shorter ones (e.g., a single 2-hour nap is better than two 1-hour naps). However, even a very short nap (e.g., 30 minutes) may be helpful. A period of sleepiness and somewhat impaired performance, "sleep inertia," can occur immediately upon awakening from a nap. Sleep inertia generally lasts 10 to 15 minutes before improving. Sleep inertia may be worse with naps in very sleep-deprived individuals. If possible, avoid performing critical functions immediately upon awakening from a nap.

Sleeping at the scheduled time must be considered an important duty. It can be as crucial as performing critical aspects of the mission. Personnel instructed to sleep should not feel guilty about sleeping while others work. Personnel who are working should not resent those who are sleeping. Optimizing your teammate's sleep will allow him to perform better later, will improve your chance of sleeping later, and will promote mission accomplishment.

Naps can be taken near, or even in, the workplace (e.g., in a reclining chair). It will be easiest to fall asleep if naps occur during the late-night/early-morning hours or in the afternoon. These naps can prevent spontaneous, uncontrolled sleep episodes that can increase incidents or accidents or jeopardize mission success.

C. Medications

Stimulant medications are sometimes used to maintain wakefulness and performance during periods without sleep. Coffee is a very common stimulant that many people use to "self-medicate" at such times. Caffeine should be avoided anytime close to a scheduled sleep period (preferably at least 6 hours before) since it will decrease the amount and quality of sleep. Additionally, large amounts of caffeine tend to cause tremors. This can interfere with performance of fine manual tasks. You should be aware that caffeine is an ingredient in many products (e.g., soft drinks and OTC pain relievers).

Your physician may decide to administer prescription stimulants, such as amphetamines, during some operations. The timing and dose of such medications is important. Never use prescription stimulants other than on the instruction of a physician. One difficulty with stimulants is that they interfere with subsequent recovery sleep. Sometimes use of a stimulant requires follow-up use of a sedative to allow subsequent sleep.

Sleeping medications can facilitate sleep under nonoptimal conditions. However, they also can impair performance and may not be appropriate during military operations. Do not use any (even OTC) sleeping medications during a military operation, except under a physician's supervision.

D. Other Strategies

Allow extra time for all jobs. Sleep deprivation slows you down. Mistakes may occur when you are trying to work too fast.

Memory of recent events and verbal communications are impaired. Confirm comprehension of orders by repeating them back. Write down important information and read it back.

Know your sleep needs. If you are a commander know the needs of the personnel you command. When possible, those who have gotten the least sleep (relative to their needs) should be assigned to easy, short, interesting tasks, or should be allowed to sleep.

Sleep loss makes you irritable. Be aware that your companions are not deliberately irritating you.

If an individual is falling asleep on the job or seeing things that are not there, it is evidence of extreme sleepiness. Sleep is essential in such a case.

IV. CONCLUSION

Sleep is a vital physical need. Without sleep, humans have degraded performance, and alertness. This is not a sign of weakness or low motivation. The best countermeasure for sleep deprivation is **SLEEP** (see Naps). Planning and allocating time for personnel to sleep is a critical but often ignored factor in military logistics. Human sleep requirements should be managed like other mission assets for successful operations. Often the personnel most critical to the operation get the least sleep. A commander feels his constant presence is required, so he does not sleep and thereby puts the mission at risk. Sleep deprivation is cumulative. If you start an operation already sleep-deprived, you have one count against you that will add to any sleep limitation imposed by mission requirements. Individuals are poor at accurately assessing their level of sleepiness. There can be individual differences in these factors, so tailor this information to your body and operational requirements. Do not rely on only one approach. Utilize multiple strategies to promote performance and alertness during operations.

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13. ABSTRACT (Maximum 200 words)

Sleep is a vital physical need. Without sleep, humans have degraded performance and alertness. Sleep deprivation is cumulative. Planning and allocating time for personnel to sleep is a critical but often ignored factor in military logistics. Circadian rhythms are daily fluctuations in physiological and behavioral functions controlled by an internal clock. Having to work or sleep at the wrong phase of your circadian cycle, as with jet lag or shift work, can impair performance or sleep. Sleep deprivation and circadian rhythms interact. Sleep deprivations exaggerates the impairment in alertness seen at the circadian low point. This manual presents important facts about sleep, the effects of sleep deprivation and circadian rhythms, and discusses sleep management techniques.

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