AIRMECHANIZATION: DETERMINING ITS TACTICAL VIABILITY ON THE AIRLAND BATTLEFIELD

A Monograph

by

Major Darrell E. Crawford
Aviation

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

First Term AY 88-89

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; Distribution is unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies, USAC&GSC 6b. OFFICE SYMBOL (If applicable) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Fort Leavenworth, Kansas 66027-6900	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
AIRMECHANIZATION: Determining its Tactical Viability on the AirLand Battlefield (U)

12. PERSONAL AUTHOR(S)
MAJ Darrell E. Crawford, USA

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Monograph	FROM _____ TO _____	89/01/05	74

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Airmechanization, Heavy Lift Helicopters, Airmobility, Light Armored Vehicles, Air Assault, Army Aviation, maneuverability, fires

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

In recent years some theorists have asserted that because of the limitations of ground maneuver, the lethality of the modern battlefield, and the pace of technological change there is a need to replace current conventional war-fighting concepts with new, and perhaps radical solutions. Airmechanization is one such solution. There are two approaches to this concept. The "heavy-lift" approach would leave the track/rotor interface as it is today and use a powerful advanced cargo aircraft (ACA) to transport light armored vehicles during combat operations. This approach represents an evolutionary, and perhaps inevitable step in the conduct of war. The "Main Battle Air Vehicle" (MBAV) approach would replace main battle tanks with lightly armored, heavily armed rotary wing aircraft, thus bridging the track/rotor interface and revdutinizing land warfare.

(cont. on back)

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
MAJ Darrell E. Crawford	(913) 684-2138	ATZL-SWV

item 19 cont.

The effort to determine the tactical viability of this concept on the AirLand Battlefield begins with an outline of the fundamental theoretical issues and an examination of airmechanizion's historical roots. Next, the current corps aviation brigade is described and an airmechanized organization proposed as an alternative. Then, a hypothetical situation is created to compare the tactical effectiveness of both units.

This monograph finds that the heavy-lift approach to airmechanization is viable on the AirLand Battlefield. In the Middle East scenario presented the Airmech Brigade, equiped with light armored vehicles and advanced cargo aircraft, can accomplish the mission better than the current corps aviation brigade. Mission accomplishment is very much a function of what is logistically supportable and the ACA provides the capability for operations over great distances be mechanized and aviation units which consume large quanties of supplies. The ACA also provides a higher order of tactical maneuver and flexibility in the objective area.

This study concludes that the helicopter will, in all probility, evolve technologically and doctrinally toward a heavy-lift approach and eventually to an MBAV type airframe. An operational concept needs to be developed that explores this new operational dimension and keeps industry clearly in focus as to what capabilities are desired for the advanced cargo aircraft and the main battle air vehicle. The heavy-lift approach should be pursued as a vehicle for the development of tactics, techniques, and procedures that will impact on emerging airmechanized doctrine.

Airmechanization: Determining its Tactical Viability on the Airland Battlefield

by

Major Darrell E. Crawford
Aviation

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

5 January 1989

School of Advanced Military Studies
Monograph Approval

Name of Student: Major Darrell Crawford
Title of Monograph: Airmechanization: A Concept Whose Time Has Come?

Approved by:

William H. Janes
Lieutenant Colonel William H. Janes, M.A. — Monograph Director

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

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

Accepted this 16th day of December 1988.

ABSTRACT

AIRMECHANIZATION: DETERMINING ITS TACTICAL VIABILITY ON THE AIRLAND BATTLEFIELD, by MAJ Darrell E. Crawford, USA, 34 pages.

In recent years some theorists have asserted that because of the limitations of ground maneuver, the lethality of the modern battlefield, and the pace of technological change there is a need to replace current conventional warfighting concepts with new, and perhaps radical solutions. Airmechanization is one such solution. There are two approaches to this concept. The "heavy-lift" approach would leave the track/rotor interface as it is today and use a powerful advanced cargo aircraft (ACA) to transport light armored vehicles during combat operations. This approach represents an evolutionary, and perhaps inevitable step in the conduct of war. The "Main Battle Air Vehicle" (MBAV) approach would replace main battle tanks with lightly armored, heavily armed rotary wing aircraft, thus bridging the track/rotor interface and revolutionizing land warfare.

The effort to determine the tactical viability of this concept on the AirLand Battlefield begins with an outline of the fundamental theoretical issues and an examination of airmechanization's historical roots. Next, the current corps aviation brigade is described and an airmechanized organization proposed as an alternative. Then, a hypothetical situation is created to compare the tactical effectiveness of both units.

This monograph finds that the heavy-lift approach to airmechanization is viable on the AirLand Battlefield. In the Middle East scenario presented the Airmech Brigade, equipped with light armored vehicles and advanced cargo aircraft, can accomplish the mission better than the current corps aviation brigade. Mission accomplishment is very much a function of what is logistically supportable and the ACA provides the capability for operations over great distances by mechanized and aviation units which consume large quantities of supplies. The ACA also provides a higher order of tactical maneuver and flexibility in the objective area.

This study concludes that the helicopter will, in all probability, evolve technologically and doctrinally toward a heavy lift approach and eventually to an MBAV type airframe. An operational concept needs to be developed that explores this new operational dimension and keeps industry clearly in focus as to what capabilities are desired for the advanced cargo aircraft and the main battle air vehicle. The heavy-lift approach should be pursued as a vehicle for the development of tactics, techniques, and procedures that will impact on emerging airmechanized doctrine.

TABLE OF CONTENTS

AIRMECHANIZATION: DETERMINING ITS TACTICAL VIABILITY ON THE AIRLAND BATTLEFIELD

I. INTRODUCTION

The purpose of this paper is to analyze airmechanization and determine if it is a tactically viable concept for the U.S. Army on the AirLand battlefield. Airmechanization theorists assert that because of the limitations of ground maneuver, the lethality of the modern battlefield, and the pace of technological change there is a need to replace current conventional warfighting concepts with new, and perhaps radical solutions. As the name suggests, aviation plays an important part in those solutions. Supporters of airmechanization have suggested various organizational and equipment changes to implement the airmech concept, but there has been little tactical analysis of the potential impact of those changes on the battlefield.

Airmechanization is a combined arms concept employing advanced technology systems and relying on a more intimate relationship between armor and helicopters to improve mobility and firepower to gain a decisive advantage in battle. There are two approaches to this concept. The "heavy-lift" approach combines light armor and/or antitank vehicles, and/or motorized infantry in the same tactical formation with heavy-lift helicopters. This method leaves the track/rotor interface as it is today, with tanks and helicopters remaining separate combat systems. The "Main Battle Air Vehicle" (MBAV) approach replaces main battle tanks with lightly armored, heavily armed rotary wing aircraft, thus merging tank and helicopter systems into one vehicle and bridging the track/rotor interface.[1]

Within the next few years two important decisions will be made which make this an important time to review the airmech concept: the first will be the size, type, and employment doctrine of the future armored family of vehicles; the second will be the capabilities and design of an advanced cargo aircraft (ACA).[2] Together, these decisions represent an opportunity to improve the U.S. Army's ability to " . . . move forces in relation

to the enemy to secure or retain positional advantage"[3] on the battlefield.

This paper utilizes a four part methodology to analyze airmechanization. First, the concept will be outlined and the fundamental theoretical issues identified. Next, airmechanization's historical roots will be examined to determine if the concept is as revolutionary as it sounds, or simply an evolutionary, perhaps inevitable step in warfare. Third, the current corps aviation brigade will be described and an airmechanized organization proposed. Lastly, a hypothetical situation will be constructed to compare the tactical effectiveness of the aviation unit to that of the airmech. The Wass de Czege model of relative combat power will be used to analyze the two units, with formulas and data in field manuals and CGSC student texts integrated to determine sustainment capability. Based on the conclusions, a determination will be made regarding the tactical viability of the airmechanized brigade on the AirLand Battlefield. Finally, the implications of the airmechanization concept will be considered.

II. AIRMECHANIZATION

Airmechanization is a relatively new concept that attempts to integrate new technology with proven military theory to solve an old problem: how to get the greatest combat effectiveness from the forces available. For a force that is smaller than its enemy, such as the U.S., and even all of NATO when compared to the U.S.S.R., the problem becomes how to fight a war outnumbered and win. Two men, Brigadier Richard E. Simpkin of Great Britain, and General Doctor F.M. von Senger und Etterlin of West Germany, who died within three months of each other (3 November, 1986, and 10 January, 1987, respectively,[4]) were largely responsible for the theoretical development of airmechanization.

The Concept

Von Senger und Etterlin saw airmechanization as a futuristic concept that described warfare dominated by a Main Battle Air Vehicle (MBAV), which, he postulated, would take the place of main

battle tanks as the predominant weapon system on the battlefield. Von Senger, former Commander-in-Chief, Allied Forces Central Europe (CINCCENT), emphasized that

> *it is within such a new dimension that improvements for land armies are to be found. The step into the future must aim at integrating air mobility with the modern technology available for applying superior firepower, so as to create a new arm from this combination. A new arm which is to be utilised, not for improving the combat effectiveness of existing arms but which is to be used independently in the new operational dimension I have discussed.*[5]

What he saw was a future battlefield dominated by an MBAV with unique characteristics and freed from the pace of ground maneuver. Some of those characteristics were:[6]

Maximum Speed - 300 K/HR

Cruising Range - 600 K

Payload (assumed to be armament/electronics and protection) - 4000 LBS *(Note - Richard Simpkin believed von Senger was "badly adrift" here, and suggested technology will be available to boost the payload to 9000 LBS.[7])**

AH-64 Apache characteristics, as a means of comparison, are:[8]

Maximum speed - 290 K/HR

Cruising Range - 508 K

Payload - 4090 LBS**

Von Senger felt that the advantages of an MBAV outweighed the disadvantages. Its vulnerability to fixed wing aircraft would be offset by speed and agility, and to air defense systems by very low level or nap of the earth flight and target standoff. As for the substantial logistics effort to sustain an MBAV fleet, he felt

---

* The weight of 9000 lbs. was reached by multiplying Simpkin's percent of "all-up mass" (total weight) of armament/electronics and protection, 37.5%, by the maximum weight of his hypothetical Main Battle Air Vehicle, 12 tons.

** This payload is 23.5% of AH-64 total weight, 17,400 lbs.)

that it was no more than the high price of high technology (although offset by equally high payoff), and exactly the same problem being encountered by ground based systems. Among its advantages were the ten fold increase in deployment speed over land systems or formations, an unlimited ability to disperse in the depth of the theater or region, a superior ability to concentrate firepower quickly, and its great flexibility in terms of the combination of weapons mix attached to the system.

Von Senger saw airmobility as an intermediate stage in the development of airmechanization. During his last visit to the Royal United Services Institute for Defence Studies he discussed at length how he felt the aviation and infantry reinforcements available to NATO should be reorganized to form an airmobile corps in theater reserve.[9] But, despite this recognition of airmobility as a first step, his definition of the term airmechanization never changed. It was still futuristic and still required an MBAV to be implemented.

Brigadier Richard E. Simpkin defined airmechanization in broader terms. He extended the definition backward in time, from the future to the present, giving it meaning under current conditions and technology. To Simpkin, airmechanization meant ". . . a shift of the weight of combat manpower away from the mechanized maneuver force as such towards the helicopter element and the artillery."[10]

As early as 1979 Simpkin questioned ". . . the validity *for the Warsaw Pact v. NATO scenario* of the West's current tank concepts and (suggested) the need to complement or maybe in the long run replace these with new and radical solutions."[11] In 1982, his writings revealed that his "new and radical solutions" were actually no more than a shift towards independent operations by helicopter forces, and the creation of a large operational airmechanized division in reserve.

> *The extension of the helicopter element in size and role, trebling of the mechanized force and the expansion of the artillery increase the dimensions of this division's battlefield, the tempo of its*

operations and above all its ability to concentrate fighting power in time and space.[12]

His analysis led him to consider the rather innovative approach of combining a family of light armored vehicles with heavy lift helicopters, but he rejected it as too expensive and vulnerable.

By 1984, Simpkin's thoughts on airmechanization embraced von Senger's then recent Main Battle Air Vehicle concept, but he no longer ruled out the "heavy-lift" approach. In true Jominian fashion (whose approach to theory Simpkin found more "lucid" and "sound" than Clausewitz), he compared the two different airmech forces, heavy-lift versus MBAV, in great detail. He concluded that the MBAV was not only feasible, but possible by the late 1990's. He added that "whether or not they retain a (main battle tank) . . . advanced armies will undoubtedly follow the Soviet example in developing light mechanized forces . . ." transportable by air.[13] When considering airmechanization,

the crunch question is whether it is more effective, and more cost-effective, to leave the track/rotor interface as it is and helilift light armour when needs be, or to provide MBAV-based formations which would at once bridge this interface and enhance the combat worth of independent rotary-wing forces.[14]

What is implicit in the writings of both men, von Senger and Simpkin, is the potential for decisive effect by airmechanized forces. Decisive effect means the achievement of a tactical victory in battle which has a direct and positive impact on the operation (The operation being the level above the battle and below the campaign). Decisive effects are achieved by destruction of the enemy maneuver force and/or seizing from that force the terrain which it occupied or controlled. It is airmechanization's potentially decisive effects which motivated both men to stress the importance of independent action by large aviation formations equipped with advanced technology aircraft. What made the matter urgent to them was the growing Soviet threat.

Theoretical Issues

Soviet superiority is what attracted Simpkin and von Senger to airmechanization. The Soviet Union has a formidable, increasingly sophisticated conventional force, while the West no longer has the technological edge it once depended on to make up the difference. The threat has parity, if not outright superiority, in many combat systems. Development of the Soviet operational maneuver group, the presence of independent tank formations (battalions and regiments), and the proliferation of airborne and air assault units also indicate that the threat has a well developed maneuver doctrine. These advantages allow the Soviets to seek a highly favorable correlation of forces which they feel will minimize their risk and increase the probability of success.

Many have recognized the potentially destabilizing effect of Soviet superiority and the need to do something about it. Traditionally in warfare the development of a maneuver doctrine has accompanied this realization.[15] In the present situation that has meant the development of AirLand Battle doctrine, which, even if not a true "maneuver" doctrine, certainly centers on maneuver as the dynamic element.[16] * It appears as though this doctrine is going to be around for a while, because the ". . . Army 21 Interim Operational Concept focuses on maneuver as the dynamic element of battle."[17]

A maneuver oriented doctrine favors the continued exploitation of the air dimension because aviation represents a formidable potential maneuver capability. "Properly planned and executed, such high tempo maneuver has enormous potential for dislocating and destroying enemy forces . . . ."[18] Von Senger went so far as to suggest that warfare stood at a watershed. "On the one side mechanised forces are slowing down against the mounting power of attrition by modern firepower, while on the other current helicopters (and forthcoming advanced rotary wing

---

* "In maneuver doctrine, maneuver is the ultimate tactical, operational and strategic goal while firepower is used primarily to create opportunities for maneuver."[19]

vehicles) have the ability to restore the power of manoeuvre to armies."[20]

Liddell Hart's "indirect approach" best explains how aviation can apply its maneuver advantage. The direct approach is used when one side has the combat power to attack enemy strength. It is a *two dimensional*, attrition based strategy where *mass* decreases with *time* until the larger attacker prevails over the weaker defender. The direct approach relies on firepower as its primary source of strength and is relatively static and geographically oriented in nature. The defender is locked in a death-grip from which he cannot escape. The indirect approach, by contrast, is used when one side has the ability to avoid enemy strength, and instead, attacks his weakness. It is a *three dimensional* maneuver based strategy where *space* interacts with *mass* and *time*. The indirect approach relies on mobility and speed and is therefore dynamic and force oriented in nature. It involves the acceptance of risk to overcome disadvantage.[21] Aviation's inherent maneuver ability and growing firepower capability lends itself to the indirect approach in dealing with the numerically superior Soviets, because it ". . . can do the one thing that almost every theorist and analytical historian agrees about--*it can move dispersed and fight concentrated*" (emphasis is the original).[22]

III. HISTORICAL ROOTS: EVOLUTIONARY OR REVOLUTIONARY?

Historically, U.S. Army combat aviation has been primarily a means of combat support. In the 1980's, however, that has changed to a large degree, due mainly to aviation forming its own branch and becoming a combat arm. The primary differences between Aviation and the ground gaining arms, Infantry and Armor, are that Aviation operates in a different dimension, and that it can only "deny" terrain to the enemy, not "control" it.[23] This progress has moved Aviation closer to the concept of airmechanization in that it now has the potential for independent action. The only steps that remain to be taken are that of bridging the gap between the air and the mechanized force--determining the track/rotor

interface--and building a force of substantial size and with the equipment necessary for decisive effects. However, change, especially when it is revolutionary, does not come easily to an established bureaucracy, and the Army is one of the oldest and largest. What must be determined is whether airmechanization is revolutionary, or evolutionary.

Historical Analysis

Airmechanization's conceptual roots can be traced back well past the introduction of the helicopter, or even the airplane, to the American Civil War. In 1865, General James Harrison Wilson, a Union Cavalry commander, invaded the South with a cavalry corps and an idea that embraced more than the usual limited cavalry objective. Wilson, who had been given the latitude of an independent commander, had an entirely new kind of campaign in mind. He saw the cavalry as the only arm that could accomplish it, playing a decisive rather than the traditional supporting role. "Wilson's concept was . . . ambitious; it was nothing less than a cavalry invasion: a raid raised to a higher power."[24]

Jumping forward sixty years, the debate over mechanization between the two World Wars provides a close parallel with the present debate over the potential contributions of rotary wing aircraft. Then, as now, many were suspicious of new technology, especially when it had the potential to change doctrine. In his book, Armored Warfare, J.F.C. Fuller attempted to outline the new theory of war which the internal combustion engine created; ". . . a *theory founded on a new degree of movement*" (emphasis is the original).[25] "The present revolution," he said, "lies in the application of the principles of war to changing conditions."[26] He went on to suggest that the interrelationship of tanks and aircraft was so important that they should be formed within the same organization.[27] Today, it is the helicopter which is creating the *new* theory of movement and is causing some theorists and doctrine writers to reevaluate the principles of war. Current organizations, with aviation units organic to all divisions and corps, and the U.S. Army's present budget priorities underscore the importance of the interrelationship between the ground gaining arms and aviation.

The idea behind airmechanization became clearly distinguishable as a new form of warfare tied to the air dimension in the mid 1920's. As early as 1926, Soviet Field Marshal Mikhail Tukhachevskiy spoke of the potential of airborne landings of motorized detachments in the enemy rear. The objectives of those detachments was to be not only disruption of logistical operations and command, control, and communications functions, but also enemy formations enroute to the front, resources, and war industry. With these missions Tukhachevskiy clearly viewed his concept to have not only operational implications, but also potentially decisive effects.[28]

Airmobility, ". . . using Army aircraft whenever and however they (improve) our Army's ability to fight,"[29] was the next stage of airmechanization's historical development. In 1962, the final report of the Howze Board recommended that five of the U.S.'s 26 active and reserve Army and Marine divisions be reorganized and equipped to become air assault divisions, and that three air cavalry combat and five air transport brigades be formed. The cost was to be $4.2 billion over 5 years, an amount General Herbert Powell, commanding general, Continental Army Command, considered ". . . conservative considering the DOD directive to achieve markedly increased tactical mobility."[30] The Army settled for an air assault division.

During testing of that division, the 11th Air Assault, aviation maneuver potential did not go unnoticed. Wargaming of past battles by the chain of command, playing them with helicopters on one and then on both sides, to analyze the effects of those aircraft on the battle was very educational. As General Kinnard, the commanding general, observed,

> *the almost incredible ability to mass our forces in space and time over very large distances and essentially independent of the terrain (was an important implication of airmobility). This capability had great possibilities. To me the most interesting was the idea that with our kind of force we could focus more on an enemy force and less on the*

terrain than any known army unit. Further, even though the enemy might achieve surprise and enjoy initial superiority in forces and firepower, our ability to mass permitted a rapid turning of the tables.[31]

Kinnard went on to say that he had ". . . the firm conviction that Army Aviation possesses the dormant potential to change completely the way armies fight."[32]

One type of the potential General Kinnard spoke of would first be realized by the Soviets.

Although the United States Army rushed into the air cavalry business with cries of 'vertical envelopment', it was the Soviets, with manoeuvre theory in their bones, who grasped the true significance of the helicopter, built up a massive body of rotary-wing technology, and stuck with the concept through all its teething troubles.[33]

That Soviet concept developed from an air assault capability into logistical support of armor formations by heavy-lift helicopters, and presently exists in the form of air assault and airborne battalions, brigades, and divisions equipped with light, helicopter transportable armored vehicles (BMD). Only a current shortage of heavy-lift helicopters and the centralized command and control of those aircraft at *front* level limits this capability.

Conclusion

From this historical overview, it can be concluded that airmechanization was evolutionary in its conceptual development. As I have defined it, airmechanization takes what is usually considered as a combat support system, the helicopter, and combines it in some manner with the primary ground combat system, the tank, to gain a decisive advantage in battle by improving their collective mobility and firepower. That is precisely what General Wilson did in 1865 when he first employed cavalry, originally designed as a supporting arm, to achieve decisive

results through independent action. In Wilson's case the primary ground combat system of the day that he was combining with was the soldier. By increasing the number of mounted soldiers and arming them with the most technologically advanced weapon on the battlefield, the Spencer rifle, Wilson was able to act independently and decisively.

Between the World Wars, the romance between air and armor began, with the marriage taking place during World War II. The mechanized/aviation similarities were many: major technological change was suspect until proven otherwise; a higher order of mobility was created, changing the conditions for application of the established principles of war; and a closer working relationship recognized and implemented. During the early period of mechanization, Tukhachevskiy made an intellectual leap into the future when he envisioned the potential of airborne landings of motorized detachments and clearly viewed the concept to have potentially decisive effects. The accuracy of his vision was remarkable. After World War II, and as the helicopter came of age, the quest for a maneuver advantage led to the next evolutionary step: airmobility. As with Wilson in the Civil War, decisive advantage was gained by combining a combat support system, this time the helicopter, with the same ground system, the soldier.

The last evolutionary steps that must be taken to reach airmechanization are to establish the track/rotor interface that will tie the helicopter to the *primary** ground combat system, the armored fighting vehicle, and to organize and equip an airmech unit large enough to have a decisive effect. This *evolutionary* step would be the heavy-lift approach. What is potentially *revolutionary* about airmechanization is the idea of the MBAV approach to the track/rotor interface: transferring the primary combat vehicle from the ground and into the air dimension, and

* The tank will obviously not be the primary weapon system on all potential battlefields, most notably those of the low-intensity type. But, even though the high-intensity scenario might be less likely it is arguably the most dangerous, and on it the tank continues to be the primary weapons system in quantity and doctrinal focus.

perhaps changing the character of warfare. Of the two approaches to airmechanization presented, only the evolutionary heavy-lift approach will be analyzed in the remainder of this paper.

IV. THE MODELS

To determine airmechanization's tactical viability for the U.S. Army, a notional airmechanized unit must be created and compared to the current corps aviation brigade. The purpose of this comparison is to determine if new aircraft designs, coupled with new organizations and doctrine, offer improved tactical capabilities over those currently envisioned. An attempt will be made to remain close to the parameters of House Armed Services Committee Program Budget Decision 725, which reduces the Army's aircraft inventory from approximately 8600 currently, to approximately 6950 in 1995, but this figure will not be treated as non-negotiable.* Other budget parameters will not be considered, with the assumption being that budgetary priorities are always subject to change if better systems or concepts are discovered, or if priorities change.

The Aviation Brigade

The corps aviation brigade is used for comparison rather than the divisional brigade because there are no CH-47's and insufficient AH-64's at division to build an airmech capability. Only near term aircraft (or those at least *feasible* by the turn of the century) will be considered. The new Aviation Modernization Plan will be applied to actual and notional battalions affecting the numbers of aircraft in both.[34] **

---

* According to John Davoren in CACDA, these are the figures in House Armed Services Committee Program Budget Decision 725.

** The Aviation Modernization Plan changes to current TOE's:

A. Attack Battalion: (1) 18 AH-64's become 15; (2) 13 OH-58C's become 10 LHX; (3) 3 UH-1's become 2 UH-60's.

B. Medium Lift Battalion: (1) Three CH-47D companies become six, each with 8 CH's instead of 16; (2) I assume the six new companies will form into two battalions instead of one; (3) I assume the 3 UH-1's become 4 UH-60's so that each battalion has 2.

C. Command Aviation Battalion: (1) I assume the 15 OH-58D's in the Target Acquisition Company become 11 LHX; (2) I assume the 30 UH-1's in the Command Aviation Company become 21 UH-60's.

Because of their likelihood of employment, the contingency corps aviation brigade will be the basis of comparison. Field Manual 1-111 Coordinating Draft, Aviation Brigades, says that "the corps aviation brigade's mission is to plan, to coordinate, and to execute aviation and combined arms operations in support of the corps scheme of maneuver."[35] The Brigade will have a total of 324 helicopters, including 75 AH-64's and 48 CH-47D's (figure 1).

The Corps Aviation Brigade is considered a maneuver force, and might receive a variety of doctrinal missions throughout the depth of the battlefield. In close operations it could be expected to execute a counterattack or conduct security operations

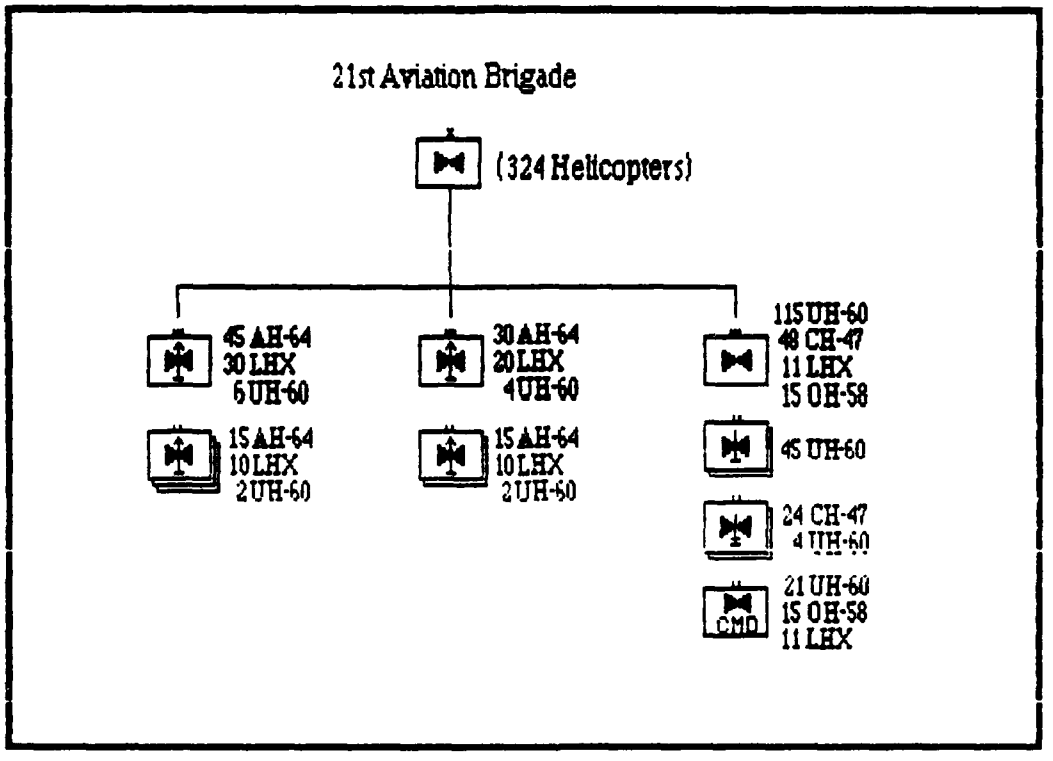


FIGURE 1

for the corps, or be placed OPCON to a division to support the full range of offensive or defensive operations. In deep operations, the Corps Aviation Brigade will be the Corps commander's primary instrument for projecting combat power. In rear operations, the Brigade is ideally suited for operations against Level III threats when task organized. As a maneuver

headquarters, the Aviation Brigade would be expected to receive attachments of ground maneuver units for specific missions.[36]

The Airmech Brigade

An Airmech Brigade is offered as an alternative to the Corps Aviation Brigade. This Airmech Brigade is built around the "heavy-lift" approach, which leaves the track/rotor interface as it is, combining a family of light vehicles in the same tactical organization with an advanced cargo aircraft* (figure 2). This

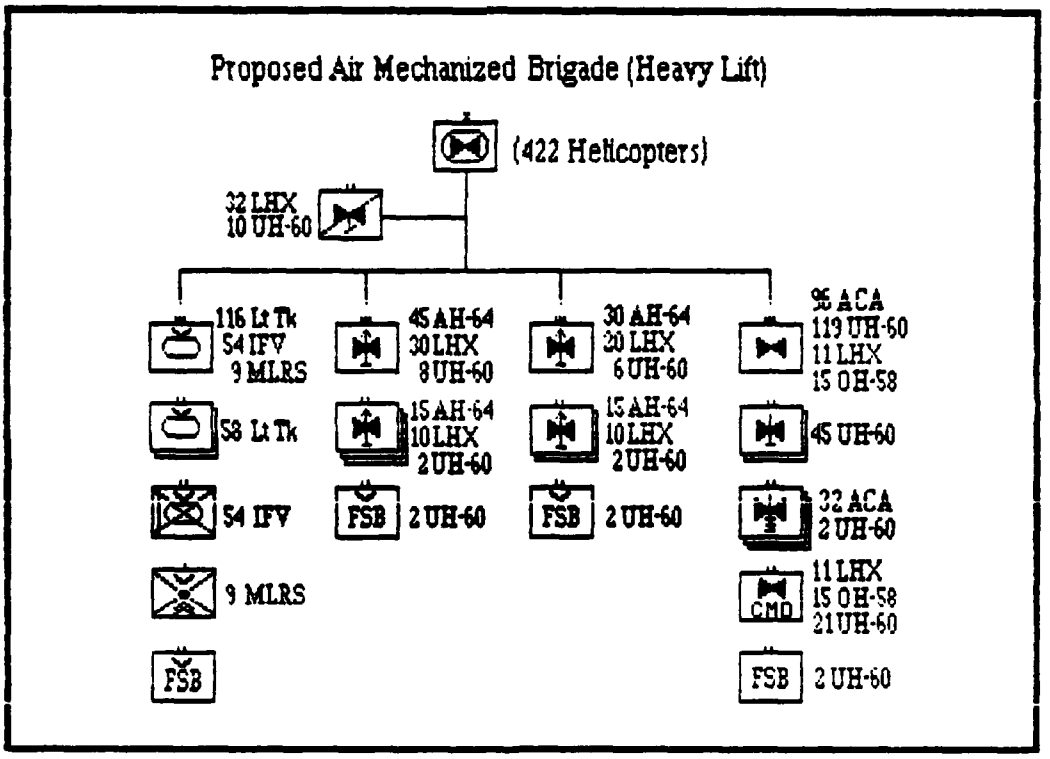


FIGURE 2

---

* The Advanced Cargo Aircraft is assumed to be similar in size and design to the CH-54B Skycrane. That design allows the load to be carried within the airframe's center of gravity, reducing its minimum altitude and making it more maneuverable. Three types of cargo pods would have to be designed for the aircraft to allow maximum efficiency in carrying dry cargo, fuel, and water. An informal fact sheet, dated 16 November 1987, from Systems, MLSD, Ft. Rucker, to the Aviation Team, Combat Division, Material Integration Directorate, CACDA, proposes that the conceptual ACA should have a *lift capacity of between 35,000 and 50,000 lbs. and a mission radius of between 350 and 500 km (@ 4,000 ft. PA, 95 deg. F).* According to Mr. Chris Southard on CACDA's Aviation Team there are those in industry and DOD who believe such an aircraft can be built to military specifications by the mid 1990's if money and priority are available. Mr. Southard commands an Army Reserve CH-47 company and flew the CH-54 Skycrane in Vietnam.

organization is the same as the Aviation Brigade with three important exceptions. First, the CH-47D's have been replaced by an ACA, and instead of 48 the number has been increased to 96. The capabilities and characteristics of the ACA are assumed to be those published in a USAAVNC fact sheet sent by Ft. Rucker to CACDA, Ft. Leavenworth, this year.[37] The primary mission of the ACA's will be to move selected Airmech Brigade vehicles and provide dedicated logistic support to the Airmech Brigade's deployed units.

The second exception to the Airmech organization is that an organic armored regiment has been added. The capabilities and characteristics of the regiment's one mechanized infantry battalion's Infantry Fighting Vehicles (IFV) are assumed to be the same as the M2.* The capabilities and characteristics of the regiment's two armor battalion's light tanks are assumed to be the same as the Cadillac Gage Commando Stingray.** The regiment's fire support is provided by a battery of organic MLRS.***

---

* The Infantry Fighting Vehicle (IFV) is assumed to have the same characteristics as the Bradley IFV, except modified to reduce the combat weight slightly, to under 25 tons.

** Light Tanks (Lt Tk) in the armor battalion are the Cadillac Gage Commando Stingrays. I am not implying that this particular light tank is the best one for the mission. This is simply one that is available now and used for purposes of comparison.

Crew of 4
Combat weight: 21 tons
Max speed: 43 mph
Fuel capacity: 200 gal
Max range (at 40 km/hr): 302 miles
Armament: 105mm main gun; 7.62 MG; 12.7 MG [38]

When computing combat power in the model provided by USACGSC Student Text 100-9, The Command Estimate, the light tank is equated to the M60A3 for two reasons: first, the main gun of each is a 105mm; second, there is little difference between the combat power of an M60A3 (2.35) and the M2 (2.0), therefore making a subjective reduction in the light tanks combat power unnecessary.

*** The MLRS is the same currently fielded, except modified to reduce the combat weight from approximately 28 tons to under 25. The only reason the MLRS battery is assigned to the airmech brigade, instead of a 155mm howitzer battalion as was attached to the aviation brigade, is because of the number of vehicles. The potential exists for combat vehicles in the airmech brigade to be airlifted by the advanced cargo aircraft. Therefore, the number of vehicles that might have to be carried becomes critical, with the fewer the better. In terms of combat power, as quantified by ST 100-9, the two units are equal, and the tonnage of class V that each unit consumes is similar, meaning that the assignment of either artillery unit to the aviation, or airmech brigade does not constitute an advantage or disadvantage.

The third exception is that forward support battalions have been given to the Brigade's four regiments, each tailored to the needs of the unit to which it is assigned.*

The Airmech Brigade's mission statement is modified for the purposes of this paper to include the missions currently associated with both the corps and divisional brigades: to conduct combined arms operations to find, fix, and destroy enemy forces, using maneuver to concentrate and sustain combat power at the critical time and place.[39]

Summary

Two issues remain that pertain to both brigades. One is aviation support by Corps to the assigned divisions, and the other is command and control. Although the Corps Aviation/Airmech Brigade would normally be placed in reserve with a number of "on order" and "be prepared" missions, it will operate independently in the scenario to be presented. The Brigade will be tasked to perform a difficult deep operation, but instead of being cross-FLOT it will be far to the right flank. The mission is designed specifically to take the Airmech Brigade to the limit of what its capability is perceived to be in order to determine the unit's maximum cost and effectiveness. While the Corps Aviation/Airmech Brigade would still normally have the implied mission of general support and troop and cargo lift to the divisions, the difficulty of the mission presented them will prevent most of that support from being provided.

Command and control of ground maneuver units by aviation headquarters' is a controversial subject in some circles. Both the corps and division aviation brigades are commanded by a brigadier general in war, which makes the attachment of a ground maneuver brigade-size organization, as is done in the following paragraphs, credible. Because the armor "regiment" is organic to the envisioned Airmech Brigade organization, the Airmech Brigade would need to be commanded by an O-7 even in peacetime.

---

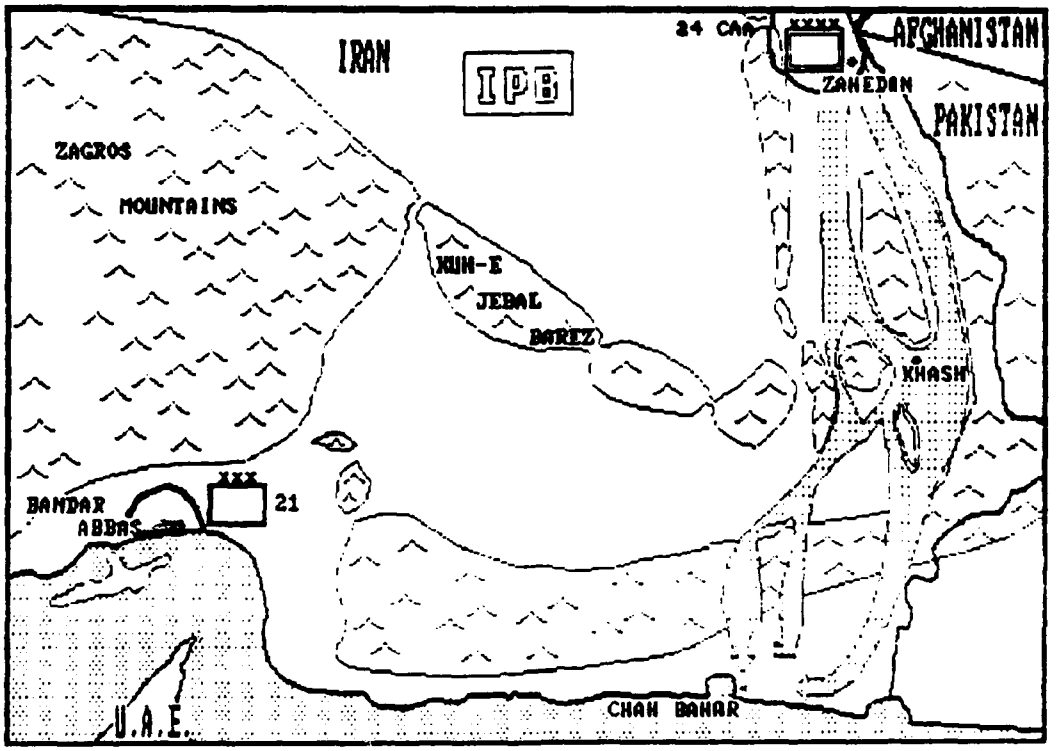
* The Forward Support Battalion in the two aviation regiments and aviation group are composites put together from existing organizations found in the Air Assault and Heavy divisions. (See Appendix C)

These two brigades, the Aviation and the Airmech, are the models to be tested and evaluated. The question that must be answered is whether or not the airmech heavy-lift organization will improve the Aviation Brigade's ability to destroy enemy forces.

V. THE SCENARIO

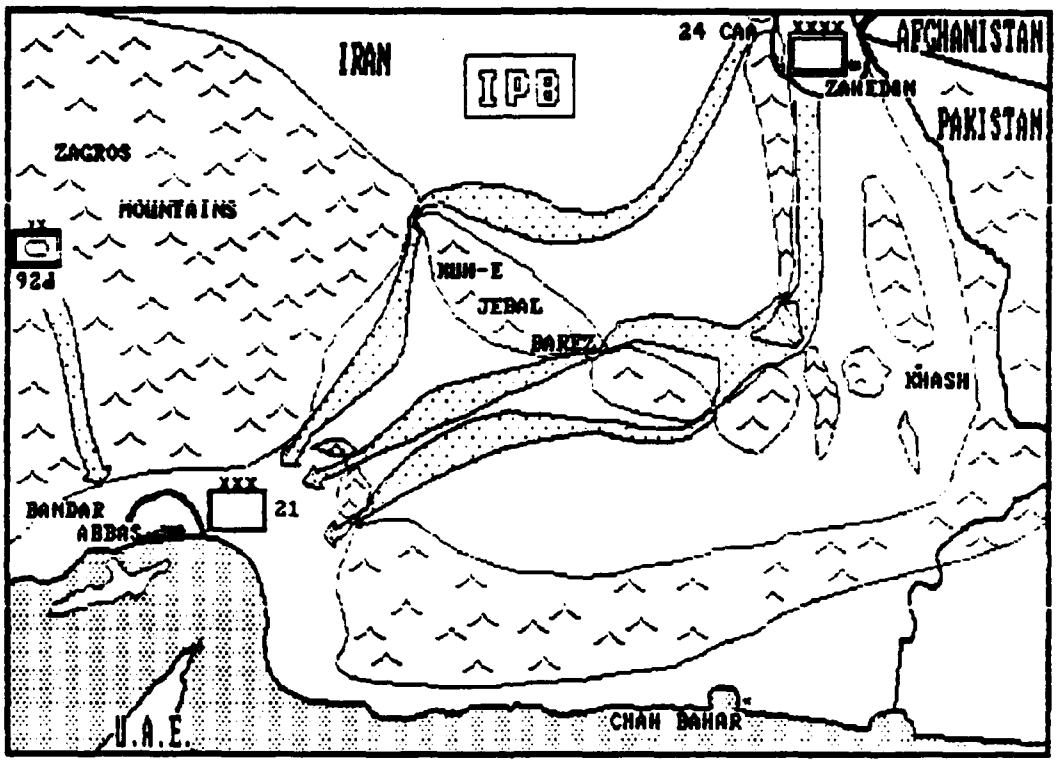
A southwest Asian scenario will be used to test the tactical effectiveness of aviation vs. airmech units. The situation is that outlined in the USACGSC Middle East Exercise (MEEX) for AY 87-88 (appendix A). The year is 1998, to accommodate the integration of new aircraft.

The U.S. Indian Ocean Command (USINDCOM) has been directed to deploy elements to southern Iran to secure and protect the Strait of Hormuz. It is D+14 of that deployment. The 21st Airborne Corps has established a lodgement and is about to begin moving to defensive positions. The 24 Combined Arms Army of the i Turkestan *Front* is expected to send its lead two motorized rifle



SKETCH MAP 2

divisions south to seize Chah Bahar (sketch map 2), and the following motorized rifle and tank divisions southeast to seize the three passes through the Kuh-E Jebal Barez mountains (sketch map 3). The Iranian 92d Armor Division is also expected to advance toward Bandar Abbas and attack the Corps.

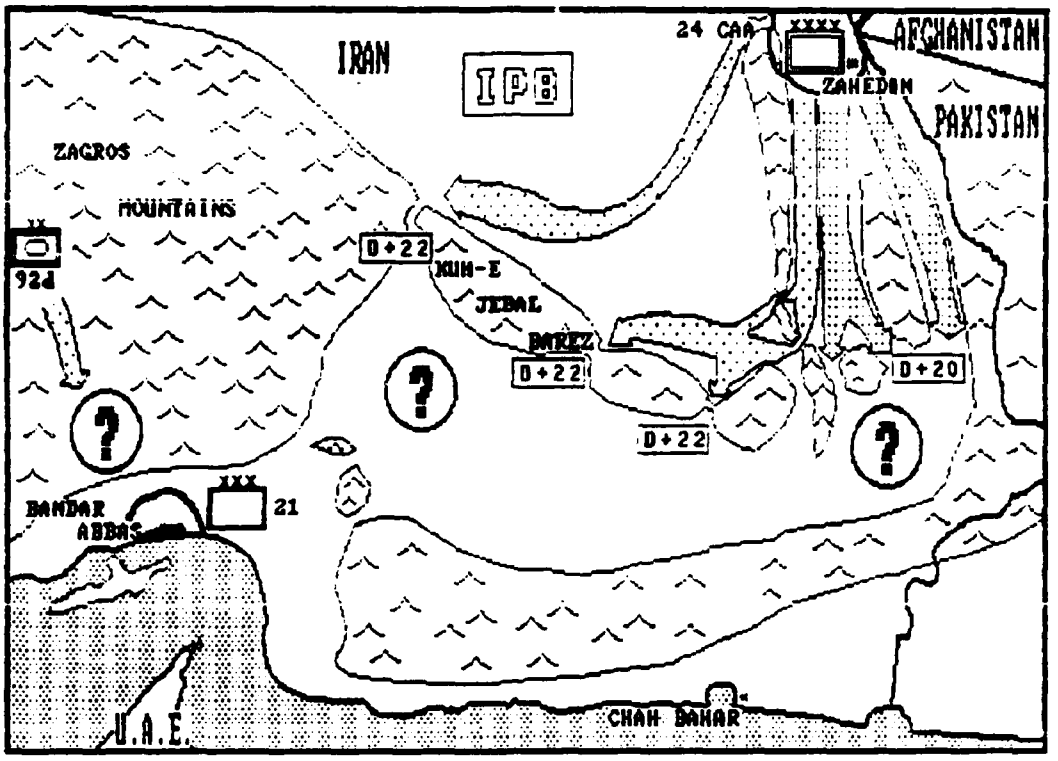


SKETCH MAP 3

The Dilemma

The initial dilemma for 21 Corps is how to defend Bandar Abbas and stop the advance toward Chah Bahar (sketch map 4). The 1 Turkestan *Front* commander will divide his first CAA in the initial attack. If 21 Corps were to divide itself in like manner it would expose itself to defeat in detail if 40 CAA, the *Front's* second echelon, advances rapidly, or 21st Corps is prevented from quickly consolidating. Another solution is necessary.

The 21st Airborne Corps has four days (D+14 until D+18) before the Soviets begin to move, and possibly air assault into Khash. The Corps then has two days before expecting ground attack at Khash (D+20), and four before a ground attack on the three passes (D+22). From D+14 until D+18 the Corps will be busy moving



SKETCH MAP 4

out to its defensive positions. The still "immature" theater logistics base will not allow that perimeter to be larger than 150 kilometers from the port, a fact that is not expected to improve until after D+60.

Air parity exists, with local superiority possible for critical periods of planned activity. Both sides know that defeat is certain without air cover, therefore neither is expected to risk the bulk of its aircraft unless forced to by the other side. The consequence will be that primarily a ground battle will be waged with limited air support and a large air reserve, and that reserve will be used only to avert operational defeat.

The Course of Action

Corps has decided to deploy the Aviation/Airmech Brigade into the Khash area to destroy the two enemy divisions. A brief description of the mission given to each brigade is discussed here and compared in the next section.

An armor brigade and all of the 21 Aviation Brigade is sent to Khash to destroy the two attacking reinforced MRD's. The 21

Aviation Brigade commander is in overall command. The CINC promised Corps the C-130's necessary to support the two brigades with an ALOC, since the GLOC is too long and all Corps transportation assets will be required to support the defense of Bandar Abbas. The quantity of supplies in theater is sufficient to accomplish both the Corps and 21 Aviation Brigade missions.

The plan was decided upon on D+14, and Corps priority of effort allowed the *21st Aviation Combat Command** to get into position with all equipment and a small stockpile of supplies by D+18. Defensive preparation was completed before arrival of the enemy main force on D+20. Total distance by road from the Corps boundary to Khash is approximately 550 kilometers. Convoy rate of march was 200 kilometers per day, and closure of the convoy took around 14 hours.**

The Aviation Combat Command will be evaluated within the Middle East scenario first. Next, the Airmech Brigade will be substituted for the Aviation Combat Command to compare the ability of each to perform the mission. The mission will be the same, but C-130 support will not be required. The Airmech defense against enemy ground units, like that of the Aviation, will also begin on D+20. The distance of 263 kilometers from the Corps support group to the BSA and Forward Area Rearm and Refuel Point (FARRP) is the greatest distance the advanced cargo aircraft can fly with a maximum load and return. At this distance, two trips/sorties are possible in a day. The distance of 120 kilometers from the BSA to the combat trains and FARRP allows four trips/sorties to be made.***

As the 24 CAA main attack towards Bandar Abbas progresses,

---

* The term *combat command* was used by World War II Armored Divisions to denote a heavily reinforced brigade which operated as a fighting headquarters within the division commanders scheme of maneuver and intent. That term is borrowed here because the Aviation Brigade is heavily reinforced and acting independently.

** A faster rate of march than the Soviets was allowed because the U.S. force was significantly smaller, and the Soviets are on an already extremely long LOC stretching back well into Afghanistan.

*** The maximum altitude on any of these routes is 1750' above mean sea level, and exists at two locations. The first is a pass located at 27 degrees, 42 minutes north, 60 degrees, 41 minutes east, and the other is the flat area from 60 kilometers southwest of Khash to Khash itself.

enemy movement through the southwest-most pass of the Kuh-e Jebal Barez mountains will threaten the Airmech Brigade's ALOC. Therefore, an attack helicopter heavy task force must be prepared to move to the defense of that area.

Because of the distances involved, the paucity of forces in theater, and the fact that the theater of operations is the same as the theater of war at the present time, the maneuver being conducted by the Aviation/Airmech Brigade has operational implications. But the battle only involves a reinforced brigade against two reinforced divisions. It is planned at the tactical level, therefore it is appropriate to study this battle in a tactical framework.

The Criteria

Within this tactical framework a determination must be made as to which of the two Corps brigades, aviation or airmech, would have the greatest tactical effectiveness, and therefore the best chance of accomplishing the mission. The Wass de Czege model of relative combat power will be the criteria to compare the two units (appendix B).

To keep the focus of the evaluation on new aircraft designs, organization, and doctrine, the types of units that are given to the Airmech Brigade, organic and attached, are attached to the Aviation Brigade. This is done to ensure each unit gets the same quantity of equipment, thus preventing an unfair advantage by one organization over the other. As mentioned earlier, the Aviation Modernization Plan will be applied to *both* organizations, which will, in effect, reduce the number of aircraft in the current Corps Aviation Brigade and its airmech equivalent by replacing old aircraft with newer, more capable ones.

The effects of the firepower, maneuver, protection, and leadership of the two units will be compared with each other and to that of the opposing force. It is assumed that any slight advances in technology over the next ten years by the U.S. will be offset by the USSR, and vice versa. For that reason current ground organizations and equipment will be compared with the understanding that the relative combat power of the two sides will not change significantly. Since the advanced cargo aircraft and

LHX are being added to the Airmech Brigade, the Havoc and Hokum helicopters are added to the Soviet force. Product improvement of the Mi-26 Halo is assumed also.

VI. ANALYSIS AND EVALUATION

THE SOVIET 31ST AND 49TH MRD'S

Because the Wass de Czege model is a *relative* combat power model, the two Soviet divisions which will face the Aviation or Airmech Brigade in the east should be evaluated.

Firepower

Calculations based on the values in the AY 1988-89 version of Student Text 100-9 give the two enemy divisions and their attachments from *Front* a firepower rating of 106.30 (appendix C). The Soviet force has 34 maneuver battalions (counting battalions that contain the Havoc attack helicopter) and 24 artillery battalions, giving them an almost four to one ratio in total firepower. For artillery, the ratio is 24:1, which makes fire support their most important advantage over the U.S. force. There is not a tank division facing the Aviation/Airmech Brigade, but the enemy force is still equipped with 440 T-64 tanks.[40] They also have the standard BTR and BMP equipped infantry battalions. The relatively high density of armor and infantry vehicles provides enough mass to achieve a significant amount of shock effect. The presence of the Havoc and Hokum helicopters is significant, giving them a sophisticated attack helicopter with a night capability and a dedicated air-to-air helicopter with which to counter the AH-64.

Maneuver

The Soviet divisions are capable of a high maneuver effect with excellent ground and air mobility. A Soviet helilift capability exists at *Front* level in the 24 Mi-24 Halo helicopters there. Those aircraft can be deployed in the area of operations in support of the Combined Arms Army's BMD equipped air assault battalion. The rugged terrain, untrafficable in many areas, will be more restrictive to the attacker, confining the Soviets to the road much of the time.

Protection

The Soviets are attacking, so protection will be difficult. Higher than normal dispersion and slower than normal rates of advance are expected in the desert.[41] As a result, most Soviet combat vehicles will be loaded on heavy equipment transports (HET's) initially, and will move that way as far south as possible, being very vulnerable the whole time. If forced to offload and fight, the enemy will only be able to bring a portion of its firepower to bear due to the few roads and limited off road movement. The Soviet night fighting capability is presently limited, but by the late 1990's should be markedly improved.

Leadership

The Soviet leadership must deal with the problems of climate and terrain. Logistics will be very difficult due to the desert conditions and the congestion on the few roads. ALOC's will be critical. The size of force the enemy must support and the number of helicopters available to *Front* will probably dictate that most available rotary wing and many of the fixed wing aircraft will be dedicated to the supply effort, severely restricting the tactical flexibility of air delivered, ground combat power. Weather threatens Soviet air resupply and tactical support efforts.

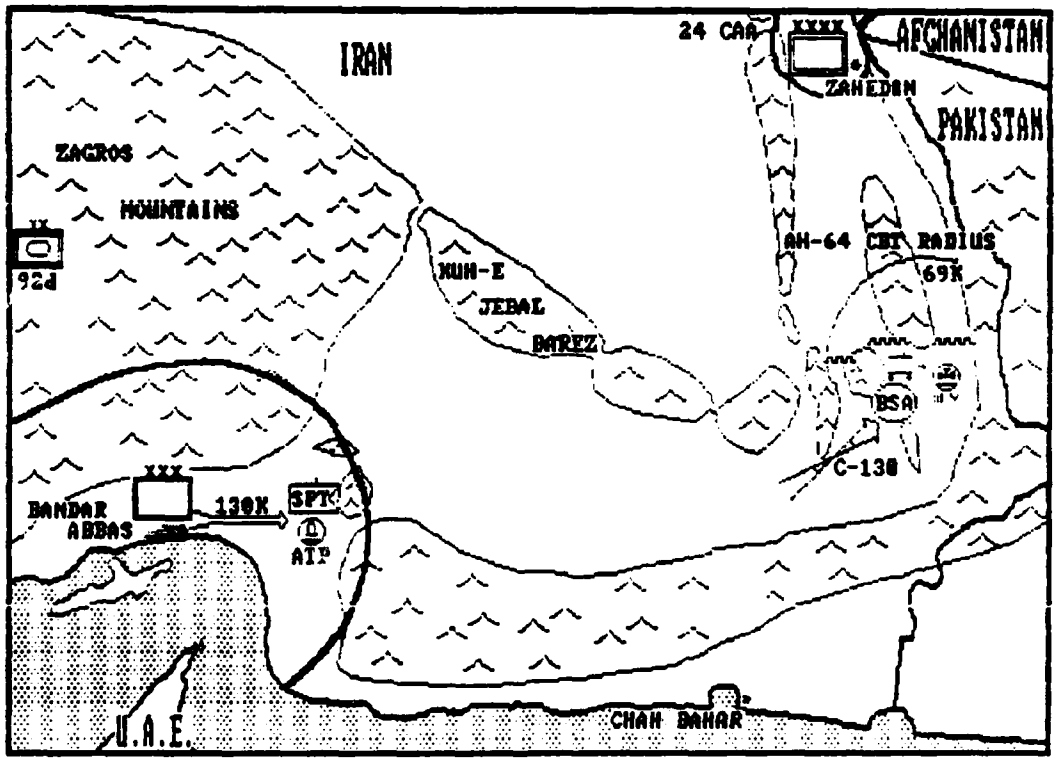
Soviet Summary

In summary, the two Soviet divisions are vulnerable to attack as they move south to seize Chah Bahar. Distance dictates that tracked vehicles be moved by HET if possible, and with the Soviet fleet of HET's, it is. That will mean fewer maintenance difficulties, faster transit along the route, and a higher level of readiness once in the area of Chah Bahar. Faster transit will decrease the window of vulnerability to attack. Therefore, the Soviets must be made to download their combat vehicles and fight before they are ready, robbing them of the initiative and making them vulnerable to defeat. An attack by air only can slow them down, but will not necessarily force them to download and fight. A coordinated air/ground attack must be launched by the Aviation/Airmech brigade to decisively engage the two Soviet divisions.

Rugged terrain and the lack of roads will limit the number of ground maneuver units which can be massed at any one point, which will improve the force ratio for the U.S. at that point. Terrain, as is always the case, favors the defender. Once the advance is slowed, or stalled, the column will be exposed and the divisions vulnerable to attack helicopters. A pitched air-to-air helicopter battle will ensue (primarily Hokum vs. LHX for low altitude air superiority),* with the advantage going to the U.S.'s assumed superior numbers.

THE AVIATION BRIGADE

Of the two U.S. brigades being considered, the Aviation Brigade will be evaluated first (appendix D). It has been deployed as depicted in sketch map 5.



SKETCH MAP 5

---

* This statement is made based upon two assumptions. First, it is assumed that U.S. helicopter air-to-air doctrine is fully developed by the late 1990's, and second, that the LHX becomes the primary air-to-air rotorcraft.

Firepower

The Aviation Brigade, with attachments, has a firepower rating of 28.00. Firepower is available from eight (five air and three ground) maneuver battalions, and one artillery battalion. The artillery is where the U.S. Brigade is at its greatest disadvantage, and will require the most effort to overcome.

Within the Aviation Combat Command, the armor brigade has the same flexibility that it normally would, except that it is operating independently of other armor formations, and therefore cannot achieve the shock effect inherent in the mass of an armor division. The attack helicopter regiments, if employed in support of, or supported by, the armor brigade, become tied to the speed of ground maneuver. However, the Aviation Brigade commander is not limited to that course of action. He can employ them independently, either deep, within the main battle area, or in the rear, thus allowing them enough freedom of action to use their speed and mobility as required, but within the intent of the overall scheme of maneuver. In fact, all of these attack helicopter options are the same as they would be normally. The presence of the LHX is significant, because it will be counted upon to hunt down the enemy Havoc attack helicopters, while also protecting the AH-64's from the Hokum air-to-air threat.

The volume of class V anticipated, 529 short tons on the first day, imposes a potential logistical restriction on firepower. The ground line of communication and supply (GLOC) stretches 550 kilometers, which is much too long to support with brigade, or even Corps assets. Air Force C-130's will be needed for the establishment of an air line of communication and supply (ALOC).

Maneuver

The Brigade is capable of a high maneuver effect. Ground and air mobility are both excellent, since all units assigned or attached have tracked or wheeled vehicles. The armor and mech battalions have tracked vehicles that are fast and mobile, and the number of attack helicopters in the Brigade provides a substantial amount of firepower that is unencumbered by the terrain. The altitude of the Khash area, however, limits MI-61 performance to a

combat radius of 69 kilometers.[42] Additionally, the 90 UH-60 and 48 CH-47D helicopters available provide a sizeable dismounted maneuver transport capability. As with the firepower limitation imposed by resupply of class V, the class III (bulk) required (almost 377,000 gallons) will necessitate aerial resupply by Air Force C-130's to accomplish the mission.

Protection

Protection will be critical to mission accomplishment because of the distance between the Brigade and the 21st Corps main battle area (MBA). Being on the defensive, however, improves the situation somewhat. The excellent night fighting capability of the unit's combat vehicles and aircraft will allow most operations to be conducted in that environment, allowing a measure of protection from enemy air and reducing the effects of the heat. Logistics will again be a weakness, even in the area of protection, because the volume of water and anticipated medical evacuation will require fixed wing support. An existing airstrip and/or areas that can be rapidly improved for C-130 landings will be necessary, and must be protected. Multiple airstrips will be required to ensure at least one is operational at all times. Airstrips are fixed, not easily camouflaged, and easily targeted.

Leadership

Leadership is the key element of the equation and determines the level of relative combat power achieved. Effective maneuver, firepower, and protection depend on the abilities of the leader. Climate, austerity of the environment, distance to friendly lines, and logistics will challenge the commander and his staff and impact on leadership effect.

Aviation Brigade Summary

In summary, the number and type of weapons systems, combined with the combat support and combat service support units attached, make this a very powerful tactical formation with two major limitations. First, the force is very mobile, but flexibility is limited because the armor brigade is a relatively small mechanized formation and the combat radius of the AH-64 is limited by altitude. Second, the Brigade depends on potentially scarce Air

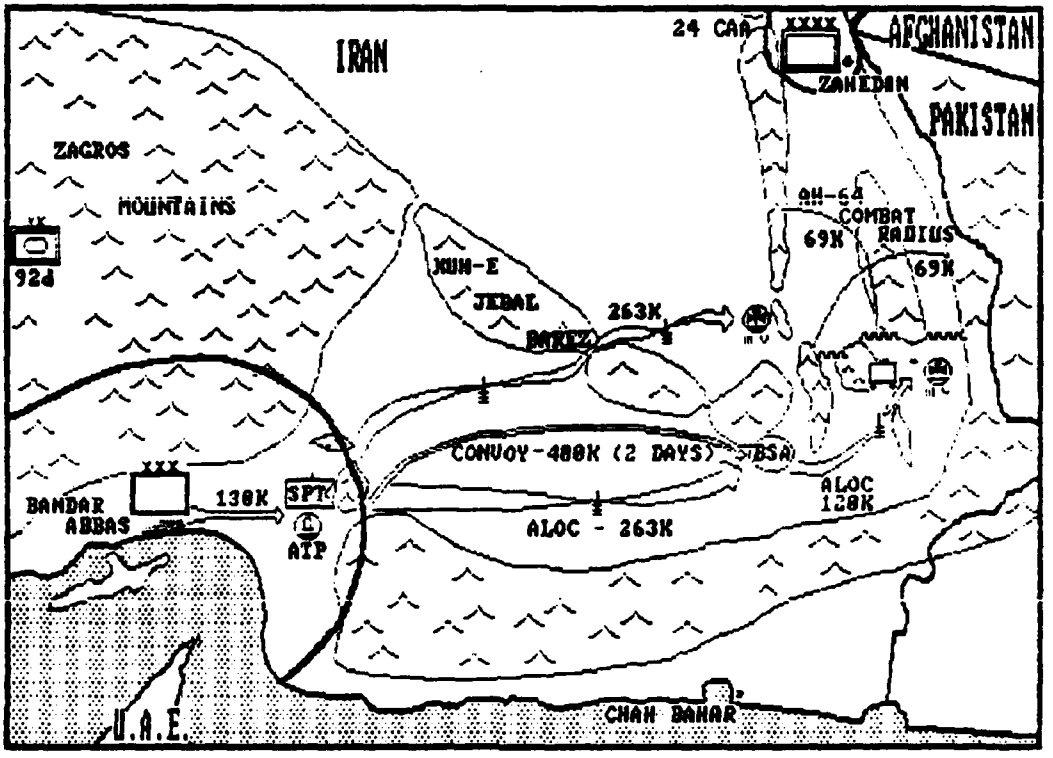
Force C-130's for logistical support, which need fixed airstrips and are vulnerable to the weather.

THE AIRMECH BRIGADE

The Airmech Brigade will now be evaluated (appendix C). It is deployed as depicted in sketch map 6.

Firepower

Calculations give the Airmech Brigade and its attachments, like its aviation counterpart, a firepower rating of 28.00. Also like the Aviation Brigade the airmech unit has the firepower effect of eight maneuver battalions, plus artillery, with artillery being the weak point in the brigade's capabilities.



SKETCH MAP 6

To give the Airmech Brigade a helicopter transportable light tank, the Cadillac Gage Commando Stingray is used. In terms of firepower, the Stingray can provide lethality, accuracy, and acquisition similar to the M1. Achieving mass, however, is again a problem. A relatively small number of tanks limits shock effect and the ability to engage the enemy decisively from several

directions at once, thus reducing unit flexibility. But because of the advanced cargo aircraft's ability to helilift the light armored vehicles, it is possible, at least theoretically, to multiply their effect through rapid displacement. This would offset their limited numbers and raise the armor regiment's flexibility to a level below that of an armor division, but above that of an armor brigade.

Flexibility is increased in other ways. One is having the option of exploiting attack helicopter success with armor ferried into a created or discovered void. Another is the increased range of the AH-64 battalions, made possible by larger FARRPS transported by the ACA more quickly and to greater distances than is possible with a medium lift helicopter. Still another is the ability to quickly displace the self-propelled MLRS. The MLRS battery provides a capability similar to a 155mm howitzer battalion with fewer weapons systems (and therefore fewer vehicles), but similar class V requirements.

This new found flexibility has limitations. Logistical requirements will be a competing demand on ACA assets, as up to 3209 short tons of cargo must be carried on any given day. The reduced amount of armor protection on the new family of armored vehicles makes the light tank more of an antitank gun than a tank, thus reducing its flexibility of employment. Finally, the ACA is more vulnerable, due to its size and the numbers of them.

The range and lift capacity of the ACA frees the Airmech Brigade from the necessity to rely on Air Force C-130's, which precludes significant logistical limitations on firepower. The ACA can handle the up to 852 short tons of ammunition per day and still meet all of its other logistical requirements.

Maneuver

The Brigade is capable of a high maneuver effect. Like the Aviation Brigade, ground and air mobility are excellent. The helilift capability helps out as well. Besides adding to unit flexibility, the ACA reduces the amount of time required to move a given amount of combat power around the battlefield.

As with firepower, no limitation is imposed by resupply of class III (bulk). The ACA can transport forward all the bulk fuel

required by the Airmech Brigade each day. The ACA's obtaining supplies from the Corps support group will refuel at that location, eliminating the requirement to haul forward 93,000 to 186,000 gallons of the up to 553,391 gallons required by the brigade each day.

Protection

The night fighting capability of the unit is excellent, allowing protection from enemy air and the heat. The lighter and smaller family of armored vehicles lends to the protection of the ground force, being harder to observe and acquire, while the larger and more numerous ACA has the opposite effect in the air. Lighter vehicles, however, mean less protection from enemy armor defeating ammunition. Normal loss rates of ACA will not threaten the Airmech Brigade's critical ALOC, but higher than normal rates obviously would. To offset this, there is a 30% buffer if the helilift of combat vehicles is not needed.* Overall unit protection, as influenced by sustainment, will not be a weakness as long as the ACA continues to fly.

Leadership

In terms of leadership effect, the improved logistical capability will allow the commander to operate with more flexibility. On the other hand, replacement of casualties within the technical MOS's will be a weakness. Weather will also pose a leadership challenge. Weather can limit the tactical flexibility and protection made possible by the helilift of armored vehicles and temporarily stop the flow of supplies over the ALOC, although the latter can be offset by stockpiling and caching as long as prolonged periods of inclement weather are not experienced.

---

* This is the key to success for the heavy-lift airmech concept. Everything depends on the ACA's ability to meet logistical demands and having enough sorties remaining to move selected combat, combat support, and combat service support vehicles about the battlefield as required. Wargaming shows that this is possible, but depends on leadership to make the timely decisions which allow flexibility. [e.g.: if the 30% extra cargo capacity each day is used to stockpile supplies from D+14 to D+19, then all ACA can be used on D+20 to move vehicles. With all aircraft available it would be possible to move 576 vehicles 66 kilometers (see page C-10). If stockpiling wasn't possible, then on any given day the 30% buffer would allow up to 72 vehicles to be moved 132 kilometers (page C-9). As can be seen by the tables in appendix C, many such combinations are possible.]

Airmech Brigade Summary

Like the Aviation Brigade, the Airmech is a powerful tactical formation in terms of the number and type of weapons systems it has. That power is reduced by the vulnerability of its lightly armored vehicles, but offset by the flexibility of employment and autonomy allowed by helilift. It is not tied to fixed airstrips or potentially scarce C-130's. Like the Aviation Brigade and its fixed wing support, the Airmech Brigade is vulnerable to high aircraft loss rates and the weather.

VII. CONCLUSION AND SUMMARY

Conclusions

In the scenario and organizations presented, the Airmechanized Brigade can best accomplish the mission of destroying the two division enemy force. Mission accomplishment is very much a function of what is logistically supportable, and the Airmechanized Brigade can accomplish the mission with organic assets. The Aviation Brigade, on the other hand, requires a substantial amount of C-130 support (or perhaps by 1998 it will be C-17's) that cannot be relied upon for a tactical battle. Operational and strategic priorities will almost certainly take precedence over tactical requirements when limited Air Force transport assets are apportioned.

The advanced cargo aircraft, combined with the new family of armored vehicles, gives the Airmech Brigade greater tactical flexibility, especially in terrain such as southeastern Iran. The potential exists in airmechanized units to ferry armor and mechanized infantry about the battlefield to exploit favorable conditions that are discovered or created. Attack helicopter operations are also affected: FARRP's can be transported further, faster, and with more fuel and ammunition. In an area of the world outside Europe, where continuous front line traces are not possible and flanks and rear areas are accessible to those who can reach them, the ability to dramatically extend the operating range of tanks and attack helicopters has enormous potential.

If the Airmech Brigade is more tactically viable than the existing Aviation Brigade, the question is should the Army

airmechanize its corps aviation brigades? Realistically, the answer should be no. The U.S. Army cannot afford to airmechanize its corps aviation brigades at the present time. Even if the ACA were produced, an airmech brigade with the capabilities described in this monograph would require about twice as many airframes as is currently projected for the corps aviation brigades. With a price tag that might be twice that of a CH-47D, not including the higher maintenance and operating costs, it is obvious that expense will play a very important part in the decision to develop an airmechanized unit which takes the heavy-lift approach.

Another issue is heavy lift support to the remainder of the Corps, which would have to take second priority to a mission as demanding as the one outlined. Still another issue is fuel consumption, a significant problem in a world of shrinking fuel supplies and rising fuel costs. Using data compiled for the two brigades presented in this paper, the Airmech Brigade would consume 32% more fuel than the Aviation Brigade and its attachments, or about as much as a J-series heavy division.

All of these issues would require a close look at cost versus benefit. The purpose of this paper, however, is to determine the tactical viability of the airmech concept, not its affordability. The fact is that airmechanization is tactically viable and has considerable potential.

To exploit the potential outlined in this paper the advanced cargo aircraft should be developed as the follow-on to the CH-47D. With 48 ACA's a brigade could project a measure of combat power that could impact directly (transport artillery, M2's, etc.) or indirectly (bulk fuel and ammo) at the critical point on the battlefield much faster, to a greater distance, and with significantly more flexibility upon arrival than is possible with even a product improved CH-47D. If the argument is accepted that the airmechanization concept has potential then fielding the ACA in even a logistics role at least provides a testbed for technical improvement, development of procedures, and the accrual of tactical experience. It can also be a vehicle for developing future doctrine. The technology has existed for several years for a heavy lift helicopter capable of lifting up to 60 tons.[42]

Industry can probably develop a production ready advanced cargo aircraft by the late 1990's with the capabilities described in this paper, but not without a firm commitment in money and priority.[44]

Summary

Historical evidence suggests that the concept of airmechanization is an evolutionary and inevitable step in warfare:

(1) The value of employing a traditionally combat support arm to achieve decisive results through independent action was proven as early as the American Civil War.

(2) Like the tank in the 1920's and 1930's, the helicopter is causing us to review and revise our existing theory of movement.

(3) In 1926 the potential of airborne landings of motorized detachments was recognized as not only possible, but potentially capable of decisive effects.

(4) The development of air assault and attack helicopter capabilities and their potential for independent action has established a strong aviation presence and supporting doctrine within the U.S. Army.

(5) The helicopter will, in all probability, evolve technologically and doctrinally toward a heavy lift approach and eventually to an MBAV type airframe.

Critical analysis of a likely scenario indicates that airmechanization is a viable concept for the US Army on the AirLand battlefield. In the face of growing Soviet superiority, airmechanization's inherent maneuver and growing firepower capability is well suited to attacking enemy strength using the indirect approach.

VIII. IMPLICATIONS

The heavy-lift approach is the last evolutionary step in the airmechanization concept described in this monograph. The next step would be a revolutionary one, substituting a heavily armed, lightly armored main battle air vehicle for the tank as the

primary weapons system on the battlefield. It would be revolutionary because it would turn airmobility's means of transport into a means of combat,[45] taking the primary weapons system for waging war out of the ground dimension and into von Senger's new operational dimension.

The existence of a fleet of MBAV's would dramatically change maneuver warfare by altering the time/space relationship and removing any semblance of battlefield linearity. Three implications can be drawn from this eventuality. First, an operational concept needs to be developed that explores this new operational dimension. The U.S. cannot afford to ignore a concept with the potential that airmechanization has. Second, once an operational concept has been developed, industry should be kept clearly in focus as to what capabilities are desired for the ACA and the MBAV. Third, the heavy-lift approach should be pursued as a vehicle for the development of tactics, techniques, and procedures that will impact on emerging doctrine.

Using heavy-lift experience as a foundation for future MBAV based doctrine makes very good sense when viewed from the perspective of the 1980's and Airland Battle. In a historical monograph written for the U.S. Army's Training and Doctrine Command, John Romjue pointed out that during its development,

> *. . . the (AirLand Battle) concept required an alert mental grasp of the potentialities of the new Army 86 equipment already in production and oncoming. . . . But the AirLand Battle concept was not tomorrow's doctrine only. It was not intended to remain on the shelf until all the new systems were fielded. Rather it could, with adjustment, be implemented immediately and with great payoff.*[46]

If the airmechanization concept is tomorrow's doctrine, it need not remain on the shelf until the MBAV is fielded. It can, with adjustments, be implemented in the interim using the ACA heavy-lift option. Using an old analogy, the AirLand Battle concept put the *doctrinal* horse back in front of the *technological* cart.

Airmechanization can be viewed as an attempt to keep doctrine where it belongs--out front.

The rapid growth of Aviation has impacted upon Army doctrine. With the advent of Aviation as a maneuver arm there is a growing potential for ground maneuver units to be task organized under aviation for command and control. As this author suggested in an article that appeared in Army Aviation magazine in May, 1986, aviation will ". . . seek the attachment of ground units and the opportunity to act as the maneuver headquarters for a specific mission."[47] This monograph suggests the feasibility of this proposition and implies that it has even more potential in the future.

The last implication of this study deals with the operational level of war. Assuming the advanced cargo aircraft is approved and fielded, is an airmechanized division at the operational level viable or affordable? In a recent article in Military Review, John Adams argued that in the more likely areas of world conflict, including southwest Asia, tactical mobility and firepower will be critical. He concluded that ". . . reconfiguring at least one light infantry division to either motorized or air assault appears appropriate," and adds that ". . . conversion of a second light division to mechanized appears warranted."[48] Given the viability of airmechanization, and in view of strategic realities the question of creating a highly mobile and flexible division with the combat power of armored vehicles and the ability to be partially self-deployable needs to be addressed.

ENDNOTES

1. Richard E. Simpkin, "Flying Tanks?--a tactical-technical analysis of the 'main battle air vehicle'," Military Technology, (August 1984), 80.

2. The information concerning the two decisions came from the following sources. The implication concerning their importance is my own.
John Davoren, and Chris Southard, Aviation Systems Analysts, Combat Division, Material Integration Directorate, CACDA, Ft. Leavenworth, KS, 1988. Series of interviews conducted by the author.
MAJ Doug Whiteside, and Ben Stuttler, Armor Systems Analysts, CACDA, Ft. Leavenworth, KS, 1988. Series of interviews conducted by the author.

3. Field Manual 100-5, Operations, (Washington, D.C.: U.S. Government Printing Office, 5 May 1986), p. 12.

4. "Brig Richard Simpkin: Tank officer turned military thinker," (Obituary), London Times, 4 November 1986, p. 22g.
"Gen Ferdinand von Senger," (Obituary), London Times, 13 January 1987, p. 14g.

5. General Doctor F.M. von Senger und Etterlin, "New Operational Dimensions," RUSI, (2 June 1983), 15.

6. Ibid., p. 12.

7. Simpkin, "Flying Tanks?--a tactical-technical analysis of the 'main battle air vehicle'," 64.

8. Field Manual 100-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), (Washington, D.C.: U.S. Government Printing Office, October 1987), p. 3-13.

9. General Doctor F.M. von Senger und Etterlin, "The Air-mobile Divisions: Operational Reserves for NATO", RUSI, (1 March 1987), 23-30.

10. Richard E. Simpkin, Antitank: An Airmechanized Response to Armored Threats in the 90's, (Oxford, England: Brassey's Publishers, LTD, 1982), 272.

11. Richard E. Simpkin, Tank Warfare, (New York: Crane Russak and Co, Inc., 1979), 22.

12. Simpkin, Antitank, p. 273.

13. Simpkin, "Flying Tanks?--a tactical-technical analysis of the 'main battle air vehicle'", p. 80.

14. Ibid.

15. Edward N. Luttwak, "The American Style of Warfare and the Military Balance", Survival, (January/February 1979), 57.

16. FM 100-5, p. 12.

17. Combined Arms Center Development Activity, "Armored Family of Vehicles," (Ft. Leavenworth, KS: Unpublished CACDA White Paper, 9 September 1985), p. 2.

18. COL Richard Hart Sinnreich, et al, "Employment of Combat Aviation," (Ft. Leavenworth, KS: Unpublished SAMS White Paper, April 1986), p. 2.

19. William S. Lind, "Some Doctrinal Questions for the United States Army," Military Review, (March 1977), p. 58.

20. Senger, "Airmobile Divisions: Operational Reserves for NATO," p. 28.

21. Simpkin, Race to the Swift, pp. 20-22.

22. Ibid., p. 120.

23. Field Manual 1-100 Revised Final Draft, Army Aviation In Combat Operations, (Washington, D.C.: U.S. Government Printing Office, August 1988), p. 1-16.

24. Stephen Z. Starr, "Climax In Alabama", School of Advanced Military Studies Foundations of Military History: Course 1 Readings, (Ft. Leavenworth, KS: School of Advanced Military Studies, 1988), p. 30.

25. J.F.C. Fuller, Armored Warfare, (Harrisburg, PA: The Telegraph Press, 1943), p. 3.

26. Ibid., p. 11.

27. Ibid., p. 27.

28. Mikhail Tukhachevskiy, "New Problems in Warfare", U.S. Army War College Art of War Colloquium: Soviet Operational Concepts by Various Soviet Authors, (Carlisle Barracks, PA: U.S. Army War College, November 1983), pp. 7-8.

29. LTG (Retired) Harry W.O. Kinnard, "Air Mobility Revisited, Part I," U.S. Army Aviation Digest, (June 1980), p. 3.

30. Gen. Hamilton H. Howze, "The Howze Board, Part III: Winding Up a Great Show", Army, (April 1974), p. 21-22.

31. LTG (Retired) Harry W.O. Kinnard, "Air Mobility Revisited, Part II," U.S. Army Aviation Digest, (July, 1980), p. 8.

32. Ibid., p. 14

33. Simpkin, Race to the Swift, p. 47.

34. Department of the Army, Army Aviation Modernization Plan, (Washington, D.C.: U.S. Government Printing Office, May 1988), p. 8.

35. Field Manual 1-111 Coordinating Draft, Aviation Brigades, (Washington, D.C.: U.S. Government Printing Office, October 1988), p. 1-6.

36. Ibid., pp. 3-19 to 3-25.

37. U.S. Army Aviation Center fact sheet sent by Ft. Rucker to the Aviation Team, Combat Division, Material Integration Directorate, CACDA, Ft. Leavenworth.

38. "Cadillac Gage Commando Stingray Light Tank," Jane's Armour and Artillery, ed. Christopher F. Foss, 9th ed., (Surrey, UK: Jane's Information Group, 1988), pp. 146-149.

39. FM 1-111 Coordinating Draft, pp. 1-6 and 1-8.

40. Field Manual 100-2-3, The Soviet Army: Troops, Organization, and Equipment, (Washington, D.C.: U.S. Government Printing Office, 16 July 1984). p. 4-34.

41. Field Manual 100-2-2, The Soviet Army: Specialized Warfare and Rear Area Support, (Washington, D.C.: U.S. Government Printing Office, 16 July 1984), p. 8-1.

42. FM 101-20 Coordinating Draft, pp. 1-18 and 19.

43. William P. Jones, "Army's Heavy-Lift Gap: New Helicopter Needed", Army, (January 1986), p. 44.

44. Conversation with Chris Southard, CACDA, 1988.

45. CPT Darrell E. Crawford, "Airborne Aviation: Training as We Expect to Fight", Army Aviation, (May 31, 1986), p. 46.

46. John L. Romjue, "From Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982." TRADOC Historical Monograph Series, ed. Henry O. Malone, Jr., (Ft. Monroe, VA: Training and Doctrine Command, June 1984), p. 46.

47. John A. Adams, "Balancing Strategic Mobility and Tactical Mobility", Military Review, (August 1988), p. 20.

48. Senger, "New Operational Dimensions," p. 12.

49. Staff Battle Exercise 321, Middle East Exercise: Student Advance Book, (Washington, D.C.: U.S. Government Printing Office, 1987-88), p. 7.

50. Ibid., p. 10.

51. COL Huba Wass de Czege, "Understanding and Developing Combat Power," (Ft. Leavenworth, KS: Unpublished Monograph, 10 February 1984), p. 5.

52. Ibid., p. 6.

53. Ibid., p. 12.

54. Ibid., p. 13.

55. Ibid., p. 15.

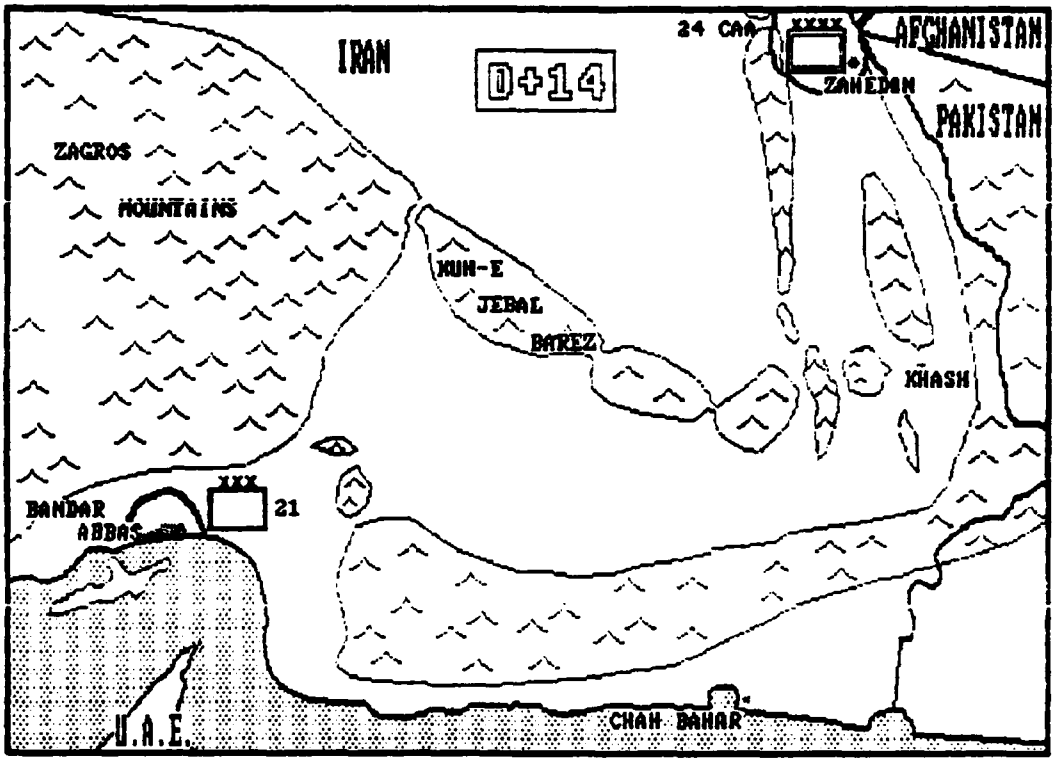
56. Ibid., p. 17.

57. Ibid., p. 16.

APPENDIX A: SOUTHWEST ASIAN SCENARIO

A southwest Asian scenario will be used to test the tactical effectiveness of aviation vs. airmech units. The situation is that outlined in the USACGSC Middle East Exercise (MEEX) for AY 87-88. The year is 1998, to accommodate the integration of new aircraft.

"The Army commander at Shiraz, Major General Shamlou Rasfani, a hero of the Iran-Iraq war, decided to rebel and carried his troops and the population of the Shiraz region with him."[49] He has declared himself the ruler of Iran, and also his intention to occupy Bandar Abbas and close the Strait of Hormuz. Iran's central government has privately asked for U.S. intervention, mindful of the impact such a request could have on the general population. The Soviet Union is sending arms and money to the rebel forces of Shiraz and affirms its lawful right to intervene.



SKETCH MAP 1

"The National Command Authorities through the Joint Chiefs of Staff directed the Commander in Chief, U.S. Indian Ocean Command (USINDCOM) to deploy elements to the area...to secure and protect the Strait of Hormuz"[50] * (figure 3). An independent People's Republic of Baluchistan has been proclaimed by the leaders of the separatist movement, the Baluchistan People's Liberation Front. As a result of these two events, the Soviet Union repositioned its 1 Turkestan *Front* along the borders of Pakistan and Iran, while moving additional forces into

---

* Lead elements of the Corps came ashore on D+6 and began the relief of the MEF. By D+17 all of the above elements were ashore. The 21st Aviation/Airmech brigade arrived early in the movement plan because of its combat power, reconnaissance capability, and flexibility, and in anticipation of early employment.

Afghanistan. (figure 4).

It is now D+14 (sketch map 1). The 21st Corps has established a lodgement and is about to begin moving to positions to defend the Strait of Hormuz and the Gulf of Oman coastal area. The Soviet Turkestan *Front* has 24 CAA marshalling in eastern Iran, in the vicinity of Zahedan, and 40 and 28 CAA's marshalling in southwest Afghanistan. All are preparing to advance toward the Strait, and will begin no earlier than D+18.

It has been determined that the 24 CAA's lead two motorized rifle divisions (MRD's) will advance south to seize Chah Bahar, and the following two, including the army's one tank division (TD), will attack southwest toward Bandar Abbas to seize the passes through the Kuh-E Jebal Barez mountains. Destruction of the Corps will be accomplished by the follow-on armies. The 24 CAA's lead two divisions must advance half way from Zahedan toward Khash before the following two can start toward Bandar Abbas due to congestion of combat service support (CSS) vehicles on the few roads in the area. Soviet frontal aviation has established itself at the Zahedan airfield and can provide an air umbrella out to 400 kilometer from that location with its MIG 27's (distance subjectively decreased from maximum range of 600 kilometers to provide loiter time).

The two lead MRD's will advance south along one or more of two possible avenues of approach toward Chah Bahar (sketch map 2). This is 24 CAA's supporting effort and is expected to begin on D+18. A division is expected to advance on each avenue of approach, the main effort initially, to Khash, being in the west. At 100 kilometers per day, it should take the Soviets two days to cover the 200 kilometers by road from their assembly area to Khash, putting them there on D+20. The 24 CAA air assault battalion, possibly augmenting a *Front* effort, can be expected to assault the currently unusable airstrip at Khash the day of, or day after (D+18 or 19) the two divisions depart Zahedan to start the attack south. The airstrip will be essential for the forward basing of the air support required to cover the continued Soviet drive.

The following MRD and TD will advance southwest toward Bandar Abbas (sketch map 3). This is 24 CAA's main effort. A division is expected to advance on each of the two avenues of approach (the southern avenue breaking into two), with the main effort in the south. Their attack will begin one day after the supporting attack to Khash, therefore putting them at the southeast most pass on the fourth day, or D+22 (250-300 kilometers at 100 kilometers/day). The Iranian 92nd Armored Division, loyal to the rebels, is also expected to advance toward Bandar Abbas.

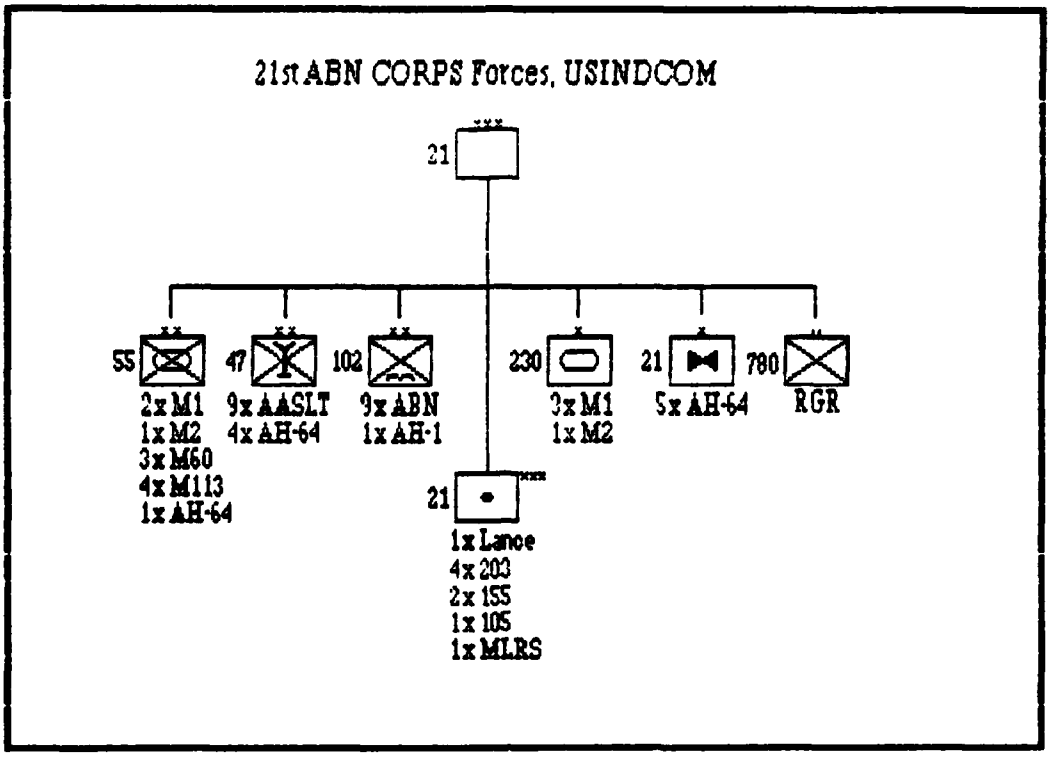


FIGURE 3

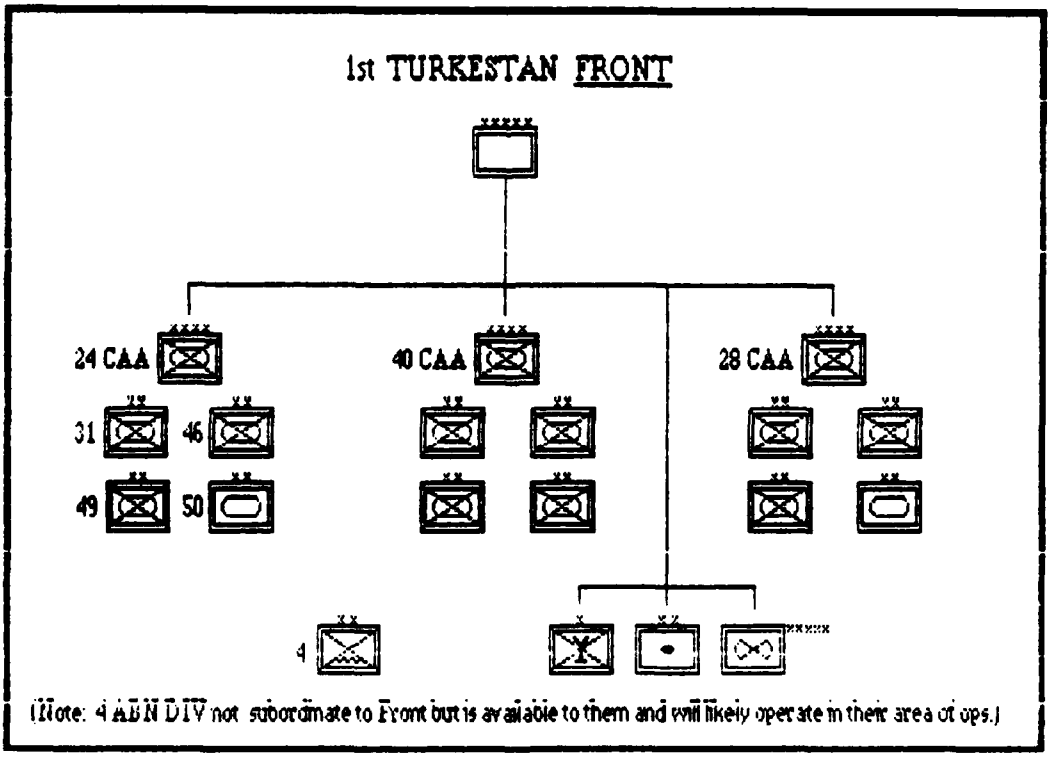


FIGURE 4

FIREPOWER RATIO (ST 100-9, JULY 88)

US UNIT BEING EVALUATED: 21st Corps

	US BNs (J)		
M113 =	1.50 x	4.00	(NO. OF BN's)
M2 =	2.00 x	2.00	"
LIGHT INF =	0.50 x	19.00	" (My value, not in ST)
M1A1 =	3.15 x		"
M1 =	3.00 x	5.00	"
M60A3 =	2.25 x	3.00	"
ACR SQDN =	2.75 x		"
CAV SQDN (J) =	1.50 x	4.00	"
CAV SQDN (H) =	2.00 x		"
AH-64 =	4.00 x	10.00	"
AH-1 =	3.00 x	1.00	"
FA =	2.00 x	17.00	"
MLRS(BTRY) =	2.00 x	4.00	"

USSR UNIT BEING EVALUATED: 1 Turkestan Front (3 CAA's)

	USSR BNs		
BTR =	1.00 x	70.00	(NO. OF BN's)(10 in Iran 92d AR DIV)
BMP =	1.50 x	52.00	"
BMD =	1.00 x	10.00	" (My value, not in ST)
AASLT =	0.50 x	15.00	" (My value, not in ST; includes 4th ABN DIV)
T80(ITR) =	2.42 x		"
T80(TR) =	1.56 x	18.00	"
T80(MRR) =	2.00 x	2.00	"
T64(ITR) =	2.23 x		"
T64(TR) =	1.44 x	30.00	"
T64(MRR) =	1.86 x	60.00	"
T72(ITR) =	1.86 x		"
T72(TR) =	1.20 x		"
T72(MRR) =	1.55 x		"
T55(ITR) =	1.00 x		"
T55(TR) =	0.64 x	3.00	" (Iranian 92d AR DIV)
T55(MRR) =	0.83 x	3.00	" (Iranian 92d AR DIV)
AT =	1.00 x	22.00	"
AH (Havoc) =	3.50 x	18.00	" (Increased: 2 to 3.5)
FA =	2.00 x	225.00	"
MRL(BTRY) =	1.00 x	67.00	"

US CBT PWR = 128.25

USSR CBT PWR = 958.79

RATIO 1:7.48

APPENDIX B: COMBAT POWER

The Wass de Czege Model

The Wass de Czege model is a guide to how to think about combat power, not what to think. Its purpose is to teach military judgement to US Army officers.

The model "can be used to assess readiness and to identify important training material and force structure requirements. It can also be used to identify necessary changes in fighting concepts and doctrine."[52]

Currently, there are two methods US Army officers tend to use when judging combat power: (1) intuition, and (2) counting gross numbers of weapon systems. "The problems with the first method, the 'gut feeling of the senior commander' approach, is that a wide range of possible conclusions can flow from such loosely structured and unscientific analysis.... The second method--the weapons/units counting method--appears sound on the surface, (but) the danger with this type of analysis is that it can lead to simplistic and fatalistic thinking based on judgements about only the quantifiable aspects of the battlefield."[53]

"Combat power is always relative, never an absolute, and has meaning only as it compares to that of the enemy. Combat power is defined as that property of combat action which influences the outcome of battle. It has meaning only at the time and place where battle outcomes are determined. Prior to battle there exists only capability. Leaders and the forces of their environment, to include the actions of the enemy, transform this capability into combat power. Superior combat power has been generated on the battlefield by superior leaders and superior units against forces vastly superior by any objective criteria. The appropriate combination of maneuver, firepower, and protection by a skillful leader within a sound operational plan will turn combat potential into actual combat power. Superior combat power applied at the decisive place and time decides the battle.[54]

Maneuver is the dynamic element of combat. Its effects contribute to combat power. Its enabling capabilities are relative movement or mobility, knowledge of the enemy and terrain, effective command and control, flexible operational practices, sound organization, and reliable logistical support.

Firepower is the destructive force essential to realizing the effects of maneuver. Its effects contribute to combat power. Its necessary ingredients are efficient and effective target acquisition, viable and effective command and control, a steady supply of the right munitions, and the tactical and operational mobility necessary to place weapons within range of critical targets.

Protection is the shielding of the fighting potential of the force so that it can be applied at the decisive time and place. Its effects contribute to combat power. It has two components: (1) actions to counter enemy firepower and maneuver, i.e. security, dispersion, cover, camouflage, deception, suppression, and mobility; and (2) actions to keep soldiers healthy, maintain their fighting morale, reduce the impact of severe weather, keep equipment in repair, and keep supplies from becoming lost.

Leadership is that upon which all others depend. It provides purpose, direction, and motivation in combat. "...Leaders must be men of character; they must know and understand soldiers and the physical tools of battle; and they

must act with courage and conviction.... In short, it is the overall effect the leader creates...through proper application of his potential maneuver, firepower, and protection capabilities which generates relative combat power."[55]

The relative combat power model: [56]

$$L_f(F_f+M_f+P_f-D_e)-L_e(F_e+M_e+P_e-D_f)=\text{The outcome of battle}$$

L_f=friendly leadership effect

L_e=enemy leadership effect

F_f=friendly firepower effect

F_e=enemy firepower effect

M_f=friendly maneuver effect

M_e=enemy maneuver effect

P_f=friendly protection effect

P_e=enemy protection effect

D_e=enemy degrading of friendly firepower, maneuver, and protection

D_f=friendly degrading of enemy firepower, maneuver and protection

The combat power model can be divided into four sub-models: firepower effect, maneuver effect, protection effect, and leadership effect. e.g.: [57]

I.	Firepower effect	1st level of abstraction
a.	Volume of fire	2nd level of abstraction
1.	Number of delivery means	3rd level of abstraction
(a)	etc.	etc.

"A commander or staff officer with a specific unit in mind could, and would, if he were employing this method of analysis, go to a fourth and fifth or even sixth level in order to examine his situation and courses of action. He would do this in order to identify every variable over which he had control. The leader's task then is to examine his variables in terms of his ability to affect them and to choose the course of action which in his judgment maximizes his combat power. This is generally the thought process leaders might intuitively follow given enough appropriate experience."[58]

APPENDIX C: ANALYSIS OF 21ST AIRMECH BRIGADE

BRIGADE ORGANIZATION

	PERS	CBT VEH/WPN	TAC VEH/TLR	CS/CSS VEH/TLR	5000 GAL TKR	2500 GAL TRK	TOTAL VEH/TLR
AIRMECH BDE HQ SRC 01202L000	89 (AVN BDE HQ, AASLT DIV USED)		28				28
CAV SQDN SRC 01265L000	479		98	6			104
ARMOR REG HQ SRC 87042J420	90		27				27
LT AR BN (x2) SRC 17235J410	1104 (M60A3 BN USED)	150	196			12	358
MECH BN SRC 07245J410	844	79	138				217
MLRS BTRY SRC 06398J400	131	9	63			1	73
FSB (1x2) SRC 63005J430	426	1	178	13	10		202
AH REG HQ (x2) SRC 01202L000	178 (AVN BDE HQ, AASLT DIV USED)		56				56
AH BN (x5) SRC 01385J420	1320		345	20		35	400
FSB (AVN) (x3) HHD, FSB (SRC 63006J400) FWD SPT MED CO (SRC 08027L000) SUPPLY CO FSB (SRC 42004J400) MAINT CO (SRC 43067L000) AVN MAINT CO (SRC 01927L000)	1575		651	123 (THESE UNITS PUT TOGETHER AS A COMPOSITE TO APPROXIMATE WHAT AN FSB FOR AN AVN REG/GP MIGHT LOOK LIKE)	30		804
AVN GP HQ SRC 01202L000	89 (AVN BDE HQ, AASLT DIV USED)		28				28
ACA BN (x3) SRC 01245L000	1416 (CH-47D BN ASSUMED TO APPROXIMATE ACA BN REQUIRMENTS)		315	24			339
UH-60 BN (x2) SRC 01205L000	700		170	16			186
CMD AVN BN SRC 01215L000	398 (CMD AVN BN, AASLT DIV, PLUS EXTRA OH CO, 01218L, USED)		88	8			96
ATTACHMENTS:							
SIG CO SRC 11208L000	179		51				51
C&J PLT SRC 34277L000	30		6				6
ADA BN SRC 44145L000	452		179				179
ENG CO SRC 05147J400	164	12	37	10			59

TOTALS:	PERS	CBT VEH/WPN	TAC VEH/TLR	CS/CSS VEH/TLR	5000 GAL TKR	2500 GAL TRK	TOTAL VEH/TLR
W/O ATTCHMNTS	8839	239	2381	210	40	48	2918
ATTCHMNTS	825	251	273	220			295
GRAND TOTAL	9664	251	2654	220	40	48	3213

Notes:
(1) Trailers under 2 1/2 tons are not counted because it is assumed they could be transported with their prime mover under the ACA. Trailers 2 1/2 tons and over are counted separately because it is assumed they will require their own sortie to move.
(2) CBT VEH/WPN (combat vehicles and weapons) include those listed on the TO&E under class VII K and M.
(3) TAC VEH/TLR (tactical vehicles and trailers) include those listed on the TO&E under class VII O.
(4) CS/CSS VEH/TLR (combat support and combat service support vehicles and trailers) include those listed on the TO&E under class VII A and W.

FIREPOWER RATIO (ST 100-9, JULY 88)

US UNIT BEING EVALUATED: 21st Airmech Brigade (Heavy Lift)

	US BNs (J)			
M113	= 1.50 x		(NO. OF BN's)	
M2	= 2.00 x	1.00	"	
LIGHT INF	= 0.50 x		"	(My value, not in ST)
M1A1	= 3.15 x		"	
M1	= 3.00 x		"	
M60A3	= 2.25 x	2.00	"	(Cadillac Gage Stingray)
ACR SQDN	= 2.75 x		"	
CAV SQDN (J)	= 1.50 x	1.00	"	
CAV SQDN (H)	= 2.00 x		"	
AH-64	= 4.00 x	5.00	"	
AH-1	= 3.00 x		"	
FA	= 2.00 x		"	
MLRS(BTRY)	= 2.00 x	1.00	"	

USSR UNIT BEING EVALUATED: 31 MRD + 49 MRD

	USSR BNs			
BTR	= 1.00 x	12.00	(NO. OF BN's)	
BMP	= 1.50 x	8.00	"	
AASLT/ABN	= 0.50 x	3.00	"	(My value, not in ST;
T80(ITR)	= 2.42 x		"	1 Bn CAA, 2 Front)
T80(TR)	= 1.56 x		"	
T80(MRR)	= 2.00 x		"	
T64(ITR)	= 2.23 x		"	
T64(TR)	= 1.44 x	6.00	"	
T64(MRR)	= 1.86 x	6.00	"	
T55(ITR)	= 1.00 x		"	
T55(TR)	= 0.64 x		"	
T55(MRR)	= 0.83 x		"	
AT	= 1.00 x	3.00	"	(1 Bn CAA)
AH (Havoc)	= 3.50 x	2.00	"	(Increased: 2 to 3.5)
FA	= 2.00 x	21.00	"	(1 Bn CAA; 6 Bn Front)
MRL(BTRY)	= 1.00 x	9.00	"	(1 Bn CAA)

US CBT PWR = 28.00

USSR CBT PWR = 106.30

RATIO 1:3.80

LOGISTICS PLANNING: 21ST AIRMECH BRIGADE

Classes of Supply (ST 101-10-1/2)

Class I	4.03	(Water 6.70 gal/man/day) (Note 1)
Class III (Pkg)	0.59	
Class IV	8.50	
Class VIII	1.22	
Class IX	2.50	
Total	16.84	Ston/Man/Day, plus water

Projected Rate of Personnel Losses, Defense (ST 101-6)

Losses 3.5 % first day
Losses 1.9 % succeeding days
28 % of losses KIA/MIA
72 % of losses WIA
64 % of WIA treated and returned to duty
35 % of WIA evacuated to corps
14 % of those evacuated to corps return to duty starting D+5 at
2 % per day for
7 days

Projected Rate of Equipment Losses, Defense (ST 101-6)

	1st Day	Suc/day
LT TK	0.20	0.25
IFV	0.20	0.15
MLRS	0.10	0.10
AH64/LHX	0.30	0.25
ACA/UH60	0.20	0.20
SPT VEH/TLRS	0.15	0.15

Loss Category			
0.15	Non-repairable		
0.85	Repairable		
	Veh	A/C	Time
	0.20	0.20	10 Hrs
	0.25	0.30	24 Hrs
	0.20	0.30	72 Hrs
	0.35	0.20	Evac

Notes:
(1) Minimum water ration allowed in FM 101-10-1/2.

(2) This table calculated on a computer spreadsheet and numbers that appear to be slighty off are actually correct; the spreadsheet takes fractions into account during calculations while only whole numbers, or whole "systems" are displayed.

21st Airmech Brigade Projected Personnel Losses

D+19 PERSONNEL = 9664			(End of day strength)
D+20 PERSONNEL = 9664 *0.035 =	338		(Day's casualties)
9664 - 338 =	9326		(End of day strength)
D+21 PERSONNEL = 9326 *0.019 =	177		(Day's casualties)
9326 - 177 =	9149		(Adjusted Strength)
338 * 0.72 * 0.64 =		156	(D-Day returns to duty)
9149 + 156 =	9304		(End of day strength)
D+22 PERSONNEL = 9304 *0.019 =	177		(Day's casualties)
9304 - 177 =	9128		(Adjusted Strength)
177 * 0.72 * 0.64 =		81	(D+1 returns to duty)
9128 + 81 =	9209		(End of day strength)
D+23 PERSONNEL = 9209 *0.019 =	175		(Day's casualties)
9209 - 175 =	9034		(Adjusted Strength)
175 * 0.72 * 0.64 =		81	(D+2 returns to duty)
9034 + 81 =	9115		(End of day strength)
D+24 PERSONNEL = 9115 *0.019 =	173		(Day's casualties)
9115 - 173 =	8942		(Adjusted Strength)
173 * 0.72 * 0.64 =		80	(D+3 returns to duty)
8942 + 80 =	9021		(End of day strength)
D+25 PERSONNEL = 9021 *0.019 =	171		(Day's casualties)
9021 - 171 =	8850		(Adjusted Strength)
171 * 0.72 * 0.64 =		79	(D+4 returns to duty)
8850 + 79 =	8929		(Adjusted Strength)
338 * 0.72 * 0.35 * 0.14 / 7 =		2	(D-Day returns to duty)
8929 + 2 =	8931		(End of day strength)
D+26 PERSONNEL = 8929 *0.019 =	170		(Day's casualties)
8929 - 170 =	8759		(Adjusted Strength)
170 * 0.72 * 0.64 =		78	(D+5 returns to duty)
8759 + 78 =	8837		(Adjusted Strength)
338 * 0.72 * 0.35 * 0.14 / 7 =		2	(D-Day returns to duty)
177 * 0.72 * 0.35 * 0.14 / 7 =		1	(D+1 returns to duty)
8837 + 2 + 1 =	8840		(End of day strength)

21st Airmech Brigade Projected Equipment Losses

	LT TANK	IFV	MLRS	AH64	LHX	ACA	UH60	SPT VEH	Overall % REMAINING
Equip. @ start:	116	54	9	75	93	96	148	2962	100
D+20 Losses									
Loss	23	11	1	23	28	19	30	444	
10 hr repair	4	2	0	4	5	3	5	76	
Remain	97	45	8	56	70	80	123	2593	
% Remain	83 %	83 %	92 %	75 %	75 %	83 %	83 %	88 %	83
D+21 Losses									
Loss	24	7	1	14	17	16	25	389	
10 hr repair	4	1	0	2	3	3	4	66	
24 hr repair	5	2	0	6	7	5	8	94	
Remain	82	42	8	50	62	72	110	2365	
% Remain	70 %	77 %	86 %	67 %	67 %	75 %	75 %	80 %	75
D+22 Losses									
Loss	20	6	1	13	16	14	22	355	
10 hr repair	3	1	0	2	3	2	4	60	
24 hr repair	5	1	0	4	4	4	6	83	
Remain	70	38	7	44	53	64	98	2153	
% Remain	60 %	70 %	81 %	58 %	58 %	67 %	67 %	73 %	67
D+23 Losses									
Loss	17	6	1	11	13	13	20	323	
10 hr repair	3	1	0	2	2	2	3	55	
24 hr repair	4	1	0	3	4	4	6	75	
72 hr repair	4	2	0	6	7	5	8	76	
Remain	64	36	7	43	53	62	95	2036	
% Remain	55 %	67 %	78 %	58 %	58 %	64 %	64 %	69 %	64
D+24 Losses									
Loss	16	5	1	11	13	12	19	305	
10 hr repair	3	1	0	2	2	2	3	52	
24 hr repair	4	1	0	3	3	3	5	69	
72 hr repair	4	1	0	4	4	4	6	66	
Remain	58	34	7	41	50	59	91	1917	
% Remain	50 %	63 %	75 %	54 %	54 %	61 %	61 %	65 %	61
D+25 Losses									
Loss	15	5	1	10	13	12	18	288	
10 hr repair	2	1	0	2	2	2	3	49	
24 hr repair	3	1	0	3	3	3	5	65	
72 hr repair	3	1	0	3	4	4	6	60	
Remain	53	32	6	38	47	56	86	1804	
% Remain	46 %	60 %	72 %	51 %	51 %	58 %	58 %	61 %	57
D+26 Losses									
Loss	13	5	1	10	12	11	17	271	
10 hr repair	2	1	0	2	2	2	3	46	
24 hr repair	3	1	0	3	3	3	5	61	
72 hr repair	3	1	0	3	3	3	5	9	
Remain	48	30	6	36	44	53	82	1650	
% Remain	41 %	56 %	66 %	48 %	47 %	55 %	55 %	56 %	53

Note: This table calculated on a computer spreadsheet and numbers that appear to be slighty off are actually correct; the spreadsheet takes fractions into account during calculations while only whole numbers, or whole "systems" are displayed.

Projected Airmech Class V Requirements (101-10-1/2)

Description (4)	No. of Systems		STON/WPN/DAY 1st Day	STON/WPN/DAY Suc Day	Total STON/DAY 1st Day	Total STON/DAY Suc Day
MG 7.62MM	94	(1)	0.213	0.128	20.0	12.0
MG 5.56MM	72		0.003	0.002	0.2	0.1
MG CAL .50	42		0.042	0.025	1.8	1.1
GRN LCHR 40MM	113		0.013	0.007	1.5	0.8
DRAGON GM	36		0.073	0.109	2.6	3.9
AH64 2.75 RKT	98	(2)	0.495	0.297	48.5	29.1
MORTAR 4.2"	6		2.320	0.400	13.9	2.4
RIFLE 5.56MM	643		0.002	0.001	1.3	0.6
M60 105MM (3)	116		1.980	1.188	229.7	137.8
M3 CFV 25MM	6		0.184	0.143	1.1	0.9
M3 CFV TOW	6		0.296	0.346	1.8	2.1
ITV TOW	12		0.445	0.543	5.3	6.5
M2 IFV 25MM	54		0.142	0.111	7.7	6.0
M2 IFV TOW	54		0.198	0.247	10.7	13.3
AH64 30MM	98	(2)	0.375	0.292	36.8	28.6
AH64 HELLFIRE	98	(2)	1.069	1.166	104.8	114.3
MLRS	9		30.545	30.545	274.9	274.9
ADA 20MM	27		1.704	1.023	46.0	27.6
STINGER	60		0.048	0.031	2.9	1.9
				TOTAL	811.4	664.0
				(Note 5)	40.6	33.2
				GRAND TOTAL	851.9	697.1

Notes:
(1) Includes ground and vehicle mounted.
(2) LHX computed as 1/4 of an AH64 for its weapons capacity.
(3) Used to approximate Cadillac Gage Stingray Light Tank.
(4) Maneuver units and ADA weapons only--see next note.
(5) Five percent subjectively added for units and weapons not considered in this table.

Daily Airmech Logistics Requirements

	Misc. (2)		Class V (3)		Water (2)		Cl III Bulk (3)		Total STON/Day (1)	Begin Day: PERSTAT	% Equip (4)
D+20	81	+	852	+	297	+	1978	=	3209	9664	100
D+21	79	+	578	+	287	+	1640	=	2583	9326	83
D+22	78	+	521	+	286	+	1477	=	2362	9304	75
D+23	78	+	464	+	283	+	1317	=	2142	9209	67
D+24	77	+	447	+	280	+	1269	=	2072	9115	64
D+25	76	+	422	+	277	+	1197	=	1972	9021	61
D+26	75	+	397	+	274	+	1128	=	1875	8929	57

Notes:

(1) Supplies shown are based on beginning of day personnel and equipment status. It is assumed that enough supplies can be delivered to the theater and made available by corps to support the brigade.

(2) Miscellaneous supplies and water based on personnel status. Water = pers x 6.7 gal/man/day x 8.337 lbs/gal / 2000 lbs/ston. The answer has been subjectively increased by 10% for weight of bulk containers, which are assumed to have been constructed to be efficiently carried by the ACA, thus maximizing that capability.

(3) Classes III Bulk and V based on equipment status. Bulk fuel = % equip. O/H x 553,391 gal/day x 6.5 lbs/gal / 2000 lbs/ston. As with water, 10% added for ACA transportable bulk containers.

(4) Equipment on hand, less battle loss.

Airmech Brigade Cargo Capacity vs. Requirement

	No. A/C	@75% OR	Load Each (ST) (1)	Unit Cap. (ST)	Sorties (2)	Total Capacity (ST) (3)	*	Expec Cap. (ST) (4)	Total Cargo (ST)	Avail. Cap. (5)
D+20							*			
ACA	96	72	x 25 =	1800 x	3 =	5400	*			
UH60	148	111	x 3.1 =	344 x	3 =	1032	*			
					Total	6432	*	4566 -	3209 =	1358
							*	(1358 ST = 72 sorties)		
D+21							*			
ACA	80	60	x 25 =	1501 x	3 =	4504	*			
UH60	123	93	x 3.1 =	287 x	3 =	861	*			
					Total	5365	*	3808 -	2583 =	1226
D+22							*			
ACA	72	54	x 25 =	1344 x	3 =	4031	*			
UH60	110	83	x 3.1 =	257 x	3 =	771	*			
					Total	4802	*	3409 -	2362 =	1047
D+23							*			
ACA	64	48	x 25 =	1197 x	3 =	3592	*			
UH60	98	74	x 3.1 =	229 x	3 =	687	*			
					Total	4279	*	3037 -	2142 =	895
D+24							*			
ACA	62	46	x 25 =	1159 x	3 =	3477	*			
UH60	95	71	x 3.1 =	222 x	3 =	665	*			
					Total	4141	*	2940 -	2072 =	867
D+25							*			
ACA	59	44	x 25 =	1104 x	3 =	3312	*			
UH60	91	68	x 3.1 =	211 x	3 =	633	*			
					Total	3946	*	2801 -	1972 =	829
D+26							*			
ACA	56	42	x 25 =	1048 x	3 =	3145	*			
UH60	86	65	x 3.1 =	200 x	3 =	601	*			
					Total	3747	*	2660 -	1875 =	785

Notes:

(1) Standard day of 95 deg F and 4000' PA used. Even under these conditions the ACA is expected to move a 25 ton load.

(2) Three sorties allows a maximum combat radius of about 132 kilometers and a fairly sustainable flight time of 6 to 7 flight hours per aircraft, per day.

(3) This total capacity is the maximum that would be possible, assuming every flyable aircraft was filled to its limit.

(4) This expected capacity assumes that each ACA filled to only 75% of its weight limit due to space (cube) and other limitaitons, and that only 50% of the UH60's are used for cargo.

(5) Available capacity is what is left over--a safety margin. It is this extra capacity which appears to be the key to success for airmechanization. It allows extra supplies to be carried and stockpiled. As a result of this stockpiling more aircraft can be freed to provide flexibility in moving combat systems around the battlefield.

Advanced Cargo Aircraft Lift Capability

No. ACA's Available	Distance (Km)	Round Trip Time (1)	No. of Trips	No. of Refuels (2)	Loads Carried	Flight Time (3)
72	263	2.6	2	2	144	7.3
72	132	1.4	5	3	360	9.6
72	132	1.4	4	2	288	7.7
72	66	0.8	8	2	576	8.5
72	66	0.8	6 (4)	2	432	8.9

Notes:

(1) Includes 10 minutes for upload and download time. The assumption is that loads are containerized and ready for immediate and rapid hookup. Special containers for bulk fuel and water are assumed for maximum efficiency in moving these critical item. Calculated at average speed of 120 Knots (216 Km/hour).

(2) Thirty minutes allowed per refuel; assumes fuel available at upload or download site unless otherwise noted. End of mission refuels included; three hours assumed between refuels.

(3) Includes 30 minutes to reach the PZ and 30 more to return to unit after end of mission. (Flight times that approach 8 or 9 hours in a day should be considered surge efforts. This cannot normally be sustained, and will probably result in reduced OR before long.)

(4) This last calculation assumes refuel is off site, 30 minutes away.

DAILY FUEL ESTIMATE (GALLONS) (FM 101-10-1/2)

US UNIT BEING EVALUATED: AIRMECH BDE

CATEGORY		MOGAS	DIESEL	JP-4
AMPHIBIOUS EQUIPMENT	(AB)	0.0	0.0	
CONSTRUCTION	(CE)	2226.0	3072.0	
GENERATORS	(GN)	5948.4	2097.6	
HEATING EQUIPMENT	(HG)	5870.4	302.4	
MATERIAL HANDLING EQUIP	(MH)	72.0	2899.2	
STATIONARY EQUIP - MISC	(SG)	5558.4	1784.4	
STATIONARY EQUIP - VEH MTD	(SV)	432.0	0.0	
TRACKED VEH - IDLE	(TI)	0.0	1612.0	
TRACKED VEH - CROSS CNTRY	(CC)	0.0	28702.2	
TRACKED VEH - SEC RDS	(SR)	0.0	20016.0	
WHEELED VEHICLES	(WV)	1560.0	27060.0	
OTHER VEHICLES	(OV)	468.0	32.4	
AVIATION	(AV)			443677.2
		MOGAS	DIESEL	JP-4
TOTALS BY TYPE FUEL:		22,135	87,578	443,677

GRAND TOTAL, ALL FUELS: 553,391 GAL/DAY

BULK FUEL USAGE, 21ST AIRMECH BDE:

SUMMARY OF BULK FUEL USAGE (FM 101-10-1/2 OCT 87)
STANDARD PROFILE:

AB	CE	GN	HG	MH	SG	SV	TI	CC	SR	WV	OV	AV
12	12	12	12	12	12	12	3.8	5.6	5.1	100	12	4

AIRMECH BDE HHC (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	0	0	0	2.1	0	DS

CAV SQDN (SRC 01265L100; AIR RECON SQDN, AASLT DIV)

0	0	21	25.2	0	14.3	0	0	0	0	1.4	0	MO
0	16	2.3	0	2.6	0	0	0	0	0	13.3	0	DS

(LHX COMPUTED AT 91 GAL/HR) 4330.4 J4

AR REG HQ (SRC 87042J420; INF BDE HHC, MECH DIV, 5M1 5M2)

0	0	8.9	5.8	0	4	0	0	0	0	0	0	MO
0	0	0	0	0	5	0	9.2	72.7	76.6	1.6	0	DS

INF BN MECH M2; 1ST BN (SRC 07245J410; MECH DIV 5M1 5M2)

0	0	8.5	7.6	0	24.1	0	0	0	0	0.1	0	MO
0	0	1.1	0	0	12	0	147	1744.3	1130.9	14.2	0	DS

LT AR BN (SRC 17235J410; M-60 BN, MECH DIV 5M60 5M113)

0	0	3.9	23.6	0	16	0	0	0	0	0	0	MO
0	0	0.6	0	0	7	0	102.5	1315.6	967.5	11.4	0	DS

(STINGRAY TRACKED VEH ESTIMATES ARE COMPUTED AT 62% OF M60A3 VALUES)

LT AR BN (SRC 17235J410; M-60 BN, MECH DIV 5M60 5M113)

0	0	3.9	23.6	0	16	0	0	0	0	0	0	MO
0	0	0.6	0	0	7	0	102.5	1315.6	967.5	11.4	0	DS

(STINGRAY TRACKED VEH ESTIMATES ARE COMPUTED AT 62% OF M60A3 VALUES)

FA BTRY MLRS (SRC 06398J400; MECH DIV 5M1 5M2)

0	0	5.2	1.8	0	4.5	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	15.5	169.4	113	7.2	0	DS

FSB (1x2) (SRC 63005J430; MECH DIV 5M1 5M2)

0	0	43.4	25.4	0	59.2	0	0	0	0	0.1	0	MO
0	21	15.9	0	37.4	23	0	11	114.2	105.6	22.1	0	DS

ATK HELO REG HQ; 1ST REG (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	0	0	0	2.1	0	DS

ATTACK HELICOPTER BN AH-64; 1ST BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

ATTACK HELICOPTER BN AH-64; 2ND BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

ATTACK HELICOPTER BN AH-64; 3RD BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

FSB (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6		MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0		DS
												284	J4

ATK HELO REG HQ; 2ND REG (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0		MO
0	0	0	0	0	0	0	0	0	0	2.1	0		DS

ATTACK HELICOPTER BN AH-64; 1ST BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0		MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					3735.5	J4

ATTACK HELICOPTER BN AH-64; 2ND BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0		MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					3735.5	J4

FSB (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6		MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0		DS
												284	J4

AVIATION GROUP HQ(CBT SPT) (SRC 01202L000; HHC CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0		MO
0	0	0	0	0	0	0	0	0	0	2.1	0		DS

MED LIFT BN; 1ST BN (CBT AVN BN CH-47; SRC 01245L100; AASLT DIV)

0	0	29	48.4	0	39.9	12	0	0	0	1.7	10.4		MO
0	16	0	0	5.2	0	0	0	0	0	15.8	0		DS
							(CH-54B FUEL CONSUMPTION OF 716.4 GAL/HR USED FOR ACA)					23209	J4

MED LIFT BN; 2ND BN (CBT AVN BN CH-47; SRC 01245L100; AASLT DIV)

0	0	29	48.4	0	39.9	12	0	0	0	1.7	10.4		MO
0	16	0	0	5.2	0	0	0	0	0	15.8	0		DS
							(CH-54B FUEL CONSUMPTION OF 716.4 GAL/HR USED FOR ACA)					23209	J4

MED LIFT BN; 3RD BN (CBT AVN BN CH-47; SRC 01245L100; AASLT DIV)

0	0	29	48.4	0	39.9	12	0	0	0	1.7	10.4		MO
0	16	0	0	5.2	0	0	0	0	0	15.8	0		DS
							(CH-54B FUEL CONSUMPTION OF 716.4 GAL/HR USED FOR ACA)					23209	J4

CBT AVN BN UH-60 (SRC 01205L000; AASLT DIV)

0	0	16.5	25.2	0	13.3	0	0	0	0	1.6	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.8	0		DS
												6426	J4

CBT AVN BN UH-60 (SRC 01205L000; AASLT DIV)

0	0	16.5	25.2	0	13.3	0	0	0	0	1.6	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.8	0		DS
												6426	J4

COMMAND AVIATION BATTALION (SRC 01215L000; AASLT DIV)

0	0	20.5	25.2	0	15.8	0	0	0	0	0.7	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.1	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					4581	J4

FSB (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6		MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0		DS
												284	J4

BDE CBT SPT ATTACHMENTS (COMPOSITE OF SIG CO, ADA BN, AND C&J PLT, AASLT DIV; PLUS AN ENG CO's, MECH DIV 5M1 5 M2)

0	0.5	83.4	5.8	0	24.9	0	0	0	0	4.4	0	MO
0	17	0.6	0	0	5	0	36.5	393.6	325.6	19.4	0.1	DS

APPENDIX D: ANALYSIS OF 21ST AVIATION BRIGADE

BRIGADE ORGANIZATION

	PERS	CBT VEH/WPN	TAC VEH/TLR	CS/CSS VEH/TLR	5000 GAL TKR	2500 GAL TRK	TOTAL VEH/TLR
AVN BDE (CORPS) SRC 01400L000	3765		901	104			1005
ATTACHMENTS:							
ARMOR BDE HQ SRC 87042J420	90		27				27
M1 BN (x2) SRC 17235J410	1104	150	204			24	378
M2 BN SRC 07245J410	844	79	138				217
FA BN 155 SP SRC 06398J400	711	61	127			3	191
FSB (1x2) SRC 63005J430	426	1	178	13	10		202
AVN CSS (x3) HHD, FSB (SRC 63006J400) FWD SPT MED CO (SRC 08027L000) SUPPLY CO FSB (SRC 42004J400) MAINT CO (SRC 43067L000) AVN MAINT CO (SRC 01927L000) AVN MAINT CO (SRC 01927L000)	1575		651	123	30		804
SIG CO SRC 11208L000	179		51				51
C&J PLT SRC 34277L000	30		6				6
ADA BN SRC 44145L000	452		179				179
ENG CO SRC 05147J400	164	12	37	10			59
TOTALS:							
W/O ATTCHMNTS	3765		901	104			1005
ATTCHMNTS	5575	303	1598	146	40	27	2114
GRAND TOTAL	9340	303	2499	250	40	27	3119

Notes:
(1) Trailers under 2 1/2 tons are not counted because it is assumed they could be transported with their prime mover under the ACA. Trailers 2 1/2 tons and over are counted separately because it is assumed they will require their own sortie to move.
(2) CBT VEH/WPN (combat vehicles and weapons) include those listed on the TO&E under class VII K and M.
(3) TAC VEH/TLR (tactical vehicles and trailers) include those listed on the TO&E under class VII O.
(4) CS/CSS VEH/TLR (combat support and combat service support vehicles and trailers) include those listed on the TO&E under class VII A and W.

FIREPOWER RATIO (ST 100-9, JULY 88)

US UNIT BEING EVALUATED: 21st Aviation Brigade

	US BNs (J)			
M113 =	1.50 x		(NO. OF BN's)	
M2 =	2.00 x	1.00	"	(1 Bn 55 Mech)
LIGHT INF =	0.50 x		"	(My value, not in ST)
M1A1 =	3.15 x		"	
M1 =	3.00 x	2.00	"	(2 Bn 55 Mech)
M60A3 =	2.25 x		"	
ACR SQDN =	2.75 x		"	
CAV SQDN (J) =	1.50 x		"	
CAV SQDN (H) =	2.00 x		"	
AH-64 =	4.00 x	5.00	"	
AH-1 =	3.00 x		"	
FA =	2.00 x	1.00	"	(1 Bn 55 Mech)
MLRS(BTRY) =	2.00 x		"	

USSR UNIT BEING EVALUATED: 31 MRD + 49 MRD

	USSR BNs			
BTR =	1.00 x	12.00	(NO. OF BN's)	
BMP =	1.50 x	8.00	"	
AASLT/ABN =	0.50 x	3.00	"	(My value, not in ST;
T80(ITR) =	2.42 x		"	1 Bn CAA, 2 Front)
T80(TR) =	1.56 x		"	
T80(MRR) =	2.00 x		"	
T64(ITR) =	2.23 x		"	
T64(TR) =	1.44 x	6.00	"	
T64(MRR) =	1.86 x	6.00	"	
T55(ITR) =	1.00 x		"	
T55(TR) =	0.64 x		"	
T55(MRR) =	0.83 x		"	
AT =	1.00 x	3.00	"	(1 Bn Front)
AH (Havoc) =	3.50 x	2.00	"	(Increased: 2 to 3.5)
FA =	2.00 x	21.00	"	(1 Bn CAA; 6 Bn Front)
MRL(BTRY) =	1.00 x	9.00	"	(1 Bn CAA)

US CBT PWR = 28.00

USSR CBT PWR = 106.30

RATIO 1:3.80

LOGISTICS PLANNING: 21ST AVIATION BRIGADE

21st Aviation Brigade Projected Personnel Losses

```
D+19 PERSONNEL = 9470                                        (End of day strength)

D+20 PERSONNEL = 9470 *0.035 =  331                          (Day's casualties)
                 9470 -  331 =
                              9139                           (End of day strength)

D+21 PERSONNEL = 9139 *0.019 =  174                          (Day's casualties)
                 9139 -  174 = 8965                          (Adjusted Strength)
                  331 * 0.72 * 0.64 =  153                   (D-Day returns to duty)
                 8965 +  153 =
                              9118                           (End of day strength)

D+22 PERSONNEL = 9118 *0.019 =  173                          (Day's casualties)
                 9118 -  173 = 8944                          (Adjusted Strength)
                  173 * 0.72 * 0.64 =   80                   (D+1 returns to duty)
                 8944 +   80 =
                              9024                           (End of day strength)

D+23 PERSONNEL = 9024 *0.019 =  171                          (Day's casualties)
                 9024 -  171 = 8853                          (Adjusted Strength)
                  171 * 0.72 * 0.64 =   79                   (D+2 returns to duty)
                 8853 +   79 =
                              8932                           (End of day strength)

D+24 PERSONNEL = 8932 *0.019 =  170                          (Day's casualties)
                 8932 -  170 = 8762                          (Adjusted Strength)
                  170 * 0.72 * 0.64 =   78                   (D+3 returns to duty)
                 8762 +   78 =
                              8840                           (End of day strength)

D+25 PERSONNEL = 8840 *0.019 =  168                          (Day's casualties)
                 8840 -  168 = 8672                          (Adjusted Strength)
                  168 * 0.72 * 0.64 =   77                   (D+4 returns to duty)
                 8672 +   77 = 8750                          (Adjusted Strength)
                  331 * 0.72 * 0.35 *
                        0.14 /    7 =    2                   (D-Day returns to duty)
                 8750 +    2 =
                              8751                           (End of day strength)

D+26 PERSONNEL = 8750 *0.019 =  166                          (Day's casualties)
                 8750 -  166 = 8583                          (Adjusted Strength)
                  166 * 0.72 * 0.64 =   77                   (D+5 returns to duty)
                 8583 +   77 = 8660                          (Adjusted Strength)
                  331 * 0.72 * 0.35 *
                        0.14 /    7 =    2                   (D-Day returns to duty)
                  174 * 0.72 * 0.35 *
                        0.14 /    7 =    1                   (D+1 returns to duty)
                 8660 +    2 +    1 =
                                        8663                 (End of day strength)
```

21st Aviation Brigade Projected Equipment Losses

	HOW		SPT VEH		Overall % REMAINING
Equip. @ start:	24		2838		100
D+20 Losses					
Loss	2		426		
10 hr repair	0		72		
Remain	22		2485		
% Remain	92	%	88	%	83
D+21 Losses					
Loss	2		373		
10 hr repair	0		63		
24 hr repair	1		90		
Remain	21		2266		
% Remain	86	%	80	%	75
D+22 Losses					
Loss	2		340		
10 hr repair	0		58		
24 hr repair	0		79		
Remain	19		2063		
% Remain	81	%	73	%	67
D+23 Losses					
Loss	2		309		
10 hr repair	0		53		
24 hr repair	0		72		
72 hr repair	0		72		
Remain	19		1951		
% Remain	78	%	69	%	64
D+24 Losses					
Loss	2		293		
10 hr repair	0		50		
24 hr repair	0		66		
72 hr repair	0		63		
Remain	18		1837		
% Remain	75	%	65	%	61
D+25 Losses					
Loss	2		276		
10 hr repair	0		47		
24 hr repair	0		62		
72 hr repair	0		58		
Remain	17		1728		
% Remain	72	%	61	%	57
D+26 Losses					
Loss	2		259		
10 hr repair	0		44		
24 hr repair	0		59		
72 hr repair	0		53		
Remain	16		1624		
% Remain	69	%	57	%	53

Notes:
(1) Only those that have changed from the airmech brigade are listed.
(2) This table calculated on a computer spreadsheet and numbers that appear to be slighty off are actually correct; the spreadsheet takes fractions into account during calculations while only s, whole numbers or whole "systems" are displayed.

Projected Aviation Class V Requirements (101-10-1/2)

Description (2)	No. of Systems	STON/WPN/DAY 1st Day	STON/WPN/DAY Suc Day	Total STON/DAY 1st Day	Total STON/DAY Suc Day
M1 105MM	116	0.936	0.576	108.6	66.8
M109 155MM HO	24	9.770	9.974	234.5	239.4
			TOTAL	503.3	407.8
			(Note 1)	25.2	20.4
			GRAND TOTAL	528.5	428.2

Note:
(1) Five percent subjectively added for units and weapons not considered in this table.
(2) Only entries that have changed from the airmech brigade are listed.

Daily Aviation Logistics Requirements

	Misc. (2)		Class V (3)		Water (2)		Cl III Bulk (3)		Total STON/Day (1)	Begin Day: PERSTAT	% Equip (4)
D+20	80	+	529	+	291	+	1347	=	2247	9470	100
D+21	77	+	355	+	281	+	1118	=	1831	9139	83
D+22	77	+	321	+	280	+	1011	=	1689	9118	75
D+23	76	+	287	+	277	+	903	=	1543	9024	67
D+24	75	+	274	+	274	+	862	=	1486	8932	64
D+25	74	+	261	+	272	+	822	=	1429	8840	61
D+26	74	+	244	+	269	+	768	=	1355	8750	57

Notes:
(1) Supplies shown are based on beginning of day personnel and equipment status. It is assumed that enough supplies can be delivered to the theater and made available by corps to support the brigade.
(2) Miscellaneous supplies and water based on personnel status. Water = pers x 6.7 gal/man/day x 8.337 lbs/gal / 2000 lbs/ston. Weight of water has been subjectively increased by 10% for weight of bulk containers.
(3) Classes III Bulk and V based on equipment status. Bulk fuel = % equip. O/H x 553,391 gal/day x 6.5 lbs/gal / 2000 lbs/ston. As with water, weight of bulk fuel increased by 10%.
(4) Equipment on hand, less battle loss.

DAILY FUEL ESTIMATE (GALLONS) (FM 101-10-1/2)

US UNIT BEING EVALUATED: 21ST AVIATION BDE

CATEGORY		MOGAS	DIESEL	JP-4
AMPHIBIOUS EQUIPMENT	(AB)	0.0	0.0	
CONSTRUCTION	(CE)	6.0	2496.0	
GENERATORS	(GN)	4352.4	1808.4	
HEATING EQUIPMENT	(HG)	4540.8	0.0	
MATERIAL HANDLING EQUIP	(MH)	72.0	2719.2	
STATIONARY EQUIP - MISC	(SG)	4630.8	1668.0	
STATIONARY EQUIP - VEH MTD	(SV)	144.0	0.0	
TRACKED VEH - IDLE	(TI)	0.0	6185.3	
TRACKED VEH - CROSS CNTRY	(CC)	0.0	58739.0	
TRACKED VEH - SEC RDS	(SR)	0.0	42346.8	
WHEELED VEHICLES	(WV)	1010.0	24140.0	
OTHER VEHICLES	(OV)	218.4	126.0	
AVIATION	(AV)			221699.6
		MOGAS	DIESEL	JP-4
TOTALS BY TYPE FUEL:		14,974	140,229	221,700

GRAND TOTAL, ALL FUELS: **376,903 GAL/DAY**

BULK FUEL USAGE, 21ST AVIATION BDE:

SUMMARY OF BULK FUEL USAGE (FM 101-10-1/2 OCT 87):
STANDARD PROFILE:

AB	CE	GN	HG	MH	SG	SV	TI	CC	SR	WV	OV	AV
12	12	12	12	12	12	12	3.8	5.6	5.1	100	12	4

AVN BDE HQ (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	0	0	0	2.1	0	DS

AR BDE HQ (SRC 87042J420; MECH DIV 5M1 5M2)

0	0	8.9	5.8	0	4	0	0	0	0	0	0	MO
0	0	0	0	0	5	0	9.2	72.7	76.6	1.6	0	DS

INF BN MECH M2; 1ST BN (SRC 07245J410; MECH DIV 5M1 5M2)

0	0	8.5	7.6	0	24.1	0	0	0	0	0.1	0	MO
0	0	1.1	0	0	12	0	147	1744.3	1130.9	14.2	0	DS

TANK BN M1 (SRC 17235J420; MECH DIV 5M1 5M2)

0	0	3.9	23.6	0	16	0	0	0	0	0	0	MO
0	0	0.6	0	0	7	0	675.8	3865.9	3059.8	14.4	0	DS

TANK BN M1 (SRC 17235J420; MECH DIV 5M1 5M2)

0	0	3.9	23.6	0	16	0	0	0	0	0	0	MO
0	0	0.6	0	0	7	0	675.8	3865.9	3059.8	14.4	0	DS

FA BN 155 SP (SRC 06365J420; MECH DIV 5M1 5M2)

0	0	18.1	13	0	21.3	0	0	0	0	0	0	MO
0	0	5.3	0	0	20	0	72.4	432.5	545	17.1	10.4	DS

FSB (1x2) (SRC 63005J430; MECH DIV 5M1 5M2)

0	0	43.4	25.4	0	59.2	0	0	0	0	0.1	0	MO
0	21	15.9	0	37.4	23	0	11	114.2	105.6	22.1	0	DS

ATK HELO REG HQ; 1ST REG (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	0	0	0	2.1	0	DS

ATTACK HELICOPTER BN AH-64; 1ST BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

ATTACK HELICOPTER BN AH-64; 2ND BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

ATTACK HELICOPTER BN AH-64; 3RD BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0	MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0	DS

(LHX COMPUTED AT 91 GAL/HR) 3735.5 J4

AVN CSS (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6	MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0	DS

284 J4

ATK HELO REG HQ; 2ND REG (SRC 01202L000; HHC, CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0	MO
0	0	0	0	0	0	0	0	0	0	2.1	0	DS

ATTACK HELICOPTER BN AH-64; 1ST BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0		MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					3735.5	J4

ATTACK HELICOPTER BN AH-64; 2ND BN (SRC 01385J420; MECH DIV 5M1 5 M2)

0	0	13.3	14.8	0	9	0	0	0	0	0	0		MO
0	8	0	0	2.6	0	0	0	0	0	9.5	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					3735.5	J4

AVN CSS (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6		MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0		DS
												284	J4

AVIATION GROUP HQ(CBT SPT) (SRC 01202L000; HHC CBT AVN BDE, AASLT DIV)

0	0	7.3	0	0	1	0	0	0	0	0	0		MO
0	0	0	0	0	0	0	0	0	0	2.1	0		DS

MED LIFT BN (CBT AVN BN CH-47; SRC 01245L200; AASLT DIV)

0	0	29	48.4	0	39.9	12	0	0	0	1.7	10.4		MO
0	16	0	0	5.2	0	0	0	0	0	15.8	0		DS
							(48 CH-47D's, 4 UH-60A's)					18462	J4

COMMAND AVIATION BATTALION (SRC 01215L000; AASLT DIV)

0	0	20.5	25.2	0	15.8	0	0	0	0	0.7	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.1	0		DS
							(LHX COMPUTED AT 91 GAL/HR)					4581	J4

CBT AVN BN UH-60 (SRC 01205L000; AASLT DIV)

0	0	16.5	25.2	0	13.3	0	0	0	0	1.6	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.8	0		DS
												6426	J4

CBT AVN BN UH-60 (SRC 01205L000; AASLT DIV)

0	0	16.5	25.2	0	13.3	0	0	0	0	1.6	0		MO
0	16	0	0	2.6	0	0	0	0	0	9.8	0		DS
												6426	J4

AVN CSS (COMPOSITE OF AVN MX, AND FWD SPT MED AND MX CO's, AASLT DIV, AND SUPPORT CO, MECH DIV FSB)

0	0	27.1	25.2	2	29.7	0	0	0	0	0.2	2.6		MO
0	22	42.2	0	54.4	20	0	0	0	0	12.6	0		DS
												284	J4

BDE CBT SPT ATTACHMENTS (COMPOSITE OF SIG CO, ADA BN, AND C&J PLT, AASLT DIV; PLUS AN ENG CO's, MECH DIV 5M1 5 M2)

0	0.5	83.4	5.8	0	24.9	0	0	0	0	4.4	0		MO
0	17	0.6	0	0	5	0	36.5	393.6	325.6	19.4	0.1		DS

BIBLIOGRAPHY

MANUALS

Department of the Army. Army Aviation Modernization Plan. Washington, D.C.: U.S. Government Printing Office, May 1988.

Field Manual 1-100 Revised Final Draft. Army Aviation In Combat Operations. Washington, D.C.: U.S. Government Printing Office, August 1988.

Field Manual 1-111 Coordinating Draft. Aviation Brigades. Washington, D.C.: U.S. Government Printing Office, October 1988.

Field Manual 100-10. Combat Service Support. Washington, D.C.: U.S. Government Printing Office, 18 February 1988.

Field Manual 100-10-1/1. Staff Officers' Field Manual Organizational, Technical, and Logistical Data (Volume 1). Washington, D.C.: U.S. Government Printing Office, October 1987.

Field Manual 100-10-1/2. Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2). Washington, D.C.: U.S. Government Printing Office, October 1987.

Field Manual 100-15. Corps Operations (Coordinating Draft). Washington, D.C.: U.S. Government Printing Office, January 1988.

Field Manual 100-2-1. The Soviet Army: Operations and Tactics. Washington, D.C.: U.S. Government Printing Office, 16 July 1984.

Field Manual 100-2-2. The Soviet Army: Specialized Warfare and Rear Area Support. Washington, D.C.: U.S. Government Printing Office, 16 July 1984.

Field Manual 100-2-3. The Soviet Army: Troops, Organization, and Equipment. Washington, D.C.: U.S. Government Printing Office, 16 July 1984.

Field Manual 100-5. Operations. Washington, D.C.: U.S. Government Printing Office, 5 May 1986.

Field Manual 101-20. U.S. Army Aviation Planning Manual. Washington, D.C.: U.S. Government Printing Office, 6 January 1984.

Field Manual 101-5-1. Operational Terms and Symbols. Washington, D.C.: U.S. Government Printing Office, October 1985.

Field Manual 63-3J. Combat Service Support Operations-Corps. Washington, D.C.: U.S. Government Printing Office, 12 August 1985.

Staff Battle Exercise 321. Middle East Exercise: Planning Reference Book. Washington, D.C.: U.S. Government Printing Office, 1987-88.

Staff Battle Exercise 321. Middle East Exercise: Student Advance Book. Washington, D.C.: U.S. Government Printing Office, 1987-88.

Student Text 100-9. The Command Estimate. Washington, D.C.: U.S. Government Printing Office, July 1988.

Student Text 101-6. G4 Battle Book. Washington, D.C.: U.S. Government Printing Office, 1 June 1988.

BOOKS

Clausewitz, Carl von. On War. Edited and translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1976.

Fuller, J.F.C. Armored Warfare. Harrisburg, PA: The Telegraph Press, 1943.

Hart, B.H. Liddell. Strategy. New York: Praeger Publishers, 1967.

Jomini, Baron de. The Art of War. Translated by Capt. G.H. Mendell and Lieut. W.P. Craighill. Westport, CT: Greenwood Press, 1977.

Posen, Barry R. The Sources of Military Doctrine. Ithaca, NY: Cornell University Press, 1984.

Simpkin, Richard E. Antitank: An Airmechanized Response to Armored Threats in the 90's. Oxford, England: Brassey's Publishers, LTD., 1982.

_____. Race To The Swift: Thoughts on Twenty-First Century Warfare. London: Brassey's Defence Publishers, 1985.

_____. Tank Warfare. New York: Crane Russak and Co, Inc., 1979.

Starr, Stephen Z. "Climax In Alabama". School of Advanced Military Studies Foundations of Military History: Course 1 Readings. Ft. Leavenworth, KS: School of Advanced Military Studies, 1988.

Tukhachevskiy, Mikhail. "New Problems in Warfare". U.S. Army War College Art of War Colloquium: Soviet Operational Concepts by Various Soviet Authors. Carlisle Barracks, PA: U.S. Army War College, November 1983.

ARTICLES

Adams, John A. "Balancing Strategic Mobility and Tactical Mobility." Military Review, (August 1988), 9-23.

Crawford, CPT Darrell E. "Airborne Aviation: Training as We Expect to Fight." Army Aviation, (May 31, 1986), 44-46.

Dick, Charles J. "Soviet Operational Concepts: Part I." Military Review, (September 1985), 30-45.

_____. "Soviet Operational Concepts: Part II." Military Review, (October 1985), 4-19.

Foss, MG John William. "The Combat Aviation Brigade in the Light Division." U.S. Army Aviation Digest, (August 1986), 2-11.

Glantz, David M. "The Nature of Soviet Operational Art." Parameters, (Spring 1985), 2-12.

Grist, Brigadier R.D., OBE. "Airmobile Forces in Central Europe." RUSI Journal, (Spring 1988), 41-48.

Hall, COL George M. "The Cycle of Military Technology." Military Review, (August 1988), 42-48.

Harvey, MAJ Gary L. and MAJ David R. King. "Evolving the Army of the 21st Century." Military Review, (August 1988), 2-8.

Howze, Gen. Hamilton H. "The Howze Board, Part III: Winding Up a Great Show." Army, (April 1974), 18-24.

Jones, William P. "Army's Heavy-Lift Gap: New Helicopter Needed." Army, (January 1986), 40-44.

Kinnard, LTG Harry W.O. "A Victory in Ia Drang: The Triumph of a Concept." Army, (September 1967), 71-91.

_____. "Air Mobility Revisited, Part I." U.S. Army Aviation Digest, (June 1980), 1-5, 26-27.

_____. "Air Mobility Revisited, Part II." U.S. Army Aviation Digest, (July 1980), 8-14.

Lind, William S. "Some Doctrinal Questions for the United States Army," Military Review, (March 1977), 54-65.

_____. "Military Doctrine, Force Structure, and the Defense Decision Making Process." Air University Review, (May/June 1979), 21-27.

Luttwak, Edward N. "The American Style of Warfare and the Military Balance." Survival, (January/February 1979), 57-60.

Ostivich, BG Rudy. "Part I: Dramatic Changes in Emerging Aviation Doctrine." U.S. Army Aviation Digest, (November 1986), 3-9.

Parker, Ellis D. "The Challenge of Winning." U.S. Army Aviation Digest, (September 1985), 2-9.

Rose, COL John P., LTC John E. Peters, and LTC Michael A. Pandolfo. "What Will the Army Look Like in 2010?" Army, (July 1988), 18-24.

Saint, LTG Crosbie E. and COL Walter H. Yates Jr. "Attack Helicopter Operations in the AirLand Battle: Close Operations." Military Review, (June 1988), 2-15.

_____. "Attack Helicopter Operations in the AirLand Battle: Deep Operations." Military Review, (July 1988), 2-9.

Sandrart, General Hans Henning von. "Considerations of the Battle in Depth." Military Review, (October 1987), 8-15.

Senger und Etterlin, General Doctor F.M. von. "The Air-mobile Divisions: Operational Reserves for NATO." RUSI, (1 March 1987), 23-30.

_____. "New Operational Dimensions." RUSI, (2 June 1983), 11-15.

Simpkin, Richard E. "Flying Tanks?--a tactical-technical analysis of the 'main battle air vehicle'." Military Technology, (August 1984), 62-80.

_____. "Airmechanized Forces for the '90s." Armor, (July-August 1981), 54-57.

Snow, LTC Joel J. "AirLand Battle Doctrine Tenets in Opposition." Military Review, (October 1987), 63-67.

Starry, General Donn A. "A Tactical Evolution--FM 100-5." Military Review, (August 1988), 2-11.

_____. "Extending the Battlefield," Military Review, (March 1981), 31-50.

Stubbs, Kevin D. "Beyond the Army of Excellence." Military Review, (August 1988), 24-41.

MANUSCRIPTS

Combined Arms Center Development Activity. "Armored Family of Vehicles." Ft. Leavenworth, KS: Unpublished CACDA White Paper, 9 September 1985.

Glantz, COL David M. "The Soviet Conduct of War." Ft. Leavenworth, KS: Soviet Army Studies Office Staff Study, 30 March 1987.

Hood, Carlton L. "Determining the Optimum Aviation Organization for the Operational Level of War." Ft. Leavenworth, KS: Unpublished MMAS Thesis, 1984.

Hussain, Farooq, Ian Kemp, and Philip McCarty. "The Future of the Military Helicopter." London, England: Whitehall Papers, Royal United Services Institute for Defence Studies, 1986.

Kindsvatter, MAJ Peter S. "An Appreciation for Moving the Heavy Corps--The First Step in Learning the Art of Operational Maneuver." Ft. Leavenworth, KS: Unpublished SAMS Monograph, 16 May 1986.

Mowery, LTC James L. "The Division Aviation Brigade: Operational or Tactical?" Ft. Leavenworth, KS: Unpublished AOSF Monograph, 4 May 1987.

Packett, Virgil L., II. "Airmechanization: The Direction and Dynamics of Army Aviation from a Combined Arms Perspective." Ft. Leavenworth, KS: Unpublished MMAS Thesis, 1985.

Romjue, John L. "From Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982." TRADOC Historical Monograph Series, ed. Henry O. Malone, Jr. Ft. Monroe, VA: Training and Doctrine Command, June 1984.

Sinnreich, COL Richard Hart et al. "Employment of Combat Aviation." Ft. Leavenworth, KS: Unpublished SAMS White Paper, April 1986.

Tanksley, MAJ David M. "What is the Soviet OMG and What are its Implications for the U.S. Army's AirLand Battle Doctrine?" Ft. Leavenworth, KS: Unpublished MMAS Thesis, 1984.

Wass de Czege, COL Huba. "Understanding and Developing Combat Power." Ft. Leavenworth, KS: Unpublished Monograph, 10 February 1984.

Webb, MAJ George S. "Prescription for the Counterstroke: The Airmechanized Division at the Operational Level of War." Ft. Leavenworth, KS: Unpublished SAMS Monograph, 15 May 1986.

NEWSPAPERS

"Brig Richard Simpkin: Tank officer turned military thinker," (Obituary). London Times, 4 November 1986, P. 22g.

"Gen Ferdinand von Senger," (Obituary). London Times, 13 January 1987 P. 14g.

INTERVIEWS

Davoren, John, and Chris Southard. Aviation Systems Analysts, Combat Division, Material Integration Directorate, CACDA, Ft. Leavenworth, KS. A series of interviews conducted by the author, 1988.

Whiteside, MAJ Doug, and Ben Stuttler. Armor Systems Analysts, CACDA, Ft. Leavenworth, KS. A series of interviews conducted by the author, 1988.