SLEEP MANAGEMENT USER'S GUIDE

FOR SPECIAL OPERATIONS PERSONNEL

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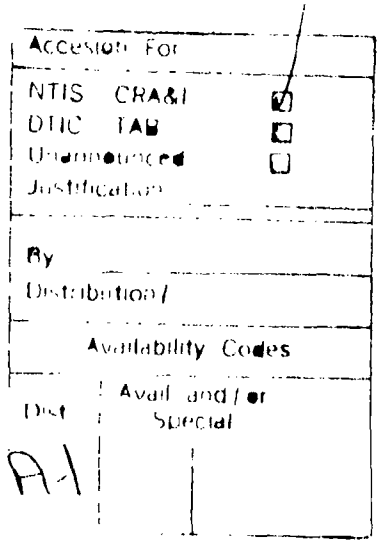

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Summary

Sleep management is the study of sleep, its effects on personnel, and methods to satisfy sleep requirements under demanding work schedules. Sleep logistics is the application of sleep management to military operations. The objective of sleep logistics is to ensure that fighting men and women at all levels obtain sufficient sleep to maintain combat effectiveness. In the past, major battles usually occurred during the day due to the limitations of night visibility and unreliable equipment (which inhibit target detection and classification capabilities). Technological advances diminish these obstacles, such that combat can occur both day and night. Sleep loss can result, making sleep logistics an important issue. Special warfare missions frequently involve night work and arduous operational schedules. This user's guide explains selected sleep management techniques for use during military operations, with particular emphasis on special operations missions. The guide will assist field commanders in using sleep logistics to prevent compromise of mission accomplishment due to sleep deprivation. It also provides basic information about the need for sleep and consequences to behavior and mood when that need goes unsatisfied. Additionally, the guide provides techniques for assessing severity of sleep debt and compensating for its ill effects. The most important steps to be taken for effective sleep management are to: a) prepare a work/rest-sleep plan to meet sleep needs; and b) employ self-diagnostic techniques to detect and compensate for the effects of sleep debt. Key facts and recommendations for sleep management are listed, along with countermeasures to the effects of sleep loss.

SLEEP MANAGERS' QUICK REFERENCE -- KEY FACTS AND RECOMMENDATIONS

- Degrading effects of sleep loss on performance, moods, and motivation to work are felt most strongly during the daily circadian trough, as defined by body temperature. The circadian trough occurs between 0200 and 0600 of the time zone to which the body is adapted.
- There is a significant loss of performance efficiency when an operation demands a longer-than-24-hour continuous work episode (CWE). After a CWE of 36 hours, target detection is 70% and decoding is 50% of baseline.
- Uninteresting and complex tasks are more seriously affected by sleep loss than interesting and/or simple tasks.
- Critical but routine tasks are often skipped, since sleep loss reduces overall willingness to respond.
- Physical work feels much heavier with sleep loss because of exaggerated perceptions of physical exertion.
- Short-term memory is seriously affected. Poor short-term memory and lapses in attention work against effective communication. Sleep loss can cause a listener to forget what was recently said in a conversation. A listener may fill the information gap by inaccurately restructuring the conversation.
- The ability to initiate action decreases with increasing sleep debt. This decrease in initiative includes all interactions among team members.
- Sleep-deprived individuals tend to overestimate their ability to perform tasks. They lose insight as to how well they are performing their assigned tasks.
- Sleep loss causes deterioration of personal hygiene.
- Often, higher ranking personnel are more likely to go without sleep because they feel their duties are the most critical and cannot be fulfilled by others. Paradoxically, this sense of duty can result in performance impairment, compromising the very goals they sought to achieve by denying themselves sleep.
- Sleep loss can be measured by the use of sleep logs to quantitate the amount and timing of sleep and by the use of a mood scale and the plus 7 task to quantitate the impact of sleep loss.
- Uninterrupted sleep is more restorative. Avoid interruptions (e.g., empty bladder prior to attempting to sleep).
- Optimize your circadian rhythms by following a regular schedule every day.
- Sleep can be improved by: following a regular nighttime routine, avoiding caffeine for several hours before bed, avoiding excessive

alcohol, avoiding tobacco, not becoming dependent on sleeping medications, using muscle relaxation techniques, developing a positive attitude about sleep and doing your worrying somewhere other than bed.

Suggestions to limit sleep deprivation during an operation are listed below:

- Resting is not sleeping. It is the amount of actual sleep that counts.
- Partial sleep deprivation over multiple days has a cumulative effect.
- We may be able to store up a little extra sleep taken ahead of time. Certainly, do not begin a prolonged operation already sleep-deprived. However, sleep periods of over 10 hours should be avoided.
- Taking naps can interfere with nighttime sleep. However, naps are beneficial when insufficient sleep is otherwise not available.
- Physical signs of serious sleep loss are: vacant stare, "glazed" eyes; pale skin; body sways upon standing, sudden dropping of chin upon sitting; intermittent loss of hand grip strength; walking into obstacles and ditches; poor personal hygiene; very slow heart rate; loss of interest in surroundings; slurred speech.
- Train to be an effective sleeper and learn techniques to help induce sleep under unusual and stressful conditions.
- Get as much sleep as possible before an operation. Avoid incurring a sleep debt before the start of an operation when sleep may be limited.
- Try to sleep at least four to five hours in a single, unbroken period each 24 hours. This amount of sleep should be adequate to maintain maximum performance for a month or longer.
- During military operations where sleep is limited, use every opportunity to take naps (preferably greater than 20 minutes). Napping is usually beneficial in maintaining task performance. However, be aware that awakening from naps may be accompanied by sleep inertia. Allow enough time (five to ten minutes) to overcome this before beginning activities.
- Use diagnostic aids, such as a sleep/activity diary, a mood scale, and the Plus 7 Task, to obtain a realistic measure of sleep debt severity.

If sleep deprivation cannot be avoided, be aware of and plan for its effects:

- Know the individual sleep loss tolerances of the personnel under your command.
- Realize that self-observation deteriorates with sleep loss. Combat unit members may be unaware of significant impairment, so institution of countermeasures should be based on the known degree of sleep deprivation, not on whether people feel they need them.
- Allow more time than usual for completion of all activities.
- Assign the most sleep deprived individuals to self-paced, interesting, and/or easy jobs.
- Critical activities may require increased numbers of personnel.
- Effective communication will require increased effort. Always confirm orders by repeating them aloud, and as sleep loss progresses, write orders down.
- Be aware of circadian rhythms. All sleep loss effects will be worst during the early morning hours (of the time zone to which you are adapted).
- Physical activity may temporarily counteract sleepiness, but activities will seem more difficult than usual, and sleepiness and fatigue will be increased afterwards.
- Sleep may be stored to some extent, thus longer than usual sleep periods (but less than ten hours) may be beneficial.
- Early bedtimes produce better results than later rising to increase sleep period.

SECTION 1 BACKGROUND AND PURPOSE

This user's guide explains the principals and applications of sleep management.

1.0 Background and Problems

Sleep management for military personnel (sleep logistics) was developed roughly 30 years ago by Lieutenant Colonel Harold Williams of the Walter Reed Army Institute of Research. Sleep logistics, which includes work/rest-sleep planning, is of serious concern when personnel must work without sleep for more than 24 hours under conditions of decreased or disrupted sleep, particularly at night.

All levels of military personnel may be subjected to such stressful work schedules: those on the front line, those involved in resupplying the front line, and those participating in special missions. Historically, major battles were often limited to daylight hours because of poor night visibility and unreliable equipment. With improved technology, these problems have decreased; as a result, personnel may be required to fight both day and night.

Behavioral problems associated with sleep loss during military operations are well documented. George E. Marshall's observation during the Normandy Operation in World War II accurately describes these problems: disorientation, overwhelming sleepiness, and inability to give and receive orders due to uncontrollable lapses in attention and poor memory. Sleep logistics has been proposed as a means of preventing these problems by way of work/rest-sleep planning.

1.1 Purpose

The purpose of this user's guide is to provide basic information for field commanders about the need for sleep and consequences to behavior and mood when that need goes unsatisfied. The user's guide outlines the best available techniques for preventing excessive sleep loss, determining the severity of sleep debt, and countering the ill effects of sleep loss so that military objectives can be achieved. This user's guide is based upon two decades of sleep research conducted by the Naval Health Research Center (NAVHLTHRSCHCEN), San Diego, California.

SECTION 2 SLEEP AND SLEEP DEPRIVATION

Section 2 describes the normal sleep/wake cycle of human beings and reviews the effects of various disruptions to this cycle.

2.0 Circadian Rhythms

Humans evolved as diurnal creatures. That is, people are designed to be active during the day and to sleep for a continuous seven- to eight-hour period each night. Every aspect of each individual (physical and mental performance, mood, body temperature, blood pressure, pulse, etc.) shows a characteristic variation over a 24-hour cycle. These 24-hour variations are called "circadian rhythms."

Generally, a person will work most effectively in the afternoon and evening (1400 to 2000), although memory processes may peak somewhat earlier; this is called the "circadian peak." The time of least effective work is in the early morning hours (0200 to 0600), or the "circadian trough." Figure 1 represents speed and performance accuracy for a mental task over two days and nights without sleep. The subjects were Basic Underwater Demolition/Sea, Air, Land (BUD/SEAL) students who had successfully completed Phase 1 training. The physical characteristics of this population closely resemble those of SEALs (Beckett et al., 1989). For accuracy (percent correct), higher numbers represent better performance. Speed (reaction time) is presented as the inverse (1/sec), so that higher numbers represent better performance for this measure as well.

FIGURE 1

The data in Figure 1 illustrate two important points. First, performance varies across the day, with the worst performances occurring during the early morning hours (the usual sleep period). As subjects continue to work into the morning and afternoon of the second and third day, performances improves relative to the preceding night, despite the fact that sleep deprivation continues to progress. Second, performance deteriorates as sleep deprivation continues. When performance at the same time on the second day is compared to that of the first day, the second-day performance is always worse. The worst performance occurs during the second late-night work period, when detrimental effects of working during the usual sleep period are compounded by effects of accumulated sleep deprivation. In summary, people work best during daytime hours and worst late at night (between 0200 and 0600); both daytime and nighttime performance can be degraded when preceded by sleep deprivation.

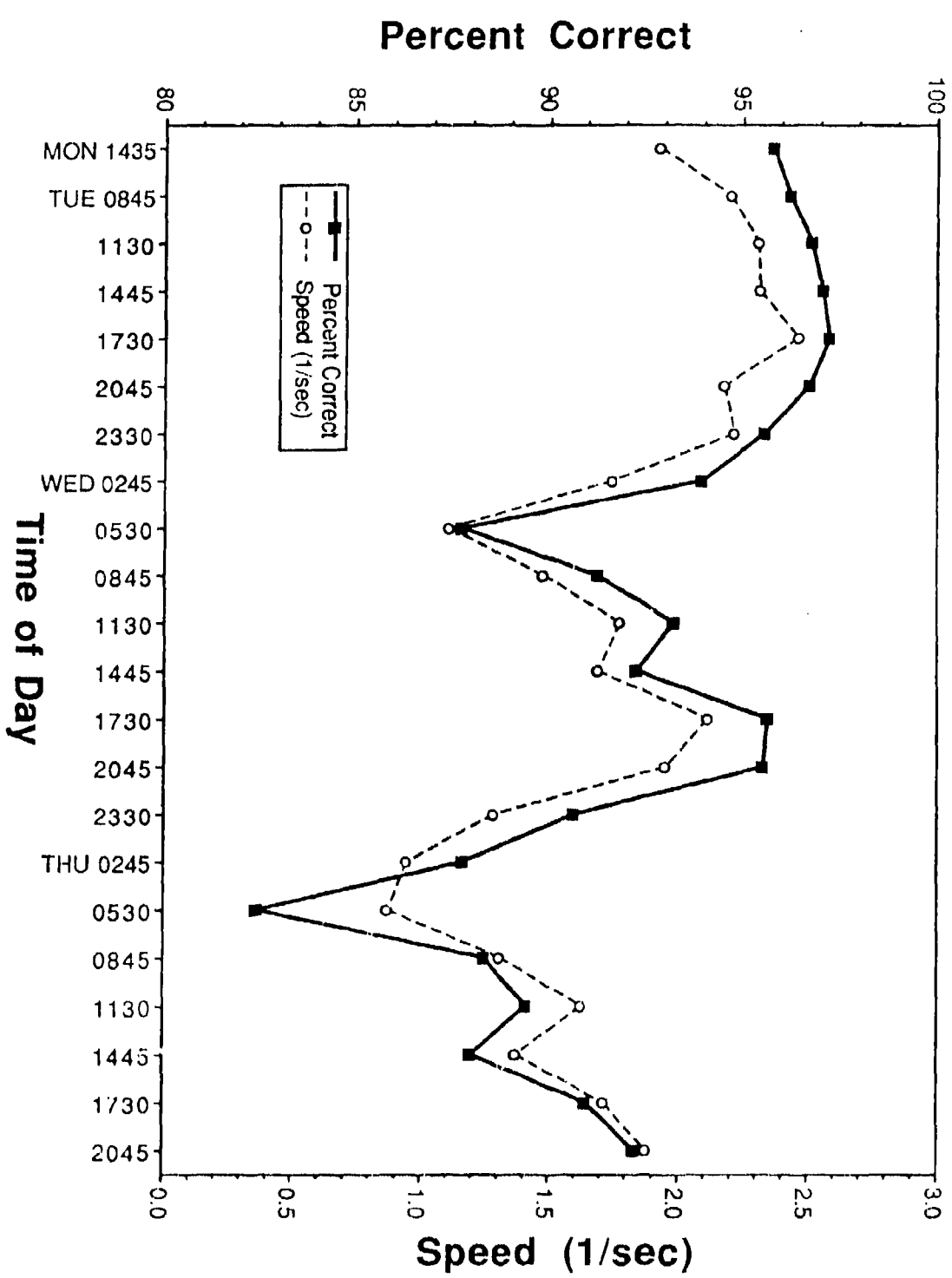

FIGURE 1: Speed (1/RT) and Accuracy on a Four-Choice Task Over Two Days of Sleep Deprivation

2.1 Sleep Deprivation

Sleep deprivation can be total or partial. Total sleep deprivation involves no sleep for 24 hours or more. In military operations, this can occur during prolonged, intense operations. Often, higher ranking personnel are more likely to go without sleep because they feel their duties are the most critical and cannot be fulfilled by others. Paradoxically, this sense of duty can result in performance impairment, compromising the very goals they sought to achieve by denying themselves sleep.

Partial sleep deprivation involves anything less than the "usual" amount of sleep a given individual requires. Sleep requirements vary from person to person, but the average ideal sleep period is seven to eight hours each night. Most people can restrict sleep to four to five hours per night for weeks (or even months) without major effects on cognitive, physical, and motor performance, although mood and motivation may suffer. As sleep is cut back beyond this, performance usually suffers. With special prolonged training, some people have learned to maintain performance on only three hours of sleep a day, divided into several nap periods. Whether or not this can be accomplished without prolonged training has not yet been fully researched.

Sleep deprivation is cumulative. A little deprivation over many days can add up. A detailed description of signs and symptoms of sleep deprivation is presented in Section 4.0.

2.2 Naps

Circadian rhythms apply to sleep as well as performance. Just as work performance is worst at night, sleep is least effective during the day. That is, a given amount of sleep taken during the day will probably be less recuperative than the same amount during the night. Sleep is most effective when taken in a single, continuous period rather than many short naps; however, nap sleep can be valuable. When total sleep deprivation is reduced to partial sleep deprivation via naps, the likelihood of improving performance, and therefore operations success, is increased. There is evidence that people can learn to nap effectively with practice. It is important to be aware that "resting" is not the same as sleeping. Only actual sleep can satisfy the body's need for sleep and reverse the effects of sleep deprivation. Merely resting, even in bed with eyes closed, does not fulfill the need for sleep.

2.3 Sleep Inertia

In daily routine, most people do not perform critical operations upon awakening. The body and mind are accustomed to awakening gradually, easing into the day's activities. When people are required to perform activities immediately upon awakening, there is often a period of confusion, sluggishness, and lack of coordination. This post-sleep state, usually lasting about five minutes, is

called "sleep inertia." Currently, no convincing evidence exists to indicate that sleep inertia worsens at any particular point in the circadian cycle. Therefore, sleep inertia should not impact on the time of day a person sleeps. However, individuals who have already accumulated a degree of sleep deprivation may show more severe or prolonged sleep inertia. Also, unusually prolonged sleep periods (more than 10 hours) may be followed by a period of severe sleep inertia.

Unlike most civilian environments, combat may require participation in complex and important behaviors immediately upon awakening. The possibility of sleep inertia must be taken into account in deciding when and for how long personnel may sleep. It must also be a determinant in assigning activities to personnel who have just awakened (awake less than five to ten minutes).

2.4 Jet Lag

The circadian rhythm of the sleep/wake cycle attunes to the part of the world where a person lives. When a person travels to a new time zone, his or her internal clock is out of synchronization with local time. For example, if a person travels east from Los Angeles to Germany, the body clock (still on home base time) will be nine hours out of synchronization with German time. Working between 1100 and 1500 German time (normally an ideal time to work) means the body and mind are working at 0200 to 0600 Los Angeles time (the circadian trough period and the worst time to work). Under these circumstances, optimal performances and moods cannot be expected. Adjustment to a new time zone is gradual, requiring a week or two for large shifts. Until adjustment is complete, signs and symptoms of jet lag will persist. During a period of jet lag, a person may experience low energy, sleepiness during the day, irritability, and moodiness. Reaction time and other aspects of performance may not measure up to usual levels. Headaches, intestinal upset, and difficulty in sleeping are likely to occur. The latter can, in turn, further aggravate jet lag symptoms.

SECTION 3 SUSTAINED OPERATIONS AND SLEEP MANAGEMENT

Section 3 defines sustained operations and sleep management.

3.0 Operational Relevance

Military operations can be prolonged. Short military operations may be closely spaced, with little recovery time in-between. Participants in one mission or operation may have to assist in subsequent missions or operations, thus limiting their opportunity for rest and recovery. Two terms used when discussing such situations are "continuous work episodes" (CWE) and "sustained operations" (SUSOPS). A CWE is a time period during which one works without pause for rest/sleep. Sustained operations contain one or more CWEs, and last for more than 24 hours. Three primary factors have limited the duration of CWEs in the past: a) limited vision at night; b) equipment unreliability; and c) limited endurance. With improved technology, the duration of CWEs is determined primarily by endurance, which is limited primarily by the need for sleep. In other words, the duration of SUSOPS is determined by the combat unit's endurance, not by weapon or target reliability, weather, or darkness.

Along with one or more CWEs, most prolonged operations include relatively quiet periods. Various levels of intensity characterize a battlefield environment. Distinct phases include movement to contact enemy forces, fighting, consolidation, regrouping, and resupply. Periods of intense, continuous fighting, with no chance for rest/sleep, are CWEs. Even on the front line, where relatively quiet periods with opportunities for short periods of rest can occur, one must always be ready to quickly resume fighting. A series of closely-spaced missions with intensive pre-mission planning and preparation requirements can approach a SUSOPS-type situation.

3.1 Sleep Management

Sleep management pertains to techniques for optimizing sleep for those who must work under demanding shifts or continuous schedules. Its purpose is prevention of and compensation for deteriorating performance, moods, and motivation caused by lack of sleep. Researchers in the area of sleep management are investigating new psychological, physiological, pharmacological, nutritional, and biochemical methods to remedy and counteract the effects of sleep loss.

Sleep logistics is the application of sleep management to military operations -- establishing and requiring compliance to a work/rest-sleep schedule. Sleep logistics plans times and places for sleep in operations or closely-spaced missions lasting a total of 24 hours or more. The objective of sleep logistics is straightforward: fighting men and women, at all levels, must have sufficient periods of quality sleep. They must be able to recuperate from the fatigue and stress of CWEs and maintain, both as individuals and as a fighting unit, combat effectiveness during SUSOPS and other stressful schedules.

3.2 Sleep Management Recommendations

Sleep management provides ways to reduce sleepiness and the accumulation of fatigue during CWEs. Using mission scenario operation guidelines, periods of available sleep and total number of possible sleep hours must be determined. Since changes in operational requirements are inevitable, it is recommended that several work/rest-sleep plans be prepared for all phases of an operation; the best plan can be adopted for altered requirements.

Predeployment Phase. Many people tend to live under conditions of mild sleep deprivation, never getting quite as much sleep as they really need. Data suggest sleep may be stored to some extent. Thus, the week before a period of intense work is not the time for personnel to put in late nights, either for work or for fun. Instead, longer-than-usual sleep periods (no more than 10 hours) would be beneficial. Early bedtimes produce better results than later rising times.

Also, personnel must become familiar with the surroundings and conditions under which they will sleep. For example, some people may have to sleep in chemical-protective garments. If sleep in such unusual conditions is anticipated in forthcoming operations, sleep management requires that personnel practice sleeping under these conditions during the predeployment phase. Similarly, good sleep managers will try out anticipated work/rest-sleep schedules before an operation. For example, if personnel will be working predominantly at night during a mission, it may be helpful to convert to a night-work/day-sleep cycle (relative to your destination time zone) for a period preceding deployment.

Deployment Phase. During the deployment phase, sleep quality can be reduced by time pressures, traveling in uncomfortable vehicles, and changes in time zone and climate. Preplanned work/rest-sleep schedules should be adopted and followed as closely as possible so that combat unit members may be fully combat effective.

Pre-combat Phase. As discussed in Sections 2.0 and 2.4, the body has a circadian rhythm associated with the time zone to which it is adapted. If deployment involves rapid transfer across more than one or two time zones, some degree of jet lag will occur. When there is a week or more delay between combat zone arrival and actual combat, personnel can adjust to the new time zone. However, when there is no delay, it may be best to stay with the work/rest-sleep pattern of the home base. In that case, combat unit members will not try to adjust their circadian rhythms to local time. Possible techniques for accelerating circadian adjustments will be discussed later in this manual.

Physiological and mental efficiency are influenced by the degree of adjustment or lack of adjustment to the local day/night cycle. For example, combat unit members working in the afternoon by local time may physiologically be working at 0200 to 0600 hours by home base time. Thus, without adjustment to

local time, daytime performance would be poor, since 0200 to 0600 hours is the circadian low point in performance efficiency. Leaders should be aware of this inefficiency and plan the workload accordingly.

Combat Phase. By using a work/rest-sleep plan, the sleep manager can avoid a situation where all personnel are physically and mentally exhausted at the same time. However, operational demands may prevent adoption of optimal work/rest-sleep and shift-work plans, and personnel will often experience significant sleep loss. Counterdegradation measures can help under these circumstances.

If the operation requirements make sufficient sleep impossible, personnel should take advantage of any lull in combat to nap. Effective napping means sleeping, not just resting.

Uninterrupted sleep for as little as 10 minutes may partially recover alertness and help maintain job performance. However, the risk of sleep inertia with naps of less than ten minutes (see Section 2.3) must be acknowledged, especially during the combat phase. The sleep manager must balance the negative effects of sleep (lost man-hours and sleep inertia), and the positive effect (improved ability to perform a job after sleep).

Post-combat Phase. Immediately following an operation, combat unit members should be allowed to sleep for up to 10 hours. Longer periods of sleep are not desirable, as they tend to cause severe sleep inertia (see Section 2.3) and delay getting back to normal schedules. Sleep lost during the operation need not be replaced hour-for-hour. After one or two long recovery sleep periods, duration should be within the normal range for subsequent sleep periods. The sleep manager should be aware that sleep inertia lasting longer than five minutes, and increased susceptibility to naps may occur during the week following SUSOPS.

SECTION 4 PERFORMANCE DEGRADATION

Sleep management will: (a) prevent degradation in performance, mood, and work motivation by devising the best work/rest-sleep plan for any operation; (b) identify the symptoms of sleep deprivation and increase combat unit awareness of those symptoms; and (c) overcome degradation by reallocation of jobs and use performance aids.

4.0 Identifying Signs and Symptoms of Performance Degradation

The signs and symptoms of sleep loss are variable. Different people have different susceptibilities, and manifestations may be intermittent. However, as sleep debt accumulates, signs and symptoms will be more prevalent and will persist. *When* these may appear in a given person depends not only on the accumulated hours of wakefulness, but also on individual tolerance to sleep loss, types of tasks to be performed, severity of the physical workload, and time of day (or point in the circadian cycle).

Mood and Motivational Changes. Early symptoms of insufficient sleep include mood changes and decreased willingness to work. Combat unit members may feel less energetic, less alert, less cheerful, more irritable, increasingly negative, and sleepy. Individuals who regard sleepiness and mood changes as signs of weakness often deny negative moods and tiredness, but may admit to decreased positive mood. After prolonged sleep loss, combat unit members will pass from increased irritability and negativism to a sense of dullness and weariness.

Impaired Attention. With progressive sleep loss, attention span becomes shortened. Sleep-deprived individuals cannot concentrate on a job for long periods of time. Intermittent, dreamlike, irrelevant thoughts or even brief "micro-sleeps" cause lapses of attention.

Short-term Memory Loss. A common sign of sleep loss is the inability to recall what one just saw, heard, or read. Memory loss is limited to recent events or to short-term memory. A sleep-deprived individual often remains confident about retaining messages, events, or data, only to find later that these have been forgotten.

Variable and Slowed Responses. Under high work demands, the best response time combat unit members can manage is affected only slightly by sleep loss. The effect of sleep loss on response time appears not as a slowing down of all responses, but as increased unevenness in response time. Some responses remain fast, while others become very slow. The danger of sleep loss is the *unpredictable* failure or slowing down of appropriate responses.

Vision Illusion/Hallucination. After more than 24 hours without sleep, some combat unit members may experience visual hallucinations. The prevalence of these hallucinations varies; some people never develop these symptoms. Auditory illusions or hallucinations are rarely experienced.

Failure to Complete Routines. Sleep loss causes carelessness toward such routines as drying feet, changing socks, or filling up canteens whenever water becomes available. Confirmation of verbal orders by repeating them aloud (the standard operating procedure) becomes automatic, without effect, and eventually disappears altogether.

Impaired Task Performance. Effectiveness in performing assigned tasks is significantly lowered when CWEs exceed 24 hours. For example, after a 36-hour CWE, a combat unit may be able to perform only 50% of the average message coding/decoding work output expected in a normal workday. Similarly, members of a combat unit may be able to detect only 70% of incoming signals. Task performance is degraded due to impaired short-term memory; decreased ability to concentrate; and intrusive, irrelevant, dream-like thoughts. Performance errors most frequently result from failure to respond to task demands (errors of omission); however, inaccurate responses tc task demands (errors of commission) also occur. Speed of reading written documents slows down. Comprehension is good after sleep loss; however, combat unit members may experience difficulty in remembering the directives in documents. Impaired performance follows a circadian rhythm. The worst performances occur during early morning hours of the time zone to which the person is adjusted.

Physical Exertion. Physical work performance is accompanied by a subjective feeling of physical exertion ranging from very light to very strenuous. The perception of exertion also follows a circadian pattern. In the early morning hours, combat unit members may feel that more effort is required to work at the same physical workload than if it were performed later in the day. Sleep loss exaggerates this phenomenon so that combat unit members may want to stop work because of the increased sensation of physical exertion. However, one can continue working without causing physical harm.

Lack of Insight. In the ordinary, non-sleep-deprived state, insights into our own behavior coincide fairly closely with the perceptions of others. If the inadequate performance of a combat unit member is corrected, that person will quickly remedy the problem because he recognizes it. However, with sleep loss, the power of self-observation deteriorates so that combat unit members become unaware of performance problems and may not even recognize them when pointed out.

Failed Verbal Communication. Failed verbal communication is caused by attention lapses combined with impaired short-term memory. Serious consequences can occur when field commanders are afflicted.

Since sleep-deprived individuals fail to remain continuously attentive to ongoing discussions, their conversation may become fragmented, wander, and contain repetitive phrases and ideas. Impatience and/or weariness due to sleep loss makes verbal communication very difficult and tends to result in misinterpretation. Members of the combat unit are less likely to have misunderstandings if they are asked questions with the answers cross-checked.

Failed verbal communications can cause orders to be ignored. A sense of numbness, omission of routines, and impaired short-term memory can also contribute to ignoring of orders.

Bickering is a manifestation of irritability caused by sleep loss. However, bickering has one positive aspect: it shows that sleep-deprived individuals are still talking to each other, exchanging orders and messages. The frequency of bickering increases with increased sleep loss, up to a point. It decreases when sleep-deprived individuals begin to have difficulty continuing to talk. As long as bickering continues, sleep-loss effects are not severe. A subsequent decline in overall message exchanges and the amount of bickering is a symptom of serious sleep loss. When bickering decreases, especially after a period of increased bickering, individuals may be in a state of mental exhaustion.

Signs of Jet Lag. As previously discussed, jet lag is commonly experienced after rapidly crossing three or more time zones. The physiological, performance, mood, and sleep effects of jet lag can compound the effects of sleep deprivation. The presence or absence of jet lag must be considered when assessing the status of combat unit members.

Signs of Shift-work Fatigue. Some work/rest-sleep schedules cause performance degradations similar to those caused by sleep loss and jet lag. A "normal" work/rest-sleep schedule calls for an 8-hours-on/16-hours-off schedule (i.e., 8 hours on duty, 16 hours off duty, with about 7 to 8 hours of continuous sleep).

It is often necessary to use shift-work in a military operation, as the available manpower pool is relatively fixed. Usually, the simplest way to plan for shift-work is to divide available manpower into two or three teams, where each team includes the supervision, skill-mix, and number of people necessary to accomplish the task. These teams rotate, providing workers around the clock. With three teams, a basic 8-hours-on/16-hours-off schedule can be established. If only two teams can be formed, the workload per team will go up (i.e., a 12-hours-on/12-hours-off schedule), and the length of rest periods will be shortened correspondingly. Occasionally, non-24-hour cycles (e.g., 8-hours-on/8-hours-off) are necessary. However, such schedules can produce more stress and fatigue than longer shifts with sleep available at the same time of day during each 24-hour cycle. The work/rest-sleep plan must balance the demands of the task to be accomplished against the fatigue (and resulting performance impairment) expected to accumulate. The physical signs of serious sleep loss are:

- Vacant stare - "glazed" eyes
- Blood-shot eyes
- Pale skin
- Body sways upon standing; sudden dropping of chin upon sitting
- Intermittent loss of hand grip strength

- Walking into obstacles and ditches
- Poor personal hygiene
- Very slow heart rate
- Loss of interest in surroundings
- Slurred speech

4.1 Preventing Performance Degradation

Sleep debt reduction best prevents fatigue-related performance degradation. This requires a properly established work/rest-sleep schedule. If possible, at least four to five hours of sleep (in a single, unbroken period) should occur per 24 hours in a single, unbroken period. This is enough sleep to prevent performance impairment for over a month in the average person.

There are large, stable, individual differences in tolerance to sleep loss. If one ranks a group of individuals in terms of tolerance to sleep loss (or ability to work without sleep) from the highest to the lowest, this ranking will remain stable across various sleep-restricting operations.

Tiring easily is not a personality weakness; the ability to do without sleep is not a learned trick. Some individuals are born as long-sleepers and others as short-sleepers. Short-sleepers tolerate sleep loss well; long-sleepers do not.

It is important for combat unit members to know their sleep loss tolerance. Some people may be overwhelmed by the loss of one night's sleep; some can take sleep loss in stride. The work/rest-sleep schedule will set an optimal pattern for the average person. If a person is sensitive to sleep loss, they should sleep more frequently (nap), or for a longer period of time to lower the rate of sleep-debt accumulation. If a person is tolerant to sleep loss, they can remain awake a bit longer than the average person. However, everyone should be careful of overconfidence in their ability to tolerate sleep loss. People succumb quite suddenly to sleepiness when sleep loss continues beyond their tolerance, certainly when it exceeds 72 hours. Being aware of this prevents the catastrophic failure in job performance often seen among people who are overconfident in their ability to ward off sleepiness.

Combat unit leaders are responsible to examine the operation scenario and determine when and for how long combat unit members may be able to sleep. Leaders must ensure that enough of the rest period entails actual sleep, since only sleep can prevent sleep debt from increasing. Leaders must not only know their own tolerance to sleep loss, but that of all others in their command. Combat unit members will suffer from imposed inaction and situational insomnia when told to sleep when they are not sleepy. Their restlessness may disturb the sleep of others in the unit.

Usually, in extended combat, involuntarily falling asleep is a more serious problem than situational insomnia or inability to sleep. However, field

commanders should be prepared to deal with some individuals who cannot sleep during the pre-mission and mission phases. Individuals who are poor sleepers in general will have worse sleeping problems under the increased stress and disruption before and during a military operation. Effective use of sleep training techniques can improve sleep under all circumstances. Sleep training techniques are discussed in Section 6.

4.2 Overcoming Performance Degradation

When signs of performance degradation begin to appear among members of a combat unit during SUSOPS, several preventive measures can be taken, such as setting aside time for naps, changing routines, or rotating jobs, if personnel are cross-trained.

The most sleep-loss-affected member should be allowed to do a task that can be accomplished at a pace set by the worker, not by the job. Sleep loss has less impact on self-paced jobs. Everyone should be encouraged to write down work to be done or messages received, and have others check what has been written for clarity and legibility.

It is unlikely that two members of a combat unit will become incapacitated by sleepiness at exactly the same time. Teaming up to do a job, or creating the buddy system, is as valid a concept in SUSOPS as in SCUBA diving. The possible use of pharmacological agents is discussed in Section 7.

SECTION 5 SLEEP MANAGEMENT IN FIELD TRAINING

Sleep management is just one of many problems a field commander faces. As the unit goes through predeployment, deployment, and combat phases, sleep management may appear to have a low priority when compared with other tasks. However, it is the responsibility of the field commander to see that combat unit members comply with sleep management recommendations. If the field commander is non-compliant with sleep discipline, sleepiness and sluggishness may result in hazards to the combat unit. The best way to remain alert and responsive to changing tactical environments is to plan for sleep. Taking naps during SUSOPS is not a sign of low fighting spirit or weakness; rather, it indicates foresight.

5.0 The Work/Rest-Sleep Plan

The work/rest-sleep plan should ensure that sufficient hours of sleep are available to everyone during all phases of a mission (see Section 2.1). Sleep management is particularly important during the predeployment or pre-mission phase, which tends to involve a heavy workload lasting over many days and weeks. Reduction of sleep to four to five hours per 24 hours does not cause serious degradation in cognitive task performances. Ideally, sleep management should seek to provide a minimum of four to five hours per day for all unit members. If total sleep per 24-hour period must be reduced from a normal seven to eight hours to less than four to five hours, careful sleep management is needed. Anyone who sleeps less than four to five hours per day over an extended period of time becomes more vulnerable to the effects of circadian rhythms and tiredness after eating. Irritability and mood changes may occur, and communication with others may deteriorate. Jobs involving hard physical work will amplify the undesirable effects of sleep loss.

During a deployment phase, it is important to provide environments which facilitate maximal sleep during rest periods. Sleep is facilitated by quiet, dark environments. Social interaction should be restricted, but reading with a small lamp is acceptable. Sleep loss is cumulative. If personnel are able to sleep only two hours or less one day, quality sleep time should be made up by sleeping five hours or more the next day; a key factor in sleep management is to avoid accumulation of a large sleep deficit.

In pre-combat and combat phases of an operation, it is unrealistic to expect that four to five hours of unbroken sleep per 24-hour period will be available. If necessary, sleep can be taken in short periods of 10 to 30 minutes. This method, however, is less recuperative than long blocks of sleep, so the longest feasible periods should be allotted. If sleep must be broken into many short periods, a longer total amount of sleep will be needed to achieve the same degree of benefit.

Sleep management is usually not considered necessary for the post-combat/post-mission phase, but plays a significant part in regaining combat

readiness. This is especially important when another combat mission phase is expected to follow shortly. The first post-combat/post-mission sleep period should be allowed to extend either to spontaneous awakening or for 10 hours (whichever comes first). This first recovery sleep should be arranged so that there will be an awake period of 12 hours or longer before the next sleep period. Inadequate sleep management will delay re-adjustment to a routine work/rest-sleep schedule.

5.1 Signs of Degradation

Review Section 4.0

5.2 Tolerance to Sleep Loss

Review Section 4.1

5.3 The Ability to Sleep

There are many factors in the field which tend to prohibit sleep. Sometimes combat unit members may not want to sleep so as not to miss exciting events. However, distractions must not cause sleep to be shortened to less than four hours per 24-hour period. Combat unit members must be disciplined to take naps. Napping is not a time-wasting luxury, but is mandatory for maintaining performance under conditions where opportunity for sleep is limited.

5.4 Aids to Measure Sleep Loss

Three aids that can help a field commander apply sleep management during a field exercise are: a) a sleep log; b) a mood scale; and c) the "Plus 7 Task."

Sleep Log. The best way to manage sleep in the field is to keep a sleep log. From the predeployment phase to the post-deployment phase, records of all sleep and nap periods should be kept. A record of total hours of sleep accumulated over the operation period should be included. Such a record will help to ensure that combat unit members are sleeping at least four to five hours per 24-hour period. If a sleep log shows that total hours of sleep (including nap periods) are less than four hours per 24-hour period, the first available long rest period must be used for sleep.

If combat unit members have not slept for 48 or more hours, a sleep period should be two hours or longer, if at all possible. While any sleep is physiologically better than none, sleep inertia may be worse after shorter naps in such sleep-deprived individuals. Also, the psychological difficulty of having to awaken so soon can impact motivation negatively. This is especially important if the sleep period should fall from 0200 to 0600, the circadian rhythm trough. The combined effects of a deeper circadian low (caused by sleep loss) and the sleep time being too short may cause personnel to feel they cannot go on.

A sleep log can be very simple. Sleep managers can write down the length of time combat unit members have slept, or the time sleep begins and the time of awakening. It should also be indicated whether or not combat unit members did moderate or heavy physical work.

An example of a convenient sleep log is included in Appendix 1. The upper and lower parts of the page represent the front and back of a 5" x 8" index card. By adding up the number of 30-minute boxes marked with a line to indicate sleep, it is possible to calculate the approximate amount of sleep that occurred in the given 24-hour period. If a sleep log card is filled out each day during an operation, the degree of accumulated sleep debt can be estimated at any time (Total Sleep/Number of Days = Sleep per Day; this should be at least 4 hours per day). You should probably consider a given sleep debt more severe if the majority of sleep has been taken in many small segments rather than a single sleep period per 24 hours.

The questions on the front of the card are phrased to fit a single sleep per 24-hour pattern, which may well not be the case under operational conditions. However, they indicate general types of information that may be valuable to sleep managers in making sleep logistics decisions.

Knowing how long it takes a person to fall asleep and whether that sleep is uninterrupted gives you a picture of how efficiently a given sleep period is being used. If someone has a two-hour period for sleep, but one hour is used waiting to fall asleep with repeated awakenings, then half the possible sleep time is wasted. In such a situation, the sleep environment should be improved if possible. Also, the individual might consider specifically training his sleep habits when he is out of the operational situation, to prevent such problems during future operations.

How rested a person feels, and whether there is a perceived need for more sleep, relate both to how restful sleep is, and the severity of the accumulated sleep debt. The mood scale serves as an abbreviated estimate of the more complex mood scale, should that not be available. Hours of work in the last 24 hours provides an indication of how much sleep limitation is based on workload, and how much leeway there might be for additional sleep. The "Remarks" section can be used for recording the presence and quantity of physical exertion.

The sleepiness scale on the back of the card (lower portion of the page) measures sleepiness subjectively. The way we feel during the late morning and afternoon of a day following a good night's sleep with no sleep deprivation in the recent past, is represented by response (1). The way we feel in the middle of the night after many days without sleep is represented by response (7). Subjective sleepiness can be very helpful in assessing the impact of sleep deprivation. However, military personnel (perhaps particularly elite groups such as SEALs) may be reluctant to admit feeling sleepy, considering it evidence of weakness. This can make the subjective sleepiness measure worthless. Sleep

managers need to convince those under their commands of the importance of answering this sleepiness scale objectively and honestly. With accurate answers, this scale can help assess whether a sleep plan is adequately fulfilling the sleep needs of personnel.

Mood Scale. A field commander should watch the moods of combat unit members for early signs of accumulating sleep debt. Since leaders know these people, they will probably be aware when their moods change from positive and energetic to negative, jittery, and defiant.

A more objective means of determining how rapidly combat unit members' moods are changing is a mood scale, such as the NAVHLTHRSCHCEN Mood Scale (Appendix 2). The NAVHLTHRSCHCEN Mood Scale consists of 19 positive and 10 negative adjectives describing moods.

Once personnel become familiar with the mood scale questionnaire, it will take less than a minute to score positive and negative changes in mood. The questionnaire should be administered to combat unit members before an operation begins, as well as while it is in progress. This enables the field commander to detect subsequent increases in negative mood, and decreases in positive moods, by comparing with the baseline phase.

Plus 7 Task. The effects of inadequate sleep can sometimes be masked when personnel put forth extra effort toward their assigned tasks. This is laudable evidence of professionalism. However, this masking may be misleading and may prevent appropriate preventive measures. It may appear that sleep loss is not affecting personnel; yet a short time later, combat unit members may show serious performance degradation.

Moderate physical work and excitement may also mask performance degradation. However, during the post-physical-work period, combat unit members will show greater deterioration of cognitive performance. The combined effects of physical work and sleep loss cause increased fatigue and sleepiness once the physical activation and excitement wear off.

The best way to detect early degradation in mental task performance, despite such masking, is to have combat unit members do an over-learned task of a rather boring nature, such as the "Plus 7 Task". The Plus 7 Task tests short-term memory, which is affected by sleep loss. It reliably detects mental degradation.

The Plus 7 Task consists of continuous additions. A random number between 5 and 9 (for example, 9) is picked. A short mental calculation is performed by adding 7 to the number (9 + 7 = 16). The calculation is performed again using the previous sum (16 + 7 = 23). These additions are all done in the head, remembering the sum and calculating the new sum by adding 7. When combat unit members can continue to do the Plus 7 Task correctly for one minute or longer without long pauses, they do not have severe sleep loss effects. If a particular individual is to be tested, the individual should say the sum aloud as it is

calculated. The sleep manager should note how steady and accurate this individual is in performing the task. Check the accuracy of the answers with a table listing a sequence of the correct sums (Appendix 3). However, more important than accuracy is whether a person can do repeated additions without long pauses. A few minutes of the Plus 7 Task, preferably with eyes closed, will reveal any mental degradation due to sleep loss.

As with the mood scale, the Plus 7 Task must be administered prior to the start of the operation to assess baseline performance. Testing should subsequently be given at least once each 24-hour period, preferably several times a day. A substantial decrease in the total number of additions completed, as well as increased number of long pauses or inaccurate additions, indicates deterioration.

5.5 Sleep Facts

A combat unit field commander/sleep manager needs to understand sleep. Following are some basic facts about sleep:

- Resting on a bed is not the same as sleep. During the deployment phase, many soldiers may be resting, but not sleeping, due to excitement. Make certain that people are asleep, not merely resting.
- People typically become sleepy at least twice a day: once in the afternoon and once during the habitual sleep time.
- There is evidence that a small amount of extra sleep can be stored in our bodies. Sleeping a little longer than the normal seven to eight hours (achieved by going to bed early rather than sleeping late) before deployment may increase tolerance to subsequent sleep loss. However, the important thing is not to begin a prolonged operation already sleep-deprived. Most people live in a chronic state of mild sleep deprivation; therefore, the main benefit of sleeping a little longer during predeployment may be to counter existing sleep deprivation.
- Excessively prolonged sleep periods (more than 10 hours) should be avoided, as they may cause exaggerated sleep inertia and a paradoxically increased feeling of sleepiness.
- To aid uninterrupted sleep, the bladder should be emptied before attempting to sleep. Waking up to urinate interrupts sleep, and getting in and out of bed can disturb others trying to sleep.
- During daytime or early morning naps, many people experience vivid dreams as they fall asleep, often waking up frightened. To some soldiers, the dreams may have a component of situational anxiety. Members of the combat unit should be reassured that vivid dreams are quite common in daytime sleep.

- There are several stages of sleep: stages 1, 2, 3, 4, and rapid eye movement (REM). Many studies have shown that the total amount of sleep, not the amount in a specific stage, is most important. The body will take care of the type of sleep obtained, if sleep time is available.

SECTION 6 SLEEP TRAINING

6.0 Sleep Training

Many behaviors affect sleep. Most people will experience some degree of sleep impairment when required to sleep under less-than-optimal conditions (e.g., wrong time of day, noisy or uncomfortable environment, presence of emotional stress). Anybody who starts out with poor sleep under ideal conditions is likely to sleep especially badly under difficult conditions.

In a young, healthy population such as Navy SEALs, a normal sleeper can fall asleep within 20 minutes, sleep seven to eight hours without any sleep disruption, and awaken in the morning feeling refreshed and alert. If a person has difficulty falling or staying asleep, or awakens in the morning feeling poorly rested, he or she is a poor sleeper and may suffer greater performance impairment during intense sleep-restricting operations. All military team members should train themselves for optimum sleep. A questionnaire to determine combat unit members' habits is included in Appendix 4.

Using sleep training techniques can improve sleep in general, and help ensure that individuals are well-rested with no sleep debt prior to deployment. In addition, the sleeping skills developed through sleep training will enable personnel to use the limited time that may be available for sleep during military operations most efficiently. If the sleep questionnaire indicates any sleep problems, the following tips will be helpful.

6.1 Summary of Good Sleep Techniques

- Optimize your circadian rhythms by: getting up, eating meals, exercising, and going to bed at the same time every day.
- Use the bed only for sleeping.
- Do the same thing every night before bed. This should be a short sequence of behaviors, starting before going to bed, and ending with a relaxing image to clear alerting thoughts from the mind.
- Establish a time and place for worrying other than at bedtime, and use it every day.
- Except during prolonged operations or before night missions, do not nap. It is best to sleep for a set duration (ideally, seven or eight hours) at the same time each night.
- Do not lie down during the day. Do not lie awake in bed for long periods. Get up and do something boring to bring on drowsiness.
- Avoid stimulants (coffee, caffeinated soft drinks, tea) after early afternoon. Avoid excessive alcohol. Avoid sleep-inducing medications. Avoid tobacco products.
- Learn a muscle relaxation technique.
- Have a positive attitude about sleep. Sleep is not just some mysterious event that happens to us; it is a behavior that can be controlled.

SECTION 7 DRUGS

7.0 Stimulants: Non-operational Use

Caffeine is a very potent stimulant drug. People who drink caffeinated beverages late in the day, after dinner, or close to bedtime generally have impaired sleep. They may have difficulty going to sleep or awaken easily during the night. They are often able to go to sleep, but the sleep is lightened by the stimulant. In this case, the person may not be aware of a sleep problem, but may not feel rested in the morning or may tend to get tired early in the evening. If more caffeine is used to counter this fatigue, there will be further impaired sleep. It is important to remember that coffee is not the only source of caffeine. Most soft drinks and tea contain caffeine, and even chocolate contains a stimulating caffeine-like drug called theobromine. Many medications also contain caffeine. A number of over-the-counter pain killers contain caffeine. All of these products should be avoided after early afternoon when working a standard daytime-work/nighttime-sleep schedule.

7.1 Stimulants: Operational Use

When working under an unusual or SUSOPS-type schedule, it is not unusual to use stimulant medications to try to counter the effects of sleep deprivation or circadian rhythms on alertness and performance. Such use should be controlled and carefully monitored. Most stimulants affect performance in a pattern known as an inverted "U"-shaped curve. This means that they appear to improve performance with increasing doses up to a point. But as the dose is increased further, performance starts to deteriorate and may even drop below baseline. Thus, drinking 20 cups of coffee a day to try to counter sleep deprivation effects may further hinder performance because of jitters and nervousness. Another factor to consider is that many drugs have less effect if consumed regularly. Routinely consuming large amounts of caffeine-containing products may decrease the effects of caffeine when really needed.

There are stronger stimulants than caffeine available by prescription. In very special limited circumstances, such medications might be used during a military operation. The most likely agents to be prescribed would be amphetamines, pemoline, or methylphenidate. It is not yet known which is the best agent. Pemoline has the advantage of being nonaddictive. In any case, medications should only be used under a doctor's direction.

If a stimulant (especially a strong one) must be used, a countering medication may be required later. For example, air crews who used stimulants to ward off fatigue when returning from distant missions, have reported great difficulty sleeping afterwards. Interference with recovery sleep could impair performance on subsequent missions. Thus, use of a stimulant may require subsequent use of a sedative -- again, only under a doctor's direction.

7.2 Sedatives

Under most circumstances, sleeping pills are not recommended for military personnel. In an operational situation, the risk of impairing critical performance is high. People are basically useless for the first four to six hours after taking a sleeping pill. Some sleeping pills impair activity the following day or even longer. Also, many sleeping pills suppress dreaming, causing less restorative sleep.

Even under non-operational circumstances, sleeping pills are not recommended. Using sleeping pills over an extended period can cause dependency. Additionally, sleeping pills can decrease effectiveness of the sleep training techniques discussed in Section 6.

One possible circumstance where sleeping pills might be appropriate for military use is with rapid transport across multiple time zones. When personnel are deployed to a distant location and need not engage in critical work soon after arrival, use of a sleeping pill to facilitate sleep during transfer, or promote sleep synchronized with the new time zone after transfer, might decrease the fatigue-related effects of jet lag. If effectiveness is demonstrated in scientific tests, new products may later become available to facilitate sleep without the side effects of sleeping pills.

Another possible situation where sedatives might be used is to allow sleep after stimulant ingestion, as was discussed in the preceding section.

7.3 Other Medications

Although nicotine is not an effective stimulant in general, those who are addicted to it may perform less well when deprived of it. Also, when a smoker (or a smokeless tobacco user) is asleep, his body starts to go into nicotine withdrawal. This often causes smokers to wake up during the night. Nicotine has a very broad range of effects on the body, including the cardiovascular system. It is possible that some of these effects could interact in a negative or even dangerous manner with the effects of some military activities (e.g., diving). Additionally, tobacco products, including smokeless tobacco, have well-established negative effects on health.

Alcohol can also cause sleep problems. First, as with any depressant drug, there is a need for more and more alcohol to induce sleep. Second, alcohol is metabolized very rapidly. A few hours after consuming alcohol, the body begins to withdraw from the effects, causing lighter sleep and a tendency to wake up. Third, alcohol suppresses dreaming. Dreaming is a very important aspect of sleep. Heavy alcohol users show chronic abnormalities in sleep. The deepest type of sleep is lost, as is observed in the very old, and a given period of sleep will be less restorative. Once these changes have occurred, they may persist, even after alcohol is no longer being used.

Most cold and allergy medications can affect either alertness or sleep. Many antihistamines tend to cause sleepiness. There are antihistamines that do not affect the brain (for example terfenadine or Seldane), but they are not currently available over the counter. If an antihistamine is needed, a physician should prescribe a non-sedating product. Most decongestants can produce a stimulant effect. If taken near bedtime, decongestants may impair sleep. When uncertain whether a particular product contains an antihistamine or a decongestant, consult a pharmacist.

SECTION 8 THE EFFECTS OF LIGHT

Light has two effects on alertness and sleep. First, there is a direct alerting or energizing effect. When personnel are sleep-deprived, working in a brightly lit area, preferably in sunlight, will help maintain maximum performance.

The second effect of light is indirect, via adjustment of circadian rhythms. Normally, everyone has a slight adjustment to his or her circadian rhythm each day. Curiously, the natural cycle of the internal circadian clock is not actually 24 hours; it is closer to 25 hours. Therefore, without adjustment, people would gradually slide in and out of phase with the world, experiencing periods of jet lag without going anywhere. However, various stimuli advance the clock each day to keep the body cycling at 24 hours. One of the most important stimuli is bright-light exposure in the morning, which can be employed when the circadian rhythm needs more extensive adjustment, as in jet lag. For example, if you have flown eastward across six time zones, you now need to be waking earlier and going to sleep earlier relative to your previous time zone. Bright-light exposure during the time period corresponding to morning in your original time zone will tend to push your rhythm forward. With a six-hour shift, this would correspond to the early afternoon period (i.e., 0700 to 1000 in your original time zone would correspond to 1300 to 1600 in your new time zone). This is the time when one should get bright-light exposure to assist in adjusting to the new time zone. Bright-light exposure during the time period corresponding to evening in your original time zone, has the reverse effect. Bright-light at the wrong time tends to cause you to go to sleep and awaken later. Therefore, after an eastward flight, you would want to avoid evening light. After a westward flight, you should avoid morning light and seek evening light (again, remember, "morning" and "evening" are defined by your original time zone). Special artificial lights are becoming available to facilitate correctly timed bright-light exposure under conditions when natural sunlight is unavailable. Light visors and light masks to provide controlled, individual light exposure are currently being tested and may be helpful during transport, but we need more definitive studies.

Controlled light exposure can also be used to shift a person's circadian rhythm deliberately out of phase with local time. For example, someone who needs to work the night shift might want to be as much as 12 hours out of phase with local time. This is possible with timed bright-light exposure. However, it requires careful protection from bright-light exposure at the wrong time of day and conformance to the new sleep-wake cycle (i.e., you can't work the night shift during the week, play by day on the weekend, and expect your body to be in phase with your work schedule). Under controlled military conditions, this may be possible. Exposure to artificial bright light could be used first to shift the circadian rhythm to the new work/rest schedule and then continued (with daily treatment during the morning) to maintain synchronization with that schedule.

SECTION 9 CONCLUSIONS/SUMMARY

Sleep research at the Naval Health Research Center (and many other research centers), has concluded that:

1. A total sleep duration of four to five hours per 24-hour period is the minimum amount required to maintain an acceptable level of performance (but with poor mood, fatigue, lowered motivation, and general malaise).
2. All sleep stages contribute equally to recovery from sleep loss. That is, one sleep stage is as effective as another in removing the undesirable effects of sleep loss.
3. It is preferable to sleep for a single, uninterrupted period rather than to take many short sleep episodes. However, short naps (20 to 40 minutes) are better than no sleep at all.
4. The body and its functions are influenced by circadian rhythms.

Sustained operations cause varying degrees of sleep debt, leading to decreased combat effectiveness and hidden cost in manpower resources. The process of removing sleep debt is quite similar to that for removing hunger. Hunger is eliminated by eating food; food logistics work scientifically to reduce hunger. Similarly, sleep logistics (management) will work to reduce sleep debt. Sleep management guidelines can help evaluate and prevent the degrading effects of sleep loss on performance, moods, and motivation to work.

The most important steps to be taken in a non-pharmacologic approach to sleep management are summarized below:

- First, and most important, prepare a work/rest-sleep plan to meet sleep needs. Sleep needs are satisfied only by sleeping.
- Second, utilize appropriate self-diagnostic techniques and performance aids to detect and compensate for sleep loss (sleep debt).
- Third, make sure personnel have good sleep skills that facilitate optimum use of opportunities for sleep before, during, and after an operation.

Important points to remember about effects of pharmacological agents in sleep management are summarized below:

- Any drug that helps keep you awake may prevent you from sleeping when you need to, and any drug that helps you to sleep may have hangover effects on performance.
- If a drug like caffeine is used repeatedly, it may have less effect than if used only once.
- Nicotine withdrawal can impair the sleep of tobacco users.

FURTHER READINGS

NOTE: For ease of readability for users of this manual, references used in preparing this manual are cited only in the bibliography, and not in the text. Please contact the authors at the address given for further information about specific reference citations.

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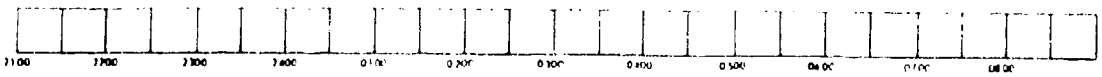
APPENDIX 1
SLEEP LOG

1. On the chart below draw a horizontal line through the squares corresponding to the half hour periods during which you were asleep during the last 24 hours. Put an X in the square corresponding to any half hour period during which you recall waking up for 15 to 30 minutes.

DAYTIME

NIGHTTIME



2. How much trouble did you have going to sleep last night?

☐ NONE ☐ SLIGHT ☐ MODERATE ☐ CONSIDERABLE

Time to fall asleep

. . MINUTES

3. How many times do you recall waking up last night?

4. How rested do you feel?

☐ WELL RESTED ☐ MODERATELY RESTED ☐ SLIGHTLY RESTED ☐ NOT AT ALL

5. Do you feel that you could have used more sleep?

☐ YES ☐ NO

6. Today's Mood

☐ VERY POOR ☐ POOR ☐ AVERAGE ☐ GOOD

Number of dreams recalled

7. Hours of work in last 24 hours?

REMARKS (Note especially reasons for loss of sleep such as duty, noise, cold, persons, etc.

SLEEP LOG NAVMED-6520/1 (REV. 4-74) NAVPRU (11-70)

Choose one of the seven statements below which best describes your present feelings. How you feel right now.

(1) Feeling active and vital, alert, wide awake.

(2) Functioning at a high level, but not at peak, able to concentrate.

(3) Relaxed; awake, responsive, but not at full alertness.

(4) A little foggy, let down, not at peak.

(5) Foggy, slowed down, beginning to lose interest in remaining awake.

(6) Sleepy, woozy, prefer to be lying down, fighting sleep.

(7) Almost in reverie; sleep onset soon, losing struggle to remain awake.

STANFORD SLEEPINESS SCALE

APPENDIX 2
NAVHLTHRSCHCEN MOOD SCALE

NAVAL HEALTH RESEARCH CENTER
MOOD QUESTIONNAIRE

This 29 item questionnaire (NHRC MQ) uses a four point Likert type response scale (not at all = 0; a little = 1; quite a bit = 2; extremely = 3). There are two scales reflecting the bi-factor theory of moods. These scales were derived using the principle components solution on limited data samples. The items in these scales and the scale ranges are:

Negative Scale: annoyed, defiant, drowsy, dull, grouchy, jittery, sleepy, sluggish, tense, tired

(simple sum of 10 item scale responses; range 0 - 30)

Positive Scale: active, alert, carefree, cheerful, able to communicate, considerate, dependable, efficient, friendly, full of pep, good-natured, happy, kind, lively, pleasant, relaxed, satisfied, able to think clearly, able to work hard

(simple sum of 19 item scale responses; range 0 - 57)

Moses, J.M., Lubin, A., Naitoh, P. & Johnson, L.C. (1974). Subjective evaluation of the effects of sleep loss: The NHRC Mood Scales. Technical Report 74-24, Naval Health Research Center, San Diego, CA.

NPRU MOOD SCALE
11ND-COM-6520/2 (5-73)

Instructions: For each item, choose one of the four answers that best describes how you feel now. Then put an "X" in that box.

NAME			AGE	SEX	DATE
ITEM	NOT AT ALL	A LITTLE	QUITE A BIT	EXTREMELY	
ACTIVE					
ALERT					
ANNOYED					
CAREFREE					
CHEERFUL					
ABLE TO CONCENTRATE					
CONSIDERATE					
DEFIANT					
DEPENDABLE					
DROWSY					
DULL					
EFFICIENT					
FRIENDLY					
FULL OF PEP					
GOOD-NATURED					
GROUCHY					
HAPPY					
JITTERY					
KIND					
LIVELY					

APPENDIX 3
PLUS 7 TASK TABLE

PLUS 7 TASK TABLE

1	2	3	4	5	6	7	8	9
8	9	10	11	12	13	14	15	16
15	16	17	18	19	20	21	22	23
22	23	24	25	26	27	28	29	30
29	30	31	32	33	34	35	36	37
36	37	38	39	40	41	42	43	44
43	44	45	46	47	48	49	50	51
50	51	52	53	54	55	56	57	58
57	58	59	60	61	62	63	64	65
64	65	66	67	68	69	70	71	72
71	72	73	74	75	76	77	78	79
78	79	80	81	82	83	84	85	86
85	86	87	88	89	90	91	92	93
92	93	94	95	96	97	98	99	100
99	100	101	102	103	104	105	106	107
106	107	108	109	110	111	112	113	114
113	114	115	116	117	118	119	120	121
120	121	122	123	124	125	126	127	128
127	128	129	130	131	132	133	134	135
134	135	136	137	138	139	140	141	142
141	142	143	144	145	146	147	148	149
148	149	150	151	152	153	154	155	156
155	156	157	158	159	160	161	162	163
162	163	164	165	166	167	168	169	170
169	170	171	172	173	174	175	176	177
176	177	178	179	180	181	182	183	184
183	184	185	186	187	188	189	190	191
190	191	192	193	194	195	196	197	198
197	198	199	200	201	202	203	204	205
204	205	206	207	208	209	210	211	212
211	212	213	214	215	216	217	218	219
218	219	220	221	222	223	224	225	226
225	226	227	228	229	230	231	232	233
232	233	234	235	236	237	238	239	240
239	240	241	242	243	244	245	246	247
246	247	248	249	250	251	252	253	254
253	254	255	256	257	258	259	260	261
260	261	262	263	264	265	266	267	268
267	268	269	270	271	272	273	274	275
274	275	276	277	278	279	280	281	282
281	282	283	284	285	286	287	288	289
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APPENDIX 4
SLEEP QUESTIONNAIRE

NHRC SLEEP QUESTIONNAIRE
(8/15/78)
Page 1

Today's Date _____

NAME _____ RANK/RATE _____ RATING _____

SEX _____ SOC SEC # _____-____-____ DATE OF BIRTH _____ AGE _____

CURRENT DUTY STATION _____ DATE ASSIGNED _____

Instructions: Please fill in the blanks or circle the answer that best applies to you. The completion of this questionnaire is voluntary. This information will be used for research only, and will not become a part of your permanent service record. THE QUESTIONS BELOW ARE ABOUT YOUR USUAL SLEEP NOW.

For questions 1 and 2, please use 24-hour clock times:

1) At what clock time do you usually go to bed on workdays? _____
On days off? _____

2) At what clock time do you usually wake up on workdays? _____
On days off? _____

3) On workdays, do you go to bed and get up at fixed, regular times?
1. Always or almost always
2. Often
3. Sometimes
4. Never or almost never

4) How long does it usually take you to fall asleep after lights-out?
_____ Hours _____ Minutes

5) Do you ever have trouble falling asleep?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

6) If you do have trouble falling asleep, how often does this happen?
1. Less than once a year
2. Less than once a month
3. About once a month
4. 1 or 2 times per week
5. 3 or 4 times per week
6. 5 or more times per week
7. Does not apply to me

7) If you have trouble falling asleep, what is it that keeps you awake?
1. Thoughts running through my mind
2. Aches and pains
3. Too much noise
4. List any other _____
_____
5. Does not apply to me

8) If you have trouble falling asleep, do you:
1. Just lie in bed
2. Turn on the light and read
3. Get up
4. List any other _____
_____
5. Does not apply to me

9) Do you take anything to help you fall asleep?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

10) If you take something to help you you fall asleep, what is it?
1. Medicine prescribed by a doctor
2. Non-prescribed medicine
3. List any other _____
4. Does not apply to me

11) How many times during your usual sleep period do you wake up by yourself and then go back to sleep?
1. Rarely or never
2. 1 or 2 times
3. 3 or 4 times
4. 5 or 6 times
5. 7 or 8 times
6. 9 times or more

12) On how many days per week does this happen?
1. 1 or 2 days per week
2. 3 or 4 days per week
3. 5 or more days per week
4. Does not apply to me

13) When you wake up during your usual sleep period, how long does it usually take to go back to sleep?
1. 10 minutes or less
2. 10 to 20 minutes
3. 20 to 30 minutes
4. 30 minutes to an hour
5. More than an hour
6. Does not apply to me

14) Do you wake up too early and find you cannot go back to sleep?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

15) On how many days per week does this happen?
1. 1 or 2 days per week
2. 3 or 4 days per week
3. 5 or more days per week
4. Does not apply to me

16) How often do you take naps?
1. Rarely or never
2. Less than once a month
3. About once a month
4. 1 or 2 times per week
5. 3 or 4 times per week
6. 5 or more times per week
7. More than once a day

17) How long do you usually sleep during your naps?
1. Between 10 and 30 minutes
2. Between 30 and 60 minutes
3. Between 1 and 2 hours
4. More than 2 hours
5. Does not apply to me

18) Do you have disturbing dreams or nightmares?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

19) Overall, what kind of sleeper are you?
1. Very good
2. Good
3. Average
4. Poor
5. Very Poor

20) If you are a poor or very poor sleeper, is this because you (mark most important)
1. Have trouble falling asleep
2. Wake up and have trouble going back to sleep
3. Have disturbing dreams or nightmares
4. Are awakened frequently by noise
5. Wake up too early (early morning awakening)
6. Wake up tired
7. Other _____
8. Does not apply to me

21) If you are a poor or very poor sleeper, how long have you had a sleep problem?
1. 1 to 6 months
2. 6 months to 1 year
3. 1 to 2 years
4. 3 to 5 years
5. 5 to 10 years
6. As long as I can remember
7. Does not apply to me

22) Were (or are) any members of your family poor sleepers, that is, have sleep problems?
Yes _____1 No _____2

23) If yes to #22, which family member, or members, if more than one?
1. Father
2. Mother
3. Brother
4. Sister
5. Does not apply to me you

24) Do you usually feel well-rested after you wake up and first get out of bed?
1. Always or almost always
2. Often
3. Sometimes
4. Never or almost never

25) Which choice below best describes how you usually feel for the first 2 or 3 hours after you wake up from your normal sleep period <u>on workdays</u>?
1. Alert, wide awake
2. High level, but not at peak
3. Awake, but relaxed
4. A little foggy, let down
5. Slowed down, sleepy
6. Fighting sleep
7. Almost asleep

26) Which choice below best describes how you usually feel in the afternoon, between 1500 and 1700?
1. Alert, wide awake
2. High level, but not at peak
3. Awake, but relaxed
4. A little foggy, let down
5. Slowed down, sleepy
6. Fighting sleep
7. Almost asleep

27) Do you ever fall asleep even though you are trying hard to stay awake?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

28) Are you easily awakened by noises?
1. Never or almost never
2. Sometimes
3. Often
4. Always or almost always

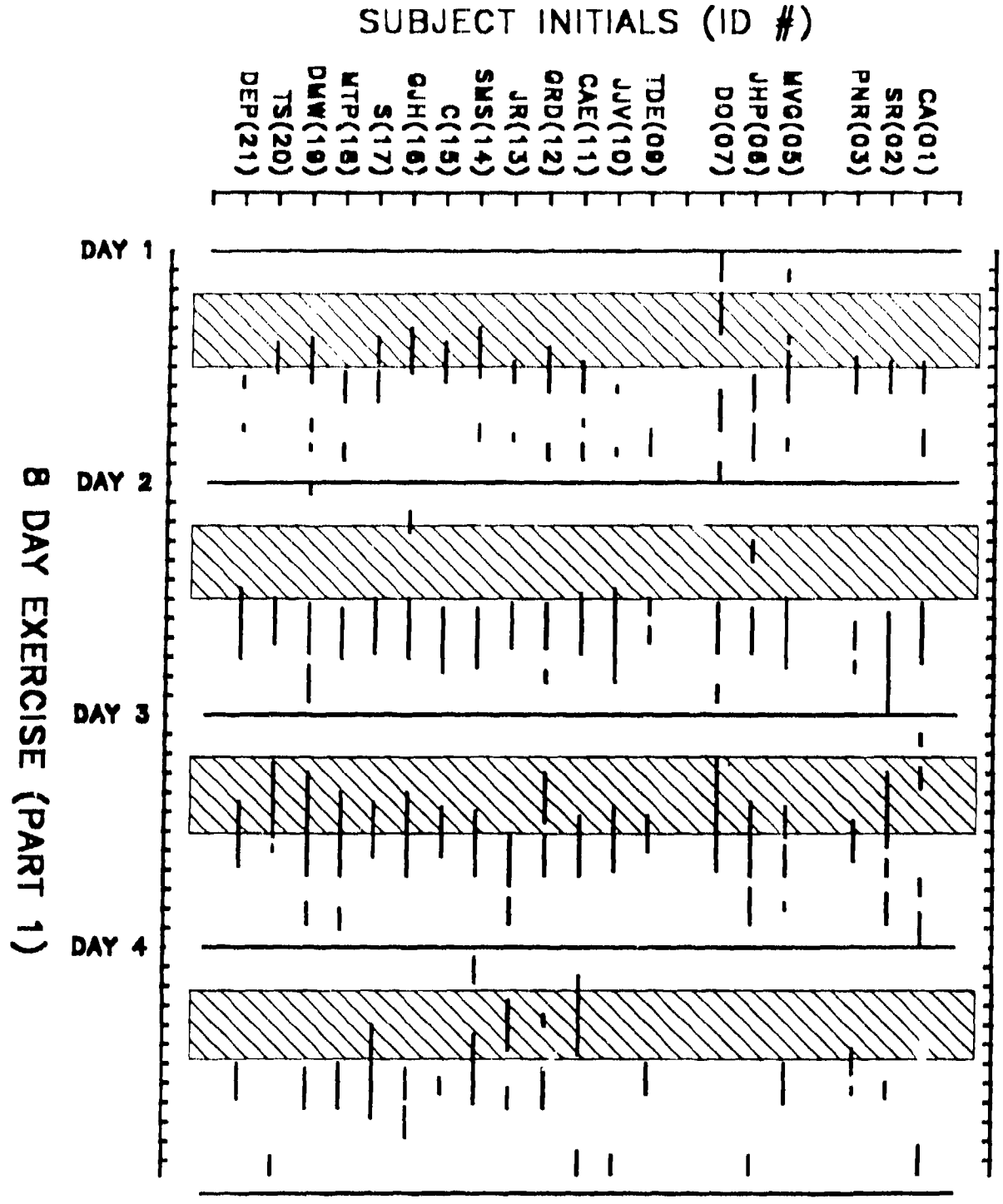
29) How much do you smoke each day?
1. None
2. Less than 1 pack
3. 1 pack
4. 2 packs
5. More than 2 packs per day

30) How much coffee, tea, or coke do drink per day? (if coke, circle coke)
1. None
2. 1 cup or 1 coke
3. 2 to 3 cups or 2 to 3 cokes
4. 3 to 5 cups or 3 to 5 cokes
5. More than 5 cups or 5 cokes

APPENDIX 5

MISSION EXAMPLE

Figures A-1 and A-2 show the sleep/wake patterns of participants in a SEAL training exercise. Sleep periods for each individual across the eight days of the exercise are marked by lines. The normal sleep periods (2200 to 0600) are marked by the shaded areas. The graph shows reduced amounts of sleep, with short fragmented sleep periods often occurring outside of the ideal sleep time. Participants in the exercise accumulated serious sleep debts. The men in this exercise felt this was a very difficult schedule and reported that they experienced extreme fatigue. This is an example of a mission where application of sleep management might have improved the alertness, mood, and general performance of the participants.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TS(20)
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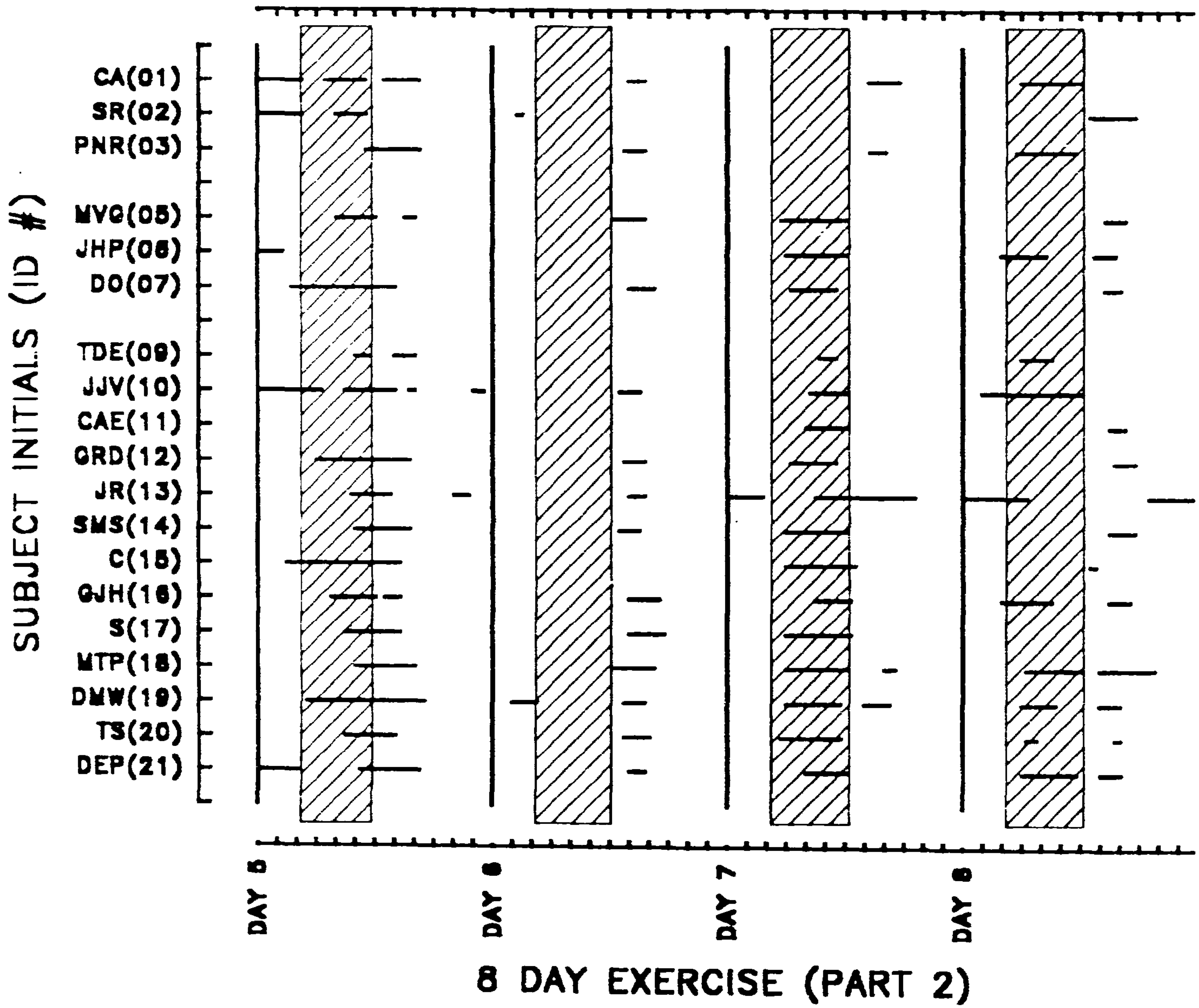
JHP(06)
MVC(05)
PNR(03)
SR(02)
CA(01)
DAY 1
DAY 2
DAY 3
DAY 4
8 DAY EXERCISE (PART 1)
SLEEP/WAKE PATTERN

Figure A-1

Figure A-2

SLEEP/WAKE PATTERN



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The objective of sleep logistics is to ensure that fighting men and women at all levels obtain sufficient sleep to maintain combat effectiveness. Special warfare missions frequently involve night work and arduous operational schedules. This User's Guide explains selected sleep management techniques for use during military operations, with particular emphasis on special operations mission. The Guide will assist field commanders in using sleep logistics to prevent compromise of mission accomplishment due to sleep deprivation. In addition, it provides techniques for assessing severity of sleep debt and compensating for its ill effects.

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