

Chapter 2

The Effects of CONOPS on Soldier Performance

OVERVIEW

Continuous combat exhausts soldiers and reduces their ability to perform tasks as quickly or effectively as necessary. Even during the first night of combat, normal sleeping habits and routines are upset. The soldier feels the effects of fatigue and the pressure of stress from noise, disrupted sleep time, and threat to life. Sheer determination, while essential for endurance, cannot offset the mounting effects of adverse conditions. Cognitive degradation involving poor decision-making begins during and after the first 24 hours of sleep deprivation.

Individual and unit military effectiveness depend on the soldiers' ability to think clearly, accurately, and quickly and upon initiative and motivation and physical strength and endurance. The longer a soldier goes without sleep, the more his thinking slows and becomes confused. Lapses in attention occur, and speed is sacrificed to maintain accuracy. Continuous work declines more rapidly than intermittent work.

Tasks like requesting fire, integrating range cards, establishing positions, and coordinating squad tactics become more difficult than

well-practiced routine physical tasks like loading magazines and marching. Without sleep, soldiers can perform the simpler and /or clearer tasks longer than the more complicated or ambiguous tasks. (See Figure 2-1.) They can do simple lifting, digging, and marching longer without sleep than a fine hand-eye coordination sequence as in tracking a target through a scope. (See Figure 2-2, page 2-4.)

Sleep loss affects remembering, choosing, assessing action effectiveness, reasoning, and new problem-solving. While comprehension is accurate, reading speed slows down and memory fails. For example, soldiers may understand but forget orders in documents. Soldiers omit tasks more often than they make errors.

After a period of sustained duty hours in which soldiers are deprived of sleep, the tendency to fall asleep is most pronounced between 0400 and 0700 hours. Consequently, during this time, vigilance, reasoning, and problem-solving are likely to be compromised.

Leaders can expect mood, motivation, initiative, planning, and preventive maintenance to decline. High motivation helps keep soldiers going but at increased risk due to impaired performance.

Leaders must recognize erratic or unreliable task performance in subordinates and

themselves. Alertness and performance decline gradually with partial sleep deprivation when sleep is limited to four to five hours each night. After five to seven days of partial sleep deprivation, alertness and performance decline to the same low levels as those seen following two days of total sleep deprivation. (See Figure 2-3, page 2-5.) After 48 to 72 hours without sleep, soldiers become militarily ineffective.

TYPE OF TASK AFFECTED

TASK	EFFECT
High Work Loads	Are more affected than low ones due to increasing attentional lapses.
Routine Tasks	Routine but critical subsidiary tasks tend to be skipped; this is part of a general unwillingness to act or respond.
Physical Tasks	Will only be affected in the presence of severe physical fatigue.

Figure 2 - 1

Note: The type of task is affected by sleep loss.

Source: UK Army Personnel Research Establishment.

**ABILITY TO CARRY OUT
VARIOUS TASKS**

EFFECT	TASK
Likely to take longer	All tasks.
Most Affected	Complex, uninteresting long tasks requiring sustained attention; newly or poorly learned tasks.
Least Affected	Short, simple, well-learned, self-paced, interesting tasks.

Figure 2 - 2

Note: The ability to carry out various tasks is affected by sleep loss.

Source: UK Army Personnel Research Establishment.

**EFFICIENCY OF
UNDERTAKING TASK
(100 is nominal "norm")**

Sleep Deprivation in Hours	Snap Shooting	Target Detection
24	71	82
36	64	71
72	56	41
Sleep Deprivation in Hours	Encode Grid Refs	Decode Grid Refs
24	90	80
36	57	47
72	50	40

Figure 2 - 3

Note: The efficiency with which an individual performs a particular task will vary according to the length of time that he has been deprived of sleep and the task that is being undertaken. The above is a table showing the efficiency with which a task might be undertaken based upon a "norm" or 100 when there is no sleep deprivation.

Source: UK Army Personnel Research Establishment.

CONDITIONS CONTRIBUTING TO DEGRADATION

Continuous combat forces soldiers to perform under adverse conditions that cause a degradation in performance. These adverse conditions include--

- o **Low light level.** The amount of light available for seeing landmarks, targets, and maps is greatly reduced at twilight and night.

- o **Limited visibility.** Smoke, fog, rain, snow, ice, and glare make seeing difficult.

- o **Disrupted sleep routines.** Every person is used to being awake or asleep during certain hours of the day/night. Disruption of the normal sleeping schedule causes performance to degrade.

- o **Physical fatigue.** Working the muscles faster than they can be supplied with oxygen and fuel creates a “debt” which may eventually make them unable to function until the deficits are made up during brief rests.

- o **Sleep loss.** The muscles can continue to function adequately without sleep, but the brain cannot. Increasing sleep debt leads to subtle but potentially critical performance failures.

EFFECTS OF SLEEP LOSS

TIME WITHOUT SLEEP	EFFECT
After 24 hrs	A deterioration in performance of tasks that are inadequately or newly learned, or are monotonous, or that require vigilance.
After 36 hrs	A marked deterioration in ability to register and understand information.
After 72 hrs	Performance on most tasks will be about 50 percent of normal.
3 to 4 days	Is the limit for intensive work including mental and physical elements. Visual illusions are likely at this stage, or earlier, especially in NBC.
0300 to 0600 hrs	Performance is at its lowest ebb.

Figure 2 - 4

Note: The effect of lack of sleep varies with the length of time an individual has been deprived of sleep.

Source: UK Army Personnel Research Establishment.

**MENTAL AND PHYSICAL FACTORS
AFFECTED BY SLEEP LOSS**

M e n t a l F a c t o r s	Attention	Lapses of attention increase in frequency and duration; information is often not registered.
	Initiative	The ability to initiate work decreases; tasks imposed by others are less likely to be affected.
	Insight	Insight is reduced; performance and abilities are overestimated.
	Motivation	Motivation is reduced; a "mental lift" or high morale can counter this.
	Moods	Most often reported are feelings of fatigue, irritability, persecution, inability to concentrate, periods of misinterpretation and disorientation, loss of interest in surroundings and events, and dominating desire to sleep. These

Figure 2 - 5

**MENTAL AND PHYSICAL FACTORS
AFFECTED BY SLEEP LOSS (cont.)**

P h y s i c a l F a c t o r s	Moods (cont.)	often appear after one night of total sleep loss and are present in most individuals after two nights without sleep.
	Personal Hygiene	Self-care deteriorates.
	Hunger	There is an increase in hunger disproportionate to time spent awake.
	Age	Young men (aver. 22 yrs) demonstrate poorer "continual mental efficiency" than middle-aged men (aver.40 yrs); older men pace themselves better.
	Eyestrain	Close work such as reading, viewing monitors, and using keyboards is likely to cause eyestrain.

Figure 2 - 5 (cont.)

Source: UK Army Personnel Research Establishment.

o **Fear.** Fear is a normal reaction to a threatening situation. It depletes the soldier's physical and mental energy.

INDICATIONS OF SLEEP LOSS AND DEGRADED PERFORMANCE

Sleep loss symptoms become more prevalent as sleep debt builds up. (See Figure 2-4, page 2-7.) Performance is affected by the hours of wakefulness, tolerance to sleep loss, and the kinds of mental or physical work. Both mental and physical changes occur, with symptoms varying among individuals. (See Figure 2-5, page 2-8.) Leaders must watch soldiers for the following indications of sleep loss and degraded performance.

PHYSICAL CHANGES

Changes in appearance include vacant stares, bloodshot eyes, pale skin, and poor personal hygiene. Other physical signs of sleep loss include the body swaying when standing, sudden dropping of the chin when sitting, occasional loss of hand grip strength, walking into obstacles and ditches, low body temperature, slowed heart rate, and slurred speech.

MOOD AND MOTIVATIONAL CHANGES

Mood changes, decreased willingness to work, and diminished performance go hand in hand. Soldiers may feel less energetic, alert, and cheerful and less interested in their sur-

roundings while, at the same time, they are more irritable and increasingly negative and sleepy. Some become depressed and apathetic. Sleepiness and mood changes are not signs of weakness. After long periods of sleep loss, soldiers go from being irritable and negative to dull and weary.

EARLY MORNING DOLDRUMS

Soldiers may feel that it takes more effort to do a physical task in the morning than it takes to do the same task in the afternoon. They may feel like stopping work due to exaggerated feelings of physical exertion. This is especially true between 0400 and 0700. During this time, the tendency to fall asleep is considerably more noticeable than at other times of the nighttime work period.

COMMUNICATION PROBLEMS

Soldiers may have difficulty deciding what needs to be said and how to say it or what someone else has said. They may not be able to carry on a conversation. They may forget what is being discussed, their minds may wander, or they may repeat themselves. Asking questions and cross-checking to avoid misunderstandings is helpful.

BICKERING

Bickering is caused by irritability. Both bickering and irritability increase with sleep

loss. When soldiers are bickering, it shows that they are still talking to each other and exchanging orders and messages. When bickering decreases, especially after a period of increased bickering, soldiers may be in a state of mental exhaustion.

DIFFICULTY IN PROCESSING INFORMATION

Comprehension and perception slow down. Soldiers take longer and longer to understand oral, written, or coded information. They may take a long time to find a location on a map and may make mistakes with map/chart coordinates. They are slow to interpret changes in enemy fire patterns. They may take longer to make sense of things seen or heard, especially patterns. They may have difficulty with spot, status, or damage reports and may not be able to assess simple tactical situations.

CHANGED RESPONSE TIME

Sleep loss also causes uneven response time. Some responses remain fast, while others become slow. The dangers are in the slowing down of appropriate responses and the delay in translating a simple order into action.

INADEQUATE RESPONSES

Soldiers may miss incoming signals. The Naval Health Research Center Report No. 86-22

entitled "Sleep Management in Sustained Operator's User's Guide" found that after 36 hours, soldiers may be able to perform message coding/decoding at only 50 percent of normal speed or detect only 70 percent of incoming signals. (Immediate correction improves the soldier's attention.)

IMPAIRED ATTENTION SPAN

Sleep deprivation causes the attention span to shorten. There is a loss of concentration on the job as dream-like thoughts cause lapses in attention. Leaders should watch for—

- o **Decreased vigilance.** Soldiers are less alert. They fail to detect the appearance of targets especially in monotonous environments.

- o **Reduced attention.** soldiers are slow to notice changes like hand signals or moving "bushes."

- o **Inability to concentrate.** Soldiers cannot keep their minds on what they are doing. They cannot follow multiple directions or perform numerical calculations. They are confused.

- o **Failure to complete routines.** Sleep loss interferes with completing routines like drying the feet, changing socks, or filling canteens when water is available. Soldiers may skip tasks like performing weapons checks.

MEMORY LOSS FOR RECENT EVENTS

When a soldier cannot recall what someone has just told him or what he just saw, heard, or read, he is exhibiting a common sign of sleep loss. His memory loss is limited to recent events. For example, a sleep-deprived soldier may forget recent target data elements or recall them incorrectly. It becomes difficult for him to learn new information.

MISPERCEPTIONS

The soldier's tired brain may see (and hear) things that aren't there. For example, he may mistake a bush for an enemy soldier. The danger is that a tired soldier may think it's real and act incorrectly for the tactical situation.

POTENTIAL FOR ACCIDENTS

There are situations such as fatigue, confusion, inadequate training, and improperly maintained equipment that increase the potential for accidents. Good leaders recognize these situations and prepare their subordinates through such means as training and awareness, sleep plans, and additional supervision to reduce the possibility of accident and injury.