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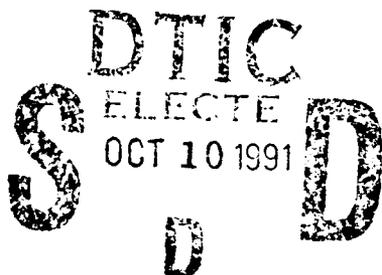


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LOGISTIC SUPPORT OF AN  
ARMORED DIVISION IN A DEEP ATTACK

A thesis presented to the Faculty of the U.S. Army  
Command and General Staff College in partial  
fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE



by

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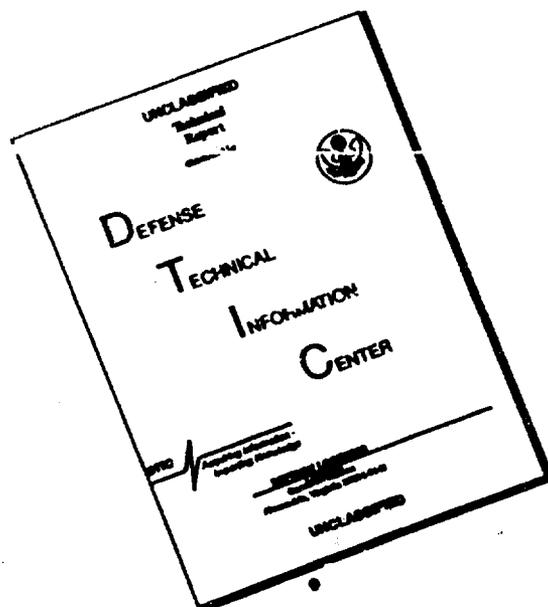
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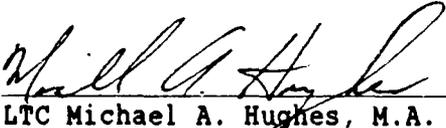
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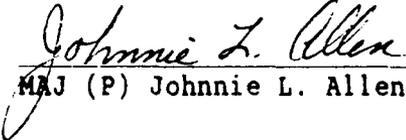
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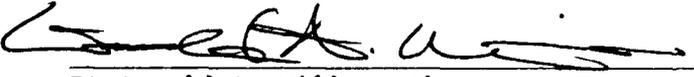
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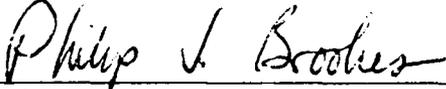
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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

## ABSTRACT

LOGISTIC SUPPORT OF AN ARMORED DIVISION IN A DEEP ATTACK by MAJ Anthony H. Kral, USA, 109 pages.

This study examines the capability of an armored division to be sustained, relying only on its organic assets, in a five day deep operation that requires the division to maneuver seventy-five kilometers forward of the FLOT. This investigation includes a study of sustainment concepts and problems experienced by the 4th and 6th Armored Divisions, assigned to 3d U.S. Army, during the pursuit through France in August and September 1944. This examination establishes the sustainment requirements for the deep attack operation and analyzes the ability of the modern armored division to satisfy these requirements. The study analyzes four alternatives to supplement the division's organic capability to support the deep attack operation.

This investigation reveals that an armored division can support a division-size deep attack, using only its organic support assets, for fifty-four hours before exhausting its fuel supply, followed by shortages in both water and dry cargo. To complete the five day operation, an armored division must be augmented by a combination of the following: 1) attachment of logistic support systems from corps, 2) sustainment over air lines of communication, 3) sustainment over ground lines of communication, or 4) sustainment through the application of scavenger logistics.

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## CHAPTER I

### INTRODUCTION

#### THE RESEARCH QUESTION

AirLand Battle is the US Army's current warfighting doctrine. AirLand Battle doctrine recognizes three areas of operations; close, rear, and deep. FM 100-5, Operations, states the following about close, rear and deep operations:

At the operational level, close operations comprise the direct efforts of corps and divisions to win current engagements. Rear operations are the activities rearward of elements in contact to assure freedom of maneuver and continuity of operations, sustainment and command and control. Deep operations consist of activities directed against enemy forces not in contact, to influence the conditions of future operations.<sup>1</sup>

For the purpose of this study, deep operations involve the use of maneuver forces in operations beyond the forward line of own troops (FLOT).

To the logistician, sustainment of all three operations is challenging, yet probably most difficult is sustainment of deep maneuver. By their very nature, deep maneuver forces function beyond the forward line of own troops (FLOT) and in areas that have, at best, tenuous lines of communication (LOC). Since modern heavy forces consume vast quantities of supplies, sustainment of these forces in a cross FLOT operation presents the greatest challenge to a logistician.

The purpose of this thesis is to determine if the heavy division has sufficient organic sustainment capability to support deep operations. Specifically, the research will determine whether a heavy division can be sustained, using its organic assets, in the conduct of a five-day deep attack operation that requires the division to maneuver seventy-five kilometers forward of the FLOT.

## BACKGROUND

Understanding the role of deep operations in AirLand Battle doctrine is fundamental in addressing the significance of the research question. Field Manual (FM) 100-5, Operations, suggests that ". . . successful deep operations will create the conditions for future victory." The manual further explains that successful deep operations ". . . isolate the battlefield, paralyze the enemy's support, and command and control. . . ." Another important aspect of deep operations is the ability to disrupt and delay second echelon formations before they can be committed in the close battle. Ultimately, deep operations create the conditions under which the close battle is fought and significantly influence the outcome of the close fight.<sup>2</sup>

The corps commander has several assets available for the conduct of deep operations; these include artillery fires, attack helicopters, electronic warfare, tactical air support, deception, and ground maneuver forces.<sup>3</sup> Arguably, the most difficult to employ, yet

most effective, asset is the ground maneuver force. This idea is supported by the following statement in FM 100-15, Corps Operations:

While the use of heavy maneuver in the deep operation is both complex and risky, it can, if executed properly, be devastating to the enemy. To place a heavy maneuver force in the enemy's rear area where it can destroy such high-value targets as artillery, reserves, follow-on forces, command and control centers, and logistic facilities can be the stroke that tips the close operations in favor of the corps.<sup>4</sup>

To destroy these high-value targets effectively, Lieutenant Colonel John S. Doerful, in his article "The Operational Art of AirLand Battle," suggests that a deep maneuver force will be required to attack from fifty to seventy-five kilometers forward of the FLOT.<sup>5</sup> A possible mission for a deep operation maneuver force would be to attack along an axis to obtain an objective, to disrupt and destroy high-value targets during the advance, attack and seize the objective, and hold the objective until link-up with friendly forces.<sup>6</sup> The across FLOT and deep penetration aspects of these operations make sustainment of heavy maneuver elements both complicated and risky. The difficulty in logistically supporting a ground maneuver deep operation force is recognized in FM 100-15, Corps Operations, when it states:

The employment of heavy maneuver elements in the corps deep operation will almost certainly be very complex and involve significant risk. Such an operation will probably require at least a brigade and probably a division-sized force to attack well beyond the corps' ability to provide responsive . . . combat service support. For these reasons, maneuver forces used in deep operations will probably require sufficient resources and augmentation to operate for up to several days, totally independent of corps level support. . . .<sup>7</sup>

The above statement notwithstanding, current doctrine in FM 100-10, Combat Service Support, recognizes two methods of sustaining deep operation maneuver forces; self-sustainment and sustainment over a line of communication or LOC. Both methods have distinct advantages and disadvantages.<sup>8</sup>

Self-sustainment is accomplished when the deep operation force carries its basic load of supplies and forages or scavenges for any additional supply requirements. While this method is the simplest to support, the uncertainty of obtaining supplies through scavenging makes this option very risky. Another technique of self-sustainment is attachment of support elements to the maneuver force. This provides more assurance of support, but may create a long logistic tail that slows down the maneuver force.<sup>9</sup>

Sustainment over a LOC can be accomplished by using either a ground LOC, an air LOC, or both. The use of a ground LOC allows for more complete support through its ability to carry large tonnages of supplies and equipment. Compared to air LOC's, ground LOC's are much less susceptible to the effects of weather. Still, the ground LOC must be either temporarily or continuously secured. While continuous security allows for the constant flow of supplies, it is very costly in terms of combat and combat support forces needed to secure the LOC. Although less manpower intensive, temporary security also requires combat, and combat support assets to open, close, and reopen supply routes.<sup>10</sup>

Sustainment over an air LOC allows for rapid support to the deep operations force, with minimum regard to terrain; however, the air LOC must be either temporarily or continuously secured and is greatly affected by adverse weather conditions. Air LOC sustainment can be accomplished through airland, airdrop, slingload, or a combination. Airlanding supplies allows for higher tonnages but requires a secure airfield. Airdrop does not require a secure airfield, but the amount of supplies needed to sustain a heavy maneuver force would require extensive airdrop and ground support equipment, based on use of the container delivery system. Use of Army helicopters to slingload supplies allows the greatest flexibility, but helicopters carry smaller loads than Air Force fixed-wing aircraft.<sup>11</sup>

Collectively, FM 100-15, Corps Operations, and FM 100-10, Combat Service Support, describe the role of maneuver forces in deep operations and explain how to sustain those forces. Yet, it is unclear whether a heavy maneuver division can actually be sustained in a prolonged deep operation. Are there sufficient organic combat service support assets available to support deep operations? Fuel and ammunition requirements, alone, will be tremendous. Requirements for food, water, medical supplies, and repair parts also must be considered.

Once sustainment requirements have been determined, the supplies must be moved. Will the division have enough tactical lift to sustain the deep attack? If not, how much more tactical lift is required and where will it come from? Given the sustainment and tactical lift requirements, are the doctrinal methods of

self-sustainment and sustainment over LOCs reasonable and realistic for support of a divisional deep attack operation? Finally, to what extent will sustainment requirements limit the duration and distance of a heavy division conducting a deep attack operation? By answering these subordinate questions, I can answer the general research question.

#### **ASSUMPTIONS**

This study assumes that deep operations will remain a fundamental part of AirLand Battle doctrine. The key role of deep operations in our current doctrine makes this a realistic assumption. Next, the study assumes that deep attacks will be conducted using division-size maneuver forces. While FM 100-15, Corps Operations, indicates that this is complicated and risky, it also points out the superb advantages of using heavy maneuver forces in deep operations.<sup>12</sup> Lastly, the study assumes that logistic support assets will be limited. Clearly, if support assets were unlimited, there would be no need for this study.

#### **DEFINITIONS OF TERMS**

For purposes of this study, the following terms are defined:

(a) Deep Operations: Operations that require a heavy division to operate across the FLOT.

(b) Class I: Food required to sustain the individual soldier. For deep operations, this will be in the form of Meal, Ready to Eat (MRE).

(c) Water: Potable drinking water needed to sustain the individual soldier.

(d) Class III: Petroleum, Oil and Lubricants needed to sustain the operation of vehicles, generators and other power equipment. This includes bulk fuels such as diesel and packaged products such as oil and grease.

(e) Class V: Ammunition required for all weapons and weapons systems to include engineer mines and explosives.

(f) Class VIII: Medical supplies and equipment

(g) Class IX: Repair parts and components needed to maintain equipment.

#### LIMITATIONS

AirLand Battle doctrine was promulgated in 1982 and recent examples of deep operations by US forces are limited. However, this limitation is overcome through the examination of logistical support of US armored divisions in the European Theater of Operations during World War II. The study will examine logistics support of the 4th and 6th armored divisions during the breakout from Normandy and pursuit of German forces in the Brittany Peninsula and eastward across France in 1944. The employment of armored divisions during these campaigns closely resembles our concept of the deep attack operation.

## **DELIMITATIONS**

The thesis will narrow its focus to a heavy division conducting a deep attack operation. For purposes of this study, the deep attack operation is defined as a mission to attack along an axis to obtain an objective, to disrupt and destroy high value targets during the advance, seize an objective and hold the objective until link-up with friendly forces. This attack is conducted in a mid-intensity combat environment and in a temperate climatic zone. The deep attack operation will last five days and require the armored division to maneuver seventy-five kilometers forward of the FLOT. The study will only examine sustainment requirements for food, water, fuel, ammunition, medical supplies and repair parts.

## **SIGNIFICANCE OF THE STUDY**

Deep operations are a critical element of AirLand Battle doctrine and figure significantly in the outcome of a close battle or engagement. Since our doctrine identifies the potential use of a heavy division in deep operations, it is important to determine if a heavy division can be sustained in such an operation. Research suggests that a potential deep operation would be a divisional deep attack that lasts five days and requires the division to maneuver seventy-five kilometers forward of the FLOT.<sup>13</sup> If this study should reveal that a heavy division cannot be sustained in the studied operation, then AirLand Battle doctrine should be reexamined to limit its definition of deep attack forces or limit the scope of deep operations.

## **THESIS HYPOTHESIS**

It is my hypothesis that an armored division can be sustained for no more than five days, relying only on its organic assets, in a deep operation that requires the division to maneuver seventy-five kilometers forward of the FLOT. I will test this hypothesis by determining the support and tactical lift requirements needed to sustain an armored division in a deep attack. Next these requirements will be compared with the division's support capabilities. Given the requirements versus capabilities, I will find out if the deep attack operation can be sustained.

## **THESIS OVERVIEW**

Chapter two of this thesis examines the logistical support of the 4th and 6th Armored Divisions in World War II. The methods of supporting these armored divisions during the breakout from Normandy and pursuit of German forces through the Brittany Peninsula and eastward across France, in 1944, are examined.

Chapter three examines the present armored division's organization, its support concepts and support capabilities. This chapter serves to contrast modern logistic support with that from the previous chapter.

Chapter four determines the daily sustainment requirements for an armored division conducting a deep attack. This information is analyzed by applying sustainment requirements against sustainment capabilities. This analysis determines if any shortfalls exist in the division's capability to sustain the deep attack.

Chapter five provides alternative methods of overcoming any shortfalls identified in the previous chapter. This chapter examines options available to sustain the armored division in a deep attack.

Chapter six evaluates the outcome of my analysis and determines the validity of the thesis hypothesis. Conclusions concerning the study's outcome are reviewed and recommendations for further research are suggested.

## ENDNOTES

<sup>1</sup>U.S. Army, FM 100-5, Operations (Washington: Department of the Army, 1986), 19.

<sup>2</sup>Ibid., 19-20.

<sup>3</sup>U.S. Army, FM 100-15, Corps Operations (Washington: Department of the Army, 1989), p. 3-2.

<sup>4</sup>Ibid., p. 3-5.

<sup>5</sup>John S. Doerful, "The Operational Art of the AirLand Battle," Military Review 62 (May 1982): 6-7.

<sup>6</sup>Bloomer D. Sullivan, "Logistical Support for the Airland Battle," Military Review 64 (February 1984): 5-6.

<sup>7</sup>FM 100-15 (1989), p. 3-5.

<sup>8</sup>U.S. Army, FM 100-10, Combat Service Support (Washington: Department of the Army, 1988), p. 2-12.

<sup>9</sup>Ibid.

<sup>10</sup>Ibid., p. 2-13.

<sup>11</sup>Ibid.

<sup>12</sup>FM 100-15 (1989), p. 3-5.

<sup>13</sup>Doerful, 6-7.

## CHAPTER II

### LOGISTIC SUPPORT OF THE 4TH AND 6TH ARMORED DIVISIONS DURING THE BREAKOUT FROM NORMANDY AND PURSUIT THROUGH THE BRITTANY PENINSULA AND ACROSS FRANCE

#### INTRODUCTION

The purpose of this chapter is to examine the logistic support of the 4th and 6th Armored Divisions during the breakout from Normandy and the pursuit through the Brittany Peninsula and across France. These operations were studied because they closely resemble our current deep attack doctrine using division-size maneuver forces. By studying logistic support during the breakout and pursuit, I will identify specific logistic factors that were critical to the operation and had significant impact on the armored divisions. Experience gained during these operations offers valuable lessons for logistic support of modern deep operations.

This chapter explores the organization of the World War II armored division and its doctrinal logistic support concepts. Next, the chapter examines the breakout and pursuit operations of the 4th and 6th Armored Divisions. The chapter examines the impact of these operations on logistics and the circumstances that required improvisation well beyond normal logistic doctrine. The chapter focuses on logistical support of food, water, fuel, ammunition, medical

supplies and repair parts supply. Transportation and protection of support forces also will be examined.

#### THE WORLD WAR II ARMORED DIVISION

The armored division of World War II was organized primarily to perform missions that required great mobility and firepower. The 1944 version of FM 17-100, Armored Command Field Manual, The Armored Division, states that ". . . it [armored division] is capable of engaging in most forms of combat but its primary role is in offensive operations against hostile rear areas."<sup>1</sup> The manual goes on to say that the chief characteristics of the armored division are high mobility, protected firepower and shock power. It is especially suited for surprise appearance on the battlefield; the rapid concentration of armored firepower; exploitation; deep penetrations into hostile rear areas; and destruction of hostile supply and ammunition facilities. While the armored division can perform several missions, its most profitable role is in exploiting success and pursuing a defeated enemy.<sup>2</sup>

There were two basic types of armored divisions employed in World War II. Of the U.S. Army's sixteen armored divisions, two (the 2d and 3d Armored Divisions) were organized under the 1942 table of organization and equipment and called "heavy" armored divisions. The remaining fourteen armored divisions, organized under a 1943 table of organization and equipment, were known as "light" armored divisions.<sup>3</sup>

The "heavy" armored division had a total strength of 14,007 personnel. It consisted of a division headquarters and headquarters company; two combat command headquarters and headquarters companies, also known as CCA and CCB; two armored regiments, each organized with two medium tank battalions and one light tank battalion; an armored infantry regiment of three infantry battalions; a division artillery headquarters with three armored field artillery battalions, a division service company; a signal company; reconnaissance battalion; an engineer battalion; a division trains headquarters and headquarters company; a maintenance battalion; a medical battalion and a supply battalion. An anti-aircraft battalion, a tank destroyer battalion and two quartermaster truck companies were habitually attached to the armored division from corps or army.<sup>4</sup>

In combat, the "heavy" armored divisions operated using three combat commands. The third combat command was designated the reserve or CCR and the headquarters of the armored infantry regiment functioned as the headquarters of the CCR. The CCR, although improvised, functioned similarly to the CCA and CCB.<sup>5</sup>

The combat commands were the fighting elements of the "heavy" armored divisions. They usually consisted of two tank battalions, one armored infantry battalion and elements of the tank destroyer, anti-aircraft and engineer battalions. Elements of the medical, maintenance and supply battalions were attached or placed in support. Normally two combat commands were committed and the third was the reserve.<sup>6</sup>

The "light" armored division had a total strength of 11,029 personnel. The division consisted of a division headquarters and headquarters company; two combat command headquarters and headquarters companies, also known as CCA and CCB; a reserve command headquarters, known as the CCR; three tank battalions, each with three medium tank companies and one light tank company; three armored infantry battalions; a division artillery headquarters with three armored field artillery battalions; a signal company; a division band; a reconnaissance battalion; an engineer battalion; a division trains headquarters and headquarters company, a military police platoon, a maintenance battalion and a medical battalion. As with the "heavy" armored division, an attached anti-aircraft battalion, tank destroyer battalion and two quartermaster truck companies were habitually associated with the "light" armored division.<sup>7</sup>

The "light" armored divisions' operated with three combat commands, with the reserve command used as a fighting command or as a true reserve into which the CCA and CCB would rotate their troops. The CCR increased in size when armored groups were attached to the division.<sup>8</sup>

Each combat command of the "light" armored divisions usually operated with two task forces; one consisted of a tank battalion (less one medium tank company), a rifle company of armored infantry, a tank destroyer platoon and an engineer platoon. The other task force usually consisted of an armored infantry battalion (less one rifle company), one medium tank company, a tank destroyer platoon and an

engineer platoon. The armored artillery was attached to, or in direct support of, the combat command. The major difference between the task forces was that the first was heavy in tanks and light in infantry, the second was stronger in infantry and lighter in tanks.<sup>9</sup>

Figures 1 and 2, on pages 17 and 18, provide wiring diagrams of the "heavy" and "light" armored divisions.

From a sustainment perspective, a significant difference between the two divisions was the lack of the supply battalion in the new "light" armored division's table of organization and equipment. The "heavy" armored division's supply battalion consisted of a headquarters and headquarters company, two truck companies and a medical detachment. A major contribution to the "heavy" armored division's sustainment was the ninety-six, 2 1/2 ton cargo trucks and ninety-six, 1 ton trailers provided by the supply battalion's two truck companies. These trucks carried 336 tons of ammunition or other critical supplies for the division.<sup>10</sup>

The existence of the supply battalion in the "heavy" armored division reflected the doctrine that the armored division might operate far from the mass of forces and well beyond normal support of the field army. The battalion was organic to the "heavy" armored division on the grounds that army supply establishments would lag behind the fast moving armored divisions. The supply battalion could support the "heavy" armored division up to 250 miles from the nearest army supply point.<sup>11</sup> When the need for the supply battalion was raised during the "light" armored division's reorganization, General George S. Patton Jr., made the following comment from North Africa:

Div HQ (271)

-HQ Co (111)

-Service Co (160)

ARMOR (4,848)	HQ & HQ Co CCA (61)	INF (2,389)	HQ & HQ CO CCB (61)
2 Armored Regts (2,424 ea)		Armd Inf Regt (2,389)	Recon Bn-- (872)
--HQ & HQ Co (172)		-HQ & HQ Co (138)	Sig Co---- (256)
--Recon Co (202)		-Svc Co (151)	Engr Bn--- (1,174)
--Service Co (191)		-3 Armd Inf Bn (700 ea)	AA Bn----- (atched)
--Maint Co (188)			TD Bn----- (atched)
--2 Med Tank Bn (599 ea)			Trk Co(2)- (atched)
--Lt Tank Bn (473)			
Total Strength: 14,007			
Medium Tanks: 232			
Light Tanks: 158			
SP Hows 105mm 54			
Carriers Half-track: 733			
Vehicles, All types: 3,630			
	ARTILLERY (2,127)		DIV TRAINS (1,948)
	-HQ & HQ Btry (15)		-HQ & HQ Co (159)
	-3 Fld Arty Bn (704)		-Supply Bn (414)
			-Med Bn (502)
			-Maint Bn (873)

Figure 1. The World War II "Heavy" Armored Division.<sup>1,2</sup>

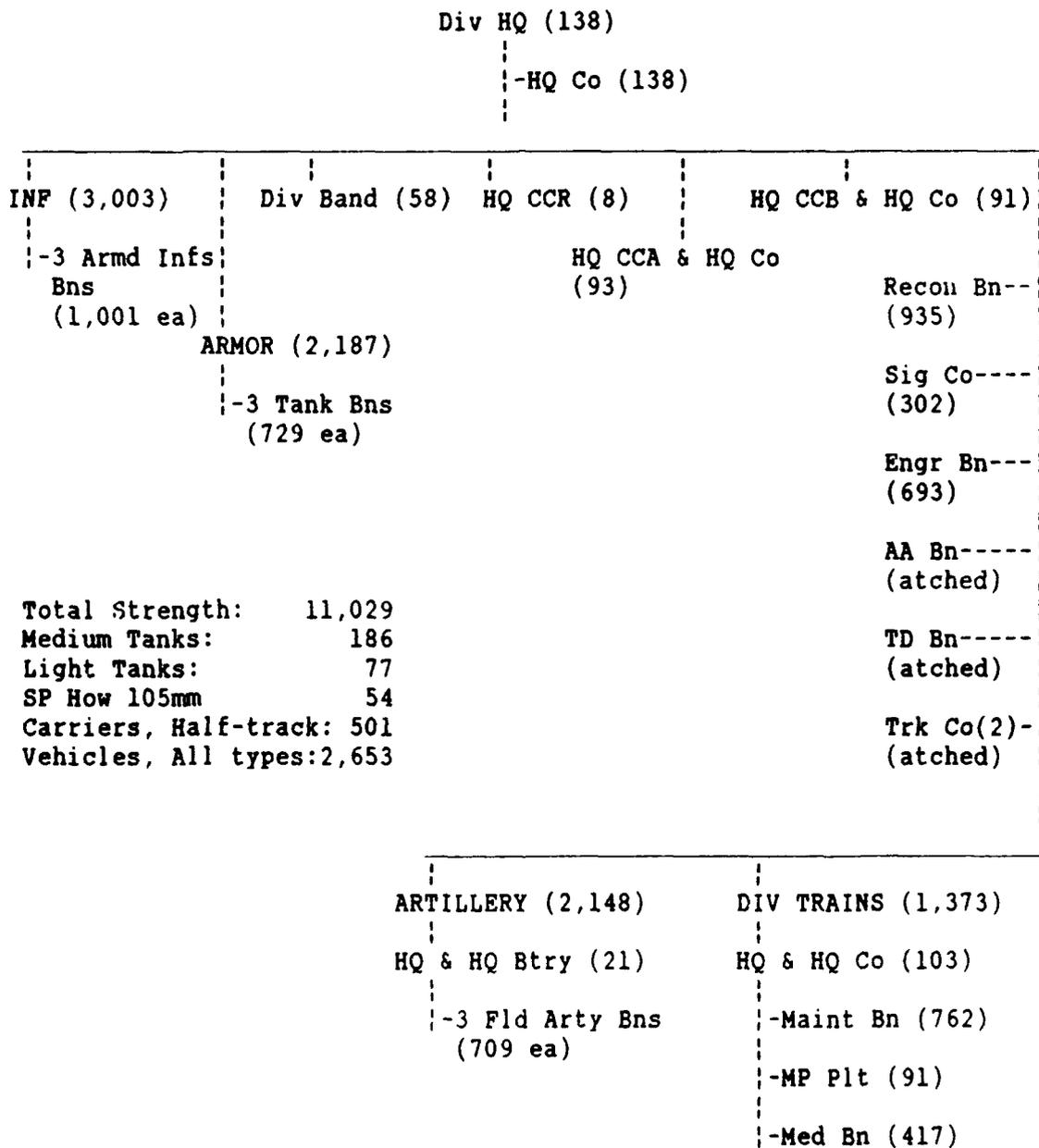


Figure 2., The World War II "Light" Armored Division.<sup>13</sup>

Unquestionably, our original concept that we needed 250 miles of rolling supplies is erroneous. In the fighting we are now having, and did have, you were damn lucky if you go forward three miles a day. When a breakthrough occurs you can always steal enough trucks from corps or army to give you the additional rolling reserve.<sup>14</sup>

This idea appealed to those who wanted to do away with the supply battalion and Patton's statement that the division was oversupplied sealed the fate of the supply battalion in the "light" armored division.<sup>15</sup>

In August and September 1944, General Patton would discover that it was not always possible to "steal" trucks from corps or army. Based on the "light" armored division's experience in Europe, a 7 November 1945 conference on the organization and equipment of the armored division recommended the addition of the supply battalion to the "light" armored division.

#### ARMORED DIVISION LOGISTIC SUPPORT CONCEPTS

Except for the supply battalion, logistics support for the "heavy" and "light" armored divisions was very similar. Each division organized its logistical support elements into trains; both at the unit and division level.

The unit trains were divided into "A" and "B" trains. The "A" trains were analogous to today's combat trains and followed close behind the combat elements with essential supplies and services. The "B" trains, similar to today's field trains, were located in the combat command's service center or in the division service area. Non-combat essential supplies and unit mess sections made up the "B" trains.<sup>16</sup>

The division trains, somewhat analogous to today's division support command, had a headquarters and headquarters company, a maintenance battalion and a medical battalion. The "heavy" armored division also had the supply battalion. Elements of the military police and signal companies were also in the division trains. Unit "B" trains also might be attached to the division trains.<sup>17</sup>

By doctrine, the field army supported the corps and division. The corps and division were organized as combat elements only. For food, fuel and ammunition, "division and corps were not in the channel of supply, except in emergencies."<sup>18</sup> The army pushed materiel to forward supply points that were accessible to the trucks of the division.<sup>19</sup> According to FM 17-100, Armored Command Field Manual, The Armored Division, divisional units had to pool all their available transportation from the unit trains to pick-up supplies from the army's railheads, truckheads or supply points. In this capacity, the unit trains functioned under unit, combat command or divisional control.<sup>20</sup>

To ensure adequate supply, it was necessary for the army railhead or supply point be within thirty-five miles of the unit trains bivouac site. This allowed the unit trains' trucks to operate at night and make around trip before daylight.<sup>21</sup> In a protracted operation, where it was impossible or impractical to establish railheads or supply points within reach of the division, unit distribution occurred directly from army supply points using army trucks. Here, type loads contained predetermined amounts of Class I, III, and V supplies for each unit of the division.<sup>22</sup>

For Class I supplies, the daily ration request or division strength report was submitted forty-eight hours before issue. Unit mess sections carried a maximum of one and two-thirds and a minimum of two-thirds day of supply of rations.<sup>23</sup> Water points were located within hauling distance from unit bivouac areas. The division engineer emplaced water purification units after consulting with the division G4. Unit transportation picked up water from the purification sites.<sup>24</sup>

Class III, fuel and lubricant, supply points were established by the army on recommendation from the division G4. Since the armored division lacked organic fuel and lubricant vehicles, these supply points were within thirty-five miles of the most distant unit "B" trains.<sup>25</sup> Typically, fuel was supplied in five gallon cans which were filled and picked-up at the field army's supply point. For protracted operations, where a field army supply point would be too far away, the armored division required attachment of a quartermaster company, gasoline supply, to operate a division Class III supply point.<sup>26</sup> The quartermaster gasoline supply company consisted of fuel tank trucks that set up a divisional supply point and decanted fuel into 5 gallon cans.

The field army controlled Class V, ammunition, supplies. Ammunition was allocated to corps, and corps reallocated supplies to the division.<sup>27</sup> As a rule, the field army would provide at least one unit of fire within thirty-five miles of the most distant unit "B" trains. Preferably, ammunition was kept on wheels as a rolling reserve

and operated as a mobile army ammunition supply point. The ASP could move forward quickly to allow unit trains to refill without exceeding the seventy mile turn-around.<sup>28</sup>

For major end items, the army or communications zone normally delivered replacement combat vehicles, fully supplied and equipped for battle, to the division maintenance battalion. These vehicles also would be supplied with the necessary replacement crews.<sup>29</sup> Repair parts were supplied by army supply points and transported by the division's maintenance battalion. Additionally, units carried sufficient repair parts to conduct organizational maintenance for at least twenty-four hours of combat service. FM 17-50, Armored Force Field Manual, Logistics, states "spare parts necessary for the maintenance of all types of vehicles within the organization will be maintained."<sup>30</sup>

The armored division had sufficient transportation only for its personnel and equipment. Fuel in vehicle tanks and on organic trucks was sufficient for approximately 100 to 125 miles of operation under favorable conditions.<sup>31</sup> Experience had shown that no matter how many miles the division moved, it would consume the equivalent of 100-125 miles of fuel and lubricants each day.<sup>32</sup> Ammunition vehicles carried only one-half of cannon ammunition, thirty-seven millimeter or larger, and one-fourth refill of small arms ammunition.<sup>33</sup> In the "heavy" division the supply battalion's ninety-six trucks and trailers allowed the division to maintain a small rolling reserve of ammunition, totaling 336 tons.<sup>34</sup> A small amount of spare parts and medical

supplies were carried in the maintenance and medical battalion trains.<sup>35</sup> To provide sufficient fuel and ammunition support, the armored division would have to be reinforced with additional quartermaster truck companies from the field army. Two additional quartermaster truck companies were required to haul the 1,900 tons of ammunition required daily.<sup>36</sup> For extended operations, two and one-half quartermaster truck companies were required to transport fuel.<sup>37</sup> Doctrinally, air transport of supplies was an emergency, rather than routine measure. If required, supplies were delivered by transport airplanes to airfields in possession of the division or by parachute or glider to marked drop zones protected by the division.<sup>38</sup>

The foregoing has shown that the World War II armored division was far from self-sufficient. Doctrinally, the division would require up to four and one-half truck companies and a quartermaster gasoline supply company to sustain operations when it was more than thirty-five miles from an army supply point. Later, this study will examine what happened when the armored divisions were over four hundred miles from the nearest supply facility.

### **THIRD U.S. ARMY'S BREAKOUT AND PURSUIT ACROSS FRANCE**

On 25 July 1944, following a saturation bombing campaign, U.S. forces ruptured German defenses near St. Lo, France. On 1 August 1944, the 3d U.S. Army, under command of Lieutenant General George S. Patton, Jr., moved through the gap and pressed the attack to capture Granville and Avranches.<sup>39</sup> Elements of 3d Army then advanced in four

directions at once; south to the Loire River, north to a junction with the British near Falaise, east toward the Seine River and west into the Brittany Peninsula.<sup>40</sup>

The 4th and 6th Armored Divisions, part of VIII Corps, participated in the Brittany campaign and then turned east to participate in the dash across France. The 3d Army's primary mission was to clear Brittany, and by 3 August 1944, the 4th and 6th Armored Divisions had thrust eighty miles into the heart of the peninsula. The Brittany campaign was given first priority, as the capture of the ports of Brest, St. Malo and Lorient were critical to support any serious moves eastward toward the Seine River.<sup>41</sup>

Due to early successes, on 3 August 1944, 3d Army was directed to employ only the minimum forces necessary to clear the Brittany Peninsula and shift its priority of effort eastward to the Mayenne River. By 6 August, 3d Army was directed to continue eastward, cross the Sarth River and prepare to occupy the Chartres Plain and close the Paris-Orleans gap between the Seine and Loire Rivers. By 7 August 1944, the 4th and 6th Armored Divisions had raced over three hundred miles across Brittany and were laying siege to the heavily fortified ports of Brest and Lorient.<sup>42</sup> Interestingly, the decision to shift the main effort to the east was made before capturing the Brittany ports.

On 8 August 1944, elements of 3d Army had captured Le Mans and five days later had reached Argentan. By 19 August 1944, Patton had established a bridgehead on the Seine, thirty miles below Paris.

During this time, the battle for the Brittany ports continued amid stubborn German defense. Earlier, on 14 August 1944, the 4th Armored Division was released from the Brittany campaign for use in the eastward drive across France.<sup>43</sup>

By this time, operations had gone beyond the original objectives of Operation Overlord. With the capture of bridgeheads across the Seine, the original plans called for a halt in the U.S. advance. However, the German forces were very weak and Patton felt no need to stick to the original plan. On 19 August 1944, the Supreme Allied Command made the decision to continue the pursuit at a maximum rate.<sup>44</sup> Yet, the logistically important Brittany ports were still not captured. Also, the nature of the advance, bypassing many enemy units, made supplying the force extremely difficult.<sup>45</sup> Clearly, logistic considerations were subordinated by the tactical advantage of the pursuit.<sup>46</sup>

By the end of August 1944, the 6th Armored Division had joined the drive eastward. 3d Army had crossed the Marne River and was preparing to cross the Meuse. By 23 August 1944, the logistic strain of the pursuit was starting to take its toll. At the end of August 1944, supply shipments were decreasing and the advance was noticeably affected by the lack of supplies, particularly fuel. On almost empty fuel tanks, elements of the 3d Army pressed eastward to establish two bridgeheads over the Moselle River; one near Metz and the other near Nancy. By 12 September, however, the sustained drive had come to a halt at the Moselle River.<sup>47</sup>

During the Brittany campaign, from 29 July to 14 August 1944, the 6th Armored Division covered over three hundred miles. In this drive, some vehicles, such as liaison, message center and supply trucks, had travelled over two thousand miles.<sup>48</sup> The 4th Armored Division attacked into the Brittany Peninsula and then moved east to spearhead 3d Army's race across France. During the period of 26 July to 31 August 1944, the division had moved more than seven hundred miles. In this action, the armored vehicles travelled over 1,500 miles, while supply vehicles had travelled over four thousand miles.<sup>49</sup>

#### LOGISTIC IMPACTS ON THE PURSUIT

A German general once remarked that the "blitzkrieg is paradise for the tactician, but hell for the quartermaster."<sup>50</sup> Ernie Pyle, the wartime newspaper columnist, described the August and early September operations as ". . . a quartermaster's purgatory."<sup>51</sup> In fact, difficulties in providing support occurred almost simultaneously with the breakout at St. Lo; as logisticians found it was almost impossible to sustain the U.S. forces in a rapid pursuit.

To provide adequate support, logistic planners had counted on their ability to establish a good depot system and lines of communication. Yet, once the pursuit started, logisticians had to abandon all their previous plans. The sudden manner in which the lines of communication were extended made the use a depot system impractical. The daily burden of delivering supplies over three to four hundred miles did not allow for the establishment of a depot based supply system.<sup>52</sup>

The events of early August clearly established that conventional methods of supply had little application in supporting a rapid pursuit. As such, many expedients were used.<sup>53</sup> Through extraordinary effort, the bare essentials were supplied. However, by the last week in August 1944, with U.S. forces at the Meuse River and the tip of the Brittany Peninsula, supply deliveries fell off dramatically.<sup>54</sup> Trucks, overloaded by fifty to one hundred percent, were forced to carry loads from Normandy depots to front-line troops and could not keep up with the pace of the advance. By mid-September 1944, the pursuit could no longer be sustained.<sup>55</sup>

The 6th Armored Division, in the Brittany Campaign, identified that support became difficult due to the rapid increase in distance between the combat elements and the 3d Army supply points. On 31 July 1944, 3d Army supply installations were within the doctrinal thirty-five mile distance from the division's service parks. By 8 August 1944, the division was near Brest and the nearest 3d Army supply point was over two hundred miles away.<sup>56</sup>

Due to great distance, it was necessary for the division to establish its own intermediate supply points. The "light" armored division, lacking a supply battalion, was not even remotely organized to do this and had to man these points "out-of-hide." The attachment of two quartermaster truck companies and a quartermaster gasoline supply company made it possible to resupply the division. Without these attachments, the rapid movement of the division would not have been possible. Even with the division supply points, trucks still made four hundred mile round trips to 3d Army supply points.<sup>57</sup>

The expedient measures used by the 6th Armored Division were also put to use by other armored divisions. These innovations were the establishment of division supply points when 3d Army installations were not in close support; the use of all available personnel to man these supply points regardless of normal duty assignment; and the requirement for at least two quartermaster truck companies and a quartermaster gasoline supply company to support extended operations.<sup>58</sup> While these ideas were reported by the 6th Armored Division as expedient measures, a closer look at doctrine would have revealed that these requirements were anticipated for protracted operations.

The 4th Armored Division operated almost independently and maintained its own supply lines, even though its combat commands were ninety miles apart and 3d Army supply installations were over one hundred miles to the rear.<sup>59</sup> To sustain its operations, the 4th Armored Division had three quartermaster truck companies and a quartermaster gasoline company attached.<sup>60</sup>

#### CLASS III SUPPLY

While logistical difficulties in all classes of supply occurred during the pursuit, gasoline was the first and most important shortage experienced by 3d Army and its armored divisions. At the outset of operations, 3d Army had planned to keep over 1,500,000 gallons of gasoline in reserve, expecting to use about 350,000 gallons per day. With the pace of the pursuit, these reserves were depleted by 7 August

1944 and operations were supplied on a daily basis. After depleting its reserves, 3d Army received an average of 382,000 gallons of gasoline daily, from 6 to 19 August 1944. This was just enough fuel to sustain the army's fast paced operations in the east and its extended supply lines in the Brittany Peninsula.<sup>61</sup>

On 23 August 1944, gasoline shipments to 3d Army were short of daily requirements and a critical situation began to develop. By 30 August 1944, this situation was extremely critical.<sup>62</sup> Table 1 provides a breakdown of 3d Army fuel requests and deliveries from 23 August to 3 September 1944.

TABLE 1  
3D U.S. ARMY FUEL REQUESTS AND RECEIPTS  
23 AUGUST - 3 SEPTEMBER 1944<sup>63</sup>

<u>DATE</u>	<u>REQUEST (GAL)</u>	<u>RECEIPT (GAL)</u>
23 AUG	260,000	216,280
24 AUG	250,000	285,555
25 AUG	250,000	197,450
26 AUG	450,000	315,530
27 AUG	375,000	402,635
28 AUG	450,000	352,490
29 AUG	375,000	143,480
30 AUG	400,000	31,975
31 AUG	775,000	294,280
1 SEP	1,050,000	110,600
2 SEP	750,000	25,390
3 SEP	<u>590,000</u>	<u>49,930</u>
TOTAL	5,975,000	2,425,615

From 28 August to 3 September 1944, Patton's army was virtually immobilized. General Eisenhower had granted logistical priority to the British and American armies in the north, leaving 3d Army with only one-quarter of its daily gasoline allocation.<sup>64</sup> As a result, 3d Army began strict fuel rationing. To alleviate part of the problem, 3d Army used over 500,000 gallons of captured gasoline. Yet, gasoline was so short, that it was difficult to find even enough fuel to make daily ration and ammunition deliveries. More plentiful gasoline deliveries began on 5 September 1944, but the fast paced pursuit was not resumed.<sup>65</sup>

Interestingly, the shortage of gasoline resulted less from a lack of supply than a lack of transport to move the supplies. In fact, gasoline stocks at Normandy went up from twenty-five million gallons on 1 August 1944 to twenty-seven million gallons on 19 August 1944. While this study will discuss transportation in more detail, it is important to note that inadequate transportation, rather than lack of gasoline was the chief limiting factor in support during the pursuit.<sup>66</sup>

In the Brittany campaign, the 6th Armored Division found that it used two to three times the gasoline than it expected, based on the amount of ground covered.<sup>67</sup> The division G4 writes:

The logistical standard for an armored division of 1000 gallons of gasoline for a move of one mile is not correct. In actual practice, it takes almost twice that amount where there are engagements which temporarily halt the columns and cause idling, movement off the roads and maneuvering.<sup>68</sup>

The resupply of gasoline for 6th Armored Division was handled by the unit trains until supply lines became too long. It was then necessary to establish a divisional Class III supply point in the division trains using the two attached quartermaster truck companies and the quartermaster gasoline supply company. Despite the use of these units, the 6th Armored Division needed 3d Army to haul 70,000, 80,000 and 40,000 gallons of gasoline on 4, 7 and 9 August 1944 respectively.<sup>69</sup> In addition, the 6th Armored Division made use of expedients such as using captured German fuel and "finding" 200,000 gallons of gasoline that came off a Landing Ship, Tank or LST earmarked for VIII Corps. The division also kept representatives at the army fuel supply point to ensure they got their fair share.<sup>70</sup>

#### **CLASS V SUPPLY**

Unlike gasoline, ammunition supply problems were the result of actual shortages of ammunition and the lack of transportation. As a result, ammunition was rationed throughout the operation.<sup>71</sup>

Due to the amount of labor involved in handling ammunition, 3d Army and its armored divisions attempted to keep their Class V stocks uploaded. To do this, all trucks carried double their rated capacity and made round trips of 160 miles per day. Since most trucks were carrying fuel, it was difficult to find vehicles to haul ammunition. More than a few times, the maintenance battalion would provide its organic trucks to haul ammunition.<sup>72</sup> Remember that the primary purpose of the supply battalion's truck companies was to haul 336 tons

of ammunition. Unfortunately, none of Patton's armored divisions were authorized a supply battalion.

#### CLASS I, WATER, VIII AND IX SUPPLY

While the supply of gasoline was the most critical issue in the pursuit, shortages developed in other classes of supply. Class I deliveries suffered from the same difficulties as the forward movement of other supplies; a lack of transportation. For the most part, U.S. troops in the pursuit subsisted on C, K and 10-in-1 rations. These rations were requisitioned based on the strength of the command, with a normal delivery time of three days. As the supply lines became extended, the time lag lengthened to as much as ten to seventeen days. By the second week in August 1944, ration deliveries to 3d Army fell short by over one million individual meals.<sup>73</sup>

Shortages of rations were partially relieved by using captured food. On 17 August 1944, over 150 tons of frozen meat and vegetables were captured at St. Malo on the Brittany Peninsula.<sup>74</sup> Over two million pounds of frozen beef and 500,000 pounds of canned beef were captured near Orleans on 9 September 1944. These rations were inspected and issued to front line troops. Also, five thousand bags of flour were captured and used by 3d Army's field bakeries.<sup>75</sup>

The 6th Armored Division G4's report on the Brittany campaign shows that Class I supply presented few problems. This was because each vehicle carried three days emergency rations and the division trains carried two additional days of rations on its attached trucks.

As such, it was unnecessary to obtain daily resupply.<sup>76</sup> In other words, the division used attached transportation to make themselves nearly self-sufficient in Class I supplies.

Historical records indicate that water supply posed few problems. At the outset of the Brittany campaign, the 6th Armored Division operated two water points.<sup>77</sup> This proved inadequate for the rapid advance of the division. To solve this problem, CCA, CCB, CCR and the division trains, each received an attached water purification unit from the division engineer. This allowed water points to be close to supported elements. However, since only two trucks were allotted to the engineers for transporting the water point equipment, it was necessary for two of the commands to use organic trucks to haul the purification units. This deprived them of trucks which otherwise could have carried ammunition or gasoline.<sup>78</sup>

Medical supplies constituted a small fraction of the supplies required during the pursuit. For the most part, air shipments from Britain alleviated shortages.<sup>79</sup> Whole blood was the most critical medical supply item. In one case, the shortage of blood required an airdrop to the 6th Armored Division.<sup>80</sup> Another expedient used by the divisions was resupply via ambulances returning to the division following patient evacuation.<sup>81</sup>

Repair parts supply had little impact on supply operations when compared to the requirements for rations, fuel and ammunition. As a result, few repair part supplies were shipped to units. In fact, repair parts received by 3d Army in early September 1944 averaged less

than 300 tons per day; less than one-tenth of the total allocation.<sup>82</sup> Limited repair part supplies for quartermaster, signal, engineer, medical, chemical and ordnance equipment were carried in the division trains by the branch supply offices.<sup>83</sup>

#### TRANSPORTATION

Transportation, or more accurately, the lack of it, became the "Achilles' heal" of the logistic effort in August and early September 1944. The sudden success of U.S. forces brought heavy demands on all available transport. In actuality, the amount of transport shrank with every advance of the combat elements. This occurred because of the longer turn-around required between the supply points and the front line units.<sup>84</sup>

Originally, logistic planners at Supreme Allied Command headquarters had hoped to make extensive use of the rail network in France. Unfortunately, damage to the rail system forced planners to decide that the only way operations could be sustained was by motor transport. From this necessity the "Red Ball Express" was born; taking truck assets from newly arrived divisions and borrowing truck companies from the British.<sup>85</sup> The communications zone organized the famous "Red Ball Express" as a nonstop conveyor belt of trucks connecting the Normandy depots with the field armies. At its peak, the Red Ball Express used six thousand trucks that ran twenty-four hours a day. On a single day, the Red Ball delivered 12,342 tons of supplies. To furnish the Red Ball with trucks, three newly arrived infantry

divisions were stripped of their trucks and left immobilized at Normandy.<sup>86</sup> While the "Red Ball Express" was the lifeline of U.S. forces, the trucks were habitually overloaded by fifty to one hundred percent above rated capacity and preventive maintenance was almost nonexistent. In addition, the trucks of the "Red Ball Express", themselves, consumed over 300,000 gallons of fuel daily.

To augment the communications zone's effort, 3d Army gathered every available truck by immobilizing engineer dump truck companies, heavy and light pontoon companies and artillery and anti-aircraft units. These trucks were pooled and used to make long trips back to the Normandy depots. These actions supplemented the deliveries made by the Red Ball Express.<sup>87</sup>

The armored divisions relied on the attached quartermaster truck companies to move their supplies. The 6th Armored Division G4 said the following about the two attached quartermaster truck companies:

The attachment of the two quartermaster truck companies . . . was undoubtedly a major contributing factor to the success of supply in this [Brittany] campaign. Without them, so rapid a move could not have been made. Through the use of these companies, the division was able to carry a rolling reserve of almost all classes of supply and to resupply the combat units as their needs arose.<sup>88</sup>

Even with the attached truck companies, the armored divisions had to use organic trucks, such as those in the maintenance battalion, to move critical supplies.

In the final analysis, the pursuit could not have been sustained if it were not for the marshalling of transportation assets at all levels. Throughout this period, motor transport bore the heaviest burden, as it was habitually overloaded and was required to transport supplies at distances exceeding four hundred miles.<sup>89</sup>

To alleviate the pressure on motor transport, it was only natural to look to air transport. Aerial resupply had the advantages of speed and freedom of movement. However, these advantages were countered by low volume and tonnage, uncertainty of availability, inadequate ground facilities and landing fields, enemy interference and poor weather. Due to these problems, doctrine recognized aerial resupply as an emergency measure only and was to be used for units cut off from normal supply channels.<sup>90</sup> However, to support the pursuit, aerial resupply in August and September 1944 became more of a norm than an exception.

The first air transport of supplies to 3d Army occurred on 19 August 1944 at Beille airstrip near Le Mans. A total of twenty-one C47 transport planes landed with forty-seven tons of Class I supplies. On 20 August 1944, 165 plane loads of Class I supplies were received at Beille. On 25 August 1944, 207 cargo planes landed at Bricy airfield near Orleans with 507 tons of rations, ammunition and repair parts. On 26 August 1944, 449 planes delivered 1,164 tons of supplies to 3d Army.<sup>91</sup>

By the end of August the cargo aircraft were diverted to support upcoming airborne operations, and aerial resupply dropped off considerably. Yet, for a short, but critical period, it had become an important source of transportation for the movement of supplies.

While rail was not as effective as logistics planners had originally hoped, it was used to a limited extent in the campaign. The first use of rail to support 3d Army was on 14 August 1944. Here, thirty trains of Class III supplies moved to Le Mans. By using rail instead of trucks, 3d Army saved over 175,000 gallons of gasoline in September.<sup>92</sup> Another transportation asset used to support ground forces was the Landing Ship, Tank or LST. Support to the 6th and 4th Armored Divisions was provided by three LSTs that brought in supplies from Britain. The LSTs landed on the beach near St. Micheal en Greive with five hundred tons each of Class I, III and V supplies as well as much needed trucks that carried the supplies.<sup>93</sup>

#### **PROTECTION**

The presence of bypassed enemy units complicated supply problems and subjected support units to attacks by enemy pockets of resistance. In the Brittany campaign, 6th Armored Division's method of protecting its trains was typical of actions taken by other armored divisions.

The problems of trains and convoy security were first met by attaching two anti-aircraft batteries to the division trains. The anti-aircraft sections would act as convoy escorts and provide bivouac

protection. Besides these batteries, personnel from the maintenance battalion were expected to operate and fire the medium tanks that were in the battalion's park for repairs. Later, when enemy activity in the rear increased, the division trains received an attached company of light tanks, a company of infantry and a section of tank destroyers.<sup>94</sup>

During movement, the advanced guard consisted of an infantry company, minus two platoons, and a platoon of light tanks. An infantry platoon and tank destroyer section marched in the middle of the column. The rear guard consisted of a tank company minus two platoons and a platoon of infantry. Anti-aircraft sections were dispersed throughout the columns. A section of light tanks escorted advance supply points and another section was used for convoy escort. Two squads of infantry escorted resupply convoys. The basis of escort protection was a section of light tanks and two anti-aircraft sections per each twenty-five truck convoy. A platoon of infantry was added as the situation demanded or for convoys of over fifty vehicles. While this protection was necessary for the sustainment of the division, it removed a significant amount of firepower from the combat commands.<sup>95</sup>

#### **SUMMARY**

In sum, logistic considerations, more than anything else, limited the pace of 3d U.S. Army's and the 4th and 6th Armored Division's operations in August and September 1944. In terms of supply, the most critical item was class III, specifically gasoline.

Other critical supplies were class V and class I. The World War II armored divisions were somewhat self-sufficient in other classes of supply. Water supply problems were solved by attaching organic water purification units to the combat commands.

More critical than the supplies was the ability to transport the supplies to the front. The armored divisions lacked the organic transport needed to move fuel and ammunition from distant supply points to combat units. This problem worsened when the supply battalion, with ninety-six trucks and trailers, was removed from the "light" armored division's table of organization and equipment. The field army's transportation assets were tied up moving supplies from the Normandy depots and could neither establish forward supply bases nor augment the beleaguered divisions with additional trucks.

These support problems forced 3d U.S. Army and the 4th and 6th Armored Divisions to use many unconventional and expedient measures to support the forces. These included immobilizing entire units to use their trucks for resupply, establishing non-doctrinal division supply points, using captured food and fuel, attaching additional quartermaster truck and supply companies, using aerial resupply on a routine basis and making use of unique supply methods such as beach landing craft to deliver supplies. To maintain continuous support, armored divisions dedicated several combat units to protect the division trains and resupply convoys. This experience in World War II provides insights on possible requirements and expedients that may be required in today's operations.

## ENDNOTES

<sup>1</sup>U.S. Armored Command, FM 17-100, Field Service Regulations--The Armored Division (Washington: War Department, 1944), 2.

<sup>2</sup>Ibid., 68.

<sup>3</sup>U.S. War Department, ETO, The General Board, Study No. 48 (Washington DC, n.d.), 7.

<sup>4</sup>Kent R. Greenfield, Robert R. Palmer and Bell I. Wiley, The Organization of Ground Combat Troops, United States Army in World War II (Washington, D.C., 1947), 320.

<sup>5</sup>General Board Study, No. 48, 7.

<sup>6</sup>Ibid.

<sup>7</sup>Greenfield, Palmer, and Wiley, 320.

<sup>8</sup>General Board Study No. 48, 8.

<sup>9</sup>Ibid.

<sup>10</sup>U.S. Armored Force, FM 17-57, Field Service Regulations--Supply Battalion Armored Division (Washington: War Department, 1944), 6.

<sup>11</sup>Greenfield, Palmer, and Wiley, 323.

<sup>12</sup>David F. Gross, "Logistics Implications of the Operational-Level Offense," (MMAS Thesis, U.S. Army Command and General Staff College, 1984), 12.

<sup>13</sup>Ibid., 13.

<sup>14</sup>Ibid., 332.

<sup>15</sup>Ibid.

<sup>16</sup>FM 17-100 (1944), 101.

<sup>17</sup>Ibid.

<sup>18</sup>Greenfield, Palmer, Wiley, 365.

<sup>19</sup> Ibid.

<sup>20</sup> FM 17-100 (1944), 97.

<sup>21</sup> Ibid.

<sup>22</sup> U.S. Armored Force, FM 17-50, Field Service Regulations--Logistics (Washington: War Department, 1942), 53.

<sup>23</sup> Ibid., 56.

<sup>24</sup> Ibid., 59.

<sup>25</sup> Ibid., 61.

<sup>26</sup> Ibid., 63.

<sup>27</sup> Gross, 18.

<sup>28</sup> FM 17-50 (1942), 65-66.

<sup>29</sup> FM 17-100 (1944), 100.

<sup>30</sup> FM 17-50 (1942), 95.

<sup>31</sup> FM 71-100 (1944), 97.

<sup>32</sup> FM 17-50 (1942), 63.

<sup>33</sup> FM 17-100 (1944), 97.

<sup>34</sup> FM 17-50 (1942), 34.

<sup>35</sup> Ibid.

<sup>36</sup> Ibid., 65.

<sup>37</sup> Ibid., 63.

<sup>38</sup> Ibid., 35.

<sup>39</sup> Roland G. Ruppenthal, Logistical Support of the Armies, Vol. I, May 1941-September 1944 (Washington, D.C.: United States Center of Military History, 1985), 475.

<sup>40</sup> Christopher R. Gabel, "The Lorraine Campaign: An Overview, September-December 1944," U.S. Army Command and General Staff College, 1985, 1.

<sup>41</sup>Ruppenthal, 482.

<sup>42</sup>Ibid., 478.

<sup>43</sup>Ibid.

<sup>44</sup>Ibid., 479.

<sup>45</sup>George F. Hofmann, The Super Sixth (Louisville, KY: Sixth Armored Division Association, 1975), 95.

<sup>46</sup>Ruppenthal, 483.

<sup>47</sup>U.S. War Department, Hq., Third U.S. Army, "After Action Report," September 1944, Chapter 3, 61.

<sup>48</sup>U.S. War Department, Hq., 6th Armored Division, European Theater of Operations, "G-4 Report of the Brittany Campaign, 29 July-14 August 1944," 1.

<sup>49</sup>U.S. War Department, Hq., 4th Armored Division, European Theater of Operations, "After Action Report, 17 July-31 August 1944," 3.

<sup>50</sup>Ruppenthal, 489.

<sup>51</sup>Ibid.

<sup>52</sup>Ibid., 496.

<sup>53</sup>U.S. War Department, Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945," Part 21, 3.

<sup>54</sup>Ruppenthal, 490.

<sup>55</sup>Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945," Part 21, 5.

<sup>56</sup>U.S. War Department, Hq., 6th Armored Division, European Theater of Operations, "Operation of 6th Armored Division Trains During the Brittany Campaign," 26 August 1944, 1.

<sup>57</sup>Hofmann, 94.

<sup>58</sup>Hq., 6th Armored Division, "Operation of the 6th Armored Division Trains During the Brittany Campaign," 2.

<sup>59</sup>Hq., 4th Armored Division, "After Action Report, 17 July-31 August 1944," 3.

<sup>60</sup>Christopher R. Gabel, "The 4th Armored Division in the Encirclement of Nancy," U.S. Army Command and General Staff College, 1986, 2.

<sup>61</sup>Ruppenthal, 504.

<sup>62</sup>Ibid., 505.

<sup>63</sup>Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945," Part 21, 4.

<sup>64</sup>Gabel, "Lorraine Campaign," 5-6.

<sup>65</sup>Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945," Part 21, 6.

<sup>66</sup>Ruppenthal, 509.

<sup>67</sup>Hofmann, 94.

<sup>68</sup>Hq., 6th Armored Division, "G-4 Report of the Brittany Campaign, 29 July-14 August 1944," 2.

<sup>69</sup>U.S. War Department, Hq., 6th Armored Division, European Theater of Operations, "Quartermaster Supplies During the Brittany Campaign 27 July-16 August 1944," 1.

<sup>70</sup>Hofmann, 94-95.

<sup>71</sup>Ruppenthal, 527.

<sup>72</sup>Ibid., 527.

<sup>73</sup>Ruppenthal, 517.

<sup>74</sup>Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945," Part 21, 4.

<sup>75</sup>Ibid., 6.

<sup>76</sup>Hq., 6th Armored Division, "G4 Report of the Brittany Campaign, 29 July-14 August 1944," 1.

<sup>77</sup>U.S. War Department, Hq., 6th Armored Division, European Theater of Operations, "Engineer Supply Operations," 26 August 1944, 1.

<sup>78</sup>Hq., 6th Armored Division, "G-4 Report of the Brittany Campaign, 29 July-14 August 1944," 2.

<sup>79</sup>Ruppenthal, 519.

<sup>80</sup>Hofmann, 96.

<sup>81</sup>U.S. War Department, Hq., 6th Armored Division, European Theater of Operations, "Medical Service during Normandy and Brittany Campaigns," 22 August 1944, 2.

<sup>82</sup>Ruppenthal, 518.

<sup>83</sup>Hq., 6th Armored Division, "G4 Report of the Brittany Campaign, 29 July-14 August 1944," 2.

<sup>84</sup>Ibid., 558.

<sup>85</sup>Ibid., 487.

<sup>86</sup>Gabel, "Lorraine Campaign," 5.

<sup>87</sup>Ruppenthal, 494.

<sup>88</sup>Hq., 6th Armored Division, "G-4 Report of the Brittany Campaign, 29 July-14 August 1944," 2.

<sup>89</sup>Ruppenthal, 570.

<sup>90</sup>Ibid., 572.

<sup>91</sup>U.S. War Department, Hq., Third U.S. Army, "After Action Report, Vol. II, 1 August 1944-9 May 1945, Part 5, 12.

<sup>92</sup>Ibid., 22.

<sup>93</sup>Ibid., 11.

<sup>94</sup>Hq., 6th Armored Division, "Operations of the 6th Armored Division Trains During the Brittany Campaign," 2.

<sup>95</sup>Ibid., 4.

## CHAPTER III

### ORGANIZATION AND LOGISTIC SUPPORT FOR THE MODERN ARMORED DIVISION

#### INTRODUCTION

While the previous chapter described the organization and support concepts for the World War II armored division, this chapter examines the organization and logistics support doctrine of the modern heavy division (SRC 87000J430), hereafter called an armored division. Specifically, this chapter explores the mission of the armored division, its organization and its support concepts. Primary focus is on the supply of food, water, fuel, ammunition, medical supplies, repair parts and transportation.

#### THE MODERN ARMORED DIVISION

Today's armored division is a mechanized force that is employed over wide areas where it is afforded both long-range and flat trajectory fire. FM 71-100, Division Operations, states:

They [armored divisions] destroy enemy armored forces and seize and control land areas, including populations and resources. Heavy divisions can rapidly concentrate overwhelming combat power to breakthrough or envelop enemy defenses. They then strike to destroy fire support, command and control and service support elements.<sup>1</sup>

The studied armored division consists of a division headquarters and headquarters company, three brigade headquarters

companies, six armor battalions, and four mechanized infantry battalions. The division artillery or DIVARTY has a headquarters and headquarters battery, three self-propelled 155mm artillery battalions, a multiple launch rocket system or MLRS battery and a target acquisition battery or TAB. The armored division's aviation assets consist of a combat aviation brigade headquarters and headquarters company, a cavalry squadron, two attack helicopter battalions, a combat aviation company and a general support aviation company. The division's support command or DISCOM has a headquarters and headquarters company/material management center, an aviation maintenance company, a main support battalion or MSB and three forward support battalions or FSBs. The armored division also has a separate engineer battalion, a military intelligence battalion, a signal battalion, an air defense artillery battalion, a chemical company and a military police company.<sup>2</sup> The total number of personnel in the armored division is 16,979.<sup>3</sup> Figure 3, on page 43, provides a wiring diagram of the armored division.

The division headquarters provides command, control and supervision of the tactical operation of the armored division. The maneuver brigade headquarters provides the command and control necessary to employ two to five armor or mechanized infantry battalions and various combat support and combat service support units. The only unit assigned to the brigade is the headquarters and headquarters company, all other units are attached, under operational control or placed in support of the brigade. The brigade operates as a combined

DIV HQ (265)

-MP CO (149)	-3 BDE HQS (91 ea)	-DIVARTY HQ (187)	-AVN BDE HQ (94)
-SIG BN (682)	-6 ARMOR BNs (552 ea)	-TAB (97)	DISCOM HQ- -CAV SQDRN (199) (623)
-ADA BN (626)	-4 MECH INF BNs (844 ea)	-MLRS BTRY (131)	MSB- -2 ATK BNS (1074) (264 ea)
-ENGR BN (890)		-3 HOW BN (688) (688) (730)	3 FSBs- -CAC (435) (136) (435) (458)
-MI BN (313)			-GSAC (147) AMC- (256)
-CHEM CO (146)			
-DIV BAND (41)			

TOTAL STRENGTH:	16,979
MI TANK:	348
IFV:	216
CFV:	100
ITV:	48
SP HOW 155MM:	72
ATTK HELO AH-64:	44

FIGURE 3., The Armored Division (SRC 87000J430)<sup>4</sup>

arms team, with a mix of mechanized infantry and armor battalions based on mission requirements.<sup>5</sup>

The aviation brigade provides the division commander with a command and control headquarters with organic lift, attack, observation and general support aircraft. The aviation brigade, however, is not a maneuver brigade in the same sense as the ground maneuver brigade. Instead, the aviation brigade exploits the maneuver effect of the combined arms team in coordinated operations with the ground maneuver brigades. During combat, the cavalry squadron normally works directly for the division commander as the eyes and ears of the division. The cavalry squadron is ideally suited for reconnaissance and security roles.<sup>6</sup>

The division allocates, to the ground maneuver brigades, combat support and combat service support elements collectively called the brigade "slice." These units provide direct support to the maneuver brigade and normally consist of a field artillery battalion, an engineer company, an air defense artillery battery, a chemical platoon, a military police platoon, a military intelligence team and a forward support battalion.<sup>7</sup>

#### **ARMORED DIVISION LOGISTIC SUPPORT CONCEPTS**

The division's armor and mechanized infantry battalions are supported by their own organic service support assets. These assets are the battalion's support platoon, maintenance platoon and medical platoon. These support assets are pooled together into "trains."

These trains can be controlled in one location as a unit trains, or they can be echeloned into a field trains and a combat trains.<sup>8</sup>

Keeping assets pooled in a unit trains provides for ease of coordination, better control of logistic assets, and enhanced trains' security. The echelonment of support assets into combat trains and field trains will provide immediate, responsive support, flexibility in usage and increased survivability of assets. The tactical situation dictates the make up of the combat trains. In most cases, the combat trains contains bulk and packaged Class III, Class V, maintenance teams and the battalion medical aid station. The field trains are located in the brigade support area and contain combat service support assets not needed in the combat trains. These include remaining Class III, Class V supply vehicles, the remaining elements of the maintenance platoon, the supply platoon headquarters, the supply section and the mess section.<sup>9</sup>

The maneuver brigades don't have organic combat service support units and must rely on the DISCOM to provide direct support. The DISCOM provides support to the three maneuver brigades with its three FSBs. The DISCOM'S MSB supports divisional units that are not associated with a maneuver brigade.<sup>10</sup>

The FSB has a headquarters and headquarters detachment, a supply company, a maintenance company and a medical company. The FSB's supply company receives, stores and issues, on a daily basis, 15.9 short tons of Class I, 15.4 short tons of Class II & IV, 0.7 short tons of packaged Class III and 5.0 short tons of Class VII. The supply

company also stores 55,600 gallons of bulk Class III and can distribute 73,600 gallons of fuel. The company can transload 550 short tons of ammunition, per day, at the ammunition transfer point or ATP.<sup>11</sup>

The maintenance company provides direct support maintenance for all brigade equipment except medical, communications security, airdrop, avionics, aircraft, aircraft armament and ammunition. The company maintains an authorized stockage list of up to three thousand line items of repair parts. It provides reparable exchange service for selected items and provides maintenance support teams for on-site maintenance.<sup>12</sup>

The medical company provides mobile facilities for receiving, sorting and providing initial resuscitative treatment and ground evacuation using wheeled and tracked ambulances. The company also provides emergency dental care, triage, emergency medical supply, laboratory, pharmacy and radiology services.<sup>13</sup>

Unlike the maneuver brigades, the aviation brigade does not have an FSB to provide dedicated supply, maintenance and medical support. Instead, the aviation brigade has a significant organic support structure in the form of a Class III/V platoon that provides fuel and ammunition support and aviation unit maintenance (AVUM) sections to sustain the brigade. In addition to its organic assets, the DISCOM's aviation maintenance company (AMC) provides back-up AVUM and aviation intermediate maintenance (AVIM) to the aviation brigade. The aviation brigade also gets additional supply and medical support from the FSBs and MSB.<sup>14</sup>

The other major support unit in DISCOM is the MSB. The MSB has a headquarters and headquarters detachment, a supply and services company, a transportation motor transport company, a light maintenance company, a heavy maintenance company, a missile support company and a medical company. The supply and service company receives, temporarily stores and issues, on a daily basis, 56.6 short tons of Class I; 57 short tons of Class II & IV; 4.9 short tons of packaged Class III and 18.1 short tons of Class VII. The company provides up to five water purification and supply points. It can store 30,000 gallons, issue 120,000 gallons and distribute 12,000 gallons of water per day. The supply and service company can store and issue 327,600 gallons and can distribute 207,200 gallons of bulk Class III per day.<sup>15</sup>

The transportation motor transport company provides truck transport for delivery of Class I, II, IV and VII supplies for the armored division. The company also furnishes vehicles to assist division elements requiring supplemental transportation to include emergency lift of Class V. For line hauls, trips of ninety miles one way, it can move 2775 short tons per day. For local hauls, trips of twenty miles one way, it can move 5550 short tons per day.<sup>16</sup>

The light maintenance company provides direct support maintenance support for fuel and electrical systems, power generation equipment, quartermaster and chemical equipment, utilities equipment and communication equipment. This company supports division units not supported by a forward support battalion. It also provides backup direct support maintenance to the three FSBs for light equipment

repair. It maintains the division's authorized stockage list of 10,000 line items of repair parts and the class IX supply function. The heavy maintenance company provides direct support maintenance support for automotive, artillery, engineer and power generation equipment; fire control instruments and fire control computer equipment; metalworking/machinery; canvas, small arms; and tank turrets. This unit provides support to division units not supported by FSBs and provides backup maintenance to the FSBs. The missile support company provides direct support maintenance and Class IX supply for land combat missile systems; short range air defense systems; forward area alerting radar; man-portable common thermal night sights; associated training support equipment and missile peculiar test, measurement, and diagnostic equipment.<sup>17</sup>

The medical company provides mobile facilities for receiving and sorting patients, mobile facilities for providing medical treatment for all classes of patients in the division rear area and those evacuated from medical companies in the brigade area, ground ambulance evacuation, and emergency dental, psychiatric and mental health care. The medical company also provides preventative medicine, environmental health, and optometric services. The unit backs up the FSB medical companies and supports units operating in the division support area that don't have organic medical support. It also provides a five day level of Class VIII medical supplies. Normal resupply occurs by backhaul of returning ground and air ambulances.<sup>18</sup>

Although not part of the MSB, the aircraft maintenance company is assigned to the DISCOM and provides AVIM support to the aviation brigade. The company provides AVIM for tactical, attack, utility and scout helicopters; aircraft power plants and power trains; avionic communications and electronics equipment, repair parts supply for all division aircraft and mobile maintenance support teams for maintenance assistance, technical assistance and aircraft recovery and evacuations.<sup>19</sup>

An ordnance company, ammunition, direct support (MOADS), from the corps support command or COSCOM operates an ATP in the division support area to support corps and divisional units in the division rear. The company can transload 970 short tons of ammunition at the ATP.<sup>20</sup>

#### **CLASS I SUPPLY**

COSCOM delivers Class I supplies to the MSB's ration supply point in the division support area. The Class I point breaks down the rations for the brigades, with the remaining rations used for units supported directly by the MSB. The transportation motor transport company moves the rations to the FSB's Class I supply point. Upon receipt, the supply point breaks down the rations for issue to supported units. Supported units use their organic transportation assets to pick up Class I supplies from the FSB and MSB Class I points.<sup>21</sup>

## **WATER SUPPLY**

The MSB's supply and service company can establish five water purification points. Normally, a water purification team is attached to each FSB. Ideally, water points locate as close as possible to the Class I supply point. Supported units usually pick up water at the water point using their organic water trailers. The water purification team can distribute water to supported units that do not have organic water-carrying capability and to other units on an emergency basis.<sup>22</sup>

## **CLASS III SUPPLY**

COSCOM delivers packaged Class III supplies to the MSB's supply and service company. To fill the FSB's packaged Class III requirements, the MSB's transportation motor transport company moves the supplies to the FSB. The supported unit usually picks up their packaged Class III products using their organic transportation assets.<sup>23</sup>

COSCOM delivers bulk Class III to the MSB's Class III supply point in bulk haul 5,000 gallon tankers. In some cases, the COSCOM may deliver Class III directly to the FSB supply company. The MSB delivers fuel forward to the FSB in five thousand gallon fuel-servicing tankers. MSB tankers either transfer fuel into FSB tankers, or use a trailer transfer to swap full tankers with empty tankers near the brigade support area.<sup>24</sup>

Supported units pick up fuel with their organic refueling vehicles at the Class III supply point. The supported units refueling

vehicles deliver fuel directly to combat vehicles. The FSB's supply company also may move fuel forward to a tactical refuel point. The MSB can operate a mobile filling station along the main supply route. This point provides filling station service for vehicles on the main supply route and for units that do not have organic bulk fuel supply.<sup>25</sup>

COSCOM supplies aviation fuel directly to the division aviation brigade. The aviation brigade's fuel tankers supply aviation fuel to their respective units. The aviation brigade's fuel tankers can store two days of supply of aviation fuel for the brigade. The MSB maintains one day of supply of aviation fuel to support any of the aviation brigade's additional needs.<sup>26</sup>

#### CLASS V SUPPLY

Class V supply is based on a continuous refill system. As stocks are issued, they are replaced by stocks moved up from the rear area. The armored division uses ammunition transfer points or ATPs. The usual flow of ammunition into the ATP is throughput from the corps storage area or CSA and the COSCOM's ASP. COSCOM stake and platform trailers bring ammunition to the ATP. On the first trip, COSCOM's trailers are dropped at the ATP site. On subsequent trips, COSCOM drops full trailers and picks up empty trailers and returns them to the ASP and the CSA. Supported units use their organic transportation assets to pick up their Class V supplies at the ATP. The ATP transloads ammunition on to supported unit vehicles using its forklifts and cranes.<sup>27</sup> Supported units pick up ammunition, not supplied by

the ATP, at the corps ammunition supply point or ASP. The ASP usually locates near the division rear boundary.

#### **CLASS VIII SUPPLY**

The MSB's medical company normally establishes the division medical supply point. This point maintains a five day stockage of medical supplies and locates at a site that is accessible to ambulances providing support to the forward medical facilities.<sup>28</sup> Requests are sent to the supply point by vehicles, radio or telephone. Supplies are sent forward by backhaul ground or air ambulances or by vehicles of the requesting unit. The battalion aid station replenishes their supplies by informal requests sent to the FSB. The FSB medical company forwards unfilled requests and requests for replenishments of its own supplies to the MSB's division medical supply point. The corps MEDSOM battalion resupplies the MSB's medical supply point using corps transportation.<sup>29</sup>

#### **CLASS IX SUPPLY**

The MSB's light maintenance company and the FSB's maintenance company handle repair parts. COSCOM delivers repair parts to the MSB's light maintenance company. Repair parts needed by the FSB's are then shipped forward using divisional transportation assets. In most cases, Class IX issues are picked up using unit transportation.<sup>30</sup>

## TRANSPORTATION

The principal transportation asset of the armored division is the MSB's transportation motor transport company.<sup>31</sup> The transportation company has thirty-six, 5 ton cargo trucks; thirty-three, 5 ton tractors; twenty-four heavy equipment transport tractors; twenty-four, 60 ton heavy equipment transport trailers and sixty-six, 22 1/2 ton stake and platform semitrailers.<sup>32</sup> The company uses this equipment to transport personnel, supplies and equipment in support of division personnel and logistic support operations.<sup>33</sup>

## SUMMARY

The modern armored division is a formidable warfighting force with substantial organic support capability. While the FSBs and MSB provide direct support to the brigades and division, the division must still rely on the COSCOM to push supplies to the DISCOM.

Although today's armored division has much more organic support capability than its World War II predecessor, the higher fuel and ammunition consumption of modern weapon systems may more than offset the increased support assets. In short, today's armored division may still be susceptible to the same supply and transportation problems experienced by the armored divisions during World War II. Any support shortfalls would be particularly apparent during deep operations, where supply lines are stretched and easily disrupted. In the next chapter I will determine the supply and transportation requirements to sustain an armored division in a five-day deep attack operation that requires the division to maneuver seventy-five kilometers forward of the FLOT.

## ENDNOTES

<sup>1</sup>U.S. Army, FM 71-100, Division Operations (Washington: Department of the Army, 1990), p. 1-3.

<sup>2</sup>U.S. Army, FC 71-100, Field Circular--Armored and Mechanized Division and Brigade Operations (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, 1984), p. 1-5.

<sup>3</sup>David F. Gross, "Logistics Implications of the Operational-Level Offense," (MMAS Thesis, U.S. Army Command and General Staff College, 1984), p. 1-5.

<sup>4</sup>Gross, 45.

<sup>5</sup>FM 71-100 (1990), p. 2-1.

<sup>6</sup>FM 71-100 (1990), p. 2-3 - 2-5.

<sup>7</sup>ST 100-3 (1990), p. 1-5.

<sup>8</sup>U.S. Army, FM 71-2, The Tank and Mechanized Infantry Battalion Task Force (Washington: Department of the Army, 1988), pp. 7-6 - 7-12.

<sup>9</sup>FC 71-100 (1984), p. 11-8.

<sup>10</sup>*Ibid.*, p. 11-38.

<sup>11</sup>U.S. Army, ST 101-6, Student Text--G4 Battle Book (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, 1990), p. 5-13.

<sup>12</sup>*Ibid.*, p. 5-14.

<sup>13</sup>*Ibid.*, p. 5-12.

<sup>14</sup>U.S. Army, FM 1-111, Aviation Brigade (Washington: Department of the Army, 1986), p. 6-9.

<sup>15</sup>ST 101-6 (1990), p. 5-6.

<sup>16</sup>*Ibid.*, p. 5-10.

<sup>17</sup>*Ibid.*, pp. 5-8 - 5-9.

<sup>18</sup>*Ibid.*, p. 5-4.

<sup>19</sup>U.S. Army, FM 63-2-2, Combat Service Support Operations, Armored Mechanized, and Motorized Divisions (Washington: Department of the Army, 1985), p. 6-13.

<sup>20</sup>ST 101-6 (1990), p. 4-10.

<sup>21</sup>U.S. Army, FM 63-20, Forward Support Battalion, Armored, Mecharized and Motorized Divisions (Washington: Department of the Army, 1985), p. 5-4.

<sup>22</sup>FM 63-2-2 (1985), p. 5-25.

<sup>23</sup>FM 63-20 (1985), p. 5-12.

<sup>24</sup>Ibid.

<sup>25</sup>Ibid., p. 5-13.

<sup>26</sup>FM 63-2-2 (1985), p. 5-10.

<sup>27</sup>FM 63-20 (1985), pp. 5-14 - 5-16.

<sup>28</sup>U.S. Army, FM 63-21, Main Support Battalion, Armored, Mechanized and Motorized Divisions (Washington: Department of the Army, 1986), p. 10-11.

<sup>29</sup>FM 63-2-2 (1985), p. 5-21.

<sup>30</sup>FM 63-20 (1985), p. 6-7.

<sup>31</sup>FM 63-2-2 (1985), p. 7-2.

<sup>32</sup>ST 101-6 (1990), p. 5-10.

<sup>33</sup>FM 63-2-2 (1985), p. 7-2.

## CHAPTER IV

### ARMORED DIVISION SUSTAINMENT REQUIREMENTS AND CAPABILITIES

#### INTRODUCTION

The experience of the 4th and 6th Armored Divisions in August and September 1944 points to the importance of supply and transportation in the sustainment of operations over long and unsecure supply lines. In this chapter, I will determine the daily sustainment requirements and support capability of today's armored division in the conduct of a deep attack. Again, the studied deep attack extends seventy-five kilometers from the FLOT and lasts five days. The mission of the attacking armored division is to break through initial enemy defenses, attack along an axis to obtain an objective, to disrupt and destroy high value targets during the advance and to seize and hold the objective. The division will hold the objective for twenty-four hours, when link-up with friendly forces is expected. Once the sustainment requirements are quantified, I will analyze the division's capability to support the requirements.

#### DETERMINING THE REQUIREMENTS

FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), and ST 101-6, G4 Battle Book, provide planning factors for supply

consumption. According to these manuals, requirements for most classes of supply remain relatively stable and can be calculated by multiplying a consumption factor by the number of personnel in the organization. Consumption of supply classes III (bulk) and V is more dynamic and varies based on the type of operation. As a rule, offensive operations use more Class III (bulk) than defensive operations. Class V consumption varies not only by the type of operation, but also its duration and intensity. As a result, special tables are used to predict both fuel and ammunition consumption. Consumption factors for the supply classes examined in this study are at Table 2.<sup>1</sup>

TABLE 2  
CONSUMPTION RATES

<u>CLASS OF SUPPLY</u>	<u>CONSUMPTION FACTOR</u>
I	4.41 lbs/man/day <sup>a</sup>
WTR	8.00 gal/man/day <sup>b</sup>
III(pkg)	.59 lbs/man/day
III (bulk)	Table 2-15, FM 101-10-1/2
V	Table 2-6, FM 101-10-1/2
VIII	1.22 lbs/man/day
IX	2.50 lbs/man/day

<sup>a</sup>Based on 3 MRE's/man/day.

<sup>b</sup>Based on temperate climate.

To more accurately project supply requirements, the mission of the division is broken down into parts. The scenario, described above, includes both offensive and defensive operations. In the first four days, the division conducts offensive operations to seize an objective. On the fifth day, the division defends the objective until link-up with friendly forces. It is reasonable to expect the first day's offense to be of moderate intensity as the division breaks through initial enemy defenses. The second, third and fourth day's offensive operations occur in a low intensity environment. This reflects the division's attack of relatively soft targets such as command and control centers and logistic facilities in the enemy's rear. The fifth day's defensive operation occur in a moderate intensity environment. This replicates the division defending the objective against enemy counterattack. This breakdown of the division's mission and activities facilitates a more accurate determination of sustainment requirements.<sup>2</sup>

Another factor affecting sustainment requirements is attrition. As a rule, requirements will decrease with personnel and equipment losses. To determine personnel losses, ST 101-6, G4 Battle Book, provides estimates based on the type of operation and duration. Table 3 provides daily personnel loss rates, as a percentage, for an armored division.

TABLE 3  
DAILY LOSS RATES (%) FOR AN ARMORED DIVISION<sup>3</sup>

<u>TYPE OF OPERATION</u>	<u>1ST DAY</u>	<u>SUC DAYS</u>
OFFENSE	6.6	3.5
DEFENSE	3.5	1.9

According to ST 101-6, G4 Battle Book, of the total personnel losses approximately 10% will be killed, 10% will be missing and 72% will be wounded. Among the total wounded, 10% will be returned to duty after treatment by company aidmen and 1% will die of wounds. The remaining wounded will be evacuated to the battalion aid stations, where 26% will be returned to duty and the remaining wounded are stabilized and evacuated to division clearing stations. It is reasonable to assume, in the deep attack, that any wounded who cannot be returned to duty by either the company aidman or battalion aid station will be evacuated by air ambulance to the division treatment facility or corps hospitals behind the FLOT. Any casualties that would be returned to duty from the division treatment facility or corps hospitals will be returned following the link-up on day 5.<sup>4</sup>

To project the daily casualties, I must determine the strength of the divisional force that will conduct the deep attack. It is fair to assume that only a portion of the division will cross the FLOT. For instance, most of the division headquarters, aviation brigade, MSB and other units that normally occupy the division rear will remain in place or provide support from behind the FLOT. As such, the force that directly participates in the cross FLOT operation is shown below:

DEEP ATTACK CROSS-FLOT FORCE

DIV TAC CP (+)	ADA BTRY (x3)
BDE HQ (x3)	CML CO (-)
ARMOR BN (x6)	ENGR CO (x3)
MECH BN (x4)	BRIDGE CO
GRD CAV TRP (x2)	MI COMPOSITE CO
FLD ARTY BN (x3)	MP CO (-)
MLRS BTRY	FWD SIG CO
TAB	FSB (+) (x3)

TOTAL PERSONNEL: 12,780

Using the casualty projection percentages, coupled with projected return to duty soldiers, Table 4 gives the division strength for each day of the operation. These projections assume no personnel replacements, except return to duty from company and battalion aid stations, until after link-up with friendly forces.

TABLE 4  
PROJECTED PERSONNEL STRENGTH OF THE ARMORED DIVISION

<u>DAY</u>	<u>START</u>	<u>STRENGTH</u>	<u>END</u>
1 <sup>a</sup>	12,780		12,138
2 <sup>b</sup>	12,138		11,815
3 <sup>b</sup>	11,815		11,500
4 <sup>b</sup>	11,500		11,193
5 <sup>c</sup>	11,193		10,894

- <sup>a</sup>Based on first day, offense.
- <sup>b</sup>Based on succeeding day, offense.
- <sup>c</sup>Based on first day, defense.

Equipment attrition reduces requirements for Class III and V. ST 101-6, G4 Battle Book, provides estimates for equipment losses. Table 5 provides equipment losses, as a percentage, based on the type of operation, duration and type of equipment.

TABLE 5  
EQUIPMENT LOSS RATES (%)<sup>5</sup>

<u>ITEM</u>	<u>OFFENSE</u>		<u>DEFENSE</u>
	<u>1ST DAY</u>	<u>SUC DAY</u>	<u>1ST DAY</u>
M1 TANK	25	25	20
IFV, CFV, ITV	25	20	20
155MM HOW	10	10	10
SPT SYS	15	15	15

While some equipment will be totally lost through battlefield destruction, other equipment will be repairable. Table 6 identifies the percentage of equipment losses expected to be nonrepairable and repairable.

TABLE 6  
PERCENTAGE OF EQUIPMENT LOSSES THAT ARE  
REPARABLE AND NONREPARABLE<sup>6</sup>

<u>CATEGORY</u>	<u>OFFENSE</u>	<u>DEFENSE</u>
NONREPARABLE	20	15
REPARABLE	80	85

Doctrinally, reparable losses will be fixed in one of four ways; on-site, by a direct support maintenance unit, by a back-up direct support maintenance unit or by theater army maintenance units in the rear. Table 7 provides the percent of reparable losses that will be fixed at each of the four categories of maintenance.

TABLE 7  
PERCENTAGE OF REPARABLE LOSSES REPAIRED  
BY MAINTENANCE LEVEL<sup>1</sup>

<u>CATEGORY</u>	<u>DAY 1<sup>a</sup></u>	<u>DAY 2<sup>b</sup></u>	<u>DAY 3<sup>b</sup></u>	<u>DAY 4<sup>b</sup></u>	<u>DAY 5<sup>c</sup></u>
ON-SITE	20	18	16	15	15
DS	20	18	16	15	15
BACK-UP DS	30	32	34	35	35
THEATER ARMY	30	32	34	35	35

<sup>a</sup>Based on first day, offense.

<sup>b</sup>Based on succeeding days, offense

<sup>c</sup>Based on first day, defense.

ST 101-6, G4 Battle Book, provides standard, non-changing, percentages of reparable losses that will be fixed at each category of maintenance. In this study, these percentages are modified to reflect degraded capability at the on-site and direct support maintenance categories. I have based this degradation primarily on the deep attack force's personnel losses, but it is also tied to the activity of the force. For example, even though personnel losses occur on day 5, maintenance capability is stabilized since the deep attack force is

consolidated in a defensive position; making it easier for mechanics to effect repairs.

In the studied scenario, on-site repair would be carried out by unit mechanics. Direct Support (DS) maintenance would be accomplished by the FSB's maintenance company. Due to the nature of the deep attack, equipment that cannot be repaired by the FSB will be evacuated, if possible, to a back-up DS maintenance unit; one of the MSB's maintenance companies. Any equipment evacuated behind the FLOT will not be returned to the armored division until after link-up operations. Also, no other equipment replacements will be provided until after the link-up. If the equipment cannot be safely evacuated, it will be left for follow-on forces to repair. Based on the aforementioned equipment loss factors and operational constraints, Table 8 provides the number of mission capable combat systems available at the end of each day.

TABLE 8  
MISSION CAPABLE COMBAT SYSTEMS  
(END OF DAY)

<u>DAY</u> <u>START</u>	<u>M1 TANK</u>	<u>IFV</u>	<u>CFV</u>	<u>ITV</u>	<u>155MM HOW</u>
	348	216	100	48	72
1 <sup>a</sup>	274	170	79	37	66
2 <sup>b</sup>	227	149	69	32	61
3 <sup>b</sup>	187	128	59	27	56
4 <sup>b</sup>	153	109	49	22	49
5 <sup>c</sup>	137	93	43	18	45

<sup>a</sup>Based on first day, offense.

<sup>b</sup>Based on succeeding days, offense

<sup>c</sup>Based on first day, defense.

Using the projections of personnel and equipment attrition to adjust projected consumption, I can make a more realistic estimate of daily supply requirements for the armored divisions. Table 9 provides this daily estimate.

TABLE 9  
ARMORED DIVISION SUPPLY REQUIREMENTS

CLASS	DAY 1 <sup>a</sup>	DAY 2 <sup>b</sup>	DAY 3 <sup>b</sup>	DAY 4 <sup>b</sup>	DAY 5 <sup>c</sup>
I	28.2 ST	26.8 ST	26.1 ST	25.4 ST	24.7 ST
III(p)	3.8 ST	3.6 ST	3.5 ST	3.4 ST	3.3 ST
V	1261.7 ST	525.7 ST	484.7 ST	453.3 ST	1202.3 ST
VIII	7.8 ST	7.4 ST	7.2 ST	7.0 ST	6.8 ST
IX	16.0 ST	15.1 ST	14.8 ST	14.4 ST	14.0 ST
WTR	102,300 GL	97,100 GL	94,500 GL	92,000 GL	89,500 GL
III(b)	416,000 GL	355,100 GL	318,200 GL	286,100 GL	195,200 GL
TOTAL:					
DRY CGO	1317.5 ST	578.6 ST	536.3 ST	503.5 ST	1251.1 ST
WATER	102,300 GL	97,100 GL	94,500 GL	92,000 GL	89,500 GL
FUEL	416,000 GL	355,100 GL	318,200 GL	286,100 GL	195,200 GL

<sup>a</sup>Based on first day, offense.

<sup>b</sup>Based on succeeding days, offense.

<sup>c</sup>Based on first day, defense.

#### DETERMINING THE CAPABILITIES

The next step in the analysis is to determine the capability to satisfy the above deep attack requirements. First, I will examine the

capability to support dry cargo requirements. An examination of the data in Table 9 shows that Class V accounts for 90-95% of the dry cargo requirement. Further, the bulk of the ammunition requirement is driven by the consumption of the M1 tank, the infantry fighting vehicle, the cavalry fighting vehicle, improved TOW vehicle and the self-propelled 155mm howitzer. To determine the capacity to support the ammunition requirement, I will first examine the support capability in the combat battalions, followed by the support capability of the DISCOM.

In the combat battalions, support or lift capability is represented by the combat vehicles themselves, and in the support sections, support platoons and service batteries. Assuming the studied combat systems begin the operation with a full basic load, Table 2-20 of FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), indicates that the M1 tank, infantry and cavalry fighting vehicles, improved TOW vehicles and self-propelled 155mm howitzer will carry a combined total of 1758 short tons of ammunition inside the combat vehicles.<sup>8</sup> Table 10 shows this quantity broken down by system.

TABLE 10  
 AMMUNITION CARRIED IN THE COMBAT VEHICLE

<u>VEHICLE</u>	<u>STON/SYSTEM</u>	<u># SYSTEMS</u>	<u>TOTAL STONS</u>
M1 TANK	2.7	348	946
IFV	1.4	216	306
CFV	2.6	100	260
ITV	0.6	48	26
155mm HOW	3.1	72	<u>220</u>
GRAND TOTAL :			1758

Besides carrying ammunition in the combat vehicles, combat battalion's have support organizations designed to support ammunition requirements. In the armored and infantry battalions, ammunition is handled by the support platoon. In armor battalions, the support platoon uses the 11 ton Heavy Expanded Mobility Tactical Truck or HEMTT. The infantry battalion's support platoon uses the 5 ton cargo truck. In artillery battalions, ammunition is carried by the service battery's ammunition platoon and by the ammunition sections of the firing batteries. Both organizations use the 11 ton HEMTT. An examination of the table of organization and equipment for armor, infantry and field artillery battalions using FM 101-10-1, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 1), reveals the ammunition support assets shown at Table 11.<sup>9</sup>

TABLE 11  
 AMMUNITION TRANSPORT ASSETS

<u>UNIT</u>	<u>5 TON CARGO TRK</u>	<u>11 TON HEMTT</u>
AR BN(x6)		60
INF BN(x4)	112	
ARTY BN(x3)	—	<u>150</u>
TOTAL:	112	210

These assets translate into a potential capability to haul 2870 short tons of ammunition.

The remaining 5-10% of dry cargo requirements are made up to Class I, III(pkg), VIII and IX supplies. These supplies are carried by other transportation assets, such as 2 1/2 ton cargo trucks in the support platoon, service battery or battalion headquarters and headquarters company. In some cases, supplies are carried in trucks containing other organizational equipment. For example, the mess section may carry rations with its mess equipment, or rations may be carried in the combat vehicles themselves. As such, the number of trucks allocated to carry these "other" supplies is not as easy to isolate as those dedicated to ammunition distribution. As a result, this study focuses on the Class V support capability at the combat battalion, while recognizing that additional assets may be available to move the other dry cargo requirements.

Besides the support capability in the combat battalions, the MSB's transportation motor transport company has thirty-six 5 ton cargo

trucks and sixty-six 22 1/2 ton S&P semitrailers. However, the transportation company is only authorized thirty-three 5 ton tractors to pull the semitrailers. Therefore, a maximum of thirty-three semitrailers would be available at any one time. These assets give the motor transport company the capability to move 922.5 short tons of dry cargo in support of the deep operation.

Combining the transport capability of the transportation motor transport company with the capability in the combat battalions, a maximum of 5550.5 short tons can be moved in support of the deep operation. As the operation progresses, given no resupply until after day 5, this capability is reduced through daily consumption and the loss of both combat and support systems. Based on the data from Table 5, support systems are attrited at the rate of 15% for both offensive and defensive operations. Factoring in these considerations, sustainment capability is reduced to 3630.5 short tons on day 2, 2684.3 short tons on day 3, 1796.9 short tons on day 4, and 987.5 short tons on day 5.

This analysis assumes equipment that is nonreparable was destroyed on the battlefield and contains no recoverable cargo. On the other hand, equipment which is damaged beyond the capability of DS repair, and must be evacuated or abandoned, will probably contain some recoverable cargo. Unfortunately, neither historical records or current planning figures provide data on recoverable cargo. For this study, I will assume that an average of 35% of the ammunition basic load carried in a combat vehicle and 50% of the carrying capacity of a

support vehicle will be recovered when these vehicles are damaged. These ratios take into account any damage the cargo may have sustained, as well as the consumption of supplies that may have occurred prior to the vehicle's damage. In other words, a 5 ton truck would have delivered half of its load prior to being damaged by enemy fire, or an M1 tank would have expended 65% of its internal ammunition stocks before being disabled. Given this analysis, Table 12 shows that capability exceeds requirements until late on day 5.

TABLE 12  
 DRY CARGO CAPABILITY VS REQUIREMENT

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
CAP	5550.5 ST	3630.5 ST	2684.3 ST	1796.9 ST	987.5 ST
REQ	1317.5 ST	578.6 ST	536.0 ST	503.5 ST	1251.1 ST
REMAIN CAP	4233.0 ST	3051.9 ST	2148.0 ST	1293.4 ST	-263.6 ST

Now, I will examine the capability to support Class III(bulk) requirements. Like ammunition, the deep attack's major fuel consumers are the M1 tank, the infantry and cavalry fighting vehicles, the improved TOW vehicle and the self-propelled 155mm howitzer. As with the ammunition analysis, I will first examine the support capability organic to the unit followed by the support capability of the DISCOM.

According to Jane's Armor and Artillery 1990-91, the fuel tank capacity of the M1 tank is 504 gallons; the fuel capacity of the

infantry and cavalry fighting vehicles is 175 gallons; the improved TOW vehicle's fuel tank holds 95 gallons; and the fuel tank capacity of the self-propelled 155mm howitzer is 135 gallons.<sup>10</sup> Using Tables 2-11 and 2-12 in FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), the average daily fuel consumption for the M1 tank, infantry and cavalry fighting vehicles, improved TOW vehicle and the self-propelled 155mm howitzer is 645, 165, 99 and 168 gallons respectively.<sup>11</sup> Except for the M1 tank and the 155mm howitzer, these figures indicate that the combat systems can operate for almost a day using only the fuel in the vehicle tanks.

In addition to the fuel carried in the fuel tanks, tactical units have organic refueling vehicles. In some units, organic refuelers are 1,200 gallon tank and pump units mounted on 5 ton cargo trucks and 600 gallon fuel pods mounted on 1 1/2 ton trailers. In other units, the refueler is the 2,500 gallon HEMTT fuel tanker and in one unit it is a 500 gallon collapsible drum with pump and filter separator. An examination of the table of organization and equipment for the deep attack force, using FM 101-10-1, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 1), reveals the unit refueling assets shown at Table 13.<sup>12</sup>

TABLE 13  
UNIT REFUELING SYSTEMS

<u>UNIT</u>	<u>TPU</u>	<u>HEMTT TANKER</u>	<u>500 GAL DRUM</u>
AR BN(x6)		72	
INF BN(x4)	28		
CAV TRP(x2)	2		
FA BN(x3)	9	9	
MLRS BTRY	1	1	
ADA BTRY(x3)		9	
ENGR CO(x3)	6	3	
BRIDGE CO	1		
MP CO (-)			1
FWD SIG CO	2		
FSB(x3)	<u>12</u>	---	---
TOTAL:	61	94	1

These assets translate into a capability to provide 345,300 gallons of fuel.

In addition to organic unit capability, the FSBs each have ten 5000 gallon tankers for a total of thirty tankers. The MSB has an additional thirty-four 5000 gallon tankers which can augment the FSBs' capability. These tanker assets provide an additional fuel capability of 320,000 gallons.

Assuming that all vehicles, less the M1 tank, the infantry and cavalry fighting vehicles, the improved TOW vehicle and the self-propelled 155mm howitzer, begin the operation with one day of supply in their fuel tanks, these "other" vehicles will account for 121,000 gallons of fuel. The M1 tank, infantry and cavalry fighting vehicles, improved TOW vehicle and the self-propelled 155mm howitzer will begin the deep operation with 245,000 gallons. Therefore, fuel in

the fuel tanks of the combat systems and "other" division vehicles accounts for 366,000 gallons or slightly less than the first day's consumption. Combining the fuel in the vehicle tanks with the capability of unit refuelers and DISCOM tankers, I arrive at a total support capability of 1,031,300 gallons.

As the operation progresses, given no resupply until after day 5, this capability is reduced through daily consumption and the loss of both combat and support systems. Based on Table 5, support systems are attrited at the rate of 15% for both offense and defense. Factoring in these considerations, sustainment capability shrinks to 504,874 gallons on day 2, 81,611 gallons on day 3, leaving no sustainment capability on days 4 and 5. This information is provided at Table 14.

TABLE 14  
CLASS III (BULK) CAPABILITY VS REQUIREMENT  
(GALLONS)

	<u>DAY 1</u>	<u>DAY 2</u>	<u>DAY 3</u>	<u>DAY 4</u>	<u>DAY 5</u>
CAP	1,031,300	504,874	81,611	0	0
REQ	416,000	355,100	318,200	286,100	195,200
REMAIN CAP	615,300	149,774	-236,589	-286,100	-195,200
TOT SHORTFALL			-236,589	-522,689	-717,889

In short, approximately six hours into day 3, the deep attack force will run out of fuel. Again, as with dry cargo, this analysis assumes that equipment that is nonreparable was destroyed and contains

no recoverable fuel. However, support systems which were damaged beyond the capability of DS repair will probably contain some recoverable fuel. Unfortunately, neither historical records or current planning data provide estimates of recoverable fuel. In this study, I will assume that 50% of the fuel carrying capacity of support systems will be recoverable. In other words, the deep attack force will be able to recover 1,250 gallons of fuel from a damaged HEMTT tanker. Unlike the dry cargo analysis, I am not allowing for any recovery of fuel in the damaged combat vehicles. At this point, it is unrealistic for the force to siphon fuel from the fuel tanks of damaged equipment. Based on this analysis, it appears that the deep attack force cannot be sustained with fuel, using only its organic assets, for the entire deep operation.

As in World War II, the deep attack force will carry out the operation accompanied by their organic water purification and distribution equipment. The deep attack force will deploy with its 105 authorized four hundred gallon water trailers. Based on the size of the deep attack force, it will deploy with seven of the division's Reverse Osmosis Water Purification Units or ROWPUs. The water trailers will allow for the storage and distribution of 42,000 gallons. The seven ROWPUs will produce 84,000 gallons of water. In addition, each soldier will carry at least a one quart canteen, accounting for another 3,195 gallons of water. In all, this equipment provides a total capability of 129,195 gallons of water at the start of the operation.

Based on the daily personnel losses, a 15% attrition rate for the water trailers and the loss of one ROWPU on day 4, the deep attack

force's capability is reduced to 106,934 gallons on day 2, 91,553 gallons on day 3, 72,000 gallons on day 4 and 72,000 gallons on day 5. Again, as with the ammunition and fuel examples, this analysis assumes that water trailers that are nonreparable have been destroyed and contain no recoverable water. However, trailers that must be evacuated or abandoned due to damage beyond DS repair capability will contain some recoverable water. As in the previous discussions, neither historical records or current data provide estimates of recoverable water. In this study, I will assume that 50% of the water carrying capacity of the trailers will be recovered. In other words, the deep attack force will recover 200 gallons from each damaged water trailer. While it is unlikely this water will be transferred to an undamaged water trailer, it is probable that water from the damaged trailer can be used to fill canteens and other unit water carrying equipment.

Given this analysis, Table 15 shows that the force will temporarily run out of water sometime late on day 3. Since the deep attack force has the capability to produce its own water, it can make an additional 72,000 gallons on both day 4 and 5. Yet, given the projected consumption, the deep attack force will temporarily run out of water on day 4 and 5.

TABLE 15  
WATER CAPABILITY VS REQUIREMENT  
(GALLONS)

	<u>DAY 1</u>	<u>DAY 2</u>	<u>DAY 3</u>	<u>DAY 4</u>	<u>DAY 5</u>
CAP	129,195	106,934	91,553	72,000	72,000
REQ	102,300	97,100	94,500	92,000	89,500
REMAIN CAP	26,895	13,795	-2,947	-20,000	-17,500
TOT SHORTFALL			-2,947	-22,947	-40,447

**SUMMARY**

Based on the foregoing analysis, the armored division's deep attack force can be sustained with Class I, III(pkg), V, VIII, IX for almost the entire operation. However, the force can only be sustained with fuel for about six hours into day 3 and it will run short of meeting its water requirements on days 3, 4, and 5. In conclusion, even with its more sophisticated logistics structure, the modern armored division is plagued with many of the problems experienced by its World War II predecessor. In the next chapter, I will examine ways in which the division can overcome this support shortfall applying many of the lessons learned during World War II.

## ENDNOTES

<sup>1</sup>U.S. Army, FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical and Logistical Data Planning Factors (Volume 2) (Washington: Department of the Army, 1987), p. 2-5.

U.S. Army, ST 101-6, Student Text--G4 Battle Book (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, 1990), p. 2-3.

<sup>2</sup>FM 101-10-1/2 (1987), pp. 2-135 - 2-136.

<sup>3</sup>ST 101-6 (1990), p. 2-1.

<sup>4</sup>Ibid.

<sup>5</sup>Ibid., p. 2-5.

<sup>6</sup>Ibid., p. 2.6.

<sup>7</sup>Ibid.

<sup>8</sup>FM 101-10-1/2 (1987), pp. 2-146 - 2-159.

<sup>9</sup>U.S. Army, FM 101-10-1, Staff Officers' Field Manual Organizational, Technical and Logistical Data Planning Factors (Volume 1) (Washington: Department of the Army, 1987), pp. 1-1 - 1-255.

<sup>10</sup>Christopher F. Foss, ed., Jane's Armour and Artillery, 11th ed., (Surrey: Jane's Information Group, 1990-91), 471.

<sup>11</sup>FM 101-10-1/2 (1987), pp. 2-18 - 2-52.

<sup>12</sup>FM 101-10-1 (1987), pp. 1-1 - 1-255.

## CHAPTER V

### ALTERNATIVE METHODS TO SUSTAIN THE DEEP ATTACK FORCE

#### INTRODUCTION

The previous chapter revealed significant limitations in the armored division's capability to support a deep attack force using only its organic assets. In each major commodity area; dry cargo, fuel and water, the analysis showed an inability to meet the force's requirements. The purpose of this chapter, therefore, is to examine alternatives that will "extend" the division's capability to support the deep attack force. This chapter will explore four methods of filling the support gap identified in the earlier analysis. These methods are: 1) self-sustainment using attached forces from corps, 2) sustainment over an air line of communication, 3) sustainment over a ground line of communication and, 4) scavenger logistics.

#### SELF-SUSTAINMENT USING ATTACHED CORPS SUPPORT ASSETS

Earlier, in chapter one, I described the U.S. Army's current doctrine for deep operation support. To review, FM 100-10, Combat Service Support, states that deep operations may be supported in two ways; self-sustainment and sustainment over a line of communication.<sup>1</sup>

Until now, my analysis has focused on self-sustainment using only the armored division's organic support capability. However, self-sustainment also can entail the attachment of support assets from outside the division. This concept has a historical basis, as the 4th and 6th Armored Divisions habitually received the attachment of two to three quartermaster truck companies and a quartermaster gasoline supply company from the field army. Today, however, these assets would most likely come from the corps logistics operator, the corps support command (COSCOM).

In the area of dry cargo, my analysis revealed that the deep attack force was self-sufficient until day 5, when it was short 263.6 short tons of cargo. Taking a 15% attrition rate into consideration, this equates to seventy-three 5 ton cargo trucks, or fourteen 22 1/2 ton S&P semitrailers, or a combination of the two types of vehicles. To put these numbers into perspective, a transportation light-medium truck company has fifty 5 ton cargo trucks, twenty-five 22 1/2 ton S&P semitrailers and ten 5 ton tractors to pull the semitrailers.<sup>2</sup> Therefore, the deep attack force would require a significant portion, if not all of a corps transportation light-medium truck company to overcome its dry cargo transportation shortfall.

In the Class III (bulk) arena, my analysis showed that the deep attack force ran out of fuel; being short 236,589 gallons on day 3, 286,100 gallons on day 4 and 195,200 gallons on day 5, for a total shortfall of 717,889 gallons. Again using an attrition rate of 15%, this shortfall can be overcome by 205 each, 5000 gallon fuel tankers.

Since a transportation medium truck company (POL) has sixty 5000 gallontankers, it would require almost three and one-half companies to satisfy the force's fuel shortfall.<sup>3</sup> Important to note is that these tankers, unlike those found in the MSB and FSB, are only bulk fuel haulers and cannot conduct retail fuel operations without specialized volume reducing equipment. In other words, while these bulk fuel tankers can refill a TPU or HEMTT tanker, they cannot normally pump fuel into an M1 tank or infantry fighting vehicle. As such, this somewhat limits both sustainment flexibility and responsiveness to the deep attack force.

In the area of water support, my analysis determined that the deep attack force would temporarily run out of potable water on days 3, 4 and 5; running short by 2947 gallons, 20,000 gallons and 17,500 gallons respectively. Here, there are several alternatives the division may pursue to alleviate this shortfall.

One option would be to deploy additional ROWPUs with the deep attack force. Currently, the deep attack force has seven ROWPUs, leaving three ROWPUs with elements remaining behind the FLOT.<sup>4</sup> Since the deep attack force will be short a maximum of 20,000 gallons on day 4, it will need a minimum of two additional ROWPUs, leaving only one ROWPU to support the 4,200 soldiers not involved in the cross-flot operation. Using the planning factor of 8 gallons/man/day, the personnel behind the FLOT would require 33,600 gallons of water each day and one ROWPU can only provide 12,000 gallons per day. Therefore, this alternative would require that divisional elements behind the FLOT

receive water support from corps or adjacent units to make up the 21,600 gallon per day shortfall.

Another option is to deploy semitrailer mounted fabric tanks or SMFTs with the deep attack force. The SMFT is normally found at the corps or theater army level in the quartermaster water supply company. The SMFT comes in two sizes; a 3000 gallon SMFT that mounts on a thirty foot, 22 1/2 ton S&P semitrailer and a 4570 gallon SMFT that mounts to a forty foot, 34 ton S&P semitrailer. Since the 22 1/2 ton semitrailer is pulled by tactical tractors, I will only consider the use of the 3000 gallon SMFT. Because all the division's available S&P semitrailers are hauling dry cargo, the division will require augmentation of the SMFT, the semitrailer and the 5 ton tractor. Based on an attrition rate of 15%, the deep attack force would require an augmentation of twenty SMFTs with tractors and trailers.

Still another option would be the use of water purification tablets to treat the drinking water consumed by the individual soldier. According the FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), of the 8 gallons/man/day requirement, 1.5 gallons are allocated for individual drinking water consumption.<sup>5</sup> By using water purification tablets, the requirement to produce potable water by the ROWPUs shrinks to 6.5 gallons/man/day. Comparing the water support capability with this new, lower requirement, Table 16 shows that using water purification tablets can reduce, but not totally eliminate the shortfall. Therefore, it will require a combination of the options described above to alleviate the water support shortfall.

TABLE 16  
 WATER CAPABILITY VS REQUIREMENT  
 REVISED TO REFLECT USE OF WATER PURIFICATION TABLETS  
 (GALLONS)

	<u>DAY 1</u>	<u>DAY 2</u>	<u>DAY 3</u>	<u>DAY 4</u>	<u>DAY 5</u>
CAP	129,195	106,934	91,553	72,000	72,000
REQ	83,070	78,897	76,797	74,750	72,754
REMAIN CAP	46,125	28,307	14,756	-2,750	-754
TOT SHORTFALL				-2,750	-3,504

To summarize, supporting the deep attack force under self-sustainment doctrine would require the attachment of three and one-half transportation medium truck companies (POL), one transportation light-medium truck company and up to twenty 3000 gallon SMFTs with tractors and trailers. Needless to say, these additional assets, by themselves, will increase overall sustainment requirements and will lengthen the logistics tail by up to 278 vehicles.

#### **SUSTAINMENT OVER AIR LINES OF COMMUNICATION**

An alternative to self-sustainment is sustainment over lines of communication (LOC). Instead of taking all the support assets with the deep attack force, sustaining supplies are delivered to the force over air LOC, ground LOC or both.<sup>6</sup> I will first address sustainment over air LOC, better known as aerial resupply. Aerial resupply allows for rapid support which is unencumbered by terrain. Unfortunately, aerial resupply is greatly affected by adverse weather conditions and requires

at least temporary air superiority and suppression of enemy air defense.

As discussed in chapter two, aerial resupply played a significant role in delivering supplies to the 3d U.S. Army and the 4th and 6th Armored Divisions. While considered an emergency measure, aerial resupply in August 1944 became more of a routine than an exception. For the most part, supplies were delivered by cargo planes which landed at secure airfields near the supported ground forces; known today as airland operations. Smaller quantities of very urgently needed supplies were dropped by parachutes to the armored divisions. These same categories, airland and airdrop, are used today. In addition, the advent of the helicopter has broadened the definition of aerial resupply to include slingloading supplies by army cargo helicopters.

For this study, I will examine aerial resupply using the C130E cargo aircraft and CH-47D cargo helicopter. According to Table 3-17 of FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), a C130E cargo plane can support wartime airland operations with a maximum cargo load of 24.5 short tons.<sup>7</sup> According to ST 101-6, G4 Battle Book, a C130 cargo plane carrying two each 3000 gallon tanks, known as a "bladderbird," can support airland operations with 6000 gallons of fuel.<sup>8</sup> For airdrop operations, the C130 aircraft can carry and drop sixteen A-22 Containerized Delivery System (CDS) airdrop bundles. Each bundle weighs 2200 pounds, of which the supplies account for 2000

pounds and the air items account for 200 pounds.<sup>9</sup> Table 3-8 of FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2), states that the CH-47D cargo helicopter has a payload, both external and internal load, of 20,206 pounds or 10.1 short tons.<sup>10</sup> Using these payload figures, I can determine how many C130E and CH-47D sorties will be required to overcome the sustainment shortfall of the deep attack force.

For dry cargo, the identified shortfall of 263.6 short tons can be satisfied by eleven C130E airland sorties, or seventeen C130E airdrop sorties or twenty-six CH-47D sorties. This assumes that the cargo carried is heavy and will weight out before it cubes out.

For fuel, the shortfall of 236,589 gallons on day 3 will require forty C130E "bladderbird" airland sorties, or sixty-eight C130E airdrop sorties or ninety-five CH-47D sorties. The airdrop sorties are based on each CDS airdrop bundle containing four 55 gallon drums of fuel. The CH-47D sorties are based on each sortie carrying 2500 gallons of fuel in 500 gallon collapsible drums. The shortfall of 286,100 gallons on day 4 will require forty-eight C130E "bladderbird" airland sorties, or eighty-two C130 airdrop sorties or one hundred and fifteen CH-47D sorties. The 195,200 gallon shortfall on day 5 will require thirty-five C130E "bladderbird" airland sorties, or fifty-six C130E airdrop sorties or seventy-eight CH-47D sorties.

For water, the shortfall of 2947 gallons on day 3 will require one C130E airland sortie, or one C130 airdrop sortie or two CH-47D sorties. The airland sorties are based on a C130E aircraft carrying

potable water in two, uncontaminated 3000 gallon tanks, for a total of 6000 gallons per sortie. The airdrop sorties are based on each CDS airdrop bundle containing four 55 gallon collapsible drums of potable water. The CH-47D sorties are based on each sortie carrying 2500 gallons of water in 500 gallon collapsible drums. The day 4 shortfall of 20,000 gallons can be satisfied by four C130E airland sorties, or six C130E airdrop sorties or eight CH-47D sorties. The 17,500 gallon shortfall on day 5 can be satisfied by three C130E airland sorties, or five C130 airdrop sorties or seven CH-47D sorties.

Table 17 summarizes aircraft sortie requirements for dry cargo, fuel and water.

TABLE 17  
AIRCRAFT SORTIES BY SUPPLY COMMODITY

	<u>C130E A/L</u> or	<u>C130E A/D</u> or	<u>CH-47</u>
DRY CARGO	11	17	26
FUEL	121	206	288
WATER	8	12	17
TOTAL	140	235	331

Aircraft sorties required by day of the deep attack operation are shown at Table 18.

TABLE 18  
AIRCRAFT SORTIES REQUIRED EACH DAY

	<u>C130E A/L</u>	or	<u>C130E A/D</u>	or	<u>CH-47</u>
DAY 1	0		0		0
DAY 2	0		0		0
DAY 3	41		69		97
DAY 4	52		88		123
DAY 5	47		78		111
TOTAL	140		235		331

While the seemingly high number of aircraft sorties may make aerial resupply appear untenable, it is important to put these figures in perspective. As shown in Table 17, dry cargo and water requirements make up only 13% of the sortie requirements and can be supported with relatively few aircraft. While the fuel requirement tends to drive up the number of sorties, remember that in August 1944, 3d U.S. Army, which consumed as much fuel as today's modern armored division, received almost 450 sorties of supplies on a single day. Of course, the above analysis doesn't consider attrition and requires at least temporary air superiority and suppression of enemy air defense.

#### SUSTAINMENT OVER GROUND LINES OF COMMUNICATION

The next support concept is sustainment over ground lines of communication. FM 100-10, Combat Service Support, states that sustainment over ground LOC allows for the most complete support as

large quantities of supplies and equipment can be provided to the deep attack force.<sup>11</sup> Unlike aerial resupply, ground LOCs are not as easily affected by adverse weather. A computer simulation conducted by VII Corps and 2d Support Command found that a deep attack force was best supported over a secure ground line of communication.<sup>12</sup>

An added benefit of supply over ground LOC is that it shortens the logistics tail of the deep attack force. Now, instead of taking the MSB's cargo trucks and fuel tankers with the deep attack force, these assets would remain with the MSB and be used to bring up supplies from the rear. Even better, as the 2d Support Command's simulation discovered, is the use of secure rail lines up to the brigade areas to support the deep attack force.<sup>13</sup>

The major drawback to sustainment by ground LOC is the need to secure the LOC, either temporarily or continuously. FM 100-10, Combat Service Support, states "the price [for optimum sustainment] is tying up scarce combat and combat support resources required to secure the long lines of communication."<sup>14</sup> Unfortunately, the manual does not suggest exactly what that price might be; however, our historical experience may provide some idea of the cost.

The experience of the 6th Armored Division during the Brittany campaign provides some insight on the amount of combat and combat support assets needed to secure the ground LOC. During this campaign, as the division moved over 200 kilometers from the field army's supply points, several combat elements accompanied the division's convoys and secured the ground LOC as trucks travelled back to the field army

supply points to pick-up supplies. Combat assets diverted to this mission were two anti-aircraft batteries, a light tank company, an infantry company and a section of tank destroyers.<sup>15</sup>

In the studied scenario, it is probable that sustainment over ground lines of communication would be conducted using "LOGPAC" convoys with accompanying combat elements. These elements would conceivably include parts or all of an air defense battery, a mechanized infantry company, a tank company and a section of engineers. These elements would accompany the LOGPAC, as well as temporarily secure the LOC for the convoy. If the ground LOC is to be continuously opened, even more combat and combat support elements might be required for security. Again, the decision to commit these forces rests with the combat commander and is a trade-off against requirements for combat power needed in the close battle.

#### SCAVENGER LOGISTICS

A fourth approach to filling the sustainment shortfall is the use of scavenger logistics. Scavenger logistics, also known as foraging, battlefield procurement and living off the land has been around as long as there have been armies. Sources for scavenging generally include other friendly forces, enemy forces, friendly nonmilitary sources and hostile nonmilitary sources in occupied territory. For the deep attack scenario, our force is limited to the latter three sources.<sup>16</sup>

While not specifically addressed, several doctrinal sustainment manuals at least discuss some aspects of scavenger logistics. For

example, FM 63-2-2, Combat Service Support Operations, Armored, Mechanized and Motorized Divisions, states "U.S. forces must take advantage of what they have. This includes taking full advantage of host nation resources . . . and by foraging and use of captured enemy material."<sup>17</sup> FM 100-10, Combat Service Support, specifically addresses captured material when it states:

Captured materiel can contribute to the retention of momentum by maneuver forces and provide a decreased need to consume our own supply stocks and to transport them to using units. Obvious sources are captured or overrun enemy fuel supply points and materiel which may be used for barrier and fortification construction. Such use will reduce the work load and materiel requirements of our own force.<sup>18</sup>

In short, these passages suggest that scavenging may be a way to overcome the deep attack force's sustainment shortages.

Scavenger logistics is not without historical precedence in the U.S. Army. During August and September 1944, General Patton's 3d U.S. Army employed scavenger logistics to fill support shortfalls for food and fuel. In August 1944, 3d U.S. Army made use of over 2,800,000 pounds of beef and vegetables and 500,000 pounds of flour captured at St. Malo and Orleans, France. When fuel supplies became scarce, 3d U.S. Army made use of over 500,000 gallons of captured gasoline. During the Brittany campaign, 6th Armored Division also made a battlefield procurement of 200,000 gallons of gasoline.

While many logisticians see scavenger logistics as risky, ad-hoc and a method of last resort, Major Larry D. Harmon, in his monograph "Scavenger Logistics in Support of Tactical Operations," makes a case for deliberately planned scavenger logistics. This study

explains that scavenging can be considered for sustainment, but it must be well planned and thought out. For scavenging to be viable, the logistic planner must consider the mission of the force to be sustained; the enemies capabilities, equipment and materiel that may be scavenged; assets available for scavenging in the area of operations; assets that may be available from friendly forces, to include the civilian population, and the political, legal and ethical implications of scavenging. By analyzing these factors the logistic planner can determine the potential capabilities of scavenging.<sup>19</sup>

The study concludes that employment of scavenger logistics, when properly planned, is a viable alternative and supplement to sustainment operations and provides a means of satisfying periodic sustainment shortfalls. However, scavenger logistics is not a replacement for the formal logistic system. In fact, the greatest payoff occurs when both scavenging and the formal system are used together in a complementary fashion. For the studied scenario, therefore, it appears reasonable to plan for the use of scavenger logistics, however, the formal system must be prepared to provide support if scavenging proves unable to bridge the sustainment gap.<sup>20</sup>

#### **SUMMARY**

Each sustainment method discussed in this chapter can help alleviate the deep attack force's sustainment shortfall. All of these methods have historical precedence and were used by the 3d U.S. Army and the 4th and 6th Armored Divisions during the pursuit through France

in August and September 1944. While some options may be used exclusively, such as self-sustainment using attached corps assets or sustainment over ground lines of communication, it is probably best to use some aspects of each method. In this way, the deep attack force can capitalize on the advantages of each option, while minimizing their disadvantages and risk.

#### ENDNOTES

<sup>1</sup>U.S. Army, FM 100-10, Combat Service Support (Washington: Department of the Army, 1988), p. 2-12.

<sup>2</sup>U.S. Army, ST 101-6, Student Text--G4 Battle Book (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, 1990), p. 4-27.

<sup>3</sup>ST 101-6 (1990), p. 5-6.

<sup>4</sup>*Ibid.*, p. 5-6.

<sup>5</sup>U.S. Army, FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical and Logistical Data Planning Factors (Volume 2) (Washington: Department of the Army, 1987), p. 2-8.

<sup>6</sup>FM 100-10 (1988), p. 2-13.

<sup>7</sup>FM 101-10-1/2 (1987), p. 3-28.

<sup>8</sup>ST 101-6 (1990), p. 2-3.

<sup>9</sup>FM 101-10-1/2 (1987), p. 2-177.

<sup>10</sup>*Ibid.*, p. 3-11.

<sup>11</sup>FM 100-10 (1988), p. 2-13.

<sup>12</sup>Albin G. Wheeler, "Operational Logistics in Support of the Deep Attack," Military Review 66 (February 1984): 12-19.

<sup>13</sup>*Ibid.*

<sup>14</sup>FM 100-10 (1988) p. 2-13.

<sup>15</sup>U.S. War Department, Headquarters, 6th Armored Division, "Operations of the 6th Armored Division Trains During the Brittany Campaign," 2.

<sup>16</sup>Larry D. Harman, "Scavenger Logistics," Army Logistician (July-August 1989): 24.

<sup>17</sup>U.S. Army, FM 63-2-2, Combat Service Support Operations, Armored, Mechanized and Motorized Divisions (Washington: Department of the Army, 1985), p. 1-6.

<sup>18</sup>FM 100-10 (1988), p. 1-23.

<sup>19</sup>Larry D. Harman, "Scavenger Logistics in Support to Tactical Operations," (SAMS Monograph, U.S. Army Command and General Staff College, 1986), 16-27.

<sup>20</sup>Ibid., 36.

## CHAPTER VI

### CONCLUSIONS AND RECOMMENDATIONS

#### INTRODUCTION

This study was based on the hypothesis that a U.S. armored division can be sustained for no more than five days, relying only on its organic support assets, in a deep operation that requires the division to maneuver seventy-five kilometers forward of the FLOT. The use of a division-size unit in deep maneuver is proposed by FM 100-15, Corps Operations, 1989.

To explore the potential for a division-size deep attack, the operations of the 3d U.S. Army and its 4th and 6th Armored Divisions were examined, concentrating on the pursuit through France in August and September 1944. This review revealed the problems of supporting operations over extended and tenuous lines of communication. This study disclosed that fuel was the most limiting supply commodity during the pursuit, followed by ammunition and food. However, transportation, more than the supplies themselves, was the single most limiting factor in sustainment of the pursuit.

This historical review not only provided information on support deficiencies, it also revealed the expedients and improvisation used to overcome or minimize the impact of these shortages. This included

attachment of field army truck and gasoline supply companies, the pooling of transportation assets to create the "Red Ball Express," the extensive use of aerial resupply and the use of captured enemy fuel and food.

From this historical perspective, the study focused on the capability of the modern U.S. armored division. An examination of the armored division's organic logistics support capability revealed a system much more robust and sophisticated than its World War II predecessor. However, the higher fuel and ammunition consumption of modern weapons and equipment could more than offset the increase in support assets.

The capability of today's armored division to support a five day deep operation which extends seventy-five kilometers forward of the FLOT was analyzed using planning factors from FM 101-10-1/2, Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2) and ST 101-6, G4 Battle Book. This analysis also took into account attrition of personnel and key combat and support systems. This examination disclosed a shortfall in the armored division's ability, using only its organic support assets, to logistically support a five day deep attack operation. The study revealed shortages of fuel, water and dry cargo.

Fuel was the first and most critical shortfall encountered by the force. Fifty-four hours, or 2 1/4 days, into the deep attack, the division ran out of fuel. By the end of the third day the division temporarily ran out of water. Since the division has its own water production capability, it will never totally run out of water, however,

beginning on the third day water requirements will exceed production capability. The division was most self-sufficient in dry cargo, and will only begin to run out late on the fifth day of the operation.

Since the analysis showed that the division cannot support itself for the entire deep attack, the force must look to other means of support. Current doctrine in FM 100-10, Combat Service Support, provides for the attachment of support elements from outside the division, or sustainment over lines of communication. Using assets from COSCOM to support the deep attack would require the attachment of three and one-half transportation medium truck companies (POL), one transportation light-medium medium truck company and up to twenty semitrailers with 3000 gallon SMFTs. This would increase the logistics tail by over 278 vehicles. Overcoming the shortfall by aerial resupply would require either 140 C130E airland sorties, or 235 C130E airdrop sorties, or 331 CH47D sorties. The use of ground LOCs would probably require the dedication of almost a battalion task force with accompanying air defense and engineer assets. An expedient employed in World War II to overcome supply shortages was the use of captured enemy materiel or scavenger logistics. While never a guaranteed source of supply, this method may provide additional transportation, food and fuel. It is most effective when used along with the formal system of supply. In most cases, a combination of these other methods of support will be used to augment the division's organic support capability.

## CONCLUSIONS

In summary, this study finds the following:

- That a division can be sustained for 2 1/4 days using only its organic support assets.

- That support beyond 2 1/4 days requires additional support assets from COSCOM or resupply over ground and air lines of communication.

- That use of captured supplies may reduce, but not totally eliminate external support requirements.

- Validates the hypothesis that an armored division can be sustained for no more than five days, using only its organic assets, in a deep attack operation which requires it to maneuver seventy-five kilometers forward the FLOT.

## RECOMMENDATIONS

Based on the above conclusions, the following recommendations are presented.

- Doctrinal manuals need to identify the limits of deep maneuver conducted by a division-size force.

- The use of the armored division in other theaters of operation should be explored. For instance, operations in the Middle East would put a greater demand on water supply and distribution, as well as increased consumption of repair parts. Experience in Desert Storm may provide some insight and areas for further study.

- This examination was primarily a quantitative approach to supporting a deep attack operation. There is a need for a qualitative approach to this study, in the "Face of Battle" vein, that incorporates the human factor to support operations.

- The impact of emerging doctrine such as AirLand Battle - Future on support of deep maneuver should be studied. How will the movement of support down to brigade level and up to the corps level affect support of deep operations?

- The command and control of the support organization needs to be studied. What is the best task organization for support of deep maneuver? Who and how will the attached assets be controlled?

- More study is needed on the feasibility of scavenger logistics, to include the need for a more formal and doctrinal approach to this method of resupply.

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