SLEEP DEPRIVATION AND ITS EFFECT ON COMBAT EFFECTIVENESS

A Monograph
by
Major Clinton T. Anderson
Armor

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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It concludes that the US Army currently has no doctrine for the conduct of combat over an extended period of time. Adequate doctrine has been provided for the conduct of operations in periods of both limited and unlimited visibility, but the doctrine necessary to transition to continuous operations is not available. Furthermore, recent changes in the

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by

Major Clinton T. Anderson

Armor

School of Advanced Military Studies
US Army Command and General Staff College
Fort Leavenworth, Kansas

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Monograph Approval

Name of Student: Major Clinton T. Anderson
Title of Monograph: Sleep Deprivation and its Effect on Combat Effectiveness

Approved by:

Lieutenant Colonel John F. Hepler — Monograph Director

Colonel L. D. Holder, MA — Director, School of Advanced Military Studies

Philip J. Brookes, Ph.D. — Director, Graduate Degree Programs

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ABSTRACT

SLEEP DEPRIVATION AND ITS EFFECT ON COMBAT EFFECTIVENESS, by Major Clinton T. Anderson, USA, 40 pages.

This paper examines the effects of sleep loss on the combat effectiveness of the US Army's leaders and soldiers. It begins with an examination of US and Soviet doctrine for conducting continuous operations. This section discusses the doctrinal methods and procedures that both major powers employ to maintain continuous pressure on their opponent. After laying the theoretical groundwork, it then examines the changes that have occurred in tactical force design since World War II to determine what has been done to enhance or degrade our ability to execute that doctrine. After this discussion on the mechanical aspect of combat, the paper discusses the effects of sleep loss on units and the individual soldier.

It concludes that the US Army currently has no doctrine for the conduct of combat over an extended period of time. Adequate doctrine has been provided for the conduct of operations in periods of both limited and unlimited visibility, but the doctrine necessary to transition to continuous operations is not available. Furthermore, recent changes in the force structure of our combat units (primarily Armor and Mechanized Infantry) have significantly reduced the redundancy and robustness in those units that is necessary to conduct continuous operations. During continuous operations our units will be effected by loss of sleep. Sleep deprivation affects the cognitive skills of our leaders greater than the physical skills of our soldiers. To fight the continuous operations that will be forced upon us by our opponent, we must prepare ourselves to combat the effects of sleep loss first.

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SECTION I

INTRODUCTION

> Battle is the final objective of armies and man is the fundamental instrument in battle. Nothing can wisely be prescribed in an army--its personnel, organization, discipline and tactics, things which are connected like the fingers of a hand--without exact knowledge of the fundamental instrument, man, and his state of mind, his morale, at the instant of combat. [1] ARDANT DU PICQ.

Both US and Soviet tactical doctrine emphasize the requirement to conduct operations day and night to sustain offensive momentum. Technological advances in the areas of light amplification, thermal imagery, position location, sensors, and surveillance radar systems have given us the equipment to fight around the clock. However, we continue to "miss the fundamental problem posed by continuous operations: machines can run without letup; human beings cannot."[2] Our ability to conduct continuous operations of extended duration has been seriously hampered by the recent Army of Excellence (AOE) organizational changes. AOE changes deliberately reduced the robustness and redundancy of our tactical combat units. After action reviews from the National Training Center (NTC) indicate significant degradation of unit capability due to sleep deprivation. How serious is this loss of capability, and what can we do about it?

PURPOSE

This paper will begin with an examination of US and Soviet doctrine for conducting continuous operations. This section will discuss the doctrinal methods and procedures that both major powers will employ to maintain continuous pressure on their opponent. After laying the theoretical groundwork, it will then examine the changes that have occurred in tactical force design since World War II to determine

what has been done to enhance or degrade our ability to execute that doctrine. Following this discussion on the mechanical aspect of combat, the paper will examine the effects of sleep loss on units and the individual soldier. Finally, it will present several conclusions on current US capabilities to conduct continuous operations in spite of acute sleep deprivation.

DEFINITIONS

Prior to conducting the analysis, it is necessary to define several key terms used throughout this report:

Continuous Operations (CONOPS). Combat continuing at high-intensity levels for extended periods. Individuals within a unit may have opportunities for sleep.[3]

Sustained Operations (SUSOPS). Term used when units engage in CONOPS with no opportunity for the unit to stand down and very little opportunity for soldiers to sleep more than a few minutes.[4]

Rest. The inactivity of an awake individual who is relieved from continuous mental concentration of physical exertion.[5]

SECTION II

EXAMINATION OF DOCTRINE

> It often happens that those who discuss war, taking the weapon for the starting point, assume unhesitatingly that the man called to serve it will always use it as contemplated and ordered by the regulations.[6]
> ARDANT DU PICQ.

US DOCTRINE

One of the problems plaguing US Army officers studying continuous operations is the general lack of doctrine on the subject. FM 100-5, *Operations*, recognizes that future "high- and mid-intensity battlefields are likely to be chaotic, intense, and highly destructive. They will probably extend across a wider space of air, land, and sea than previously experienced."[7] Future combat will be very fluid and nonlinear, with forces intermingled throughout the battlefield. Our potential enemies will be armed with weapons systems whose capabilities equal or exceed our own. Recent advances in technology have produced command and control systems that enable commanders to extend their span of control over greater distances. Our doctrine recognizes great changes to the nature of modern warfare in the dimension of space, but little is written regarding the dimension of time and its effect on the soldier.

The only place where CONOPS is mentioned in our operations manual is a small section under Airland Battle Imperatives titled "Understand the Effect of Battle on Soldiers, Units, and Leaders."[8] This section advises that:

> Commanders must understand that in battle men and units are more likely to fail catastrophically than gradually. . . . Staffs and commanders at higher levels must take into account the impact of prolonged combat on subordinate units. Military organizations can fight at peak efficiency for only so long.[9]

The proposed solution to this problem of prolonged combat is to "rotate units through difficult tasks to permit recuperation to the extent possible."[10]

The Army is in the process of publishing more detailed guidance on the conduct of combat operations in its "71-series" manuals. In a review of these manuals on battalion, brigade, and division operations, no additional information describes the conduct of CONOPS. The only related passages provide information on the conduct of night and limited visibility operations. These passages were heavily influenced by our ability to see at night as well as during daylight through advances in technology. No methods, procedures, or techniques were proposed to aid commanders in maximizing the abilities of their soldiers to fight around the clock, while minimizing the impact of the rigors of continuous combat.

The subject of continuous operations is discussed in detail in only one field manual, FM 22-9, *Soldier Performance in Continuous Operations.* It should be noted that the "22-series" manuals cover the doctrinal area of military leadership, and not tactical operations. As the title indicates, this manual focuses on the effect of CONOPS on the individual soldier. The manual begins by describing the challenges that future war will present to leaders. It then addresses the strategies for conserving soldier resources and the tactics for sustaining individual soldier performance.

This manual covers the requirements for small unit leaders very well. However, no guidance exists on how to fight our units over extended periods of time. Our doctrine recognizes the effect of CONOPS on our soldiers, and that future wars will extend over great distances, but nowhere do we address how to fight continuous operations. This is in direct contrast to Soviet doctrine, which expresses all operations in relation to time.

SOVIET DOCTRINE

Soviet offensive doctrine is characterized by the concept of continuous operations. "In 1924, M. Tukhachevsky expressed the concept of 'sequential operations' and the necessity to attack with 'unabated pressure' on the enemy."[11] In 1970, Soviet author A. A. Sidorenko writing on the subject of the offensive states: "The offensive . . . will be conducted night and day, in any weather, without letup until the enemy is defeated."[12] "Most recently, Marshal N. V. Ogarkov described the need to 'conduct two or more operations with brief pauses [or] even without pauses [in the battle]."[13] The intent of Soviet CONOPS is to maintain pressure until the enemy's will to resist collapses.

The Soviet commander has a doctrine that provides him the method to maintain constant, unabated pressure. The primary tactical method of maintaining this pressure is done through the echelonment of his forces. Soviet commanders, from battalion through Army, organize their forces into two echelons while maintaining an antitank reserve and an exploitation force.

At each level, unit missions are stated as a function of time and distance. The regimental commander assigns his first echelon battalions the mission of securing the regimental initial objective. Through the use of tactical decision-making aids, the regimental commander calculates that by the time the first echelon battalions has secured this objective their combat power will be exhausted. At the initial objective, he commits his second echelon battalions to the regimental's subsequent objective (division initial objective). At this point, the regiment has expended its combat power in accordance with the division commander's plan, and another regiment is committed to the attack. Likewise, this regiment has both first and second echelon objectives planned in order to achieve the division's subsequent objective.[14]

At this point, the first echelon division has expended its combat power, and the second echelon division will be committed -- and the process continues. While the second echelon division continues toward the Army's subsequent objectives, the first echelon division now becomes the center of attention of the deputy commander for rear services as this unit is reorganized and reconstituted.[15]

In a typical combat environment beyond 72 hours, an American combat battalion could expect to face four fresh Soviet battalions attacking day and night. The Soviets therefore have the capability to force the American commander into extended continuous operations with some periods of sustained operations. If we are going to win future military actions, it is imperative that we learn to conduct continuous operations.

SECTION III

EXAMINATION OF FORCE DESIGN

> Note that Army organizations and tactical formations on paper are always determined from the mechanical point of view, neglecting the essential coefficient, that of morale. They are almost always wrong.[16] ARDANT DU PICQ.

This section will examine the impact of force design changes on the US Army's CONOPS capability since World War II. World War II (1945), pre-AOE (1978) and AOE tank and mechanized infantry battalion force designs will be compared to determine how our capability to conduct CONOPS has been improved or degraded. Summaries of these comparisons are included at Tables 1 and 2.

STRUCTURE

The objective of the AOE organizational changes was to increase the number of combat formations, while holding Army end strength constant.[17] To accomplish this objective, organizations were made smaller. It was thought that smaller units would give the commander greater flexibility to weight the battle and rotate units. Additionally, smaller units were thought to be more easily controlled, and it would be easier to deploy and support such units.

TABLE 1. TANK BATTALION DESIGN COMPARISON[18]

STRUCTURE	AOE	PRE-AOE	WWII
HHC	1	1	1
Cbt spt co	0	1	0
Tank company	4	3	3
Light tank company	0	0	1
Service company	0	0	1
AGGREGATE STRENGTH			
Battalion	543	537	700
HHC	295	188	134
Cbt spt co	0	85	0
Tank company (each)	62	88	122
Light tank company	0	0	97
Service Company	0	0	119
LEADER TO LED RATIO (off+wo:enl)			
Battalion	1:12	1:14	1:15
HHC	1:12	1:9	1:10
Cbt spt co	NA	1:21	NA
Tank company	1:12	1:18	1:23
Light tank co	NA	NA	1:18
Service company	NA	NA	1:16
AGGREGATE STRENGTH			
Bn spt plt/co	34 (plt)	29 (plt)	119 (co)
Scout platoon	31	30	21
Bn commo	5	11	9
DRIVER TO VEHICLE RATIO			
Bn spt plt/co	1.1:1	1.1:1	2:1
HAUL CAPABILITY			
Battalion	506,000 lbs 34,850 cu ft	364,500 lbs 26,800 cu ft	NA
HHC	482,000 lbs 32,850 cu ft	292,000 lbs 20,500 cu ft	NA
Cbt spt co	NA	16,500 lbs 1,500 cu ft	NA
Tank co (each)	6,000 lbs 500 cu ft	14,000 lbs 1,200 cu ft	NA

TABLE 2. MECHANIZED BATTALION DESIGN COMPARISON[19]

STRUCTURE	AOE	PRE-AOE	WWII
HHC	1	1	1
Anti-armor co	1	0	0
Cbt spt co	0	1	0
Service company	0	0	1
Rifle company	4	3	3
AGGREGATE STRENGTH			
Battalion	832	873	1028
HHC	339	202	173
Anti-armor co	65	0	0
Cbt spt co	0	110	0
Service Company	0	0	73
Rifle Company (each)	107	187	251
LEADER TO LED RATIO			
Battalion	1:17	1:21	1:23
HHC	1:14	1:11	1:11
Anti-armor	1:12	NA	NA
Cbt spt co	NA	1:21	NA
Service company	NA	NA	1:9
Rifle company	1:20	1:30	1:41
AGGREGATE STRENGTH			
Bn spt plt/co	45 (plt)	32 (plt)	66 (co)
Scout platoon	31	30	21
Bn commo	10	16	9
DRIVER TO VEHICLE RATIO			
Bn spt plt/co	1.2:1	0.6:1	2:1
HAUL CAPABILITY			
Battalion	735,500 lbs 51,475 cu ft	318,000 lbs 23,300 cu ft	NA
HHC	653,000 lbs 44,150 cu ft	242,000 lbs 16,800 cu ft	NA
Anti-armor co	16,500 lbs 1,465 cu ft	NA	NA
Cbt spt co	NA	23,500 lbs 2,000 cu ft	NA
Rifle co (each)	16,500 lbs 1,465 cu ft	17,500 lbs 1,500 cu ft	NA

TANK AND MECHANIZED INFANTRY BATTALIONS

World War II tank and mechanized battalions were heavy by AOE standards (see appendix—diagrams 1 thru 6). World War II tank battalions were similar to AOE tank battalions, each having 4 tank companies. However, the total number of men and equipment was greater in the World War II battalions (700 men and 70 tanks compared to 543 men and 58 tanks). Infantry battalions during World War II were larger as well. Examine the number of infantrymen in the various battalion designs. The World War II battalion had 753 infantrymen, the pre-AOE had 561 infantrymen, and our current AOE battalion has only 428 infantrymen. Additionally, World War II tank and infantry battalions contained a service company to provide second echelon maintenance, administrative, logistical, and transportation support to the companies. The AOE battalions consolidate these administrative–logistical functions in the battalion Headquarters and Headquarters Company (HHC).

COMMAND AND CONTROL

The AOE operations and intelligence sections are larger than their World War II counterparts. The operations section has 14 personnel assigned to it, excluding the operations officer located in the command element. The intelligence section has 4 personnel assigned to it, excluding the intelligence officer also assigned to the command elements. This staffing provides sufficient personnel to permit a two shift operation that would provide a minimum or 4 hours of sleep per 24–hour period.[20]

COMMUNICATIONS

The AOE battalion's communications sections are smaller than both pre-AOE and World War II designs. The difference is a loss of dedicated wiremen to lay wire, operate the battalion switchboard, and operate the radio–retransmission station. This shortage of manpower limits the battalions ability to maintain its communications equipment and provide a wire communications network to subordinate units.[21]

TANK COMPANY

The AOE tank company is an austere organization totalling 14 tanks, as opposed to the 17 tanks of its World War II and pre-AOE counterparts. Pre-AOE companies retained organic communications and maintenance sections that AOE units have consolidated in the HHC. Although modern tanks are more durable, survivable, and potent than old ones, the reduction in the number of tanks and consequent reduction in manpower significantly effected the robustness of these units.

MECHANIZED INFANTRY COMPANY

Major changes have occurred in mechanized infantry companies since World War II as well. Compare the personnel strength of the World War II armored infantry company (6 officers, 245 enlistedmen), pre-AOE mechanized infantry company (6 officers, 181 enlistedmen) and current AOE mechanized infantry company (5 officers, 102 enlistedmen). The size of the infantry squad in World War II appears to be based on the number of infantrymen required to

perform a mission. The size of the modern infantry squad is based on the number of infantrymen that can ride in the carriers/fighting vehicles. The reduction in the number of foot infantry poses serious limitations on the capability of our infantry companies to fight dismounted.

SCOUT PLATOON

The scout platoon structure has undergone several changes since the close of World War II. Currently, the scout platoon has 6 M3 Cavalry Fighting Vehicles and a personnel strength of 30 men. Older series TOEs authorized battalion scout platoons 10 vehicles (1/4 ton gun jeeps or M113 Armored Personnel Carriers) and 30 men. The reduction in vehicle strength limits the amount of area that the scout platoon can provide surveillance. Recent NTC experience has proven that a platoon strength of 30 men is inadequate to perform CONOPS beyond 48-72 hours. World War II scout platoons had this problem as well and were routinely augmented with additional soldiers and equipment to provide adequate reconnaissance capability.[22]

SUPPORT PLATOON

The World War II support company could carry one-half of its basic load in tank ammunition and one-quarter of its basic load in small arms. This inability to haul its complete basic load increased its requirement for staging, storage, and handling the ammo. In order to sustain the logistical effort through continuous shifting of supplies forward, two drivers were authorized per vehicle.

The addition of Heavy Expanded Mobility Tactical Trucks (HEMTT) to AOE support platoons has greatly increased the cargo carry capacity of the unit. Modern technology has also developed a palletized loading system that will enable a

single person to load or unload these trucks in less than five minutes. These improvements appear to greatly enhance our logistical capability for CONOPS.[23]

However, while the AOE force structure has twice the haul capacity of the pre-AOE design, the AOE weapons systems (M1 tank, M2/3 BIFV) require greater quantities of supply items, namely fuel and ammunition. NTC experience reports that AOE weapons systems must be refueled and rearmed twice a day. A single driver per vehicle severely degrades the AOE support platoons' ability to operate during CONOPS.[24]

It is evident that in "squeezing out the fat," we have reduced some of the robustness and necessary redundancy in our tank and mechanized infantry battalions. In depending on high technology to reduce the manpower requirements of our units, we grow increasing more dependent on the individual soldier's ability to perform his job 24 hours a day.

SECTION IV

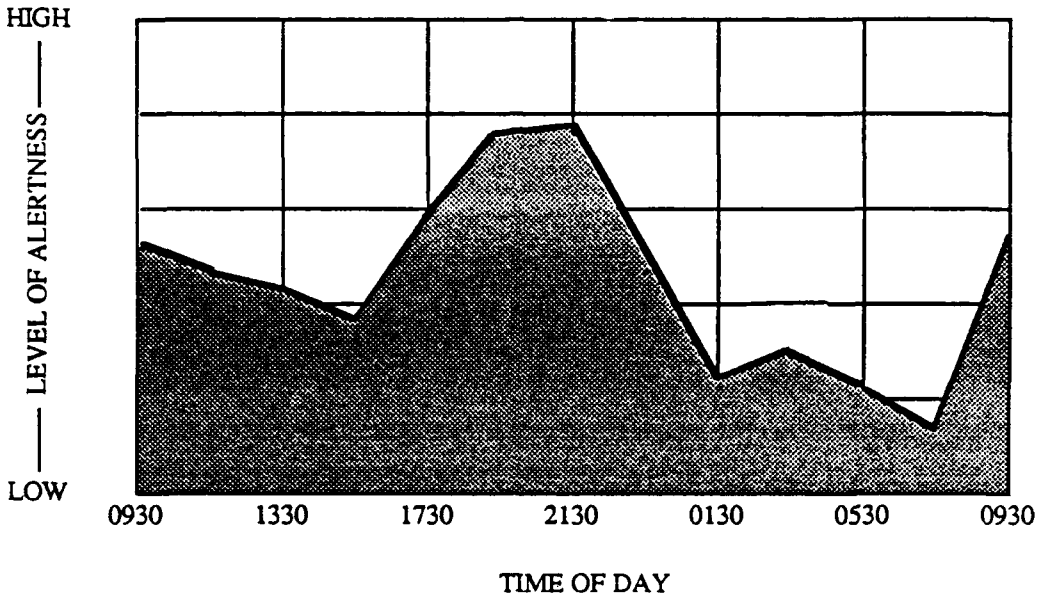
EFFECTS OF SLEEP LOSS ON COMBAT EFFECTIVENESS

> Nothing we have seen has undermined our laboratory and history-derived assumption that psychological rather than physiological exhaustion is the critical problem in any extended operation. That is, the question concerns not sleeping on the job, but persisting in a job until mental errors destroy the unit.[25] WALTER REED ARMY INSTITUTE OF RESEARCH.

Sleep research has existed primarily from the late 1920s. Since that time, there has been an increasing number of studies and reports on the effect of sleep loss on man. Yet exactly how sleep functions is still unknown. What we do know is that if we do not get enough sleep, our physical and mental behavior are altered significantly.[26]

CIRCADIAN CYCLE

A finding common to all studies on sleep is that the human body operates on a 24-hour cycle commonly referred to as the Circadian Cycle. This "internal clock" strongly influences our behavior, "telling" us when we should eat, sleep, etc. Physiologically lack of sleep affects the human body in several ways. This report is concerned with how sleep deprivation effects soldier performance. Figure 1 provides an example of this cycle and shows its effect on alertness.



Reference: CACDA, Continuous Operations Study (CONOPS), p. B-I-b-25

Figure 1. Circadian Cycle

What the studies have found is that there are peaks and valleys in our levels of alertness caused by this cycle: "Alertness varies with the time of day with a trough in alertness occurring in the early morning (0400-0700) and a peak in alertness in the early evening (1600-1900)."[27] Later paragraphs of this paper will explain the effects of sleep deprivation on combat effectiveness and substantiate the requirement for sleep. The quality of this sleep is almost as important as the amount, and units need to consider the circadian cycle when developing sleep plans. The best sleep occurs during the hours indicated by the two troughs shown in figure 1 above. Units organized to work in shifts should consider working two 12 hours shifts instead of three 8 hour shifts to permit off duty shifts to rest during these time periods. It is important to note that these effects are a function of the time of day in the time zone where the soldier currently resides. Deployment outside of that time zone will result in the Circadian rhythm being out of synchronization with the new day-night cycle.

JET LAG

The term "jet lag" refers to the difficulty individuals encounter when they rapidly change time zones. When flying east to west, the hours of the day are extended and are no longer synchronized with the travellers Circadian rhythm. This explains why the traveller is hungry between normal meal hours and sleepy before the usual bedtime hours. Flying west to east shortens the hours of the day, also disrupting the Circadian rhythm. This disruption between the soldier's Circadian Cycle and the day cycle results in degraded performance.[28]

This can have a serious effect on military units that must deploy from the United States to conduct missions around the world. Recent research by the Walter Reed Army Institute of Research indicates that jet lag degrades military performance by an average of 15 percent across all skill levels. This indicates that "unit effectiveness is reduced by 15 percent as soon as the unit deplanes!"[29]

SLEEP DEPRIVATION

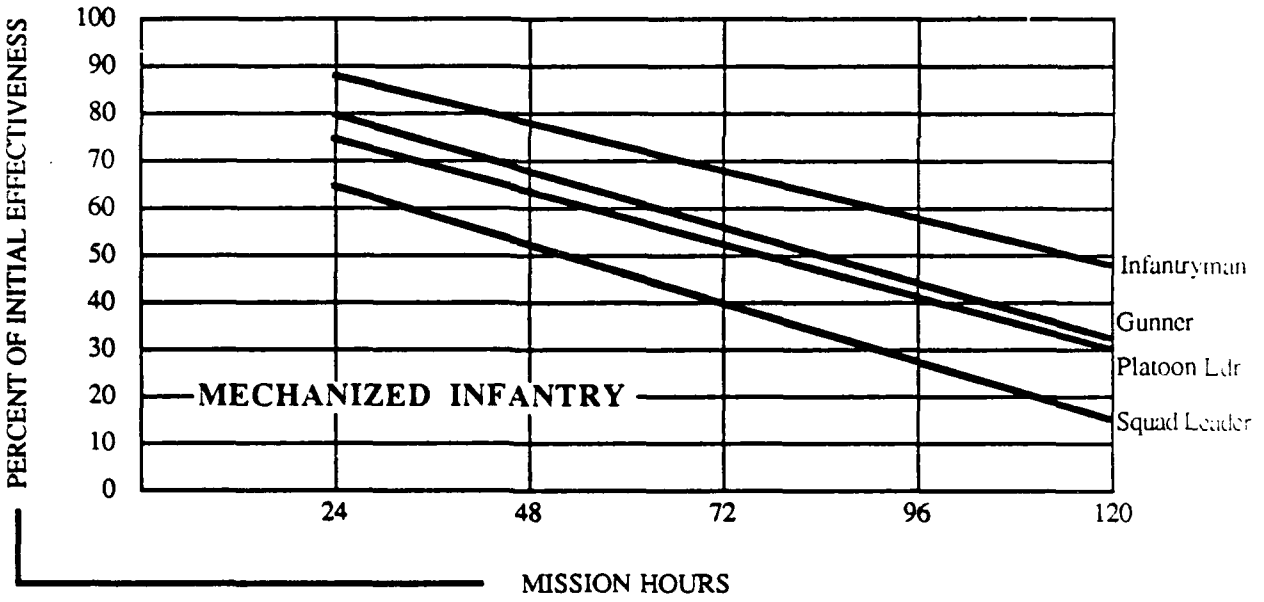
Sleep deprivation creates the same effects as jet lag. Extending wakefulness beyond the time when sleep would normally occur disrupts the synchronization between the body and day-night cycles. Several studies and exercises have been conducted to determine the effect loss of sleep has on individuals and unit performance.

A British exercise, Early Call I, conducted in 1976, evaluated the effects of sleep deprivation on three platoons of light infantry. The exercise was conducted using a controlled retrograde scenario, with each of the platoons digging-in, defending, patrolling, then moving to a new position and digging in again. One platoon operated on no sleep, one platoon was permitted 1.5 hours of sleep, and the

third platoon was allowed 3 hours of sleep per night. The platoons were judged militarily ineffective after 3, 6, and 9 days, respectively. The effects of the deprivation were primarily mental rather than physical.[30]

The Walter Reed Army Institute of Research (WRAIR) and the Army Research Institute (ARI) conducted joint research on the effects of continuous operations on soldier and unit performance in 1986. The analysis concluded that individuals can maintain cognitive performance indefinitely with six to eight hours of sleep each night. Four to five hours of sleep will maintain cognitive performance for five to six days. However, less than four hours leads to rapid decline in performance rendering the soldier ineffective in two to three days. WRAIR concluded that four and one-half hours appeared to be the break point between sustaining and degrading performance.[31]

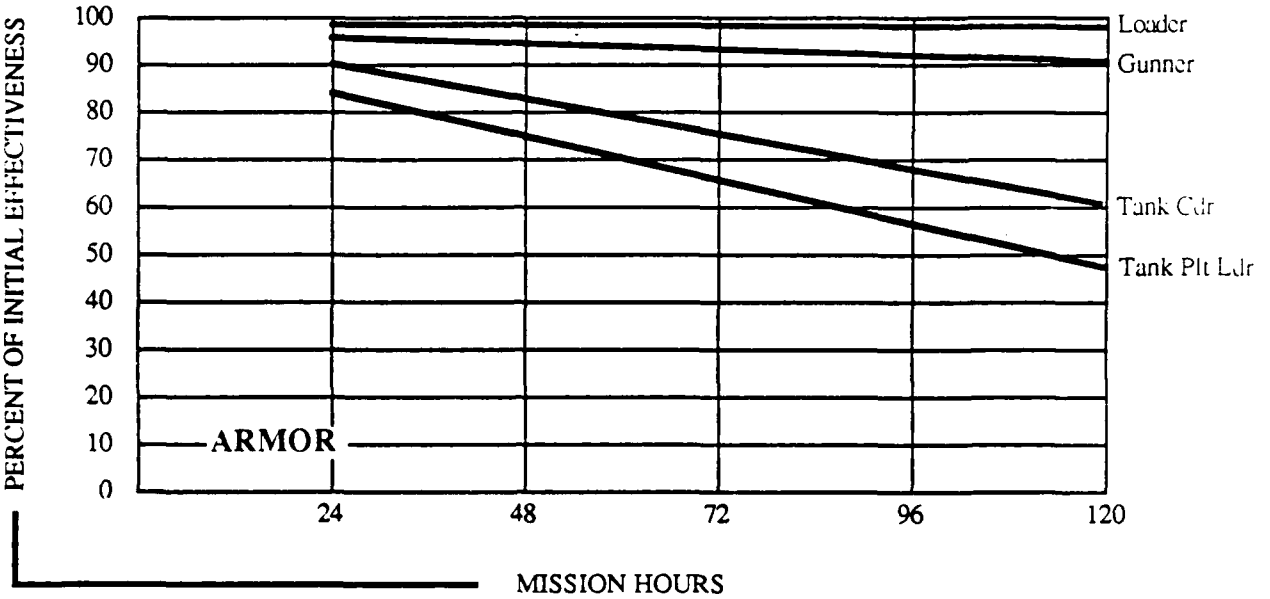
Other studies made use of computer simulation to project the rate at which various type job skills will degrade. The projections shown in the following figures are based on selected important tasks normally performed by persons in the indicated duty positions.[32] It is important to note that performance in duty positions requiring mental tasks degrade faster than those positions requiring mainly physical tasks.



Reference: FM 22-9, Soldier Performance in Continuous Operations, p. 1-8

Figure 2. Projected Performance Degradation (Infantry)

It is illuminating to compare the effectiveness of the infantry squad leader to that of his men under equal amounts of sleep loss (see figure 2). The squad leader must perform a greater amount of mental tasks than his men and is concerned with establishing defensive positions, checking fields of fire, and integrating the individual squad members into a cohesive unit. In contrast, squad members tasks are generally all physical, and while running, digging positions, and carrying heavy packs is burdensome, their performance is not affected as greatly as their squad leader's.[33]

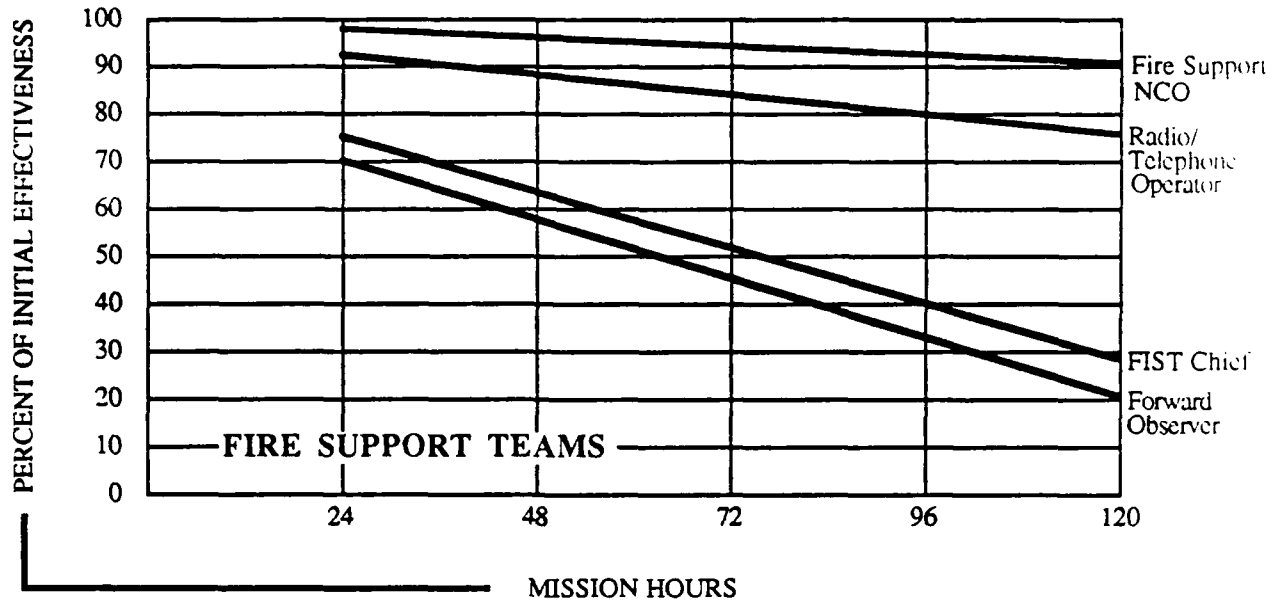


Reference: FM 22-9, Soldier Performance in Continuous Operations, p. 1-8

Figure 3. Projected Performance Degradation (Armor)

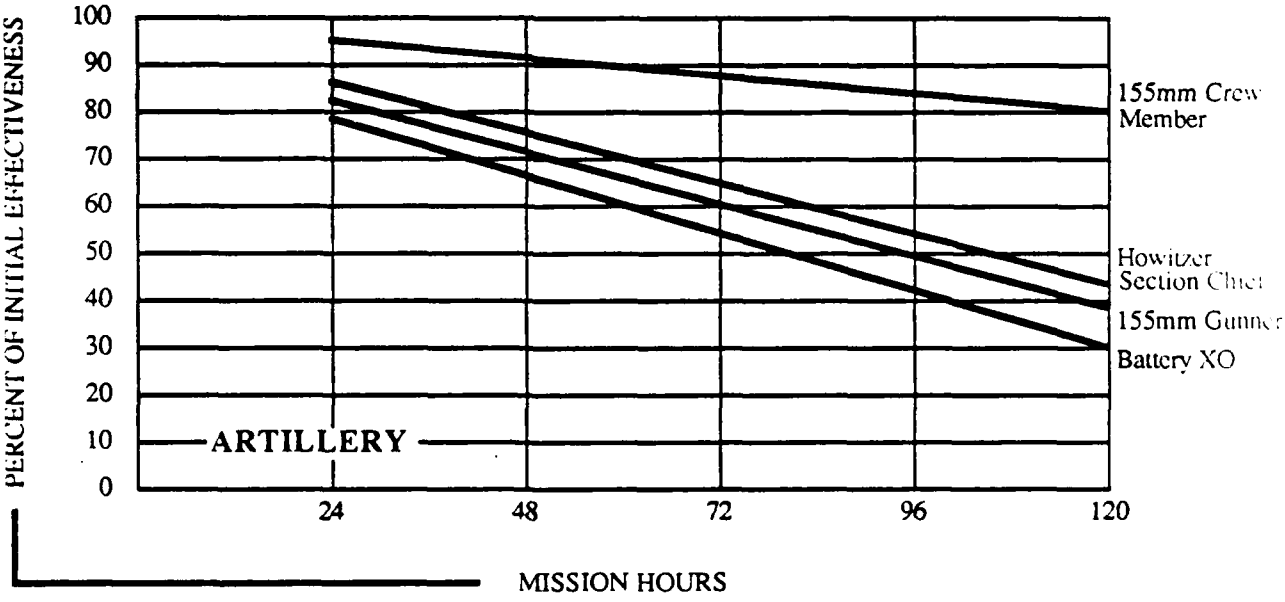
Compare the effects of sleep deprivation between tank loaders, tank commanders, and platoon leaders (see figure 3). As long as the only duties of the loader are to load and unload the main gun, care for the coaxial mounted machinegun, and do his share of vehicular maintenance, his performance remains relatively unaffected by loss of sleep. But if he were given some additional tasks requiring concentration or vigilance — such as duties on an observation post — his effectiveness would decrease significantly.

Fire support team (FIST) chiefs and forward observers are required to perform mentally complex tasks. As the number of days without sleep increases, their ability to properly call for, and adjust indirect fires will become more difficult (see figure 4). The speed at which calculations are made will be sacrificed first to maintain precision, but as sleep deprivation continues, their accuracy will deteriorate as well.



Reference: FM 22-9, Soldier Performance in Continuous Operations, p. 1-9

Figure 4. Projected Performance Degradation (FIST/FSE)



Reference: FM 22-9, Soldier Performance in Continuous Operations, p. 1-9

Figure 5. Projected Performance Degradation (Artillery)

While the calculations become more difficult for the FIST, the gun crew members' effectiveness in loading and transferring projectiles (primarily physical tasks) is hardly decremented (see figure 5). It can be noted, however, that those crew members that must concentrate on firing data, propellent charges, and fuze settings will suffer a loss of effectiveness because short-term memory and precision are required.[34]

While performing duties under limited sleep conditions, soldiers accumulate a sleep debt. In other words losing sleep adds up, and the only corrective action for satisfying this debt is sleep itself. WRAIR determined that following 36-48 hours of SUSOPS, 6 or less hours of sleep will generally not be sufficient to return the individual to normal performance levels. They found that nearly 12 hours of sleep would be required after 36-48 hours of sleep loss, and recommended that 24 hours of sleep be permitted if the individual was required to return to conditions of high cognitive workload. Figure 6 shows the approximate recovery times for various extended sleep loss periods.[35]

Recovery Time	
Deprivation Hours	Recovery Hours
48	12
72	24
96	120

Reference: Sleep Loss and Its Effect in Combat, p. 19.

Figure 6. Recovery Time

The effectiveness of a unit depends on the performance of each of its soldiers. However, when leaders fail, units disintegrate because no one is providing effective control and direction. Therefore, unit leaders must be given the highest priority and the largest allocation of sleep. The next priority must go to those soldiers who perform calculations, evaluate information, or perform tasks requiring great concentration (FIST team members, vehicle operators, etc). Any remaining time should then be allocated evenly among the remaining soldiers. Experiences during World War II, the 1973 Yom Kippur War, and, more recently, unit rotations to the NTC back these findings.

HISTORICAL EXAMPLES

The destructive effect of sleep deprivation on a unit is readily apparent in the unit history of the 5307th Composite Group (Provisional), more famously known as Merrill's Marauders. This regimental–sized light infantry group (code named, Galahad) was formed to conduct a single major mission of three months' duration. The 3,000 volunteers were formed into 3 battalion-sized units similar to the British Long-Range Penetration Groups commanded by Brigadier Orde C. Wingate in Burma at the time.[36] The unit was to operate against the flanks and rear of the Japanese. British experience with this type of unit indicated that at the close of the 90–day operation the unit would be so exhausted that its survivors would require 3 months' hospitalization and rest.[37]

Galahad began its operations in Burma in February 1944. By the end of April, after nearly 90 days of operating in the Japanese rear areas, Stilwell committed the unit to seize the airfield at Myitkyina.[38] The march to Myitkyina took nearly 30 days and was so fatiguing that nearly half of the pack mules died of exhaustion. By 27 May, physical deterioration and exhaustion of the unit was so

extensive that men were falling asleep in battle, and one battalion commander fainted three times during the course of the battle.[39]

By 4 June, Galahad's casualties totaled 2,394 out of the original 3,000. Of these, only 424 could be directly attributed to combat. Diseases such as dysentery, typhus, and malaria accounted for another 948 casualties. The remaining 1,022, were listed under psychoneurosis and miscellaneous. The vast majority of these casualties were due to total exhaustion.[40] In short, in a time span of approximately 4 months, "A light infantry regiment had been fought to extinction through the conduct of continuous operations . . . with no provision for rest, replacement, or adequate service support."[41]

Other American units experienced better success in conducting CONOPS. The 104th Infantry Division in the 1945 push for Cologne employed its regiments and battalions in such a manner that it always had fresh troops to conduct its attacks. The division rotated its battalions between offensive, defensive, and reserve actions, while applying constant pressure on the enemy yet maintaining its own combat potential. Of the 13 days' of continuous combat occurring from 23 February to 7 March 1945, the battalions averaged only 6.5 days in contact with the enemy.[42] The division was always able to keep a portion of its force out of contact to rest, rearm, and refit.

Combat Command A, 4th Armored Division, during the Lorraine campaign, (September-December 1944) rotated companies from its battalions with fresh ones from Combat Command R in order to maintain a higher level of combat performance. Many divisions used regimental and battalion rest camps to provide breaks in continuous operations for those units. Usually, these camps were nothing more than a sheltered place where units could eat, rest, and sleep for a few hours. Medical reports during the war indicated that most units would return to normal combat efficiency after 24 to 72 hours of rest.[43]

Senior level World War II British commanders recognized the degrading effects of sleep loss on command and control and compensated for it. Both Field Marshall Montgomery and Viscount Slim maintained a daily routine that included 8 hours of sleep each night. Slim explains why he insisted on keeping such a schedule:

> I had seen too many of my colleagues crack under the immense strain of command in the field not to realize that, if I were to continue, I must have ample leisure in which to think, and unbroken sleep. . . . Generals who are terrible busy all day and half the night, who fuss round, posting platoons and writing march tables, wear out not only their subordinates but themselves. Nor have they, when the real emergency comes, the reserve of vigour that will then enable them, for days if necessary, to do with little rest or sleep.[44]

In the 1973 Yom Kippur War, the Israeli Defense Force also experienced the effects of sleep deprivation. In his book, *The Heights of Courage*, Brigadier General Avigdor Kahalani describes two incidents that occurred in his tank battalion near the closing days of the war. Exhausted due to lack of sleep, he had fallen asleep near the exhaust pipe of his tank. When he awoke the next morning, he discovered that he had third degree burns on the back of his thigh. He was too numb from lack of sleep to feel the heat. In a separate incident, his deputy commander, while half asleep, shot himself in the hand with his machinegun.[45]

Recent US Army experiences at the NTC continue to expose the effect of sleep deprivation on combat effectiveness. Post training interviews[46] with several infantry and armor battalion commanders indicate sleep deprivation problems in the same areas where force design changes were made. Generally speaking, the battalion commanders felt that their battalion TOCs, communications sections, scout platoons, and support platoons lacked the redundancy of personnel to function during CONOPS.

The majority reported that they felt that the battalion TOCs were adequately staffed to perform for six days of CONOPS. Beyond six days, the ability to perform key command and control tasks became marginal due to sleep deficit accumulated from frequent moves, preparation of orders, and maintenance of proper local security.

Regarding the scout platoon, several commanders reported that their scouts were combat ineffective after 48-72 hours due to sleep loss and had to be augmented with additional forces to continue their mission. Similar comments were made regarding the shortage of support platoon drivers and the impact of sleep loss on their performance.

The National Training Center (NTC) Opposing Forces (OPFOR) maintain continuous pressure on our units in training by rotating units between the maneuver area and the cantonment area. An actual Soviet commander, through the echelonment of his forces, will be able to maintain this pressure with fresh battalions in combat. How well we will be able to maintain our effectiveness in actual combat is not yet known.

SECTION V

CONCLUSIONS

Day Operations + Night Operations ≠ Continuous Operations

Simply continuing combat through a night into a next day has little influence on combat efficiency. But continuing the battle over extended periods of time can have a debilitating effect on combat efficiency. The US Army has developed doctrine to fight operations during the day. Other manuals instruct us on how to properly employ our forces at night. But nowhere is there a manual to train us on how to fight over an extended period of time and how to do so effectively. Doctrine and force structure must be developed to address how we are to employ our tactical units to fight operations over long periods of time. Until that doctrine is written and implemented, commanders and staffs at all levels must consider how to rotate units to areas where they can rest and reorganize.

The lack of robustness and redundancy in AOE battalions will impact significantly on the ability of those units to conduct CONOPS due to sleep deprivation. Although the command element of AOE units is larger than previous designs, experience at the NTC indicates that sleep deprivation begins to degrade that elements' performance after six days. As battalion command and control elements grow tired, less forward planning will be done. Experience has shown that units and individuals suffering from sleep deprivation become more reactive than proactive. We must retain the initiative to win our future battles. To do this, we must act faster and think smarter than our opponents. We must recognize that the quality of the work done by our leaders will be degraded by lack of sleep. This degradation in the quality of our leadership, "particularly when unrecognized or unacknowledged, clearly places units in greater danger."[47] Our TOCs must make

better use of time–saving decision aids that will speed up the decision process, and ensure that our leaders receive the sleep they need for proper decision making.

The small size of the battalion scout platoon affects its ability to conduct CONOPS beyond 72 hours. To execute the counter-reconnaissance battle properly, we must have robust reconnaissance units. Our current Scout platoon structure must be reassessed to assure that it can accomplish its missions. This may require a return to 10 vehicles and the crews to operate them rather than the current 6 vehicles and crews. Until that occurs, battalions need to crosstrain maneuver platoons to augment or back up the scouts.

The lack of assistant drivers in the battalion support platoon will affect the availability of fuel and ammunition to the maneuver units. The ability of the support platoon to conduct CONOPS is severely degraded if it is forced to conduct resupply missions exceeding 12 hours per day. Experience from World War II indicates that we must have assistant operators to conduct CONOPS for longer periods of time. Until then, we need to place additional emphasis on forward planning and preplanned logistics packages that can be pushed down to subordinate combat units.

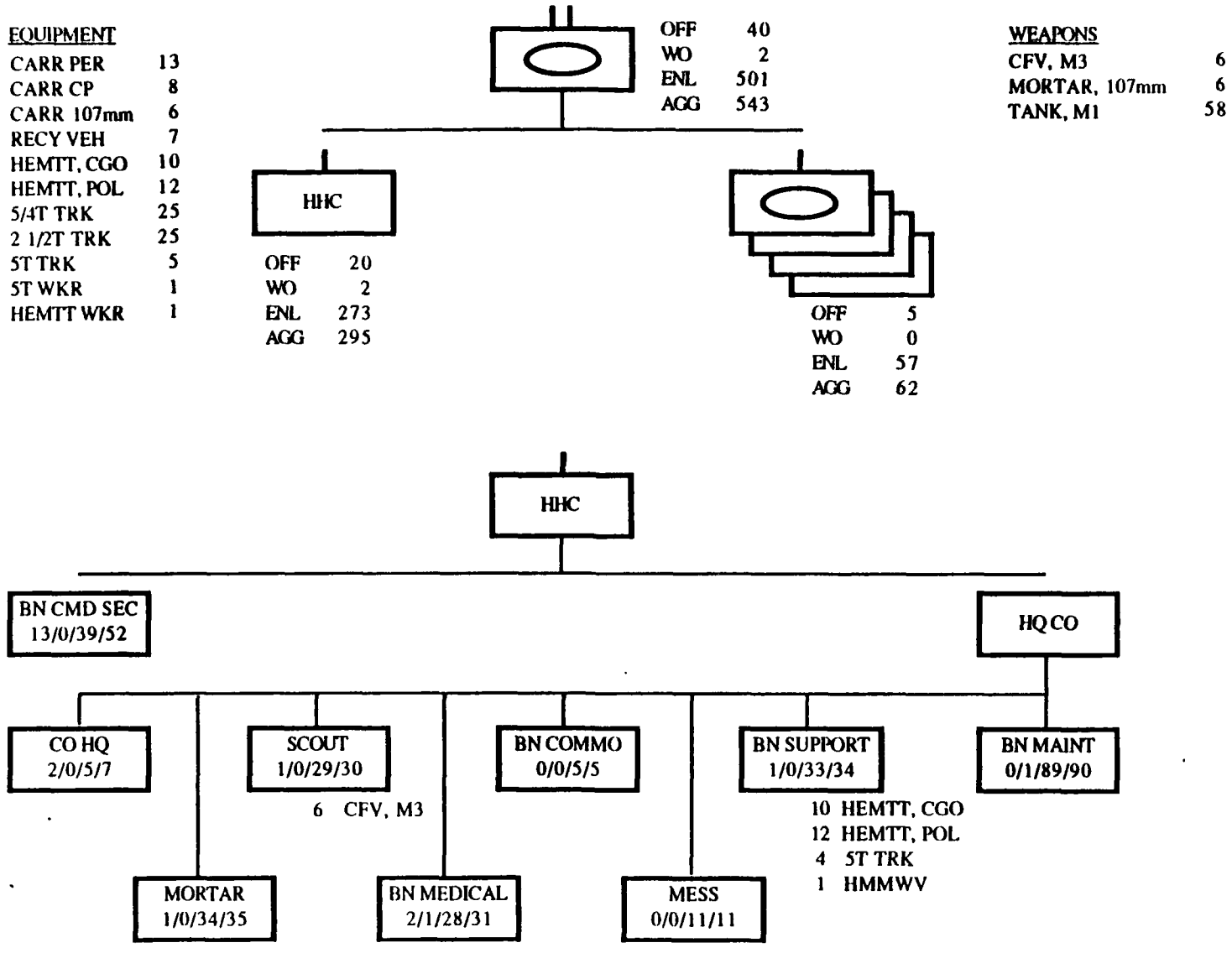
To maintain high performance in individual soldiers during CONOPS, we must train to high standards in the manner in which we are going to fight. Skills that are overtrained, those that have become "second-nature", are not as greatly affected by lack of sleep as those recently learned. In addition to overtraining on skills, we must crosstrain men as well. Tank loaders need to know how to perform the duties of gunners on our tanks. Select riflemen must be trained to gun our BIFVs. Crosstraining reduces the impact of losing that "one critical man".

To maintain the combat potential of our battalions, leaders must learn from the experience of the 104th Division. Brigade and Division Commanders will need to "rotate the lead" in offensive operations, and exchange fresh ones for tired ones

in the defense. This rotation could coincide with our AOE units requirement for frequent re-supply. As units in contact are forced to refuel and re-arm, fresh units are moved forward to maintain the momentum of the operation, thereby permitting those units to rest and replenish in relative safety.

Our most likely opponent has learned the lessons of continuous operations. He has calculated how to get the highest performance from his units, and his goal is to crush our will to resist through continuous operations. If we expect to fight the next war beyond six days, then we need to learn those lessons as well.

APPENDIX



REFERENCE: TOE 17235J420

DIAGRAM 1. AOE TANK BATTALION

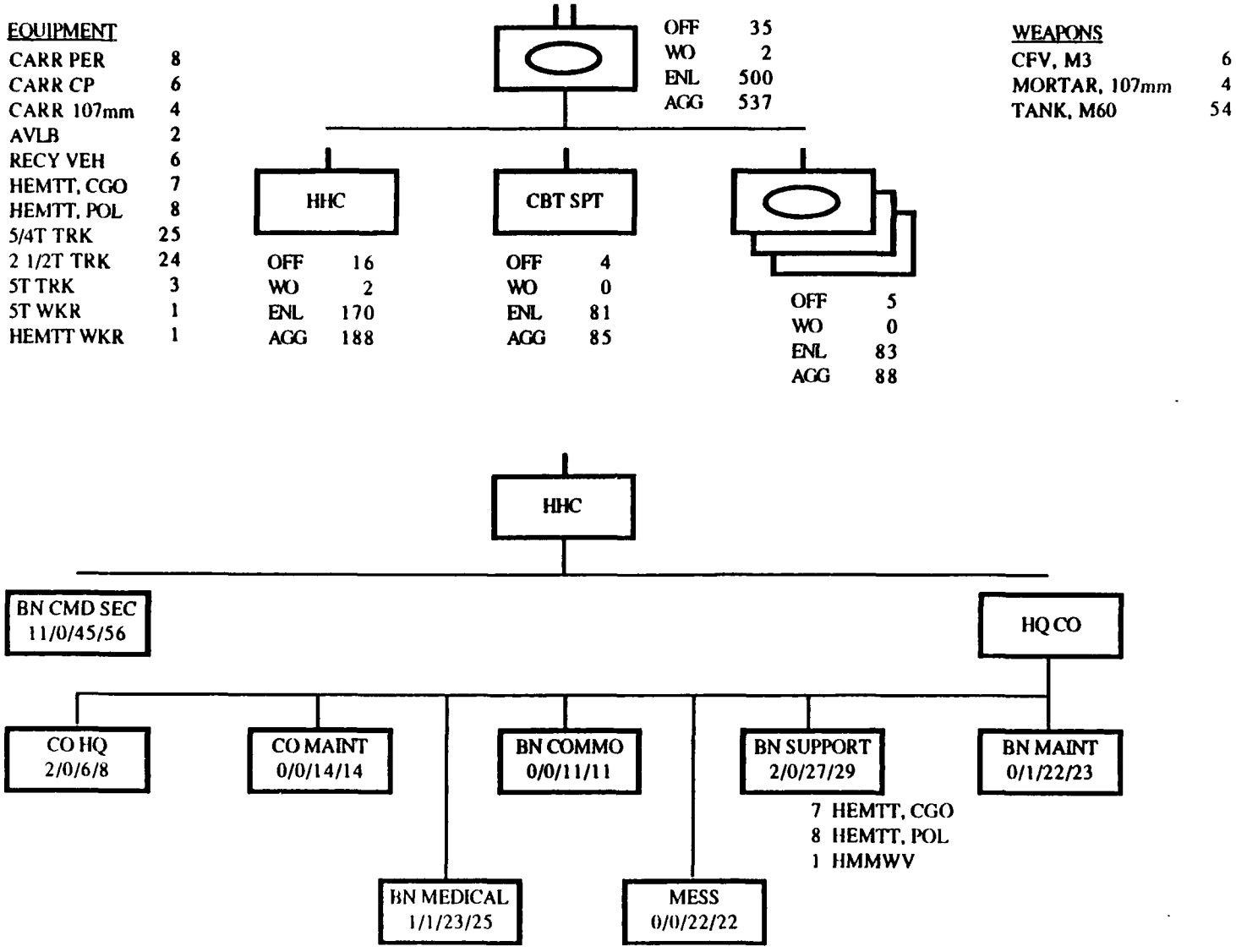


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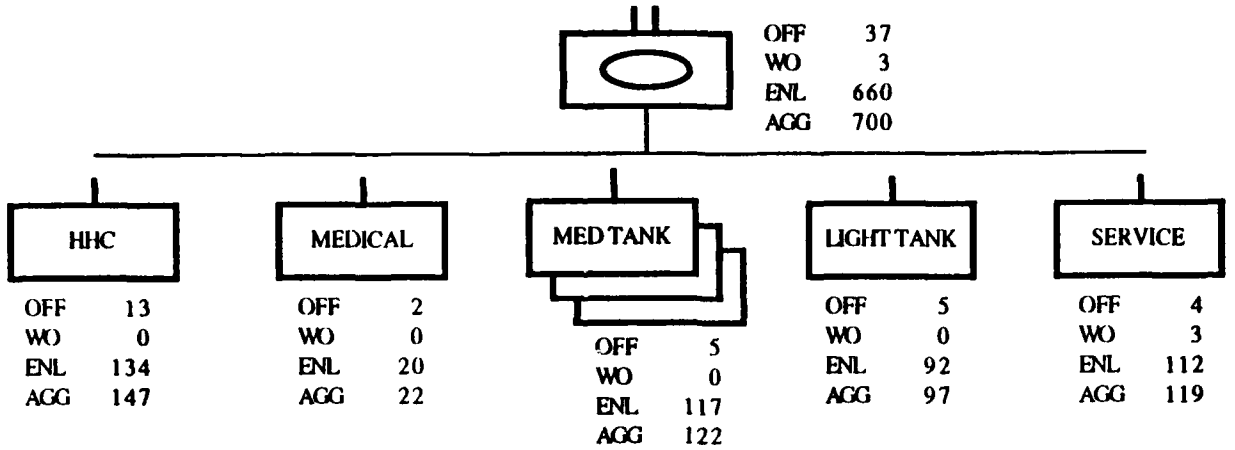
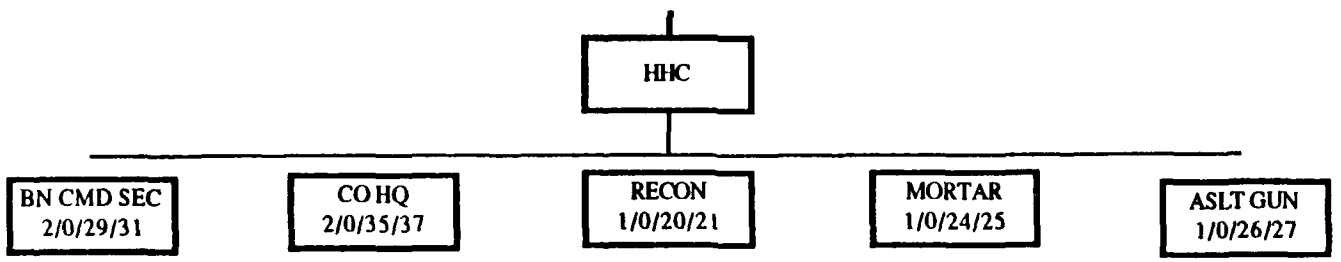
DIAGRAM 2. PRE-AOE TANK BATTALION



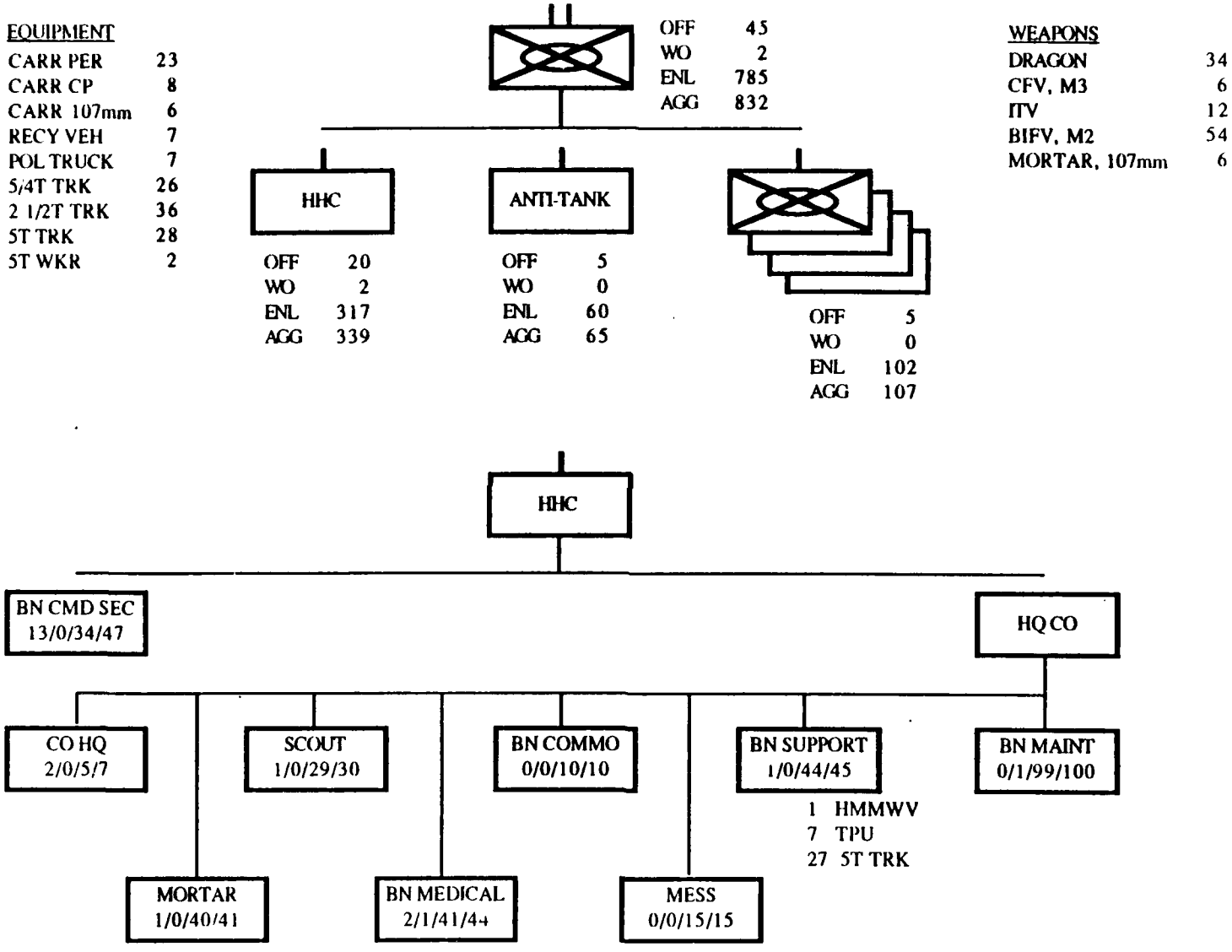


EQUIPMENT	
CARR PER	13
CARR 81mm	3
TANK MED	53
TANK LT	17
1/4T TRK	23
3/4T TRK	2
2 1/2T TRK	39
WRECKER	2
RECV VEH	5

WEAPONS	
81 mm MORTAR	9
MG .30 CAL LT	18
MG .50 CAL MD	26
SMG .45 CAL	437
RCKT LNCHR	35
105mm ASLT GUN	6

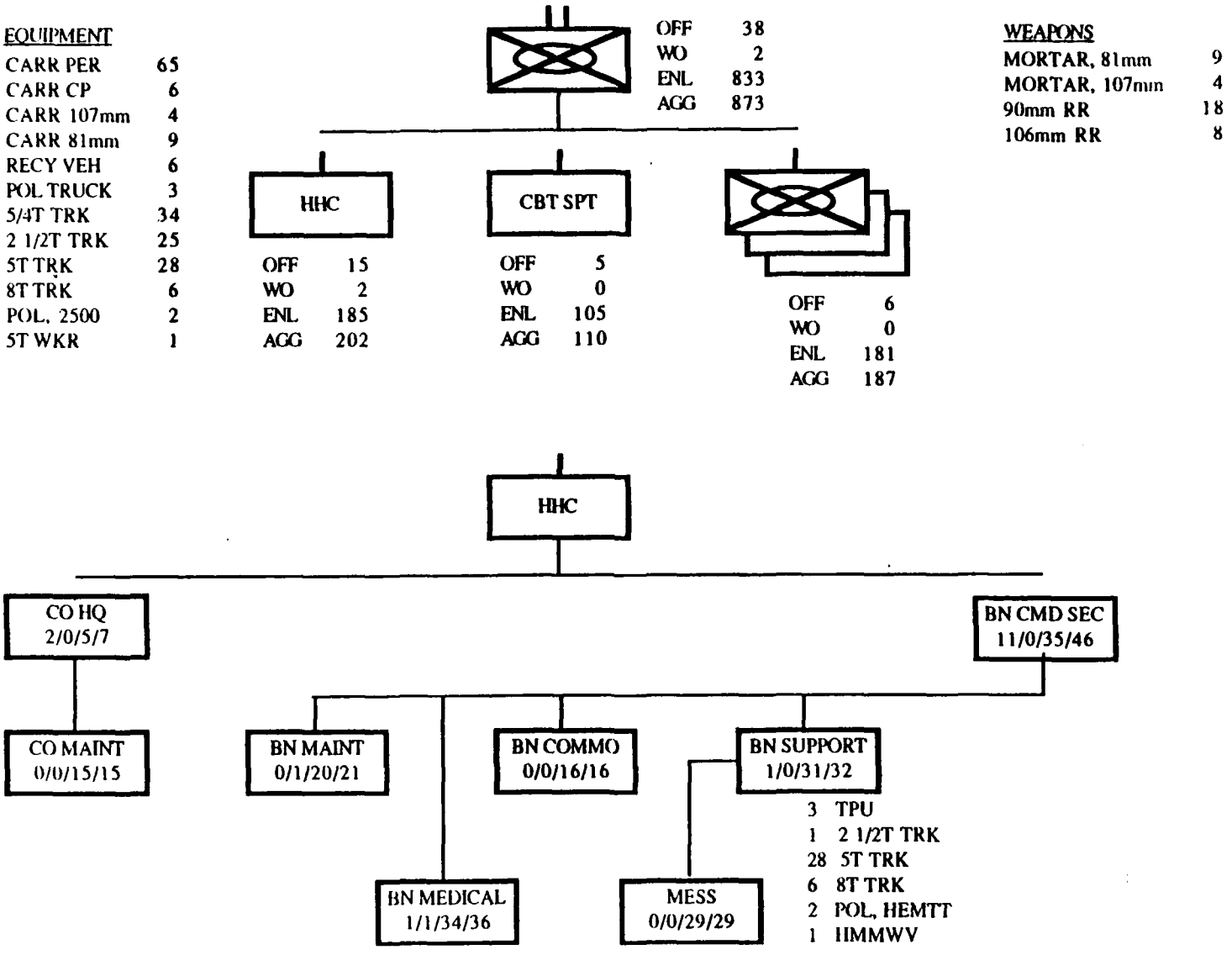
REFERENCE: TOE 17-25, 16 JUNE 1945

DIAGRAM 3. WWII TANK BATTALION



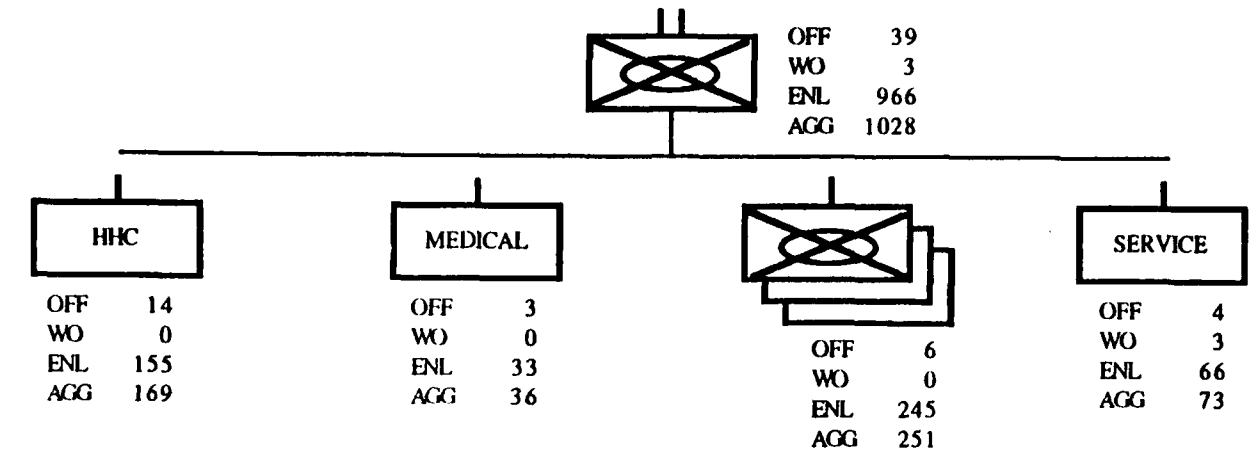
REFERENCE: TOE 07245J110

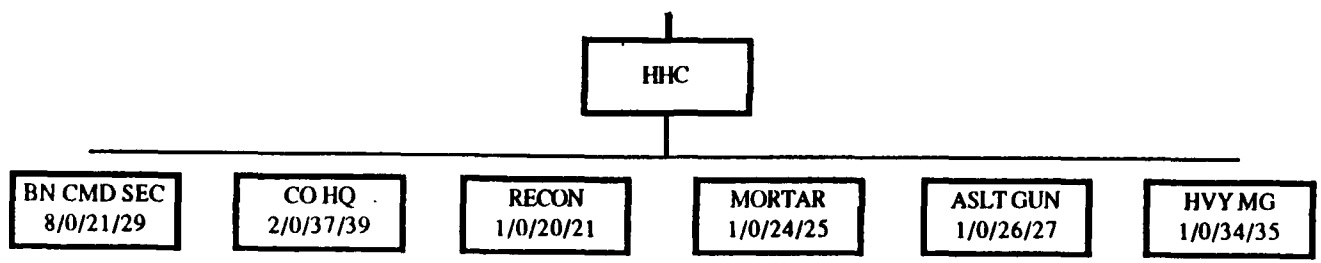
DIAGRAM 4. AOE MECHANIZED INFANTRY BATTALION



REFERENCE: TOE 07015H010

DIAGRAM 5. PRE-AOE MECHANIZED INFANTRY BATTALION





EQUIPMENT		WEAPONS	
CARR PER	72	81mm MORTAR	3
CARR 81mm	3	MG .30 CAL HVY	37
1/4T TRK	28	MG .30 CAL LT	22
3/4T TRK	4	MG .50 CAL HVY	42
2 1/2T TRK	21	AT 57mm	9
WRECKER	1	RCKT LNCHR	74
RECY VEH	1	60mm MORTAR	9
		105mm ASLT GUN	3

REFERENCE: TOE 7-25, 16 JUNE 1945

DIAGRAM 6. WWII ARMORED INFANTRY BATTALION

ENDNOTES

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[2]Frederick J. Manning, "Continuous Operations in Europe: Feasibility and the Effects of Leadership and Training," *Parameters*, September 1979, Volume IX, Number 3, pp. 8-17

[3]Combined Arms Combat Developments Activity, "Continuous Operations Study (CONOPS) Final Report," (Fort Leavenworth, KS: CACDA, 1987) p.4. Hereafter cited as CACDA.

[4]Ibid. p. 4

[5]Ibid. p. 1-1.

[6]Du Picq, p. 39.

[7]Field Manual 100-5, *Operations*, (Washington D.C.: U.S. Government Printing Office, 5 May 1986), p 2. Hereafter cited as FM 100-5.

[8]Ibid., p. 25.

[9]Ibid., p. 26.

[10]Ibid., p. 26.

[11]CACDA. p. D-I-1.

[12]A. A. Sidorenko, The Offensive (A Soviet View) (Moscow, Military Publications House, 1970); translated under the auspices of the US Air Force (Washington, D. C. : US Government Printing Office, 1973), p. vii.

[13]CACDA, p D-1.

[14]Ibid., D-I-7.

[15]Ibid., D-I-7.

[16]Du Picq, p. 122.

[17]CACDA, P. 3-2.

[18]Ibid., p. 3-8.

[19]Ibid., p. 3-9.

[20]Ibid., p. 3-2.

[21]Ibid., p. 3-2.

[22]Ibid., p. 3-3.

[23]Ibid., p. 3-4.

[24]Ibid., P. 3-5.

[25]Manning, p. 9.

[26]Major Henry L. Thompson, "Sleep Loss and its Effect in Combat," *Military Review*, September 1983, pp. 14-23.

[27]CACDA, p. B-I-b-24.

[28]Thompson,. p. 17.

[29]Ibid., p. 17.

[30]CACDA, p. B-I-b-12.

[31]Ibid., p. B-I-b-33.

[32]FM 22-9, pp. 1-7 thru 1-9.

[33]Ibid., p. 1-8.

[34]Ibid., p. 1-10.

[35]Thompson, p. 19.

[36]Charles F. Romanus and Riley Sunderland, *US Army in World War II: China-Burma-India Theater: Stilwell's Command Problems*. (Washington, DC: Office of the Chief of Military History. 1956). p. 34.

[37]Ibid., p. 34.

[38]Ibid., p. 225.

[39]Ibid., p. 240.

[40]Ibid., p. 240.

[41]CACDA, p. B-I-a-30.

[42]Thomas M. McGinnis, *Continuous Operations: The Time Dimension of Battle* (SAMS Monograph, US Army Command and General Staff College, 1987), pp. 22-23.

[43]CACDA, pp. B-I-a-16 thru B-I-a-18.

[44]William Joseph (Viscount) Slim, *Defeat Into Victory* (London: Papermac, 1972), p. 213.

[45]Avigdor Kahalani, *The Heights of Courage*. (Westport, CN: Greenwood Press, 1984), pp. 180-181.

[46]CACDA, p. C-I-1 thru C-I-10.

[47]Manning, p. 9.

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