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Sleep Readiness

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Chapter 11
Sleep Readiness

The brain is the only organ or body part that requires sleep. Sleep is crucial for tissue repair and hormone synthesis to maintain peak performance mentally and physically. Sleep sustains brain and physical health, cognition, the immune system, and recovery after physical activity. This chapter provides tools and techniques for leaders and individuals exercising sleep readiness tactics, techniques, and procedures for a range of occupations and operational environments.

PRINCIPLES

11-1. There are three basic interrelated principles of sleep health: sleep duration, sleep timing, and sleep continuity. Of these, sleep duration is paramount because the health and functioning of the brain is primarily a direct function of the amount of sleep obtained—the more sleep obtained the better. Sleep timing is critical because the brain's internal clock strongly influences the ability to initiate and maintain sleep as well as maximize the amount of sleep obtained. The extent to which sleep is undisturbed by arousals and awakenings—sleep continuity—is important because this influences both the duration and the depth of sleep, with deeper sleep being more restorative. Ultimately, the promotion of sleep health in the operational environment entails optimizing each Soldier's sleep duration, timing, and continuity to the greatest extent possible, given existing mission constraints. See ATP 7-22.01 for H2F testing and ATP 7-22.02 for drills and exercises. See also ATP 6-22.5 for further discussion on the leader's role in sleep readiness.

SLEEP DURATION

11-2. Cognitive ability and readiness vary as direct function of the amount of sleep obtained. The more sleep Soldiers get, the greater their mental acuity, with faster response times, fewer errors, and fewer lapses in attention. Also improved are judgment, problem-solving, situational awareness, mood, resilience, and general well-being—to name but a few key Soldier attributes.

11-3. Soldiers and leaders frequently ask "what is the minimum amount of sleep needed to maintain military effectiveness?" There is no clear threshold amount of sleep below which effectiveness is compromised and above which effectiveness is sustained. Most Soldiers need 7 to 9 hours of sleep every 24 hours to maximize health and sustain performance. The relationship between sleep duration and cognitive readiness (and thus, military effectiveness) is best thought of as a continuum, with more sleep always producing improved performance. Considered this way, the question becomes: "How can the amount of sleep obtained by Soldiers be maximized, given the constraints imposed by the current mission?"

SLEEP TIMING

11-4. Human beings are diurnal, designed to be awake during the daytime and to sleep during the nighttime. A portion of the brain that serves as an internal clock—sensitive to the timing of sunrise in the morning and sunset in the evening—largely controls these sleep-wake tendencies. This sensitivity keeps the brain's clock synchronized with the outside world. During those hours that the brain's clock has learned are local daytime hours, the brain produces output that facilitates activity and wakefulness. During those hours that the brain's clock has learned are nighttime hours, it signals brain deactivation, thus promoting sleep. People who work at night might be less productive and less well-rested since they work when their brains promote sleep; and they try to sleep when their brains promote wakefulness. Likewise, this is what causes "jet lag." After rapidly crossing multiple time zones, the brain's internal clock is initially out of synch with the local day-night cycle, sending out signals to promote sleep during daylight hours and sending out signals to promote wakefulness

during the nighttime hours. Normal sleep and alertness are typically not restored in the jet-lagged brain for several days—the time it takes for the brain's internal clock to resynchronize to the day-night cycle of the new, local time zone. (See paragraphs 11-34 through 11-54 for strategies to mitigate the effects of disruptions in normal sleep patterns.)

11-5. Maintaining a consistent sleep-wake schedule on both duty and non-duty days has the benefit of strengthening and reinforcing the internal wake- and sleep-promoting processes controlled by the brain's internal clock. These processes constitute the "circadian rhythm of alertness." Individuals who maintain consistent sleep-wake schedules (especially on arising at the same time each morning and experience their first exposure to daylight at the same time each day) derive the maximum benefits from the circadian rhythm of alertness, with well-consolidated sleep at night and optimum alertness during the daytime. A consistent and regimented schedule of sleep- and wake-related activities helps to lock in other biological systems associated with circadian rhythms. These include hormone release, digestion, muscle strength, and cardiovascular performance. Circadian rhythms act in tandem with the need to sleep which builds throughout a day. These rhythms optimize the process of falling asleep, staying asleep, and ensuring quality sleep.

11-6. However, Soldiers can only achieve such benefits if they get adequate sleep (for most individuals, 7 to 9 hours of sleep per night) on a regular basis. If they get less sleep (for example, 6 hours per night during the duty week), then a "sleep debt" accrues. In such cases, it is better to sleep in on off-duty days and pay down the sleep debt, rather than sacrificing sleep to try to maintain a consistent sleep-wake schedule and strengthen the circadian rhythm of alertness.

11-7. Although the circadian rhythm of alertness generally promotes a 24-hour cycle of daytime wakefulness and nighttime sleep, there is also a temporary afternoon "dip" in alertness. This dip becomes especially noticeable in individuals who have a significant sleep debt (for example, not regularly obtaining adequate sleep). For those able to take advantage of it, the afternoon dip provides an opportunity for obtaining good quality daytime sleep to help pay down any existing sleep debt. Soldiers can generally take these naps without significantly disrupting the circadian rhythm of alertness—provided that the naps are not so long or so frequent that they begin to impair the ability to initiate sleep at night.

SLEEP CONTINUITY

11-8. The restorative value of sleep is determined not only by the duration of the sleep period, but also by the continuity of the sleep period—that is, the extent to which the sleep period is continuous and uninterrupted. The sleeping brain cycles through non-rapid eye movement (known as NREM) and rapid eye movement sleep (known as REM or "dreaming sleep") every 90–120 minutes. The full benefit of sleep occurs when the brain completes 4–5 complete cycles. Non-rapid eye movement sleep makes up most of the first half of the night's sleep. During this type of sleep, the body releases hormones that help repair and rebuild muscles and replenish energy. There are three stages of non-rapid eye movement sleep: stage 1 (the lightest sleep stage), stage 2 (which accounts for approximately 50 percent of nighttime sleep), and stage 3 (the deepest and the most recuperative sleep stage). During sleep, the body clears toxins that have accumulated throughout the day (as by-products of healthy brain functioning) from the brain; it also fixes and transforms new memories into usable knowledge. Both types of sleep are essential, and it is important that the brain cycles appropriately between non-rapid eye movement and rapid eye movement sleep across the night. When sleep is interrupted or shortened, natural progression of sleep cycles are disturbed reducing the beneficial effects of the sleep.

SLEEP READINESS FUNDAMENTALS

11-9. Like the rest of the body (for example, muscles, skin, and liver), the brain has physiological needs for food, water, and oxygen—basic needs that must be met not only to ensure proper brain functioning, but to sustain life itself. However, unlike the rest of the body, the brain has one additional physiological need: sleep. The brain requires sleep to maintain normal function. Sleep is necessary to sustain not only alertness, but also higher order cognitive abilities such as judgment, decision making, and situational awareness. In short, sleep makes Soldiers better at being Soldiers.

11-10. The brain needs sleep to restore and repair itself, to work efficiently, to fix new memories, and to process new information appropriately. Sleep also clears away waste products from normal breakdown of

chemicals that accumulate in the brain during wakefulness. Prioritizing sleep, and ensuring that opportunities for Soldier sleep are maximized in all operational environments, serves to optimize brain, psychological, and immunological health. In particular, sleeping properly before training improves attention, understanding, and learning. Sleeping properly after training improves the ability to both remember and appropriately utilize newly-acquired skills and information.

11-11. Although some Soldiers may require a little more or a little less sleep, for the vast majority of Soldiers a steady diet of 7–8 hours of sleep every 24 hours is needed to sustain normal levels of brain function and health indefinitely. Most Soldiers who regularly obtain less than 7–8 hours of sleep every 24 hours pay a price: they unwittingly but steadily accrue a significant sleep debt, characterized by increasingly suboptimal alertness, reduced mental sharpness, and an impaired ability to recover from stress. These Soldiers typically believe that they are fine and may perform most basic duties adequately. From an objective standpoint, their alertness and mental acuity is significantly (and invariably) impaired. As a rule of thumb, any Soldier who sleeps two or more hours longer on days off (versus duty days) carries a significant sleep debt.

11-12. Even for those who regularly obtain the generally recommended 7–8 hours of sleep per night, more sleep can result in even better alertness and mental acuity. In brain health and mental functioning, there is no such thing as too much sleep. Therefore, to maximize brain health and functioning in an operational environment, Soldiers aim to maximize sleep as much as possible within the constraints of the operation. As sleep duration increases, so does the likelihood of mission success.

11-13. Insufficient sleep degrades the brain's function. The more sleep the brain gets, the better it functions. The effects of inadequate sleep on brain function and performance are well-documented:

- Reduced ability to concentrate, impaired judgment, problem solving and decision making.
- Increased irritability and reduced mood.
- Reduced motivation level.
- Increased reaction time and slowed response time.
- Reduced ability to effectively cope with stress.
- Increased risk of physical injury.
- Increased time to recover from injury.

11-14. Insufficient sleep negatively affects not only cognitive performance, but emotional and social functioning. Adequate sleep promotes an optimistic outlook and social acuity, but failure to obtain adequate sleep on a regular basis (for example, being chronically sleep restricted) makes a person less resilient to stress and stress-related disorders including posttraumatic stress and depression.

11-15. If the brain is starved of sleep for long enough, it will eventually fall asleep. Although severe sleepiness can be staved off momentarily by increasing environmental stimulation (for example, increasing the volume on the radio, opening a car window, getting up and walking around), no amount of effort or willpower will maintain wakefulness for long. Humans cannot resist the need for sleep any more than the need for air. In much the same way that it is impossible to hold one's breath until consciousness is lost, it is likewise impossible for the sleep-starved individual to resist sleep onset. At some point, the sleepy brain will slip into sleep, regardless of any and all efforts to avoid it. Sleep onset under such conditions is not a voluntary act. Therefore, severe sleepiness is dangerous not only to the sleepy individuals, but also to people around them. Severe sleepiness proves more dangerous when individuals engage in monotonous activities such as driving, pulling security, or monitoring equipment or computer screens.

11-16. In short, the brain has a physiological need for sleep, and sleep promotes and sustains the ability to think and maintain mental toughness. And the more sleep, the better. Although obtaining 7 to 9 hours of nightly sleep generally results in the ability to sustain normal levels of alertness and performance during the daytime, obtaining even more sleep results in greater brain readiness—enhanced mental sharpness and resilience in the field.

PROMOTING HEALTHY SLEEP

11-17. Good sleep is essential for optimal performance and readiness. Factors to consider when optimizing sleep duration and continuity include: the sleep environment, a pre-sleep routine, and a sleep schedule that conforms as closely as possible to the brain's natural circadian rhythm of alertness.

SLEEP ENVIRONMENT

11-18. Sleep duration and continuity are optimized in environments that are quiet, dark, and maintained at a comfortable ambient temperature. Some individuals believe that they sleep better with music or a television on, that they can sleep anywhere, and that ambient noise does not bother them. Research clearly shows that this is not the case. Soldiers do not get good sleep on a cot in the tactical operations center. Although sleepers are not aware of it, environmental sounds cause brief arousals—a momentary speeding of the brain's electro-encephalograph (known as EEG) activity during sleep—that effectively disrupt sleep continuity and reduce the restorative value of that sleep. Likewise, bright lights and excessively hot or cold environments can disrupt sleep continuity and reduce the restorative value of sleep.

PRE-SLEEP ROUTINE

11-19. Stress is incompatible with sleep. Pre-sleep routines that promote winding down—such as listening to soothing music, reading, or taking a warm shower or bath—30–60 minutes prior to bedtime tend to facilitate the transition to sleep. These routines will maximize sleep duration. Conversely, activities such as watching television, playing video games, chatting online, and similar interesting or engaging activities tend to arouse the brain and delay sleep onset. These activities reduce the amount of sleep obtained and should be avoided during the pre-sleep wind-down period. Tobacco product use is also antithetical to sleep. People smoke before sleep to wind down. The stimulant in nicotine tells the body to get active while it increases heart rate and alertness. Those experiencing significant stress often find relaxation techniques such as meditation and mindfulness exercises helpful.

SLEEP SCHEDULE

11-20. Adequate performance is best achieved by Soldiers who consistently get adequate sleep (7–8 hours) on a nighttime sleep-daytime wakefulness schedule aligned with the brain's natural circadian rhythm of alertness. Both sleep duration and sleep continuity are maximized on such schedules. However, military operations are often continuous (24-hours per day) and influenced by random and unpredictable events and requirements. Shift work is unavoidable for at least some deployed Soldiers, and sleep opportunities are sometimes unpredictable for virtually all deployed Soldiers. The following situations commonly contribute to sleep loss and decrements in waking performance:

- Shift work.
- Changing schedules.
- Social jet lag.

SHIFT WORK

11-21. The human brain is biologically hard-wired to be alert during the daylight hours and asleep during the nighttime and early morning hours. Because of this, poor quality sleep results from night shift work even when shift workers spend adequate time (approximately 8–9 hours) in bed during the daytime. Although such a schedule is unnatural for the human brain, some adaptation to a nighttime-awake and daytime-asleep schedule does occur over time, but such adaptation is never complete. Soldiers always pay a cost in their waking performance and daytime sleep quality. This occurs even when working consistent, steady nights. In the long term, Soldiers associate frequent shift work with weight gain and increased risks for diabetes, fatty liver disease, and cardiovascular disease. See discussions beginning in paragraphs 11-24 and 11-30 for strategies to mitigate adverse effects of shift work.

CHANGING SCHEDULES

11-22. Rapidly changing and backward shifting work-rest (duty) schedules exacerbate the problem. Leaders should always aim to optimize the Soldier's sleep to the extent possible given the existing operational constraints. Toward this end, commanders consider the following two principles:

- Strive for consistency for individual Soldiers by rotating shifts no more often than twice per month.
- Always rotate shifts in a forward direction.

These actions allows sleep to occur later on the new shift than it did on the old shift. Bodies have more difficulty adapting to backward shift rotations because that requires earlier initiation of the sleep period. This is also why it is easier to adapt to a new time zone (jet lag symptoms are less severe) following westward travel across multiple time zones versus eastward travel. It is easier to stay up a little later and sleep in than to go to bed earlier and arise earlier in a new time zone. See discussions beginning in paragraphs 11-24 and 11-30 for strategies to mitigate the adverse effects of changing schedules.

SOCIAL JET LAG

11-23. The tendency to stay up later and sleep in later on off-duty days (often the weekends when in garrison) commonly results in a phenomenon known as social jet lag. This state of mild sleep restriction results from the subsequent need to arise earlier on the first day back to work (for example, Monday following a weekend off). The effect resembles that experienced by individuals who experience jet lag after traveling eastward across a couple of time zones.

LEADERSHIP'S ROLE

11-24. While good leadership is essential for a wide range of unit outcomes, leadership behaviors that target sleep can improve the sleep habits of unit members and the unit's overall sleep culture. Sleep leadership behavior includes promotion of sleep awareness and the development and implementation of local policies that facilitate the ability of subordinates to practice good sleep hygiene. An example of sleep awareness is ensuring that subordinates understand the importance of sleep for health and readiness, as well as the negative consequences of sleep loss. Such practices (for example, moving physical readiness training from morning to the afternoon or starting the duty day later, both of which allow Soldiers to sleep later) result in improved subordinate sleep, enhanced health (reduced sick call and accident rates), and improved unit climate. The acronym SLEEP represents the following basic sleep leadership practices:

- **S**et conditions.
- **L**ead by example.
- **E**ducate and **e**ncourage.
- **P**rioritize and plan.

SET CONDITIONS

11-25. The S stands for *set conditions*. Leaders set conditions when they—

- Strive to create an optimal sleep environment by controlling noise, light, and temperature.
- Address work-related and other sources of stress for Soldiers that may be interfering with sleep.
- Implement duty schedules that optimize nighttime sleep and daytime alertness.

LEAD BY EXAMPLE

11-26. The L stands for *lead by example*. Leaders lead by example when they—

- Serve as role models for subordinates by demonstrating good sleep habits and maintaining healthy work-rest schedule.
- Look for opportunities to show they consider sleep to be a priority for unit. For example, emphasize sleep in remarks during Recovery Drills or other unit formations and functions.
- Remind Soldiers of the importance of sleep.

EDUCATE AND ENCOURAGE

11-27. The E stands for *educate and encourage*. Leaders educate when they—

- Establish a good sleep culture in the unit and ensure that subordinate leaders are also engaging in good sleep leadership.
- Encourage Soldiers to look for signs of sleep problems regularly.
- Ensure all Soldiers have access to information on effective sleep habits.
- Give Soldiers permission to nap when circumstances allow, and encourage naps when appropriate, especially during continuous operations.

PRIORITIZE AND PLAN

11-28. The P stands for *prioritize and plan*. Leaders do this when they—

- Ensure Soldiers have enough time to attend to their personal matters while still getting sufficient sleep.
- Are aware of the challenges of shift work and continuous operations, and implement schedules that mitigate their negative effects on performance and health.
- Think of sleep as an item of logistical resupply, like beans and bullets, and plan accordingly. That is, schedule enough time for Soldiers to get sufficient (or even extra) sleep before—and recovery sleep after—all missions.
- Consider having Soldiers perform less complex tasks in the early morning before 0900 and more complex tasks in the late morning and early afternoon.

11-29. Sleep is essential to health and readiness. To optimize Soldiers' alertness and performance, leaders maintain as consistent and regimented a sleep-wake schedule as possible (optimize sleep timing) with an adequate amount of sleep opportunity (optimize sleep duration). Leaders also ensure that the sleep-wake schedule conforms as closely as possible to the brain's natural circadian rhythm to optimize both duration and quality of sleep.

PLANNING FOR PERIODS OF INSUFFICIENT SLEEP

11-30. Effective leaders consider sleep an item of logistical resupply like water, food, fuel, and ammunition. Planning for sleep in training and tactical environments is a leader competency. Sleep management optimizes Soldiers' performance in austere conditions. Sleep is a force multiplier. In healthy persons, there is no such thing as too much sleep. The goal in all operational scenarios should always be to maximize sleep duration because more sleep always results in greater alertness, resilience, and mental acuity—greater readiness.

OVERALL STRATEGY

11-31. When mission requirements do not allow for adequate sleep, the goal becomes twofold: to optimize alertness and performance during waking periods to the extent possible and to maximize the ability of Soldiers to take advantage of any opportunities for sleep that do occur. Factors that determine the extent to which alertness and performance are impacted by sleep loss include:

- Individual differences in sensitivity and resistance to the effects of sleep loss.
- Individual sleep history—those who habitually sleep more tend to be more resistant to sleep loss.
- Length of continued wakefulness—the longer the period of sleep loss, the worse the performance.
- Time of day or night—the brain's circadian rhythm of alertness exacerbates the effects of sleep loss during the early morning hours, and partially mitigates the effects of sleep loss during the daytime or early evening hours.

INDIVIDUAL DIFFERENCES

11-32. No one can maintain alertness and performance indefinitely without sleep, but some individuals are more impacted by sleep loss than others. Individual differences are determined by both genetics and sleep history or habitual sleep duration. A Soldier's sensitivity versus resistance to the effects of sleep loss cannot

be predicted before the fact; therefore, leaders need to objectively measure a Soldier's performance since insufficient sleep impairs the ability to self-assess. As a rule, sleep-deprived Soldiers will overestimate their own capabilities. Leaders should expect and plan not only for reduced performance, but increasing variability in the effectiveness of Soldiers who have increased sleep loss.

TIME OF DAY OR NIGHT

11-33. The brain's internal sleepiness-alertness cycle directly impacts performance. Because of this, work performed between 2300 and 0800 hours is generally less efficient (slower and with a greater number of errors) than work performed during the daytime and early evening hours. Leaders should anticipate reduced levels of productivity and effectiveness during these hours.

JET LAG, SHIFT WORK, AND MISSIONS

11-34. Jet lag and shift work tend to result in misalignment of the circadian rhythm. Crossing multiple time zones tends to result in jet lag and impacts a Soldier's ability to adjust to the time zone and obtain needed sleep. In jet lag, circadian misalignment results from the inability of the brain's internal clock to rapidly adapt to a new time zone. In shift work, circadian misalignment results from shifting the wake period to that portion of the night when sleep typically occurs and shifting the sleep period to the daytime when the brain is primed for wakefulness.

11-35. Following travel across multiple time zones, re-adaptation can take from 3–4 days to several weeks depending on individual differences in adaptability that are determined by factors such as age and genetics. However, realignment of the internal clock with the new environment does not occur linearly. The greatest daytime deficits in alertness and performance and the most severe nighttime sleep disturbances tend to occur during the first 24 hours in the new time zone. These issues tend to be resolved in the first 3 or 4 days in a new time zone, at which point the brain's clock will typically have made significant progress in resetting itself to the local day-night schedule.

11-36. The brain's clock can more easily adapt to westward travel (to stay up later at night and sleep in longer in the morning) than to eastward travel (to go to bed earlier and arise earlier). For the same reason, it is easier for the brain to adapt to a forward rotating shift schedule (transitioning from the day shift to the evening shift to the midnight shift) than to a backward rotating shift schedule (transitioning from the midnight shift to the evening shift to the day shift). The greatest impacts from circadian misalignment seen in jet lag and shift work are sleep disturbance, deficits in self-assessment, risk of errors and accidents, and degradation of efficiency and productivity.

11-37. The following strategies assist Soldiers coping with jet lag, shift work, and operational missions:

- Before travel.
- During travel.
- After travel.
- Before missions.
- During missions.
- After missions.
- Continuous operations.

Before Travel

11-38. Up to two weeks prior to traveling, Soldiers pay down sleep debt and bank sleep by getting 8 or more hours of sleep per night. They do not attempt to pre-adapt to a new time zone. Attempting to pre-adapt by moving sleep-wake timing forward or backward is difficult to accomplish and can cause a sleep debt.

During Travel

11-39. Transcontinental flights east are generally scheduled for evening departure, allowing for in-flight sleep during periods of minimal alertness. Transcontinental westward flights are generally scheduled for

morning departure when it may be difficult to fall asleep, but long-duration flights afford the opportunity for afternoon sleep. The following tactics support in-flight sleep:

- Stop caffeine intake 6 hours prior to take-off. Do not drink caffeine until approximately 30 minutes before landing.
- Eat a meal prior to boarding or immediately after take-off. Forego any later in-flight meal service that will interfere with your sleep.
- Do not consume alcohol before or during the flight. Alcohol will make you feel drowsy, but it actually impairs sleep.
- Control effects of cabin noise, light, and temperature by using foam ear plugs (or noise-cancelling headphones), a sleep mask, and blanket. Select a window seat so that passenger and flight attendant movements do not disrupt your sleep.

After Travel

11-40. Adjust activities in new time zone based on the following guidance:

- Schedule meetings during routine alertness cycle and avoid meetings during your routine sleep cycle.
- Use 200 milligrams of caffeine (equivalent to two cups of coffee) prior to critical meetings to support alertness and mental acuity. Stop caffeine at least 6 hours prior to a scheduled sleep period.
- For fast turn-around travel (1–2 days at each time zone), maintain home time schedule as much as possible. Schedule critical meetings during peak alertness. For eastward travel, this means scheduling meetings to occur in the late afternoon or evening of the new local time. Sleep or nap during the new local day.
- Avoid alcohol since it exacerbates sleepiness and mental deficits as well as impairs sleep.
- Use sleep-inducing agents only under a physician's supervision and approval.
- Avoid over-the-counter sleep aids. These compounds do not improve sleep and they can impair post-awakening alertness and mental acuity.
- Avoid over-the-counter melatonin (marketed as a sleep aid) since it does not increase actual sleep time.
- Manage light exposure depending on the alertness boost needed. Some sources of light found in offices and hotels boost alertness. While this exposure may be useful to boost alertness, it may also lead to poor sleep quality and duration.
- Make the computer's display adapt to the time of day and use the blue light blocker during non-daylight hours to facilitate nighttime sleep and strengthen circadian rhythms.
- Be aware of sunrise and sunset times to determine bed time. Go to bed when the sun goes down. Be active and move around when the sun is up. Use naps to achieve 7–8 hours of sleep every 24 hours. Naps will improve alertness and performance.

Before Missions

11-41. The notion that one can adapt to sleep loss is a myth. Although Soldiers generally benefit from training as they fight, this does not hold true for sleep loss. Soldiers cannot be trained to perform better on less sleep. Although chronically sleep-restricted Soldiers do become accustomed to a reduced level of alertness, which they think is normal, objective assessments to reveal deficits show that there is no evidence of habituation or adaptation to sleep loss. The only possible benefit to training under conditions of sleep loss is if it increases the Soldiers' awareness and appreciation for the extent to which sleep loss impacts their physical and mental abilities. See table 11-1 for strategies to maximize mission sleep.

11-42. Although Soldiers cannot train to perform better on less sleep, they can bank sleep. Sleep banking is achieved by significantly extending the nightly time in bed to more than 8 hours per night. Soldiers must bank sleep for multiple consecutive nights prior to embarking on a mission that is likely to result in inadequate sleep. The extra sleep they obtain in this manner creates a bank of sleep they use to sustain alertness and performance during subsequent sleep loss (acute sleep deprivation or chronic sleep restriction).

Table 11-1. Maximizing mission sleep

Before
Two weeks prior, get 8 or more hours of sleep per night.
Stop caffeine and alcohol consumption at least 6 hours prior to scheduled sleep.
During
Take naps whenever possible to accumulate 7-8 hours of sleep in every 24 hour period.
Caffeine can be used to reduce grogginess on awakening.
Separate day and night shift sleep areas.
After
To reduce sleep debt or deprivation, plan on additional sleep time.
Increase sleep to 8 hours every 24 hours to return to optimal alertness and performance.

11-43. Importantly, the benefits of sleep banking are not limited just to the following day; such benefits have been shown to remain evident over days and weeks, and may last even longer. This is because the brain saves (or banks) sleep that it does not use the next day, and it expends that sleep during future periods of sleep loss. Increasing the amount of sleep prior to a mission improves performance during that mission and, as a bonus, reduces the amount of sleep subsequently needed to recover from that mission. When possible, leaders should provide Soldiers the opportunity for extended sleep (10 hours in bed per night may be optimal) for several consecutive nights (for at least one week, if possible) prior to missions likely to involve significant sleep loss. Leaders should encourage Soldiers to take appropriate advantage of this opportunity for extra sleep. Soldiers best accomplish sleep extension by going to bed earlier (rather than staying in bed later) because awakening at the same time each morning helps to sustain and strengthen the brain's circadian rhythm of alertness.

During Missions

11-44. Properly planned sleep management strategies facilitate alertness and performance in any operational scenario. They can make the difference between mission success and failure during continuous operations when the stakes are high and opportunities for sleep are restricted. The ultimate goal of these strategies is to maximize unit readiness and lethality.

11-45. Two complementary approaches optimize Soldier alertness and effectiveness during continuous and sustained operations when they have little or no opportunity for sleep. The first (and most effective) approach is to optimize sleep itself, to the maximum extent is possible to do so given operational constraints. Nothing is better, in the short- or long-term, at preventing or reversing the effects of sleep loss than sleep itself. The second approach is to directly facilitate alertness in the sleep-deprived Soldier by using a stimulant such as caffeine. This has to be done in a way that minimizes the counterproductive effects of the stimulant on the Soldiers' ability to take advantage of whatever limited opportunities for sleep may arise during the mission.

11-46. The short- and long-term goals of the first approach is to maximize sleep duration and continuity—an approach that primarily entails optimization of work-rest schedules and optimization of the sleep environment. The second approach aims to optimize alertness and performance directly with caffeine, albeit in a manner that minimizes the negative effects of the caffeine on sleep duration and continuity.

After Missions

11-47. The longer an individual goes without sleep, the greater the decline in cognitive performance, and the longer it will take to recover from the sleep debt that has accrued. In general, it takes longer to recover from chronic sleep restriction (several nights of inadequate sleep) than it takes to recover from a comparable level of acute total sleep deprivation (a single period of extended wakefulness). While it is difficult to predict precisely the amount of recovery sleep required by each individual, the goal should always be to maximize the opportunity for recovery sleep following any mission that results in sleep loss.

Continuous (24-hour) Operations

11-48. Continuous military operations are a mainstay of the Army. Soldiers must be prepared to conduct operations for extended periods with limited rest and sleep deprivation to accomplish the mission. Paragraphs 11-49 through 11-54 describes proven techniques to mitigate the impact of continuous operations on Soldiers.

Segregation of Soldiers by Shift

11-49. Sleep and living areas for Soldiers should be segregated by the shifts worked. This minimizes sleep disruptions caused by waking activities of those working other shifts.

Extra Time for Night Workers and Day Sleepers

11-50. The circadian rhythm of alertness works against daytime sleep and nighttime alertness. Soldiers working a night shift typically require more time to successfully complete tasks because they work slower or less efficiently. These Soldiers also tend to accrue sleep debt faster than those working on normal day shifts.

Extra Monitoring on the Night Shift

11-51. Soldiers engaged in mission- and/or safety-critical tasks during the descending phase of the circadian rhythm of alertness (between 2300 and 0800) can benefit from enhanced oversight and monitoring. During these times, when Soldier alertness is compromised, there is an increased risk of lapses in attention and even brief, uncontrolled sleep episodes (microsleep).

Off-duty Safety

11-52. Following nighttime work, the morning commute back home can be a time of significantly increased risk. For example, ending staff duty or charge of quarters during the early morning hours (around 0700) can put sleep-deprived Soldiers behind the steering wheel at a point in the circadian rhythm of alertness when they are at greatest risk for vehicle accidents. Providing post-shift sleeping quarters, scheduling night shifts to end during the ascending phase of the circadian rhythm of alertness (after 0900 hours), or providing post-shift transportation home can help improve the safety of Soldiers working the night shift.

De-conflicting Schedules

11-53. Commands should schedule required briefings and dining facility availability so as to minimize potential conflicts with the daytime sleep of Soldiers on duty during the nighttime. No Soldier should have to choose between food and sleep.

Sleep Prioritization

11-54. The restorative effects of sleep accrue primarily to the brain and are primarily manifested as improved cognitive performance. Accordingly, it is especially important that leaders and others engaged in higher-order cognitive tasks—such as mission planning, decision making, risk assessment, and problem solving—are afforded and take full advantage of opportunities to obtain adequate sleep.

INTERVENTIONS TO IMPROVE AND SUSTAIN READINESS

11-55. Depending on the situation, leaders can implement certain interventions to sustain or improve Soldier readiness by limiting the causes of loss of alertness and results of sleep deprivation. Leaders can use many of these methods singularly or in combination with other interventions as practicable.

NAPS

11-56. When regular nighttime sleep is not possible due to mission requirements, Soldiers can use short, infrequent naps to restore wakefulness and promote performance. When routinely available sleep time is difficult to predict, Soldiers might take the longest nap possible as frequently as time is available. During periods of restricted sleep (6 hours of sleep or less per night), napping combined with appropriate doses of caffeine may help to sustain cognitive performance and alertness.

REST BREAKS (WITHOUT SLEEP)

11-57. In addition to varying as a function of sleep loss and the circadian rhythm of alertness, performance also varies as a function of time-on-task. This effect—the tendency for performance on a continuously performed task to decline across time—is especially apparent on tasks requiring a lot of mental energy or extended vigilance, and it is reversed by simple time-off-task (rest). Time-on-task effects interact with (are exacerbated by) sleepiness. Therefore, when Soldiers perform such tasks under conditions of sleep loss or during the descending phase of the circadian rhythm of alertness, leaders can expect Soldiers will need more frequent and/or longer rest breaks. Although rest breaks reverse that portion of the performance deficit caused by time-on-task, such breaks do not reverse deficits associated with sleepiness per se (unless, of course, Soldiers get some sleep during the rest break). Sleep loss effects and time-on-task effects interactively impair performance but require different interventions.

REVERSE PHYSICAL TRAINING SCHEDULE

11-58. When it is feasible, this strategy—a delayed start time to the duty day with afternoon as opposed to morning physical training sessions—has two benefits. First, it conforms well to the brain's natural circadian rhythm of alertness. Second, it results in longer sleep durations, especially in younger Soldiers who almost invariably use a later wake time to obtain more sleep. When implemented, this schedule can result in reduced utilization of sick call and reduced accident rates.

CAFFEINE TO SUSTAIN ALERTNESS AND PERFORMANCE

11-59. Table 11-2 summarizes the caffeine doses for optimal alertness under different sleep challenges.

Table 11-2. Caffeine dose for optimal alertness

Type of sleep challenge	*Dose*
Sustained operations	• 200 mg at midnight • 200 mg again at 0400 and 0800 if needed • Use during daytime (1200 and 1600) only if needed
Night operations with daytime sleep	• 200 mg at start of night shift • 200 mg again 4 hours later • Late dose: at least 6 hours prior to start of daytime sleep
Restricted sleep (6 hours of sleep)	• 200 mg upon awakening • 200 mg again 4 hours later • Last dose: at least 6 hours prior to sleep period
mg milligram	

Caffeine Dose (200 milligrams)

11-60. For many missions some degree of sleep loss is unavoidable. In these cases, Soldiers may best accomplish short-term sustainment of alertness and performance with judicious use of a non-sleep (stimulant) intervention. For a variety of reasons (including its wide availability, its familiarity to Soldiers, and its relative safety and effectiveness), caffeine is recommended for this purpose. For most individuals under most circumstances, the optimal dose of caffeine is 200 milligrams.

Caffeine Limitations

11-61. Caffeine only temporarily helps restore alertness and performance. It does not replace sleep. Nor does it fully restore all the cognitive abilities decremented by sleep loss. In much the same way, caffeine can help keep a Soldier from falling asleep, but it does not improve that Soldier's judgment, coordination, or reaction time. Because it will interfere with the ability to initiate and/or maintain sleep, Soldiers should avoid caffeine, if consistent with mission requirements, for at least 6 hours prior to an anticipated sleep opportunity.

BEHAVIORAL FACTORS

11-62. In addition to operational requirements, sleep readiness also depends on the behavior of individual Soldiers. The conditions in which Soldiers find themselves, as well as the schedules they maintain or activities in which they participate, contribute to sleep readiness.

Exercise

11-63. Regular, moderate physical exercise facilitates subsequent nighttime sleep onset and promotes deeper (more restorative) sleep. However, vigorous exercise immediately prior to bedtime can interfere with sleep for some individuals, especially if that exercise is to exhaustion, producing a physiological stress response. During the daytime, short bouts of around 30 minutes of physical activity can result in a moderate 3-hour boost of alertness in well-rested Soldiers. Such bouts do little for reversing and sustaining alertness under conditions of significant sleep loss.

Diet

11-64. Various foods and food preparation techniques can affect sleep—both positively and negatively. Sleep-promoting foods tend to be high in fiber and low in added sugars. High-fat, fried, or spicy foods tend to negatively impact sleep. Such foods tax the stomach, are difficult to digest, and may cause nocturnal esophageal reflux or heartburn. Soldiers should avoid these types of foods prior to bedtime. As a rule, Soldiers should avoid full, heavy meals within 2–3 hours of initiating sleep. However, they should not go to bed hungry either, since hunger can also lighten and disrupt sleep. If Soldiers need to eat just prior to bedtime, their best options include a balanced snack or meal that includes fruits; vegetables; whole grains; fat proteins; and foods low in added sugar. Foods that rarely disturb sleep include Greek yogurt or cottage cheese with fruit, peanut butter on whole grain toast, cheese and crackers, milk with a small bowl of whole grain cereal, and protein bars.

Alcohol

11-65. Although alcohol increases drowsiness and can facilitate sleep onset, it subsequently lightens and disrupts sleep as the body metabolizes it during the night. It causes multiple arousals and awakenings, thus harming sleep more than it helps. The body metabolizes alcohol at a rate of about one ounce per hour. Therefore, to avoid the negative effects of alcohol on sleep, Soldiers should consume no more than one drink one hour before bedtime, no more than two drinks two hours before bedtime, and so on. However, abstinence is the best strategy when a good night of sleep is especially important for next-day activities or missions.

Sleep Environment

11-66. The importance of a sleep-friendly environment cannot be overstated. Living conditions and environments vary widely, but leaders can improve most sleep areas with a few simple steps.

Ambient Noise

11-67. Sleeping quarters should be located as far away from noisy areas (such as airfields, generators, and fueling stations) as possible. The effects of remaining uncontrollable, intermittent, random noises should be masked with a white noise generator. Finally, Soldiers can wear noise-dampening earplugs to effectively block noise and improve sleep.

Physical Comfort

11-68. Room temperature should be cool, ranging from 65–72 ºF. Sheets, bed, pillows, sleep surfaces (such as mattresses and cots), and sleeping clothes should be clean and comfortable. Mattresses should be requisitioned to fit the Soldier.

Light

11-69. Humans are not nocturnal. Soldiers are hardwired to be active during the day and to sleep at night. The brain's internal clock is very sensitive to light, and any amount of light that reaches the brain through

the eyes at night can be harmful. Even dim lights emitted from electronics such as a smart phone, computer, or television can have a negative impact. This light confuses and resets the brain's internal clock, which can misinterpret such light exposures as either an early dawn or a late dusk. In either case, such exposures incrementally weaken the brain's circadian rhythm of alertness, negatively impacting both nighttime sleep and daytime alertness. Therefore, sleeping areas should be kept dark. Blackout curtains or blinds should cover all windows. Leaders need to strictly enforce the lights out policies. To improve Soldiers' ability to avoid unwanted light exposure and thus facilitate sleep, leaders should create separate sleep areas for each shift and encourage the use of comfortable sleep masks.

Safety

11-70. Operational or training environments should be safe and secure for Soldiers to sleep in. This also applies to areas where Soldiers take naps. Ensure that Soldiers do not attempt to nap in front of, behind, or underneath trucks, tracked vehicles, or other vehicles. Soldiers need to avoid and protect against pests (for example, use mosquito nets when appropriate). Before sleeping, Solders check that snakes, spiders, ants, and other creatures are not in the sleeping area, sleeping bag, or shoes.

SLEEP MANAGEMENT PLANNING TOOL: 2B-ALERT WEB

11-71. Leaders have a planning decision aid to help plan missions and predict the effects of any sleep-wake schedule on performance. This scientifically-developed mission planning decision aid, the 2B-Alert Web, is available at http://sleep.bhsai.org. This tool can predict the effects of any sleep-wake schedule on vigilance performance, as well as the efficacy of applying both naps and caffeine as fatigue countermeasures at any point during a mission.

RESOURCES

11-72. Everyone occasionally experiences difficulty sleeping. Such difficulties may be due to anxiety, excitement, physical exhaustion or discomfort, travel across multiple time zones, or overuse of caffeine. Usually, such sleep difficulties are situational and temporary. They easily resolve with time, a change in the situation, or good sleep hygiene practices. For example, a high operational tempo may be stressful and allow little time for sleep, or allow for sleep only during the ascending phase of the circadian rhythm of alertness (for example, the daytime) when the brain's clock promotes wakefulness. However, as the operational tempo slows and Soldiers reestablish nighttime sleep opportunities, sleep problems will typically resolve.

11-73. Sometimes, however, sleep problems are more persistent and difficult to address. For example, some individuals are able to fall asleep easily at night but then experience early morning awakenings with difficulty returning to sleep. Others persistently experience difficulty initiating sleep at night and awakening when they need to in the morning. The discussion beginning in paragraph 11-74 provides some self-management strategies Soldiers can use to address these relatively persistent sleep problems.

SLEEP PROBLEMS

11-74. When Soldiers experience persistent sleep problems despite generally good sleep habits and an adequate sleep environment, a more concerted effort to improve sleep is warranted. First, Soldiers must evaluate their sleep habits and sleep environment.

11-75. For those who persistently experience difficulty falling asleep, the following suggestions and techniques may prove helpful:

- Establish a very regular and relaxing pre-sleep routine.
- Practice self-regulation activities such as relaxation exercises and guided meditations. DOD and the Department of Veterans Affairs developed available applications, and the Human Performance Resources by CHAMPS (https://www.hprc-online.org/) has various self-regulation activities:
  - Visualization or guided imagery exercises.
  - Meditation or mindfulness exercises.
  - Mental focusing exercises.
- Use an app. There are hundreds of apps for sleep and relaxation, which may help Soldiers fall asleep and track sleep.

WHEN TO SEEK EXPERT HELP

11-76. Soldiers should schedule appointments with healthcare providers if they have persistent daytime sleepiness, difficulty staying asleep, difficulty falling sleep, or disturbance of a sleeping partner with snoring and/or gasping at night.

Sleep Readiness

Soldiers should sleep as much as they can, whenever they can, as the situation allows. The vast majority of Soldiers require 7-8 hours of sleep per night to sustain performance; more sleep is better. Soldiers can maximize sleep and subsequent performance by timing sleep and caffeine use optimally. Finally, only sleep replaces lost sleep.