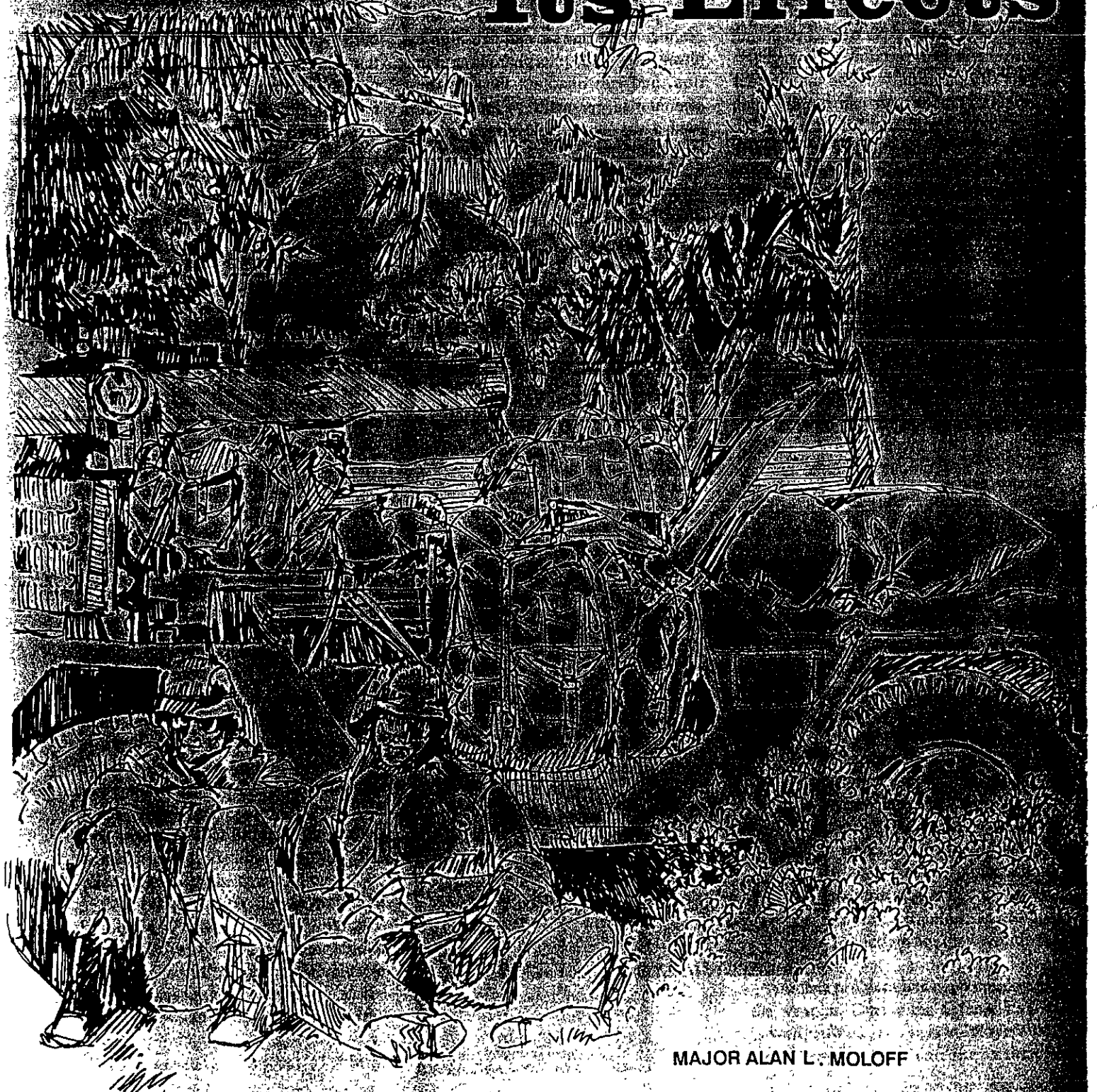
Sleep Loss And Its Effects



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The key to winning a battle, according to Field Manual 100-5, is to achieve and maintain the initiative. This means that battles in the future will have to be fought in depth, and that they will also require continuous and timely combat support.

The Soviets' doctrine, for example, calls for fighting along a broad front, in any weather, until their enemy has been defeated. The Soviets plan to echelon their forces to relieve exhausted soldiers so that continuous unrelenting pressure can be applied to the enemy.

In any future war, U.S. soldiers in both continuous operations and sustained operations will have to perform their missions without regard to weather or time of day and for extended periods without adequate rest and sleep.

Unfortunately, though, the Army does not seem to be preparing for this kind of battlefield. Most of our field exercises and training and evaluation exercises are short and use repetitive and "canned" scenarios. Both of these factors contribute to the perception that leaders can perform well with little or no sleep. The effect of this misperception will become painfully obvious during the next protracted, rapidly changing battle.

Sleep is a serious matter that deserves the same concern from commanders at all levels that they now have for water discipline. They must understand that depriving soldiers of sleep during training exercises will not "inoculate" them against the effects of sleep loss during future operations any more than depriving them of water during training will prepare them to function without it on the battlefield.

A discussion of some of the aspects of sleep may lead to a better understanding of the need for sleep discipline. First, though, the following terms need to be defined, as they apply to this discussion:

The term *continuous operations* is defined as continuous land combat with *some* opportunity for sleep, although the sleep may be brief and fragmented. *Sustained operations* is defined as continuous land combat with *no* opportunity for sleep.

The word *sleep* itself is more difficult to define precisely, although many descriptions of it are available. One dictionary, for example, defines sleep as "a natural, regularly recurring condition of rest for the body and mind, during which the eyes are usually closed and there is little or no conscious thought or voluntary movement."

A sleep state can be recognized by the electrical activity of the brain, which shows patterns distinctly different from those that appear during periods of wakefulness. During sleep, there are also changes in the levels of various hormones, and these changes, which occur in approximately 24-hour cycles, are partially responsible for the phenomenon known as *circadian rhythm.*

Other factors involved with circadian (daily) rhythm and sleep are environmental agents or events known as *zeitgaebers* —sunrise, sunset, mealtimes, and work cycles—that provide the stimulus for setting or resetting the biological clock. (Circadian rhythm is less pronounced in people who work different shifts, and experiments performed in a "*zietgaeber*-free" environment have demonstrated a physiologic day of about 25 hours instead of 24.)

Sleep deficit is defined as the total amount of sleep that has not occurred because of sleep deprivation and inadequate sleep. *Sleep deprivation* occurs when a person has had no sleep for more than 18 hours. It is generally recognized that sleep deficit can be determined by comparing the actual amount of sleep obtained to the usual eight hours per 24-hour period. This loss of sleep will commonly manifest itself as fatigue, or a reduced capacity for work as well as reduced efficiency.

The sleep-related problems that military units experience begin during the initial notification period and continue through their deployment and initial battles. Sustained or continuous operations produce a significant sleep deficit.

Several studies that have examined the effects of sleep loss have shown generally that a person's cognitive or mental abilities deteriorate faster than his physical abilities.

One study, for example, measured the various military skills of three platoons of British soldiers. Some of the skills studied were encoding and decoding messages, map reading, preparing operations orders, and physical endurance. The soldiers of one platoon were not allowed to sleep at all during a nine-day operation; those of the second were allowed to sleep 1.5 hours a night; and those of the third, three hours a night. The soldiers were observed and judged by rested senior soldiers and were said to be combat ineffective when they could no longer accomplish the mission at a minimum acceptable performance level.

All of the members of the platoon that was allowed no sleep were rated combat ineffective after four nights. Thirty-nine percent of the platoon that was allowed 1.5 hours of sleep each night were rated combat ineffective after five nights, although 52 percent of them did finish the exercise. In the platoon that was allowed three hours of sleep a night, 91 percent of the soldiers completed the exercise.

ANOTHER STUDY

Another study, conducted by the Walter Reed Army Institute of Research, tested subjects who were required to perform a variety of cognitive tasks for 30 minutes of every hour for 72 hours. Their performance on all the tasks deteriorated at the same rate and closely paralleled the decline in their mood, motivation, and initiative.

Similar studies were conducted in a simulated message center in Canada and with fire direction center teams of the 82d Airborne Division at Fort Bragg. The soldiers in the Canadian experiment demonstrated stable performance for the first 18 hours, then a decline to 70 percent of baseline performance during the next six hours. Their performance again remained stable for the next 18 hours, but further declined to 40 percent during the next six hours. The performance of the fire direction center personnel of the 82d Division showed them to be combat ineffective after 48 hours without sleep.

In 1966, the Walter Reed Army Institute of Research made

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the following observations concerning the decrease in performance due to sleep deficit:

- Sleep-deprived subjects demonstrated brief, intermittent lapses in response, and these lapses increased in frequency and duration as the sleep deficit increased. (These brief, intermittent lapses that are secondary to sleep deficit have been termed *microsleeps,* which are most frequent in the early morning hours between 0300 and 0500.)
- Intense, increased sensory stimulation, physical exercise, or shock, change in task, and feedback on performance tended to prevent or shorten these lapses.
- "Overlearned" or automatic task responses were relatively resistant to the effects of sleep loss.
- Many, but not all, tasks were affected by daily (circadian) influences and demonstrated decreased performance during the early morning hours.

Another study; "The Operational Consequences of Sleep Deprivation and Sleep Deficits," reveals some specific effects of inadequate sleep on performance:

- After being awake for 24 hours, it is extremely difficult for a person to learn new tasks.
- Sleep deprived people sacrifice speed for accuracy whenever possible.
- The quality of performance drops more if the task is based on the ability to receive instructions as opposed to the ability to give them.
- The longer a task takes, the more sensitive it is to sleep loss.
- Immediate feedback on the quality of task performance reduces the effects of sleep loss on performance.
- The performance of difficult tasks or a series of simple tasks is more sensitive to sleep loss.
- Self-paced tasks are more resistant to sleep loss than work-paced tasks.
- Newly acquired skills are more sensitive to sleep loss than skills that have become "second nature" or automatic.
- A task that requires a short term memory chain is more sensitive to sleep deprivation.

Sleep loss significantly decreases cognitive performance, and some evidence of the decrease often appears before a person

even feels physically fatigued. The person's position or function in the organization determines the significance of his cognitive deficiency.

Decreases in the performance of aviators and leaders are particularly significant. In fact, there are rigid peacetime guidelines for aircraft crew rest standards (as shown in Army Regulation 95-3). (It is uncertain what those guidelines might be in wartime.) These crew rest standards are based on a study performed by the U.S. Army Aviation Research Laboratory, which used questionnaires given to instructor pilots and initial entry rotary wing students. The standards were not based on objective, physiologic data, wartime mission requirements, or high-stress mission profiles. Unfortunately, there has not been any definitive research and development leading to work-rest guidelines for leaders.

An ongoing study by the Aviation Research Laboratory is trying to measure, by means of a wrist-motion detector, the amount of sleep various officers and NCOs get during field exercises. The initial data indicates that, during a typical field exercise, it is the battalion commander and the operations officer who suffer the greatest sleep deficit.

Four hours of sleep for each 24-hour period is essential for long term functioning, and a lack of sleep is cumulative. Soldiers who get no sleep at all (as in sustained operations) are much less capable than those who get an inadequate amount of sleep (as in continuous operations). And their performance continues to diminish until the sleep deficit is made up.

Recovery from sleep deficit varies with the severity and duration of the deficit. Soldiers must nap during continuous operations and should nap as soon as possible in sustained operations. And if naps are important for soldiers, they are even more important for leaders and personnel in positions that require cognitive performance. Naps as short as 30 to 60 minutes have been shown to improve performance significantly. A sleep-deprived soldier or leader will benefit from any amount of sleep, but the recuperative value of sleep declines as the sleep becomes more fragmented.

Since circadian rhythm is the result of complex hormonal interactions on the mind and body, and since these patterns include functional performance peaks and troughs each day, naps are most beneficial if they are taken during the naturally occurring troughs. In most people, these occur between 0300 and 0600 and between 1600 and 1800.

Circadian rhythm also affects soldiers in two other major operational areas: The first is the alteration or mismatch of circadian rhythm to activity cycles in moving from one time zone to another during deployment, and the second is the requirement to perform "round the clock."

Until this century, long marches and slow sea travel allowed for gradual circadian adjustment to changes in time zone. Today's rapid air travel and short- or no-notice deployments do not allow for such an adjustment, and it is also impractical to change meal or work-rest schedules before deployment. It is possible, however, to schedule air travel with circadian resynchronization in mind. For example, a 1700 departure from the United States for a deployment to Europe would allow troops to land in Germany around 0700 local time. The soldiers, already sleep-deprived from deployment activities, would get some rest during the flight and wake up in the early morning hours at the new location.

The higher a unit's state of readiness is before deployment or sleep deficit, the better the soldiers' performance will be. Readiness in this context includes such diverse areas as the physical aspects of being well fed, well nourished, and well hydrated. If any of these is deficient, the performance decline that is related to sleep deficit will be magnified. It is interesting to note that while high levels of aerobic conditioning do not reduce the decreases in cognitive performance due to sleep loss, they will improve recovery from that loss.

All personnel must be "overtrained" in their individual tasks so that their performance will be less degraded by sleep deficits. This requires using standing operating procedures during individual and unit training. "Overtraining" makes tasks almost reflex actions, and physiologically changes complex tasks into simple ones.

Rotating the soldiers' duties will keep them more alert and improve their performance on a multitude of tasks. This is especially important for soldiers in passive positions that require them, for example, to monitor radios and radar screens. But duties can be rotated only if the personnel are adequately crosstrained, and the duty rotation, therefore, must be based on the aptitudes and training of the individual soldiers and on unit requirements. For aviators, the rotation of duties could be as simple as frequently trading piloting and navigating duties.

Tasks that require short term memory are highly sensitive to sleep loss. In combat, some examples are fragmentary orders, radio messages, fire mission and medical evacuation requests, and flight information instructions. During continuous and sustained operations, soldiers must read back messages to ensure their accuracy and should transmit information in written form whenever possible. This technique forces both the writer and the reader to concentrate during the information transfer. Additionally, the written message allows the reader to consume and review the information at his own pace, and this reduces the effects of his sleep loss.

It is time the Army recognized that too little sleep, like too little water, is a serious threat to our battlefield performance during continuous and sustained operations. It is time we made an effort to enforce sleep discipline among our soldiers and leaders just as we enforce water discipline.

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