

FORWARD SURGICAL TEAM SUPPORT AVAILABLE TO A  
DIGITIZED DIVISION IN TOTAL ARMY ANALYSIS 05:  
IS IT ENOUGH?

A thesis presented to the Faculty of the U.S. Army  
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degree

MASTER OF MILITARY ART AND SCIENCE  
General Studies

by

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Traditionally, the United States has downsized its armed forces after periods of military success. These periods are generally accompanied by times of reduced defense budgets and military spending. Along with the Army, the Medical Department has experienced a significant reduction in its force structure over the last ten years. The assumption that future battlefields will be more survivable due to the Army's technological superiority has driven a reduction of the division casualty rates that are used to establish the force structure of the future. This assumption is not consistent with historical data. Using the employment of the 4th Armored Division during the reduction of Nancy, France, in September 1944 as a historical example, it is clear that casualties are not incurred at a standard rate over time and space. Based on this example and the similarities between the World War II era 4th Armored Division and the Force XXI division, has the reduction in medical force structure negatively affected the ability to provide far forward surgical care?

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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

FORWARD SURGICAL TEAM SUPPORT AVAILABLE TO A DIGITIZED DIVISION IN TOTAL ARMY ANALYSIS 05: IS IT ENOUGH? By MAJ Mark A. Gifford, USA, 121 pages.

Traditionally, the United States has downsized its armed forces after periods of military success. These periods are generally accompanied by times of reduced defense budgets and military spending. Along with the Army, the Medical Department has experienced a significant reduction in its force structure over the last ten years. The assumption that future battlefields will be more survivable due to the Army's technological superiority has driven a reduction of the division casualty rates that are used to establish the force structure of the future. This assumption is not consistent with historical data. Using the employment of the 4th Armored Division during the reduction of Nancy, France, in September 1944 as a historical example, it is clear that casualties are not incurred at a standard rate over time and space. Based on this example and the similarities between the World War II era 4th Armored Division and the Force XXI division, has the reduction in medical force structure negatively affected the ability to provide far forward surgical care?

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as the use of his casualty estimation tool that assisted in the development of the figures used throughout the thesis.

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## CHAPTER 1

### INTRODUCTION

Traditionally, the United States has downsized its armed forces after periods of military victory. Downsizing is generally accompanied by times of reduced military spending. When the Army goes through downsizing, so does the Army Medical Department (AMEDD). The AMEDD has gone through a significant reduction in its force structure over the last ten years. This downsizing is a result of two factors. The most important being as stated above, the Army as a whole has reduced its force structure. The second reason for the reduction in medical force structure is the concept that the anticipated casualty rates for future battles have been reduced. This reduction in casualty rates largely stems from a perceived increased effectiveness of fighting forces and the protection offered from the dispersion of units on the future battlefield.

The reduction in medical force structure has had little effect on echelon one and two medical units. At echelon one this is due to the fact that maneuver battalions have reduced their maneuver companies from four to three, while the number of treatment teams in a medical platoon of that same battalion has increased from two to three under the Force XXI design. The force structure at echelon two has also changed very little under the Force XXI redesign. In fact, there is now greater preventative health care available at echelon two than prior to Force XXI. The major area that has been affected by the medical force reduction is the far forward surgical capability. During the previous medical force structure, Medical Force 2000 (MF2K), a Mobile Army Surgical Hospital (MASH) was allocated to each division. Under the Medical Reengineering Initiative

(MRI), the MASH has been eliminated and the Forward Surgical Team has been developed to provide this surgical capability. This study shows that the casualty rate used under the Total Army Analysis (TAA) process to develop the Force XXI structure assumed great risk to patient care while reducing, if not eliminating, the flexibility and mobility of the medical leader to support the maneuver commander.

### Context of the Problem

This study is conducted during a time when the Army has experienced over ten years of downsizing. During this period technology has advanced at a rapid pace. As the Army and the AMEDD have gotten smaller, the AMEDD has assumed that present and future advances in technology will greatly improve the survivability of soldiers on the battlefield. The assumed improvement in soldier survivability and a reduced funding have led to a significant reduction in medical force structure and revised casualty rates for divisions on future battlefields.

Current scenarios that model force structures and their corresponding casualty rates are applied to theaters of operation. Decisions made by the Army based on these theater operational plans often done only for fiscal reasons may generate great risk to casualties at the division level within that theater.

This study looks at current Army assumptions in terms of casualty rates, patterns, and distribution and then compares them to historical events, specifically the 4th Armored Division's encirclement of Nancy, France, in September 1944. In the conduct of this research, the comparison of historical events and current assumptions regarding casualties on future battlefields was expected to provide a perspective on the risk that may exist if these assumptions prove false.

### The Research Question

This study focuses on the primary question: How has the reduction in the Army and the Army Medical Department impacted the sufficiency of the medical force structure under Force XXI and the Medical Reengineering Initiative (MRI) to provide timely surgical intervention for seriously wounded casualties? The following subordinate questions were developed to analyze the sufficiency of the future medical force and thus answer the primary question:

1. How does the employment of far forward surgical capability, in the form of Forward Surgical Teams, impact the survivability of seriously wounded casualties?
2. How does the employment of medical evacuation assets affect the survivability of those seriously wounded casualties that require timely surgical intervention?
3. How has the reduction in medical force structure impacted the medical planner's flexibility to surge medical capability to a point on the battlefield where additional evacuation or surgical capability is required to move or treat seriously wounded casualties?

### Assumptions

One of the principal assumptions made by the investigator as a premise for this research project is that the Force XXI division will in some fashion be a component of the future "objective force" as imagined by General Eric Shinseki, the Army Chief of Staff. The other principal assumption made by the investigator is that one can use the 4th Armored Division and other historical events to extrapolate future issues regarding casualty patterns and distribution.

In regards to the second principal assumption made by the investigator, a number of secondary assumptions are made. Future battles using armored forces will retain as high an operational tempo as has been experienced in the past. The operational readiness rates of systems will remain similar to those rates that exist today. Casualty rates and patterns on future battlefields will be similar to those experienced on previous battlefields. Historical rates of casualties, killed in action and wounded in action, will be applicable when considering the survivability of casualties on future battlefields. The rate of seriously wounded casualties to lightly wounded casualties on the future battlefield will be similar to historical experience. Casualty distribution on the future battlefield will be similar to the historical distribution of casualties on previous battlefields. All the assumptions regarding casualty survivability are based on the premise that there will not be a major leap in medical technology in the near future that eliminates the requirement for far forward surgical intervention.

#### Definition of Terms

There are common terms and definitions presented throughout the references of this study. While sometimes used in different contexts, the following definitions are used:

Medical Platoon. The medical platoon is organic to armor and infantry battalion headquarters companies. The medical platoon sorts, treats, and evacuates the sick and wounded from the area of operations in which its supported battalion is operating.<sup>1</sup>

Medical Detachment. For the purposes of this study the medical detachment refers to those medical detachments that are attached either to the regimental or battalion

headquarters. These detachments provide primary medical care and treatment to each battalion and the regimental headquarters.<sup>2</sup>

Battalion Aid Station. Battalion aid station is a generic term used to refer to the treatment facility established by the treatment squad of the medical platoon. It is normally located in the combat trains of the battalion or squadron to which it is assigned.

Medical Company. For the purposes of this study the term medical company refers to the forward and division support medical companies. These companies provide echelon two medical care. The Forward Support Medical Company is organic to a Forward Support Battalion and found in the Brigade Support Area. It supports a Brigade Combat Team and those units operating in that brigade's area of operation. The Division Medical Company is organic to the Division Support Battalion and found in the Division Support Area. It supports the units that are found in the Division Rear Area and the separate battalions in the division that do not have organic medical support.

Collecting Company. In the 1944 medical force a collecting company was comprised of a station platoon and a collecting platoon. The station platoon consisted of a collecting station section and a liaison section while the collecting platoon was comprised of an ambulance section and a litter bearer section. Each collecting company was in direct support of an infantry regiment (roughly equivalent to a modern brigade without combat support (CS) and combat service support (CSS) units. Each collecting company evacuated casualties from the regimental and battalion aid stations of the infantry regiment it supported.<sup>3</sup>

Clearing Company. The 1944 clearing company was in the division rear area and consisted of two clearing platoons. Doctrine did not definitively define the organization

of the clearing platoon but an example organization in the field manual provided for a platoon headquarters, a technical section, and a transportation section. The clearing company provided support to all three collecting companies.<sup>4</sup>

Clearing Station. The clearing station is a generic term used to refer to the treatment area within the clearing company of 1944 and the medical company in current and future doctrine. The current Clearing Station is the echelon two treatment facilities that are made up of components of the treatment platoon within the medical company in either the Forward Support or Division Support Medical Company.

Field Hospital Platoon. In 1944, the field hospital platoon was a mobile unit whose mission was to support division medical services by providing surgical aid to casualties who may not be stable enough to survive evacuation to a hospital. It was usually located near a division clearing station to ensure immediate surgical care. It could also assume the clearing company's casualties if that company was required to move to continue to support the division.

Forward Surgical Team (FST). This team is a corps asset that provides surgical augmentation for divisional and nondivisional medical companies. It provides emergency and urgent initial surgery and nursing care after surgery for the critically wounded and injured casualty until sufficiently stable for evacuation to a theater hospital. The FSTs will normally be assigned to a medical brigade or group and attached to a corps hospital when not operationally employed and further attached for support to a divisional or nondivisional medical company.<sup>5</sup>

Support. Support is comprised of many things, but for the purposes of this paper, support is defined as an action of a force which aids, protects, complements, or sustains

another force in accordance with a directive requiring such action. Support also is an element of a command which assists, protects, or supplies other forces in combat.<sup>6</sup>

Direct Support (DS). A mission requiring a force to support another specific force and authorizing it to answer directly the supported force's requests for assistance. The support provided by a unit or formation not attached to, nor under the command of, the supported unit or formation, but required to give priority to the support required by that unit or formation.<sup>7</sup>

General Support. That support which is given to a supported force as a whole and not to any particular subdivision thereof.<sup>8</sup>

Attach. The placement of units or personnel in an organization where such placement is relatively temporary.<sup>9</sup>

Operational Control (OPCON). Transferable command authority that may be exercised by commanders at any echelon at or below the level of combatant command, operational control may be delegated and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training.<sup>10</sup>

Echelon of Care. In 1944, echelons of field medical service corresponded to the echelons of general administrative responsibility. These did not necessarily correspond to echelons of command. Today echelons of care refer to treatment capability. In current and future doctrine, echelons of care refer to the treatment capability of a given medical

asset. The terms “echelon” and “level” as they relate to treatment are synonymous.

Higher echelons of care possess at least the same treatment capability as those echelons forward of it, but add additional treatment capability.

Echelon One Care. In 1944, first echelon medical services were “provided by attached medical personnel to every unit of every arm and service (except medical) of the size of a battalion or larger, whether such unit is an element of a division”<sup>11</sup> or higher organization. Today, an echelon one treatment facility is only able to provide treatment to save life, limb or eyesight by controlling bleeding, maintaining an open airway, and stabilizing a casualty enough to be evacuated to the next higher echelon for further, more advanced treatment.

Echelon Two Care. In 1944, second echelon field medical service was comprised of the collection of casualties from aid stations and their consolidation at one or more clearing stations. Today, echelon two care includes the same capability as found in the aid station as well as the ability to provide limited dental care, limited diagnostic laboratory and radiological support, and hold casualties that are anticipated to return to duty within 72 hours.

Echelon Three Care. Today echelon three care refers to the first place on the battlefield a casualty will enter a hospital. The surgical capability of an echelon three facility includes the ability to place a casualty under a general anesthetic versus local anesthetic.<sup>12</sup>

Categories of Triage. Triage is the process of prioritizing casualties on the basis of their need for surgical intervention and or likely outcome of their treatment. Casualties are generally triaged into four categories.<sup>13</sup>

Immediate. This category is for casualties whose condition demands immediate, resuscitative treatment. Generally, 20 percent of casualties are in this category.<sup>14</sup>

Delayed. This category is for casualties that can tolerate a delay in their treatment without significantly compromising the prospect of a successful treatment outcome. Generally 20 percent of casualties are in this category.<sup>15</sup>

Minimal. This category is for casualties that are superficially wounded and require little more treatment than wound cleaning, possibly under local anesthetic, and first aid type dressings. Generally 40 percent of all casualties are in this category.<sup>16</sup>

Expectant. This category is for casualties that have wounds that are so extensive that their survivability would be unlikely. Generally 20 percent of all casualties are in this category.<sup>17</sup>

Categories of Evacuation. The following categories are used in much the same manner as categories of triage; these categories determine the precedence for the evacuation of casualties.

Urgent. Category assigned to a casualty who should be evacuated as soon as possible and within a maximum of two hours in order to save life, limb, or eyesight, to prevent complications of serious illness, or to avoid permanent disability.<sup>18</sup>

Priority. Category assigned to a casualty requiring prompt medical care. This category is used when the casualty should be evacuated within four hours or his medical condition could deteriorate to such a degree that he will become an urgent category casualty.<sup>19</sup>

Routine. Category assigned to casualties requiring evacuation but whose condition is not expected to deteriorate significantly. These casualties should be evacuated within twenty-four hours.<sup>20</sup>

### Limitations

This study has several limitations. The largest was access to historical material required to compare and contrast the 4th Armored Division in its encirclement of Nancy in September 1944 and Force XXI. Many of the documents that were required to conduct this comparison were not available at the Combined Arms Research Library at Fort Leavenworth. Although time and access to material at the National Archives in College Park, Maryland, was less than optimum, the conclusions made are still valid. Casualty rate information used during the Total Army Analysis (TAA) process for fiscal year 2007 was not available since this process was ongoing at the time of writing. Due to the classification of certain parts of the TAA process, some data was not available to the investigator. Based on the limited information available regarding the Interim Brigade Combat Team (IBCT), the investigator was not able to determine casualty rates used to develop the medical force structure of that brigade.

### Scope and Delimitations

The scope of this study is limited to the far forward surgical capability of the future medical force structure and its sufficiency to care for seriously wounded casualties on the future battlefield. Further, it focuses on seriously wounded casualties, those at greatest risk if timely care is not provided.

This study is also limited in its historical comparison of the 4th Armored Division to operations during the encirclement of Nancy. The 4th Armored Division was used as a penetration and exploitation force whose superior knowledge of the battlefield allowed it to swiftly cut into the enemy's rear area and disrupt its lines of communications and routes of egress. Although the Army will not likely fight again as it did in World War II in eastern France, it is believed that this battle better illustrates a future conventional battlefield than those of the Korean or Vietnam Wars.

#### Significance of the Study

This study is not intended to find fault with the current manner in which force structures are developed. It will, however, analyze current proposed casualty rates and far forward surgical capability from the perspective of a division battle. Based on the research conducted by the investigator, this type of study has not been done before. The investigator quantifies the far forward surgical requirement based on proposed casualty rates and then analyzes the associated risks to seriously wounded casualties.

This study has the potential to be used to either validate the future medical force structure or propose a thesis to alter that force structure in order to better meet the surgical requirements for seriously wounded casualties on the future battlefield.

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<sup>1</sup>Department of the Army, FM 8-10-4, *Medical Platoon Leaders' Handbook Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 1990), 2-3.

<sup>2</sup>Department of the Army, FM 8-10, *Medical Field Manual Medical Service of Field Units* (Washington, DC: War Department, 1942), 39.

<sup>3</sup>*Ibid.*, 62-63.

<sup>4</sup>Department of the Army, FM 8-5, *Medical Field Manual for Mobile Units of the Medical Department* (Washington, DC: War Department, 1942), 73.

<sup>5</sup>Department of the Army, FM 8-14, *Employment of the Combat Support Hospital Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 1994), 1-3.

<sup>6</sup>Department of the Army, FM 101-5-1, *Operational Terms and Graphic* (Washington, DC: Government Printing Office, 1997), 1-147.

<sup>7</sup>*Ibid.*, 1-54.

<sup>8</sup>*Ibid.*, 1-73.

<sup>9</sup>*Ibid.*, 1-13

<sup>10</sup>*Ibid.*, 1-114.

<sup>11</sup>Department of the Army, FM 8-5, *Medical Field Manual for Mobile Units of the Medical Department* (Washington, DC: War Department, 1942), 9.

<sup>12</sup>Department of the Army, FM 8-10, *Health Service Support* (Washington, DC: Government Printing Office, 1991), 3-8.

<sup>13</sup>Department of the Army, FM 8-10-1, *The Medical Company* (Washington, DC: Government Printing Office, 1994), C-3.

<sup>14</sup>*Ibid.*

<sup>15</sup>*Ibid.*

<sup>16</sup>*Ibid.*

<sup>17</sup>*Ibid.*

<sup>18</sup>Department of the Army, FM 8-10-6, *Medical Evacuation* (Washington, DC: Government Printing Office, 2000), 7-2.

<sup>19</sup>*Ibid.*

<sup>20</sup>*Ibid.*

## CHAPTER 2

### REVIEW OF LITERATURE

The objective of this study is, through the use of historical data, to determine if the medical force structure has downsized to the point that it can no longer provide timely far forward surgical care. To accomplish this objective it is necessary to review the concepts of attrition and how they relate to the generation of casualties both in terms of numbers and densities. In order to do this one must review the academic works that provide the foundation for the study of attrition and casualty generation. In order to provide a brief review for the reader this chapter will summarize the Total Army Analysis (TAA) process as well as the downsizing of the medical force structure currently in existence. Critical to this study is the evaluation of operational and medical similarities between the 1944 Armored Division and its Force XXI counterpart. Given the similarities between the employment of these two divisions, today's medical planners can use historical data to assist in the determination of casualty rates and dispersion on future battlefields. This allows planners to determine the medical resources required to support the maneuver commander.

The CJCS Guide 3161, *Chairman of the Joint Chiefs of Staff Guide to Battle Casualty Rate Patterns for Conventional Ground Forces*, and *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* are two works that provide a framework for determining the number of casualties generated during a future operation. The CJCS Guide 3161, by George W. S. Kuhn of the Logistics Management Institute, is the standard for determining battle casualties for the Joint Staff and subordinate

commands. This manual provides a detailed tool to determine the rates in which battle casualties are generated given an anticipated operational form. These operational forms refer to the degree of success of the force and are identified in relation to the type of front that is generated.<sup>1</sup> These fronts are a continuous front, a disrupted front, or a disintegrated front. The rate in which casualties are generated will generally be greater with the continuous front and decrease as the front moves towards a disrupted front. These rates are stated as a number of casualties, per one thousand personnel at risk, per day of combat operation.<sup>2</sup> This work is designed to be used at theater level for corps and multi-corps operations. The only way to calculate division level rates is as a component of a corps or multicorps operation.<sup>3</sup> This method does not provide a tool to determine stand-alone division estimates nor estimates for smaller units. This model also does not provide a tool for planners to estimate disease and nonbattle injuries (DNBI). Due to these facts, and the division level focus of this study the CJCS Guide has limited applicability, although some of the facets of casualty generation discussed and applied by Mr. Kuhn are in agreement with the following book by Colonel Dupuy.

*Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War*, by Colonel (retired) Trevor N. Dupuy, identifies trends and relationships in the attrition process of historical operations. Colonel Dupuy shows that historical experience has direct application to current and future military establishments.<sup>4</sup> Enemy action causes battle casualties while the number and type of casualties are a function of many different things. The functions include the enemy force strength, the friendly force strength, the environment, as well as operational and human factors such as leadership, morale, and luck.<sup>5</sup> Battle casualties are divided into three major categories, killed in action (KIA),

wounded in action (WIA), and captured or missing in action (CMIA). Casualties that are considered KIA are those that are killed outright or die of their wounds before they receive any medical attention. Casualties that are WIA are those that are wounded and enter the medical system while still alive. Captured and missing in action are self-explanatory.<sup>6</sup> A large numbers of WIA casualties stress on the medical system for both treatment and evacuation. The treatment of these casualties gets significant attention by commanders. This command attention is due to the fact that prompt effective medical attention increases the number of wounded soldiers returned to duty as well as impacting soldiers' morale and willingness to continue to close with the enemy.<sup>7</sup>

Attrition rates allow casualty losses to be analyzed. These rates carry three dimensions, the duration for which the rate is calculated, the size of the unit in combat, and the level of combat experienced. In order to analyze these rates it is imperative that like rates are compared, battalion rates with battalion rates and daily rates with daily rates. The most common form of rate is a percentage of a unit's strength for a specific period of time.<sup>8</sup>

At the conclusion of the extensive analysis that Colonel Dupuy has conducted, he sets forth twenty-three verities that relate to personnel attrition. Three of these verities are particularly pertinent to this study:

1. The distribution of killed to wounded for the twentieth century is constant. Approximately 20 percent of all battle casualties are killed immediately while 65 percent of the remaining 80 percent will survive their wounds even with minimal medical care. The remaining 15 percent of these battle casualties are the focus of this study: the

casualties that require significant medical care, specifically surgical intervention, to save their lives.

2. The average World War II division engagement casualty rates in Western Europe were between 1 and 3 percent per day. Successful divisions were on the lower end of this spectrum during intense combat while unsuccessful divisions were closer to 2 to 3 percent per day.

3. Attrition rates in the 1973 Arab Israeli War were comparable to those in World War II. This is important because it shows that even as the battlefield continues to get more lethal, personnel casualty rates continue to stay approximately the same as those experienced in Western Europe in World War II.<sup>9</sup>

All of these verities are important when examining the future medical force structure and its ability to support the future combat force.

#### The Total Army Analysis (TAA) Process

A brief review of the TAA process will provide an understanding the system of generating force structure that medical planners used when determining the future structure. The Army develops the TAA base force in order to achieve an affordable, competent force that is capable of best supporting national objectives as well as meeting the war-fighting commanders in chief's needs. The force that is developed must meet the National Military Strategy (NMS), by defeating the threat within defined scenarios and do so in a dollar constrained environment.<sup>10</sup>

The TAA process is a biennial process that is conducted on even-numbered years. It is a two-phased, analytical, and subjective process consisting of requirements and resource determinations. The requirements determination phase comprises two separate

parts: the force guidance and the quantitative analysis. The force guidance consists of inputs and guidance from numerous sources. The Defense Planning Guidance (DGP) and The Army Plan (TAP) provide the National Military Strategy (NMS) objectives, threat data, and resource assumptions and priorities. The illustrative planning scenario (IPS) provides Department of Defense(DOD)-directed scenarios called major theaters of war (MTWs) and Small Scale Contingencies (SSCs). DPG/IPS also specifies the quantity and type of combat forces to employ for each scenario. These specific combat forces are referred to as “operating” forces. They constitute the start point for force structuring activities. The Office of the Deputy Chief of Staff for Operations (ODCSOPS) Force Structure and the ODSOPS War Plans determine the specific identification, size, and composition of the operating forces in accordance with TAP force structure guidance.<sup>11</sup>

During the quantitative analysis portion of the first phase, the Center of Army Analysis (CAA) takes the “operating” forces identified in the NMS scenarios for use in the Defense Planning Guidance (DPG) scenarios and determines the “generating” force structure needed to maintain the combat force structure. Through computer modeling, the CAA develops the echelons above division/echelons above corps (EAD/EAC), combat, combat support (CS), and combat service support forces required to support the deploying “operating” division and non-division force.<sup>12</sup> Phase I, the requirements determination, is complete after the Study Advisory Group Council of Colonels (SAG COC) and the General Officer Study Advisory Group (GOSAG) review the CAA computer generated output. This output is the total war-fighting Modified Table of Organization and Equipment (MTOE) requirement. The GOSAG recommends the

force's approval to the Vice Chief of Staff, US Army (VCSA). The VCSA's review and approval is the transition to phase II, the resource determination.<sup>13</sup>

Resource determination consists of two separate activities: qualitative analysis and leadership review. A qualitative analysis is conducted to develop the initial program objective memorandum (POM ) force, with end-strength guidance, to use in developing the POM. A series of researching forums, analysis, panel reviews, and conferences consider and validate the model-generated requirements and the analysis of those requirements. The qualitative analysis is conducted during the Resourcing Conference. This conference is held in two separate sessions, the Council of Colonels (COC) and the General Officer Steering Committee (GOSC).<sup>14</sup> Since the quantitative analysis only determined the requirements for fully resourced combat, CS and CSS units that will deploy into the theater of operations, determining the additional nondeploying force, accepting risks through reducing authorized levels of organization (ALO), and allocating resourced units must all happen during the Resourcing Conference. The qualitative phase culminates with the GOSC who review and approve the COC's decisions, review the output from the force feasibility review, and address any unresolved issues.<sup>15</sup>

The leadership review is initiated by the force program review (FPR) process that is chaired by the VCSA. The VCSA resolves any outstanding issues as well as scrutinizes, reviews, and approves the force the CSA will then brief to the SA. The resulting TAA base force represents the force structure for POM development, capturing all components and TDA requirements through the end of the POM years. The POM force meets the projected mission requirements within the anticipated end-strength and equipment levels. The final output should result in an executable POM force. The Army

forwards the POM force to the Office of the Secretary of Defense and recommends approval. The principal accomplishments of the TAA are the generation of the Army's total requirements, the definition of the required support forces, and the development of the initial POM force. The product of the TAA and POM is an approved force structure for the total Army.<sup>16</sup> It is within this detailed process that the Army Medical Department attempts to develop and retain a resource constrained force structure that will still be able to support the maneuver commander in any given theater of contingency operation.

As part of the Army's changes in missions and downsizing over the last fifteen years the Army Medical Department has been forced to reevaluate its force structure. Prior to TAA 1994 there were 162 hospitals in the force structure. These hospitals supported five corps and twenty-eight divisions with a mission focus of global conflict in Europe. By TAA 2005 there were only thirty-eight hospitals in the force structure that had to support four corps and ten divisions in two nearly simultaneous major theaters of war.<sup>17</sup> In order to make this drastic cut in the medical force structure, the Army Medical Department had to reduce its estimated division casualty rate from 2.5 to 1.1 percent. In addition to this it was necessary to reduce the evacuation policies from fifteen days at corps and thirty days at the theater level to seven days at corps and fifteen days at the theater level.<sup>18</sup> Both of these actions reduced the theater requirement for hospitalization thus justifying fewer hospitals in the force structure.

#### The Armored Division, 1944

The 1944 Armored Division was to be primarily used as an offensive and decisive tool available to corps or army commanders. Through mobility and firepower the division would perform these decisive missions and exploit opportunities created by

infantry divisions within the corps.<sup>19</sup> This vision of employment was realized by the 4th Armored Division and other armored divisions in France during the summer and fall of 1944. The 4th Armored Division proceeded through a breach in the German defenses created as part of Operation COBRA and raced across France covering over 1,000 miles in just thirty-five days.<sup>20</sup> These operations, as well as the reduction of Nancy in late September and early October, extended the division's lines of communications and evacuation. The reduction of Nancy provides the historical context for this study as it is typical of an armored division in combat during World War II. The extended lines of evacuation, due to the rapid operational tempo of the division, made far forward surgical care absolutely necessary for those seriously wounded casualties from the division.

Initially during World War II the Army did not have a highly mobile surgical capability that could closely support divisions in combat. This requirement was identified as part of planning and preparation for the invasion of Europe. The solution to this requirement was the dismemberment of the Field Hospital into platoons. Two surgical and two shock teams from auxiliary surgical groups augmented these field hospital platoons.<sup>21</sup> These platoons with their surgical teams would locate themselves as close as possible to the division clearing station to provide definitive surgical care to those seriously wounded casualties that could not survive the long ride to the Evacuation Hospital. The Third Army Surgeon believed that the utilization of these field hospital platoons, with their surgical teams, were the greatest contributing factor to the low mortality rate of 2.9 percent within Third Army.<sup>22</sup>

By locating themselves next to the division clearing station the platoon was usually between six and a half kilometers and eleven kilometers from the front lines. The

intent was to stay out of range of light artillery while in terrain providing some protection from medium and large artillery.<sup>23</sup> This also allowed those seriously wounded casualties to be operated on within one to two hours from the time that they were wounded.<sup>24</sup> During 1944 the Army discovered that the most efficient use of the surgical teams in these platoons was using one team per twelve-hour shift. With this, the platoon was able to deal with between ten and twenty major cases in a twenty-four hour period.<sup>25</sup> After twelve hours it was found that the surgeon's capabilities significantly deteriorated and the standard of care could not be maintained.<sup>26</sup> Even with twelve-hour shifts, the surgeons on these teams commented that they were continually tired and tended to work on instinct.<sup>27</sup>

#### The Digitized Division, Force XXI

Emerging doctrine for the digitized division calls for a division that can function through the full range of combat, stability, and support operations but whose primary purpose is “to close with and destroy the enemy using firepower, maneuver, and information dominance.”<sup>28</sup> The capabilities of this new division, especially its planned information dominance of the battlefield, has led to the battle space for which it is responsible to get even larger than that currently given an analogue division. This has a significant impact on the lines of evacuation, both within the division as well as to its supporting corps hospital.

As part of the downsizing of the Army Medical Department the old Mobile Army Surgical Hospital (MASH) was eliminated from the force structure. Some of these billets were used to develop forward surgical teams (FSTs). As the division battle space continues to grow along with the lines of evacuation, the FST is key to mobile, far

forward surgical capability. The basis of allocation for FSTs is one per each maneuver brigade within a division.<sup>29</sup> These teams are not self-sufficient and collocate with the brigade's Forward Support Medical Company (FSMC), usually setting up in close proximity to the clearing station. This means that its surgical capability is in a position to care for those Urgent category casualties that must be treated within two hours of wounding.

The FST has two surgical tables and the doctrinal capability to provide twenty-four operating table hours per day. This appears to allow for two twelve-hour shifts for the five surgeons assigned to the team. Doctrinally the FST can treat thirty critically wounded casualties in seventy-two hours. If the team is able to employ a work-rest cycle it can continue to function for these seventy-two hours, otherwise it must be replaced at the forty-eight hour point.<sup>30</sup> Either way, the team can treat approximately ten surgical cases a day or roughly what historical surgical organizations functioning within the division area were capable of.

As stated in chapter 1, this study uses the 4th Armored Division's experience in France in 1944, specifically the encirclement of the city of Nancy, as the historical vehicle to demonstrate the distribution and patterns of casualties on a battlefield and draw a relation to the medical doctrine supporting a digital division today. In order to do this a brief review of the 4th Armored Division's battle to envelop the city of Nancy is necessary.

#### 4th Armored Division - September, 1944

On 4 September 1944 Major General Eddy's XII (US) Corps issued Field Order Number Six. The order directed the corps to attack east in order to establish a bridgehead

over the Moselle River and seize the French town of Nancy. Based on the missions delineated in this corps order, the 4th Armored Division, commanded by Major General John S. Wood, was ordered to protect the corps southern flank while crossing the Moselle River between Pomery and Pont-A-Mousson with no more than a combat command (see appendix A). In addition to this, he was ordered to assist the 80th Infantry Division in seizing a bridgehead in the vicinity of Nancy.<sup>31</sup>

After some discussion between corps and division commanders, Major General Wood developed a plan for his division calling for Combat Command A, under the command of Colonel Bruce Clarke, to cross the Moselle River in the vicinity of Pont A Mousson and attack to the northeast of Nancy.<sup>32</sup> Between 4 and 10 September the plan for the 4th Armored Division attack changed a number of times, based principally on the inability of the 80th Infantry Division to establish a bridgehead across the Moselle River north of Toul. Another reason for the changes to the corps plan was a disagreement between the Major General Eddy and Major General Wood as to the proper employment of the 4th Armored Division. Major General Eddy wanted to flank Nancy from the south while Major General Wood wanted to utilize what he believed to be better “tank country” north of Nancy to flank the city from that direction. Finally, a compromise was reached and the plan called for the division to envelope the city of Nancy with Combat Command A attacking north of the city, while Combat Command B would attack south of the city.<sup>33</sup>

By 10 September the division plan was to have Combat Command B attack south across the Moselle River south of Toul to seize the town of Luneville and objectives in the vicinity of Vic-sur-Seille.<sup>34</sup> That evening, Combat Command B established crossing sites at Bayon and Bainville in preparation for its attack at 0700 the next morning. The

command had difficulty crossing at Bayon due to the fact that there were no suitable crossing sites for tanks.<sup>35</sup> The infantry was able to establish an initial bridgehead and by 1415 hours on 12 September a bridge was completed to allow the tanks of the 8th Tank Battalion across to block enemy efforts to reduce the bridgehead.<sup>36</sup> The crossing attempts in the vicinity of Bayon were not as successful and by the 12 September pressure from the 553rd Volksgrenadier Division and elements of the 15th Panzer Grenadier Division<sup>37</sup> forced the southern column, made up predominantly of the 51st Armored Infantry Battalion, to withdraw and cross the river at Bainville<sup>38</sup> behind the 8th Tank Battalion. The crossing of the Moselle River in this area was particularly difficult because the river was actually divided into five separate river channels and two canals. These crossings were forced over the following days, but some crossings had to be made without engineer support.<sup>39</sup>

While Combat Command B was continuing to negotiate the Moselle south of Toul, approximately forty-five kilometers to the north, Combat Command A was scheduled to attack across the Moselle River, at a location yet to be determined, and advance on Chateau Salins, a town northeast of Nancy.<sup>40</sup> On 12 September Combat Command A was forced to delay its crossing twenty four hours because the bridging materials were insufficient to facilitate crossing at Pagny. By 1200 on 12 September Colonel Clarke and his command were directed to move to an 80th Infantry Division crossing at Dieulouard. The Colonel Clarke decided to lead his crossing with Troop D, 25th Cavalry, and then advance on Chateau Salins as previously planned.

Combat Command A crossed the bridge established by the 80th Infantry Division on the morning of 13 September, just as the enemy was counterattacking to push the

infantry back across the river. As the cavalry, and two hours later the remainder of the combat command, attacked across the river and regained the high ground in the vicinity of St. Genevieve, the infantry was able to regain their lost positions by midday.<sup>41</sup> Though the command experienced occasional heavy fighting throughout the day, it was able to break through the thin defenses of the 3rd Panzer Grenadier Division and penetrate almost twenty miles into the enemy rear<sup>42</sup> to Fresnes en Saulnois by nightfall. The command was consolidated, there with the exception of its trains, which were brought up the next morning, the fourteenth.<sup>43</sup>

Combat Command A continued its drive behind the German defenses departing its assembly area at about 1300 hours on the fourteenth, after waiting for its trains to catch up. The command used predominantly secondary roads and back trails as it continued southeast. The command secured an assembly area in the vicinity of the town of Arracourt. Once the command arrived in the assembly area, it spread out into defensive positions. Task Force Abe, under Lieutenant Colonel Abrams, guarded to the east of Arracourt in the vicinity of the town of Moncourt. Task Force Curtis took up a position on the high ground south of Arracourt, while Task Force Jaques established a blocking position on Road N74 leading northeast out of Nancy.<sup>44</sup> By not using primary roads, the command was able to attack and destroy the rear echelon of the 15th Panzer Grenadier Division, which had been charged with defending Nancy. The destruction on this rear echelon and the presence of an American combat command caused great confusion with the German forces located in and around Nancy. The command only suffered two killed and twelve wounded in its attack to Arracourt.<sup>45</sup>

Meanwhile, Combat Command B continued to fight both the Germans and the terrain south of Nancy. German forces defended each water hazard the command encountered. By 14 September the command was attacking across the Meurthe River and the engineers completed the bridge at Mon sur Meurthe thereby allowing Task Force Withers to continue its advance through the Foret de Vitrimont mopping up German resistance as it went. Task Force Conley completed its crossing of the Meurthe River at the town of Damalevieres and attacked to the town of Authelput. By the end of the day, the command had not yet reached its objectives in the vicinity of Luneville, but had suffered twenty-four men killed, ninety-three wounded, and eight missing.<sup>46</sup> This operation south of Nancy was much more costly to the 4th Armored Division than the operation to the north.

Finally, on 15 September Combat Command B initiated its assault of the Marne-Rhin Canal in the vicinity of Crenic and Maixe. The initial enemy defenses at both locations prevented immediate crossings, but the engineers were able to establish bridges at those locations that night in preparation for larger crossings in the morning.<sup>47</sup> Due to continued German pressure on the 80th Infantry Division, XII (US) Corps ordered the 4th Armored Division to have Combat Command B move to Nomeny to operate against the rear of the German forces attacking the 80th Infantry Division and then attack south and southwest towards Nancy.<sup>48</sup> Due to Combat Command B's redirection towards Nancy, the division's Reserve Command, with an artillery battalion, and portions of an infantry battalion, a tank battalion, and an air defense battalion was given the mission to seize and secure the city of Luneville.<sup>49</sup> It was not until 16 September that Combat Command B

had finally advanced far enough to complete the envelopment of Nancy and link up with Combat Command A.<sup>50</sup>

On 16 September General Patton's Third Army issued a directive to the XII (US) Corps to advance rapidly to the northeast, with the hopes of penetrating the German "West Wall," before the Nazis could complete the defenses of the German frontier.<sup>51</sup> Major General Eddy delayed the execution of this directive until 19 September because he was still concerned about the security of the 80th Infantry Division Bridgehead at Dieulouard.<sup>52</sup> Before he would continue northeast in compliance with General Patton's directive, he wanted to have Combat Command B of the 4th Armored Division back from the west to assist the 80th Infantry Division.<sup>53</sup> This delay gave the German forces three additional days to reinforce their defenses east of Arracourt and Luneville and concentrate a counterattack force in the vicinity of Chateau Salins.<sup>54</sup> On the afternoon of 16 September Reserve Command left Crantanoy and seized Luneville by 2000 hours without significant German resistance. The command place posted outposts throughout the town and enemy contact was made northeast of town in the Foret de Parroy.<sup>55</sup>

The German high command directed Army Group G to counterattack the flank of the 4th Armored Division, retake Luneville, and destroy the Allied bridgeheads across the Moselle River.<sup>56</sup> This mission fell to the Fifth Panzer Army, which had just received a new commander, General Hasso von Manteuffel on 11 September, and elements of the First (GE) Army to its north.

Combat Commands A and B spent much of the day preparing for a continued attack to the east, which was scheduled to start on 19 September. Combat Command A and B's portions of the division sector were reasonably quiet on 17 September, while

enemy activity around Luneville was increasing in front of the Reserve Command. Elements of the 15th Panzer Grenadier Division attacked from Julivet and the southeast edge of the Foret de Parroy in an attempt to dislodge Reserve Command from Luneville. Elements of the 35th Tank Battalion closed with the Germans northeast of Luneville and successfully kept the Germans out of town. The contact cost the tank battalion two men killed and fifteen wounded.<sup>57</sup>

On 18 September the Fifth Panzer Army counterattacked at Luneville with the XLVII Panzer Corps (consisting of the 15th Panzer Grenadier Division and the 111th and 112th Panzer Brigades) and the LVIII Panzer Corps (consisting of the 11th and 21st Panzer Divisions and the 113th Panzer Brigade).<sup>58</sup> Though the Germans gained the initial advantage due to fog and the superiority of the Panther tanks over the American Sherman, once the fog lifted the American's strong artillery and antitank support, along with superior airpower, made the continuation of the German attack impossible.<sup>59</sup>

At daylight, the enemy attacked Luneville from the southeast with 15 tanks and 200 infantry. This attack caused the 2nd Cavalry Group to withdraw from the town leaving Troop B of the 2nd Cavalry Squadron to reinforce Reserve Command on the eastern edge of town. Reserve Command withdrew from the southeast portion of town, but held the center and northern portions of the city.<sup>60</sup> Combat Command A received orders from division about noon, ordering the command to send a task force to Reserve Command since it was under attack by enemy tanks. Task Force Hunter, commanded by Major Hunter of the 37th Tank Battalion, made up of a company of tanks, a company of infantry, a battery of artillery and a platoon of tank destroyers, was sent to assist Reserve Command.<sup>61</sup> Task Force Hunter arrived in Luneville by 1600 hours and succeeded in

clearing the Germans out of town by nightfall.<sup>62</sup> The Reserve Command continued to hold the majority of Luneville in spite of heavy enemy artillery fire on 19 September. Combat Command A of the 6th Armored Division arrived at 1800 on 19 September to relieve Reserve Command in this area.<sup>63</sup>

On 18 September Combat Command B moved in two columns northeast toward Saarbrücken in preparation for the division's attack on the West Wall. Task Force Withers encountered heavy enemy resistance south of Chateau--Salins, while Task Force Conley met little resistance during its move and bivouacked northwest of Chateau - Salins. The nineteenth of September saw Task Force Withers continue to be heavily engaged in Chateau-Salins. The task force was unable to withdraw because of the intensity of the enemy pressure. At times, the fighting the task force experienced in the town was so close the use of artillery in support was not possible. The remainder of Combat Command B held its position near Fresnes and prepared to assault Chateau-Salins to relieve the Task Force if that became necessary.<sup>64</sup> By 20 September Task Force Withers was able to fight its way out of Chateau-Salins and collocate itself with the rest of the command in the vicinity of Fresnes. On 20 September Combat Command B reported to division that German tanks were sighted in the Forêt de Chateau-Salins.<sup>65</sup>

On 19 September General von Manteuffel attacked Combat Command A with fifty-six Mark V tanks from the 113th Panzer Brigade through the fog and morning mist from the southeast in the Lezey-Arracourt area. The panzer brigade attacked down the main road from Bourdonnay towards Mayenvic, but was halted by the 37th Tank Battalion. The brigade then attempted to bypass Lezey to the south in small groups attacking first at Bezange la Petite, then at Rechicourt in an attempt to circle further

south. Due to direct fire, ten of the enemy tanks were destroyed by 1015 in the morning.<sup>66</sup> Heavy enemy activity continued all day as the pressure was maintained from the command's east and southeast. The farthest the enemy advanced was Rechicourt, and by dark the enemy activity seemed to cease. Plans for continued movement east were developed for 20 September. The command's plans called for movement northeast in two columns towards Saargumine.<sup>67</sup>

On the morning of 20 September, it appeared that the majority of the German force had withdrawn with the exception of a few tanks. Combat Command A's sector was to be taken over by the 35th Infantry Division's 320th Infantry Regiment, less one battalion, plus the 602nd Tank Destroyer Battalion under the control of Reserve Command. At about 0830 elements of Combat Command A started to move towards the Siegfried Line in two columns. At about 0915 enemy tanks attacked the command's rear, and Major General Wood ordered the columns to turn around to gain control of the situation. The task forces returned to their previous positions with Task Force Abe, concentrating around Lezey while Task Force Jaques returned to the high ground it previously occupied.<sup>68</sup>

At about 1500 hours, a force under the command of Major Kinsey and consisting of a company from the 35th Tank Battalion, five assault guns, and three tank destroyers moved to Gauzemont and started a sweep to the east towards Bures and Coincourt. Task Force Abrams initiated a sweep from Lezey to the east and the south through Ley and Moncourt. Major Kinsey's force was stopped by enemy tanks in the vicinity of Bures. The German tank's superior main armament range prevented him approaching close enough to effectively engage. Task Force Abe encountered heavy enemy tank opposition

as they drove the enemy out of Ley and then on to Moncourt. Lieutenant Colonel Abrams' force was able to take Moncourt after dark. The 37th Tank Battalion lost twelve tanks while destroying eight enemy tanks. After leaving the outpost in the vicinity of Moncourt, the rest of Task Force Abe returned to its assembly area in the vicinity of Lezey.<sup>69</sup>

The twenty-first of September was moderately quiet across the division front. Colonel Clarke had decided to send elements of Combat Command A southeast, and then to the Marne-Rhin Canal, to clear the southern flank of the division once and for all. Due to morning fog, actions were limited, but by 1200 task forces from both the 35th and 37th Tank Battalions attacked south through Coincourt and Bures to the canal. The enemy resistance encountered was less than expected, as it appeared that the Germans had withdrawn south of the canal.<sup>70</sup>

On 21 September, General Hermann Balck, Commanding General of Army Group G, issued orders for large-scale attacks to again try to drive the XII (US) Corps back across the Moselle River. The First (GE) Army was directed to attack on its left flank to drive past Chateau-Salins toward Moyenvic, while the Fifth Panzer Army was ordered to resume its attacks on the 4th Armored Division. The LVIII Panzer Corps was to attack with the 111th Panzer Brigade. Meanwhile, the 11th Panzer Division was to move from Saarbourg to strengthen the right flank of the Fifth Panzer Army and attack north to meet the First (GE) Army drive near Moyenvic.<sup>71</sup>

At 0945 hours on the morning of 22 September the 25th Cavalry Reconnaissance Squadron, which was screening the division's front in the vicinity of Juvelize, reported they were being attacked from the northeast by tanks and dismounted infantry from the

111th Panzer Brigade. The German force quickly destroyed six light tanks and two armored cars and pushed the cavalry out of Juvelize. Lieutenant Colonel Abrams moved a force from his location, in the vicinity of Lezey, through Juvelize and drove out the enemy tanks that were moving from the direction of Blanche-Eglise. The tanks withdrew to the woods of Bois du Sorgier northeast of Juvelize. Lieutenant Colonel Abrams then moved the 37th Tank Battalion to the high ground northeast of Juvelize, orienting towards Donnelay and destroyed German tanks as they moved up the road. The 37th Tank Battalion destroyed a total of 14 enemy tanks while losing only one medium tank.<sup>72</sup> By the end of the day the 111th Panzer was virtually destroyed with only seven tanks and eighty men remaining.<sup>73</sup>

The twenty-third of September was a quiet day across the division front, but enemy movement that was observed made it clear that the Germans were preparing for another counterattack. At 0545 hours on 24 September the enemy attacked in strength with heavy artillery supporting two infantry battalions and thirty tanks. Combat Command B successfully broke up the enemy attack with the effective use of the air force, artillery, and the tanks and infantry of the combat command. At one point, the combat command headquarters was within 800 yards of the enemy and the command post was forced to relocate to Gremercy. The command's losses for the day were only 1 tank but 18 men killed and 120 wounded. The majority of the killed and wounded was a result of heavy German artillery fire. The Germans fared much worse with the loss of 21 tanks and approximately 300 men killed and 500 men wounded.<sup>74</sup>

On 25 September, General von Manteuffel achieved an initial surprise by putting the 11th Panzer Division into his line north of Arracourt in Combat Command A's sector.

The division had been badly attrited over the previous months and only had two panzer grenadier regiments and sixteen tanks to bring to the fight.<sup>75</sup> For the next four days, the enemy conducted numerous infantry patrols with small amounts of armor supporting their efforts to infiltrate the 4th Armored Division's positions. As an example, throughout the twenty-fifth the enemy made no less than eighteen scattered tank and infantry attacks across Combat Command A's sector. The command effectively used direct and indirect fires to defeat each of these attacks with, at times, significant loss of personnel while continuing to hold key terrain. By dark the situation across the command front had quieted and stayed that way through the night.<sup>76</sup> Late on the twenty-fifth, Combat Command B was relieved of their sector by elements of the 35th Infantry Division.<sup>77</sup> On the twenty-sixth, Combat Command B relieved Combat Command A of responsibility of its front south of the Lezey-Arracourt line.<sup>78</sup> Enemy activity was observed throughout the division sector for the next three days, and the effective use of division artillery and, after the twenty-seventh, air force fighter-bombers, consistently turned the enemy back.<sup>79</sup> Finally, on 29 September, the Germans made a final push in Combat Command B's sector. The enemy pushed for the high ground held by the combat command. Combat Command B continued to effectively use its tanks and infantry in conjunction with artillery to hold off the enemy. Although Hill 318 was lost to the enemy for a brief period during the day, it was retaken with a well-timed and determined counterattack. This counterattack broke the back of the enemy's effort and the Germans were never able to threaten the combat command's positions after that.<sup>80</sup>

The size of the division sector, as well as the continued enemy activity affecting the division from multiple directions, caused numerous challenges throughout the

nineteen days addressed above. Of particular importance for this study was the impact of the nature of the battlefield on the treatment and evacuation of wounded soldiers. The fluid nature of the division sector had direct impact on the evacuation of wounded soldiers on multiple occasions. An extreme example of the impact of a fluid enemy situation occurred on the night of fourteen and fifteen September when six ambulances left Company A of the 46th Armored Medical Battalion and never arrived at either the 60th Field Hospital or the 110th Evacuation Hospital.<sup>81</sup> It is clear that the rate of casualties the division incurred during its crossing of the Moselle River on 12 September and during the stabilization of its defenses on 30 September was not constant. Casualties requiring treatment and evacuation to at least the clearing station ranged from a low of 3 on 13 September to a high of 115 on 28 September. The daily average number of wounded was fifty over these nineteen days.<sup>82</sup>

Today's digital division will operate in the largest battle space of any division in the Army's history. Due to a battle space that may have up to a 120-kilometer front and potentially a 200-kilometer depth, the digital division will employ its forces so that they may not be in a position to be mutually supporting at any given time. The operating environment that exists today requires this digital division to be prepared to fight in multiple directions in a nonlinear battlefield. The 4th Armored Division's combat record for September 1944 shows that it also operated over extended distances with its combat commands up to forty five kilometers apart from each other. At that time, the commands were not capable of supporting each other and were forced to function alone while still fighting to achieve the intent and end state of its higher headquarters. In the tactical situation that existed in Lorraine during September 1944 these combat commands found

themselves either attacking or defending in multiple directions on many occasions. The distances that were dealt with, as well as a multidirectional fighting, are similar to the envisioned employment of a digital division. The environment envisioned for the digital division of today will present challenges to the medical personnel of that division similar to those encountered by the medics of the 4th Armored Division during September 1944. The casualties incurred by the 4th Armored Division in September 1944 provide a sound historical premise to examine the medically significant fact that casualties do not occur at a constant rate or equally between units. It is logical therefore, to believe that these accumulation characteristics will exist on future battlefields and merits examination of the casualty rates used when developing future force structure models.

### Summary

The 4th Armored Division's experience fighting around Nancy allows for a number of parallels to be drawn between that battlefield and future battlefields and enemies. As stated earlier, the relative speed and distance that this armored division achieved, in relation to the rest of the XII (US) Corps, resulted in a noncontiguous front. The anticipated employment of a digital division in today's Army will likely result in the same type of nonlinear battlefield, thereby directly impacting the safety and the security of division and corps medical assets. For example, during the early stages of the Nancy operation, an ambulance convoy evacuating wounded soldiers, both American and German, disappeared and presumably was captured prior to its arrival at the supporting Evacuation Hospital.<sup>83</sup> In addition to configuration challenges, the Nancy battlefield presented the 4th Armored Division with numerous instances of complex terrain (e.g., canals, forests, villages, rolling hills, etc.). Future battlefields will hold similar

configuration and topographical challenges for digital divisions. Both the Germans and the Americans leveraged this complex terrain to their advantage during the battle. The Germans utilized the forests and villages as refuge from the American air power and artillery, while the Americans successfully used the rolling terrain to approach the German tanks while remaining concealed. The Americans' concealment techniques mitigated the range advantage the Germans enjoyed for the main guns of their tanks.<sup>84</sup> Future battlefields will present the digital division with similar challenges: an enemy that will fight from the refuge of built-up areas and one that will remain in close contact with the division so as to mitigate its advanced technologies. As both of these future probabilities will logically result in an increased casualty rate sustained within a digital division, a major flaw is revealed in the assumptions used to build the force structure for a digital division.

Historical data shows that casualty rates have not changed considerably over the last two hundred years. This data also shows that approximately 15 percent of all casualties on the battlefield are seriously wounded. These seriously wounded casualties are the ones that require timely surgical intervention. The armored divisions employed by the United States Army in Europe during World War II were employed to maximize their speed, mass, and lethality. This is similar to the envisioned employment of the digitized division that will close with and defeat the enemy through firepower and maneuver on the future battlefield. These similarities in employment and the historical consistencies in attrition and casualty generation allow us to analyze the suitability of the proposed medical force structure and its ability to provide timely far forward surgical care to support the future battle.

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<sup>1</sup>George W. S. Kuhn, Logistics Management Institute, CJCS Guide 3161, *CJCS Guide to Battle Casualty Rate Patterns for Conventional Ground Forces* (Washington, DC: Government Printing Office, 1998), 1-2.

<sup>2</sup>Ibid., 1-3.

<sup>3</sup>Ibid., 1-4.

<sup>4</sup>Colonel Trevor N. Dupuy, U.S. Army (Retired), *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* (Falls Church, VA: NOVA Publications, 1995), ix.

<sup>5</sup>Ibid, 4.

<sup>6</sup>Ibid, 5.

<sup>7</sup>Ibid.

<sup>8</sup>Ibid., 10.

<sup>9</sup>Ibid., 102.

<sup>10</sup>Department of the Army, US Army Command and General Staff College, ST C400, *Resource Planning and Force Management* (Ft. Leavenworth, KS: USACGSC, August 2000), 2-20.

<sup>11</sup>Ibid., 2-23

<sup>12</sup>Ibid., 2-25.

<sup>13</sup>Ibid., 2-26.

<sup>14</sup>Ibid., 2-27.

<sup>15</sup>Ibid.

<sup>16</sup>Ibid., 2-28.

<sup>17</sup>Major Georgia Jones, U.S. Army, *Medical Force Structure/Medical Planning Factors* (Presentation used in preparation for TAA 07, File name: Medical BOA\_GB 9910(M), 1999), slide 5.

<sup>18</sup>Colonel Donald C. Curry, U.S. Army, *Medical Reengineering Initiative (MRI), April 1999* (Briefing given at the Spordio Conference, 1999), slide 5.

<sup>19</sup>Department of the Army, FM 17-100, *The Armored Division* (Washington, DC: Government Printing Office, 1944), 2.

<sup>20</sup>Lieutenant Colonel Hal C. Pattison, Cavalry, “The Operations of Combat Command A, 4th Armored Division, From the Normandy Beachhead to the Meuse River, 28 July to 31 August 1944” (Thesis, Command and General Staff College, School of Combined Arms, Regular Course, 1946-1947), 49.

<sup>21</sup>Annual Report, Medical Section, Headquarters, Third U.S. Army, page 96/97, file HD 319.1-2, Box 335A, Record Group 112, E 54A, National Archives.

<sup>22</sup>*Ibid.*, 103.

<sup>23</sup>Department of the Army, FM 8-10, *Medical Field Manual Medical Service of Filed Units* (Washington, DC: War Department, 1942), 101.

<sup>24</sup>Graham Cosmas and Albert Cowdrey, *The United States Army in World War II, The Technical Services, The Medical Department: Medical Services in the European Theater of Operations* (Washington, DC: Government Printing Office, 1992), 391.

<sup>25</sup>*Ibid.*, 232, 382.

<sup>26</sup>Annual Report, Medical Section, Headquarters Third U.S. Army, page 111, file HD 319.1-2, Box 335A, Record Group 112, E 54A, National Archives

<sup>27</sup>Cosmas and Cowdrey, 382.

<sup>28</sup>Department of the Army, FM 71-100-5, *Exfor Division Operations, Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 1997), 1-14.

<sup>29</sup>Department of the Army, FM 8-10-25, *Employment of Forward Surgical Teams, Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 1997), 4-6.

<sup>30</sup>*Ibid.*, 2-1, 4-7.

<sup>31</sup>Field Order 6, Headquarters, XII Corps, XII Corps Orders, File 212-3.9, Research Group 407, National Archives.

<sup>32</sup>Headquarters, Combat Command A, Operations Journal, 30 June 1944--1 October 1944, File 604-CCA-0, Research Group 407, National Archives.

<sup>33</sup>John Nelson Rickard, *Patton At Bay: The Lorraine Campaign, September to December, 1944* (Westport: Praeger Publishers, 1999), 90.

<sup>34</sup>Combat History, 4th Armored Division, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 16.

<sup>35</sup>4AD After Action Report for September and October 1944, Headquarters, 4th Armored Division, File 604-33.4, Research Group 407, National Archives, 1.

<sup>36</sup>Combat History, 4th Armored Division 17 July--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 17.

<sup>37</sup>John Nelson Rickard, *Patton at Bay: The Lorraine Campaign, September to December 1944* (Westport: Praeger Publishers, 1999), 90.

<sup>38</sup>Ibid.

<sup>39</sup>4AD After Action Report for September and October 1944, Headquarters, 4th Armored Division, File 604-33.4, Research Group 407, National Archives, 1.

<sup>40</sup>Headquarters, Combat Command A, Operations Journal, 30 June 1944 - 1 October 1944, File 604-CCA-0, Research Group 407, National Archives.

<sup>41</sup>Combat History, 4th Armored Division 17 July - 9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 18.

<sup>42</sup>John Nelson Rickard, *Patton At Bay: The Lorraine Campaign, September to December 1944* (Westport: Praeger Publishers, 1999), 91.

<sup>43</sup>Operational Journal, 30 June 1944 - 1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>44</sup>Ibid.

<sup>45</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 18.

<sup>46</sup>Operational Journal, 30 June 1944--1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>47</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 19.

<sup>48</sup>XII Corps Report of Combat Operations, 31 August to 30 September 1944, Headquarters, XII Corps, File 212-0.3, Research Group 407, National Archives, 15.

<sup>49</sup>After Action Report, September 1944, Headquarters, Reserve Command, 4th Armored Division, File 604-CCR-0.3, Research Group 407, National Archives, 2. The actual composition of the Command was the 696th Field Artillery Battalion, the 489th Anti-Aircraft Artillery Battalion (-), the 10th Armored Infantry Battalion (-), The 35th Tank Battalion (-), and the 704th Tank Destroyer Battalion (-).

<sup>50</sup>4AD After Action Report for September and October 1944, Headquarters 4th Armored Division, File 604-33.4, Research Group 407, National Archives, 2.

<sup>51</sup>John Nelson Rickard, *Patton At Bay: The Lorraine Campaign, September to December, 1944* (Westport: Praeger Publishers, 1999), 104.

<sup>52</sup>*Ibid.*, 105.

<sup>53</sup>*Ibid.*, 104.

<sup>54</sup>F. W. von Mellenthin, *Panzer Battles* (Norman: University of Oklahoma Press, 1956), 313.

<sup>55</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, National Archives, 19.

<sup>56</sup>Donald Grey Brownlow, *Panzer Baron: The Military Exploits of General Hasso von Manteuffel* (North Quincy: The Christopher Publishing House, 1975), 123.

<sup>57</sup>After Action Report, September 1944, Headquarters, Reserve Command, 4th Armored Division, File 604-CCR-0.3, Research Group 407, National Archives, 2.

<sup>58</sup>F. W. von Mellenthin, *German Generals of World War II* (Norman: University of Oklahoma Press, 1977), 170.

<sup>59</sup>Donald Grey Brownlow, *Panzer Baron: The Military Exploits of General Hasso von Manteuffel* (North Quincy: The Christopher Publishing House, 1975), 123.

<sup>60</sup>After Action Report, September 1944, Headquarters, Reserve Command, 4th Armored Division, File 604-CCR-0.3, Research Group 407, National Archives, 2.

<sup>61</sup>Operational Journal, 30 June 1944--1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>62</sup>After Action Report, September 1944, Headquarters, Reserve Command, 4th Armored Division, File 604-CCR-0.3, Research Group 407, National Archives, 2.

<sup>63</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 21.

<sup>64</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 21.

<sup>65</sup>After Action Report for September 1944, Headquarters, Combat Command B, File 604-CCB-0.3, Research Group 407, National Archives, 2.

<sup>66</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 21.

<sup>67</sup>Operational Journal, 30 June 1944--1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>68</sup>Ibid.

<sup>69</sup>Ibid.

<sup>70</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 22.

<sup>71</sup>F. W. von Mellenthin, *Panzer Battles* (Norman: University of Oklahoma Press, 1956), 317; and Hugh M. Cole, *United States Army in World War II, The European Theater of Operations, The Lorraine Campaign* (Washington, DC: Center of Military History, 1984), 229.

<sup>72</sup>Operational Journal, 30 June 1944--1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>73</sup>von Mellenthin, *Panzer Battles*, 317.

<sup>74</sup>After Action Report for September 1944, Headquarters, Combat Command B, File 604-CCB-0.3, Research Group 407, National Archives, 2,3; and Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 23.

<sup>75</sup>von Mellenthin, *Panzer Battles*, 319.

<sup>76</sup>Operational Journal, 30 June 1944--1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>77</sup>After Action Report for September 1944, Headquarters, Combat Command B, File 604-CCB-0.3, Research Group 407, National Archives, 3.

<sup>78</sup>Combat History, 4th Armored Division 17 July 1944 - 9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 24.

<sup>79</sup>Combat History, 4th Armored Division 17 July 1944 - 9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 24-26; and Operational Journal, 30 June 1944 - 1 October 1944, Headquarters, Combat Command A, File 604-CCA-0, Research Group 407, National Archives.

<sup>80</sup>After Action Report for September 1944, Headquarters, Combat Command B, File 604-CCB-0.3, Research Group 407, National Archives, 3.

<sup>81</sup>Journal, Division Surgeon's Office, Headquarters, 4th Armored Division, File 604-26, Research Group 407, National Archives. 15 September, 3; and Annual Report of Medical Department Activities of the 4th Armored Division for 1944, Headquarters, 4th Armored Division, File HD 319.1-2, Research Group 112, National Archives, 9.

<sup>82</sup>Journal, Division Surgeon's Office, Headquarters, 4th Armored Division, File 604-26, Research Group 407, National Archives. Entries from September 12 to September 30.

<sup>83</sup>Annual Report of Medical Department Activities of the 4th Armored Division for 1944, Headquarters, 4th Armored Division, File HD 319.1-2, Research Group 112, National Archives, 9. Company A, 46th Armored Medical Battalion lost six ambulances, 21 casualties and 12 soldiers on the night of 14-15 September 1944 somewhere between Arracourt and the Dieulouard bridgehead.

<sup>84</sup>Combat History, 4th Armored Division 17 July 1944--9 May 1945, Headquarters, 4th Armored Division, File 604-0.1, Research Group 407, 21.

## CHAPTER 3

### METHODOLOGY

The objective of this study is to determine whether, after the recent downsizing of the Army Medical Department (AMEDD), the proposed medical force structure to support Division XXI is sufficient to meet the probable requirement for far forward surgical care. Under the Medical Reengineering Initiative (MRI), the structure designed to support the digitization of the force, this far forward surgical care is provided by Forward Surgical Teams (FST). In order to meet this objective one must also determine how employment of this surgical capability impacts the survivability of seriously wounded casualties, how the use of medical evacuation assets impacts this survivability, and whether the downsizing of the medical force structure under MRI has eliminated the necessary flexibility for the medical planner to surge capability to higher than expected requirements.

Chapter 1 of this study introduced the problem, provided some background information, and defined some required vocabulary. Chapter 2 reviewed literature that is pertinent to this study and evaluates the operational and medical similarities of the 1944 Armored Division and its Division XXI counterpart. Chapter 3 discusses the method in which this study was conducted, to include the research undertaken to acquire the necessary information.

Based on Colonel Dupuy's research one learns that history shows that approximately 15 percent of all casualties "on the battlefield are seriously wounded and are likely to die without medical care."<sup>1</sup> The planned division casualty rate used in the

generation of the MRI force structure for the Total Army Analysis 2005 (TAA 05) is 1.1 percent.<sup>2</sup> Given these two pieces of information, one can assume that 15 percent of 1.1 percent of a division's strength will require medical intervention to save their lives.

There are three options that can significantly increase the survivability of these seriously wounded casualties.

The first is far forward surgery. As stated, this is now provided in the form of the FST, which is collocated with the Forward Support Medical Company (FSMC) in the Brigade Support Area (BSA). If the requirement exceeds the capability of the available FST there are two other options. The first option requires these seriously wounded casualties be quickly moved to alternate surgical care, which is found in the forward area of the Corps in Combat Support Hospital (CSH). This movement is conducted by aeromedical evacuation assets, usually UH-60 Blackhawk Air Ambulances. The second option is to surge additional surgical capability into the FSMC in the form of additional FSTs.

Using the casualty rate identified in TAA 05 the investigator developed casualty numbers for the digitized division based on its required end strength and on its required end strength plus a corps slice of personnel who are anticipated to be in the division area and therefore at risk. Using these casualty numbers and the 15 percent rate for seriously wounded casualties, the investigator determined the requirement for far forward surgical care. These requirements were compared with the capability of three FSTs, taking into consideration the basis of allocation of one FST per Brigade Combat Team (BCT). If the requirement for far forward surgical care exceeds this, the investigator calculated the capability to move the excess surgical requirement to a CSH. If the ability to move these

casualties continues to exceed the requirement to provide far forward surgical care, the investigator calculated the capability within the force to surge additional surgical care forward into an FSMC.

Once the capability calculations were completed the results were compared to the patterns and distribution of casualties during the reduction of the city of Nancy, France in September 1944 by the 4th Armored Division. Previously, in chapter 2 the investigator demonstrated the similarities between the utilization of the armored division in World War Two and the proposed use of the digitized division on future battlefields. In chapter 2 the investigator also demonstrated the similarities between the employment of the FST and the employment of the comparable Field Hospital Platoon augmented with a surgical team in the division rear area.

These similarities are important because historical events allow the researcher to extrapolate casualty rate patterns and casualty distribution over space and time. Casualty patterns and distribution are important because the FST does not have an unlimited capability in its support of the FSMC. The FST is limited to conducting only a limited number of surgical cases over a period of 72 hours before it must be pulled out of the line for rest and resupply. Historical data shows that casualty patterns are impacted by many things to include the enemy strength, the mission of the friendly unit, and the relative combat power of both forces that are engaged. The distribution of casualties impacts the rate in which casualties arrive at the FSMC and the FST. This impacts the validity of the basis of allocation. If this basis is generated assuming a constant arrival of casualties over space and time then the total requirement may not be sufficient to meet the doctrinal

capacity of the team. The investigator considered each of these issues during the analysis phase in chapter 4.

#### Data and Literature Sources

In the gathering of research material for this study a number of resources were utilized. These sources included the Combined Arms Research Library (CARL) at Fort Leavenworth, Kansas, the libraries at Forts Knox, Benning, and Sam Houston, the Military History Institute (MHI), the Center of Military History (CMH) and the National Archives and Records Administration (NARA). The initial research focus was on the historical background required to establish the similarities between the digitized division and the 1944 Armored Division.

The research librarians at CARL were helpful in providing both a list of secondary sources that focused on the operational aspects of the Lorraine Campaign as well as some primary resources. The majority of the primary resources that are available at CARL is found in the special collection section on the third floor, a restricted access area. The use of the special collection area yielded some primary source material specific to the 4th Armored Division and the reduction of Nancy. All of this material was operational in nature and there was no medical material of significance. The research librarians on the third floor of CARL provided points of contact at the libraries at Fort Knox and Fort Benning.

The libraries at Fort Knox and Fort Benning provided further primary source material regarding the reduction of Nancy. After action reports for the 4th Armored Division were available through library loan at Fort Knox. These reports had been used as part of a military history seminar that was a component of the officer education

program of the Armor Center and School and were very beneficial in providing a clear understanding of the battle and the role of the 4th Armored Division. The research librarian at Fort Knox also provided information regarding studies that were conducted by Advanced Course officers during the postwar years.<sup>3</sup> Additional detail was also obtained in similar studies conducted at Fort Benning by students attending the Infantry Officer Advanced Course in the years immediately following the war.

Given the fact that both of these schools had required officers to study the war and write about their findings, the investigator contacted the library at Fort Sam Houston with the hope that a similar requirement existed for returning wartime medical officers. The library at Fort Sam Houston knew of no such requirement and stated that they retained no primary source material of any nature and that the investigator would need to contact the National Archives. The investigator contacted the historian for The Surgeon General Dr. John Greenwood, who was very helpful in focusing the medical research and providing points of contact at both MHI and CMH. Unfortunately, the historian's office at The Office of the Surgeon General was in the process of rebuilding its collection of medical material and did not have any primary or secondary sources relating to the 4th Armored Division or the reduction of Nancy.

The Internet web site for the MHI provided bibliographies for the Lorraine Campaign and the 4th Armored Division, although the medical material regarding this period was not pertinent to this study. Using the points of contact provided by Dr. Greenwood, the investigator contacted MHI only to find that one must go to Carlisle Barracks to determine the nature of the material that is available and that the library loan program is not available for material that may have been beneficial to this study. The

investigator did not have time available to travel to Pennsylvania so no further contact was made with MHI.

The investigator did have three opportunities to travel to Washington, DC, to visit the National Archives. These trips proved to be the primary repository for the research material used during this investigation. The focus of the operational research was conducted in Record Group 407, an area that yielded after-action, operational, and unit reports for the 4th Armored Division. The focus for the medical research was Record Group 112, provided the background information on both the 46th Armored Medical Battalion of the 4th Armored Division as well as casualty data for the division during the reduction of Nancy. The most significant problem encountered by the investigator during the research process was encountered at NARA. A considerable number of primary source materials for the 4th Armored Division and the reduction of Nancy were found to be signed out to CMH in the late 1960s and early 1970s. If these documents had ever been returned they were not refiled in their original location and therefore unavailable to the investigator.

The investigator found the missing documents to be predominantly medical in nature and therefore contacted CMH and spoke with Dr. Cosmas, who was the author of the US Army medical history for the European Theater of Operations. Dr. Cosmas stated that he had returned all the material he had used to write his book and redirected the investigator back to NARA. During the three visits to NARA the investigator looked at all the documents categorized as "CMH refiles" and found no record of the missing documents.

## Conclusion

Based on the similarities between the digitized division and the Armored Division of 1944, the use of historical data demonstrates the patterns and distribution of casualties during a combat operation. Knowing the required strength of the digitized division, the estimated casualty rate used during TAA 05, the capability of a FST in support of an FSMC and the fact the historical data shows that 15 percent of all casualties require medical attention to save their lives, the investigator determined whether there is sufficient far forward surgical capability in the proposed for medical structure. If a shortfall was found, the investigator conducted an analysis of available aeromedical evacuation assets and additional divisional surgical capability to determine if these assets are sufficient to mitigate the identified shortfall. The investigator conducted further analysis to determine the impact if the division casualty rate was found to be greater than 1.1 percent and if casualties were not distributed equally over space and time.

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<sup>1</sup>Colonel Trevor N. Dupuy, U.S. Army (Retired), *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* (Fairfax: HERO Books, 1990), 52.

<sup>2</sup>Colonel Donald C. Curry, U.S. Army, Medical Reengineering Initiative (MRI) April 1999 (Briefing given at the Spordio Conference, 1999), slide 5.

<sup>3</sup>Ms. Lorraine Mitchell at the USA Armor School Library was extremely helpful and proactive in finding information regarding the Lorraine campaign and making it available through the library loan program.

## CHAPTER 4

### ANALYSIS

The purpose of this study is to determine the sufficiency of far forward surgical care in the future medical force structure as it relates to the future objective force, specifically the digitized division. The sufficiency of far forward surgical care will indicate whether the Army Medical Department has downsized past the necessary level to care for wounded soldiers requiring timely surgical intervention to save lives on future battlefields. Far forward surgical care may be provided in an expeditious manner either by Forward Surgical Teams in the brigade rear areas or by use of air evacuation assets to transport surgical casualties to a location in the corps area that has the required surgical capability. In the current and future force structure the corps asset with this surgical capability is the Combat Support Hospital (CSH).

As discussed in previous chapters, this study assumes that some form of today's digitized division, the 4th Infantry Division, will be a component of the "objective force" envisioned by the Chief of Staff of the Army General Eric Shinseki. This study also uses historical data in the form of the experiences of the 4th Armored Division around the city of Nancy, France in 1944 to demonstrate the dispersion of casualties over time and space. In chapter 2 the researcher has pointed out the similarities between these two divisions in order to validate the historical data used in this chapter.

Previous research has been conducted on casualty rates and methods in estimating casualty numbers in future combat operations. As stated in chapter 2, Dr. George Kuhn's research was focused on corps and larger organizations. To the best of the researcher's

knowledge there have been no studies conducted specifically on division casualty rates and how they impact the need for far forward surgical intervention, much less the sufficiency of that capability in current or future force structure.

### Surgical Requirements

The division surgical requirement was first calculated assuming that casualties arrive equally distributed over time. Initially, this requirement was calculated using a series of division strengths. The first set of numbers reflects the division's required strength by in accordance with its current MTOE. The second set of numbers is the required strength plus an augmentation from corps of three thousand soldiers. This represents a minimal corps augmentation. The final set of numbers represent the division's required strength plus a corps augmentation of five thousand soldiers. Based on current simulations this number is more realistic given the corps support that may normally be expected if the division were in contact with an enemy force. After these initial calculations, the division's required strength plus the corps augmentation of five thousand soldiers was used for all subsequent calculations.

For the purposes of this study the required strength of the 4th Infantry Division is 15,506 soldiers. This number comes from the combined strengths of the Modified Tables of Organization and Equipment (MTOE) for the subordinate commands within the division. All of these documents have an effective date of October 2000 and are in effect at the time of this writing.

Using the division's required strength and a Division Daily Casualty Rate of 1.1 percent, the total number of daily battle casualties is 171. "Battle casualties" are defined as those casualties that are either killed, captured, or missing in action (KCMIA) or

wounded in action (WIA). The number of battle casualties is determined by multiplying the division's required strength by 1.1 percent, which is the daily casualty rate used for TAA 05.<sup>1</sup> These numbers increase to 204 for the division with a corps augmentation of three thousand soldiers and to 226 for the division with an additional five thousand corps soldiers.

The total number of WIA is 85 percent of the total daily battle casualties.<sup>2</sup> Based on this calculation the total number of WIA for the division is 145 casualties. This number increases to 173 for the division with three thousand corps soldiers and to 192 for the division with five thousand corps soldiers.

Historical data indicates that 15 percent of those soldiers who are WIA are seriously wounded and require medical care to save their lives.<sup>3</sup> Using this percentage the surgical requirement for the division for a day would be twenty-two casualties increasing to twenty-six casualties when the division is augmented with three thousand corps soldiers and twenty-nine casualties when that augmentation increases to five thousand corps soldiers.

As mentioned earlier, the Basis of Allocation (BOA) for Forward Surgical Teams (FST) is one per maneuver brigade.<sup>4</sup> The 4th Infantry Division has three maneuver brigades and would therefore expect to have three FSTs in direct support of the division. The FSTs in support of the division would have the combined capability to treat thirty seriously wounded casualties a day.<sup>5</sup> Given this capability and the greatest surgical requirement being twenty-nine casualties, there is sufficient far forward surgical capability in the division. However, this requires that the division daily casualty rate be

no greater than 1.1 percent, that the casualties be incurred at an equal rate over time, and that they be equally distributed between brigade combat teams and their respective FSTs.

The graphs used in this portion of the chapter reflect surgical casualties from twelve hours of contact with an enemy force. These casualties are distributed over time periods of 1.2 hours (72 minutes). Each bar on a specific graph reflects the number of casualties that require treatment during that specific 1.2 hour time period. This number is not cumulative from the previous time period. The horizontal bar on each graph reflects the surgical capability of the unit discussed. The value of the horizontal multiplied by the number of time periods equals the total surgical capability for a twelve-hour engagement. If a division is being discussed the capability reflects three FSTs whereas for a brigade the graph only reflects the capability of one FST.

It must be remembered that though the division has the capability to treat thirty surgical casualties a day, this is the cumulative capability of three FSTs. Each of these FSTs only has the individual capability to provide surgical care to ten casualties a day. This means that each FST cannot accept more than two casualties every 2.4 hours. Current medical doctrine states that a surgical team should conduct “major, yet relatively short (less than 2.5 hours), operative procedures.”<sup>6</sup>

History shows us that units do not incur casualties at a constant rate. The number of casualties a unit incurs “pulse” and “pause” based on the tactical situation.<sup>7</sup> This means that the closer the surgical requirement in a division approaches its capability, the less flexibility it has to react to this increase. Given these “pulses” and “pauses,” a FST may potentially exceed its capability at any given time. Figure 1 demonstrates the division’s surgical requirement distributed over ten “time periods” during a twelve-hour

battle. This figure demonstrates that although the total surgical requirement for the division is twenty-nine, the division exceeds its capability to provide far forward surgical care to seven casualties between time periods 4.8 and 8.4.

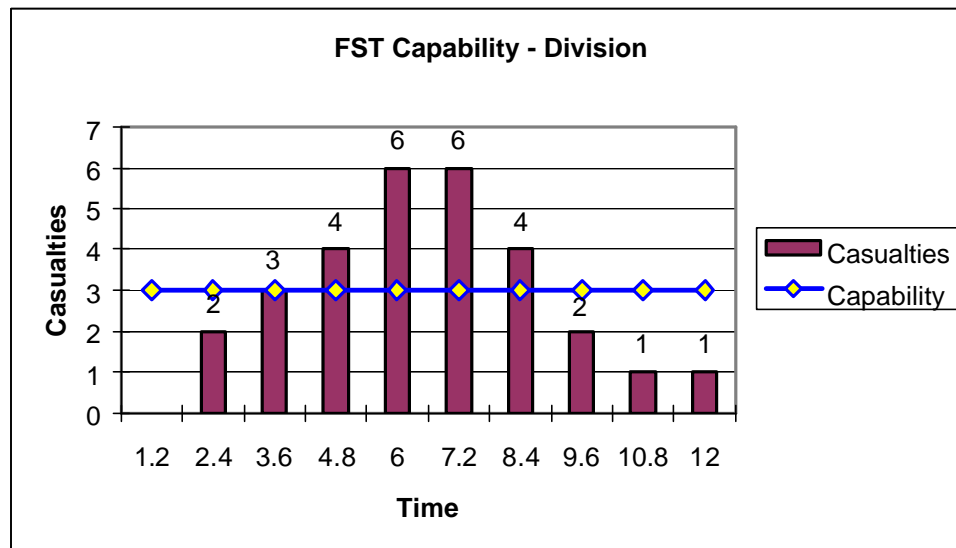


Figure 1. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*, developed by Major Bruce Shahbaz, USAR. This tool is the accepted casualty estimator within the 4th Infantry Division and III (US) Corps.

Colonel Dupuy demonstrates that smaller units, under the same circumstances, will have higher casualty rates than larger units.<sup>8</sup> This is due to the greater proportion of soldiers engaged in direct combat to those in support. As mentioned earlier, the 4th Infantry Division with its five thousand soldier corps slice and a 1.1 percent division daily casualty rate, has 226 battle casualties. If equally distributed, this translates to seventy-five casualties in each brigade, or a casualty rate of 2.15 percent. The number of WIA is sixty-four, of which ten require timely surgical intervention. If each brigade received its casualties equitably over time, each FST would be at maximum capacity.

Since casualties are not incurred equitably, a brigade surgical requirement for the same twelve-hour fight may be similar to the one depicted in figure 2.

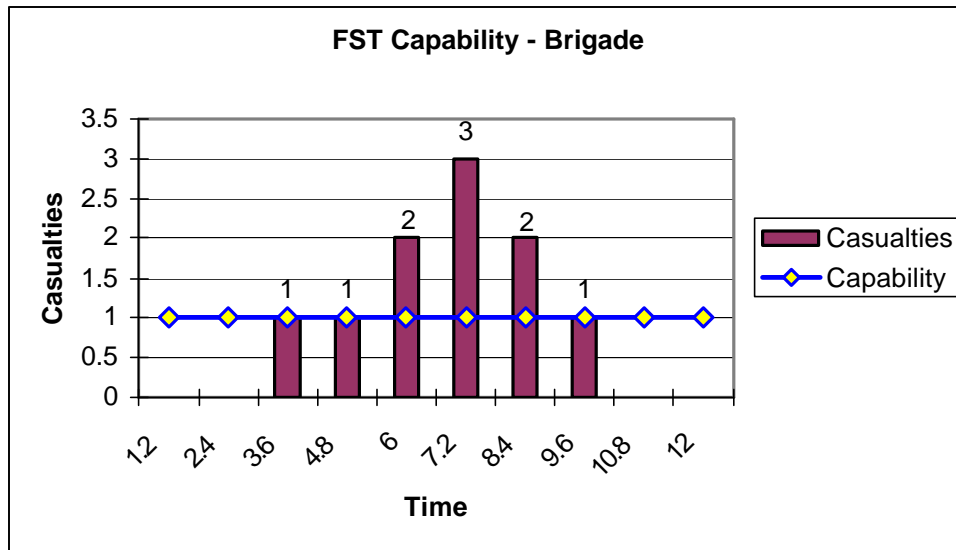


Figure 2. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*.

Just as casualties are not distributed equally over time, history has shown that casualties are also not equally distributed between units within a division. For example, a division with a 1.1 percent casualty rate may have a brigade with a casualty rate as low as 1.07 percent while another may be as high as 3.23 percent. Colonel Dupuy demonstrates an historical example of this. On 20 January 1944 the 36th Infantry Division experienced a 3 percent division casualty rate, its 141st Infantry Regiment experiencing a casualty rate of 14 percent while its sister regiment, the 143rd Infantry, experienced only a casualty rate of 5 percent. The very next day the division experienced an 8 percent casualty rate while the regimental rates were 27 and 20 percent for the 141st Infantry and the 143rd Infantry, respectively.<sup>9</sup> Given the unequal distribution of casualties over time, the

brigade scenario depicted in figure 2 shows an excess workload of four casualties during the 6.0 and 7.3 hour time periods, yet the brigade’s casualty rate remains at 2.15 percent. Figure 3 demonstrates that, given a division casualty rate of 1.1 percent, the impact of a brigade casualty rate of 3.23 percent has significant implications for casualties requiring timely surgical intervention. In this scenario a FST exceeds its capability by eight casualties over a twelve-hour engagement. This excess workload begins during the 6.0 hour time period and continues through the 9.6 hour time period.

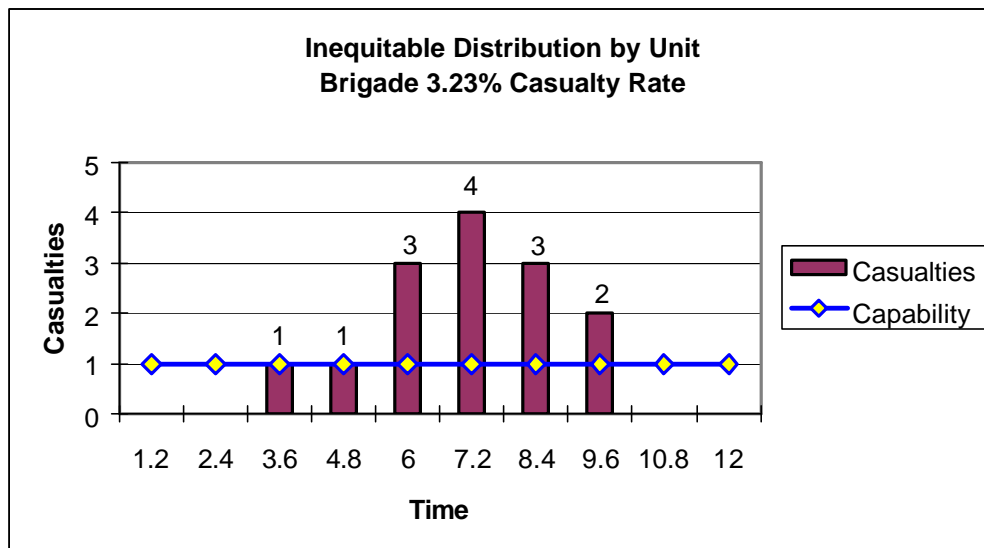


Figure 3

The 1.1 percent division daily casualty rate used in the force-structuring model for TAA 05 is a very optimistic one. Successful modern armies in the twentieth century have experienced a division daily casualty rate that has ranged from 1.1 to 1.5 percent.<sup>10</sup> When considering a division daily total battle casualty rate of 1.5 percent there is a significant impact on the division’s requirement for surgical capability. As shown in

figure 4, the division surgical requirement jumps from twenty-nine to thirty-eight casualties.

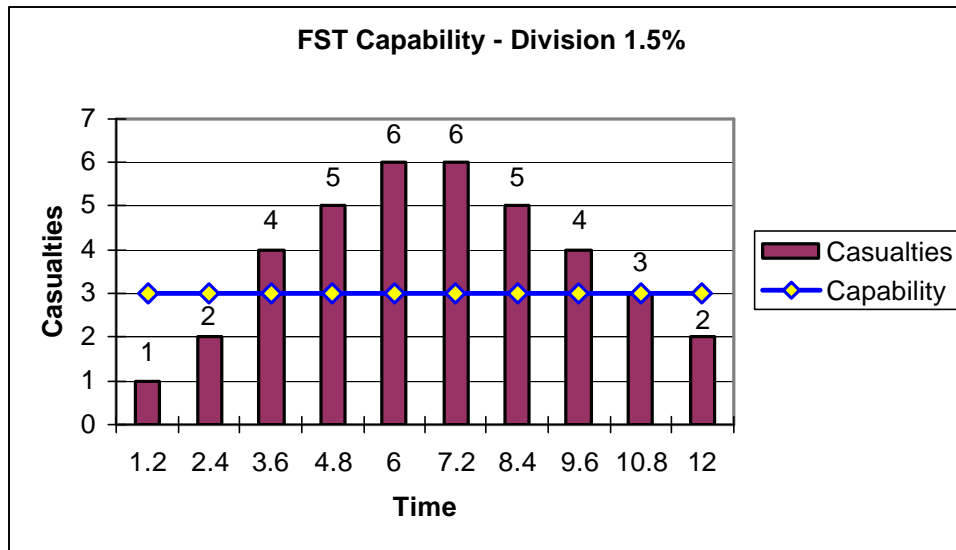


Figure 4. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*.

Assuming an equal distribution of casualties between brigades, their casualty rates increase from 2.15 percent to 2.93 percent while the surgical requirement increases from ten to approximately thirteen surgical cases per brigade. Figure 5 depicts how a brigade surgical requirement may be distributed over a twelve-hour battle assuming an equitable distribution of casualties between each of the three brigades within the division. When considering a division casualty rate that is more historically accurate, no less than six casualties per team exceed the surgical capability for each FST.

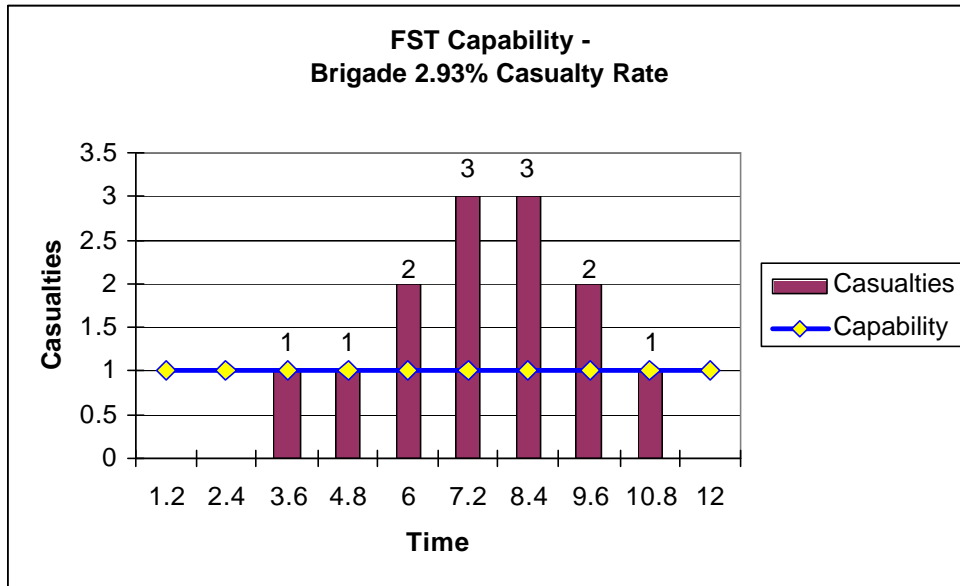


Figure 5. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*.

With the unequal distribution of casualties between brigades, casualty rates may range from 1.47 to 4.40 percent while the division casualty rate remains at 1.5 percent. Figure 6 demonstrates how the problem of excess surgical workload is increased when the inequitable distribution of casualties between brigades is considered. Given the inequitable distribution of casualties, one FST is now overloaded by thirteen surgical casualties during a twelve-hour fight.

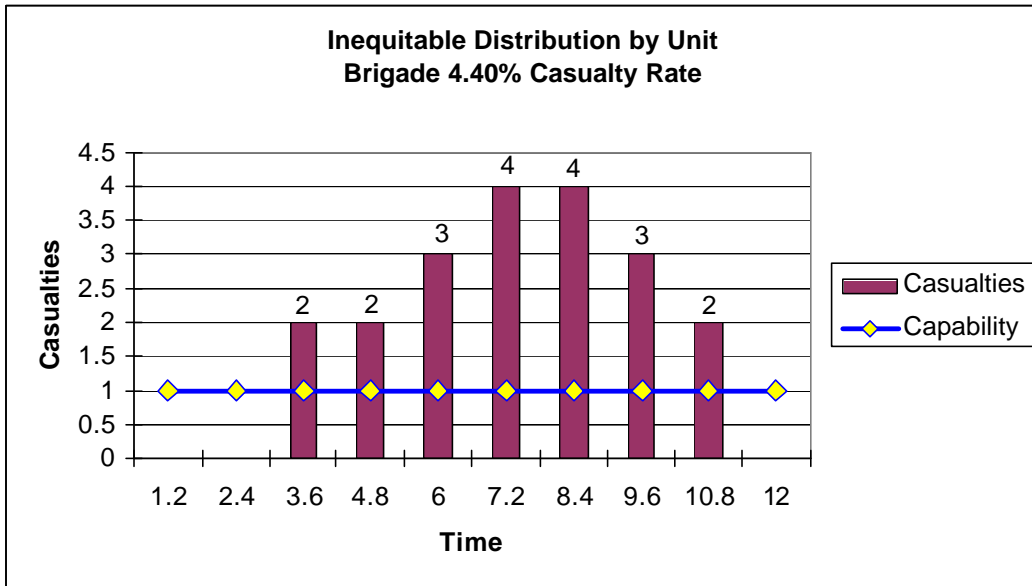


Figure 6

Medical Force Structure should be developed to support peak casualty rates or in other words the “worst case” scenario.<sup>11</sup> Given the data provided by Colonel Dupuy, armies that have not been successful in the twentieth century have experienced a division daily casualty rate that ranges from 2.0 to 3.0 percent.<sup>12</sup> Due to the fact that the United States has experienced a negative outcome in three of the last five “first battles” that it has been involved in,<sup>13</sup> it is important to consider the division casualty rate for those divisions in modern armies that have been unsuccessful in the twentieth century.

With a division Total Battle Casualty rate of 3.0 percent, the division with its five thousand soldier corps slice experiences 615 total casualties of which 523 are wounded and 78 of those seriously enough to require far forward surgical intervention. The division surgical requirement is over 2 1/2 times its FST capability using a normal basis of allocation. Figure 7 shows that this problem is exacerbated when an inequitable casualty distribution is considered over time.

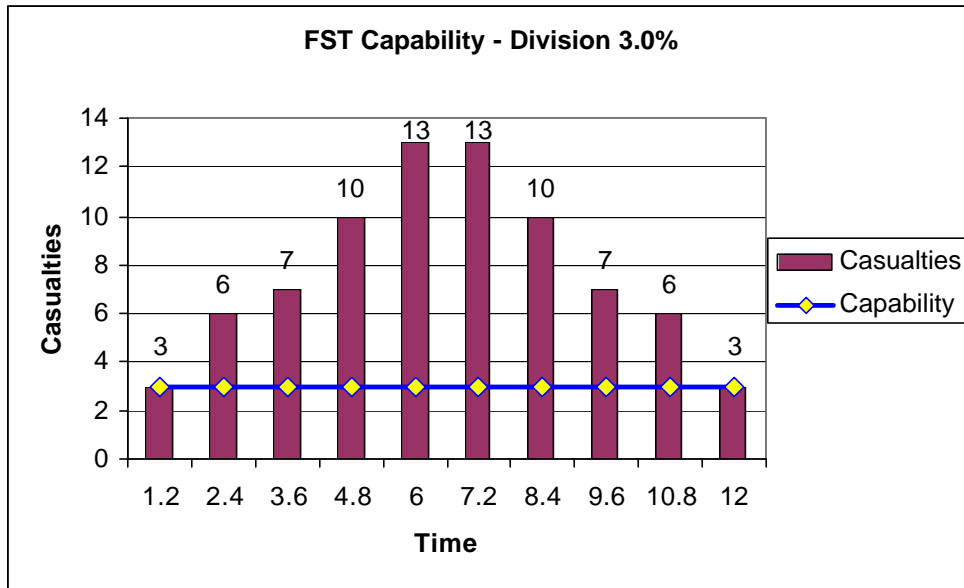


Figure 7. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*.

When the division experiences a 3.0 percent Total Battle Casualty rate, given an equitable distribution of casualties, its maneuver brigades see their casualty rate jump to 5.86 percent. This casualty rate generates 206 brigade casualties of whom 175 are wounded, twenty-six of them seriously. With twenty-six casualties requiring surgical care, each brigade also has exceeded its capability by over 2 1/2 times. Figure 8 shows how the distribution of these casualties over a twelve-hour battle may make the excess requirement an even greater problem.

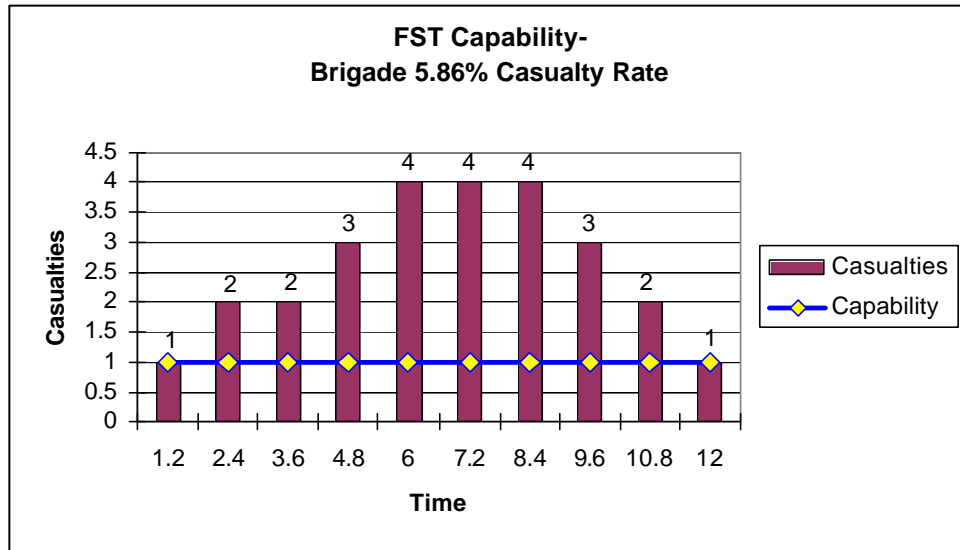


Figure 8. The data used to generate this graph was generated by using the *Medical Course of Action Tool (M-COAT)*.

In this “worst case” scenario the FST is overwhelmed by sixteen more surgical casualties than it can care for over this twelve-hour battle. When the inequitable distribution of casualties amongst the brigades is considered casualty rates range from 2.93 to 8.79 percent. Figure 9 shows that the surgical overload for the FST of the brigade experiencing an 8.79 percent casualty rate increases from sixteen to twenty-nine casualties.



Figure 9

In both the “most likely” and “worst case” scenarios there is a shortfall in surgical capability at the division as well as the brigade level. This shortfall ranges from eight to twenty-nine casualties when the distribution of casualties is not equitable over time or between brigades. This shortfall in capability may be mitigated in two key ways. The first way is to move, or evacuate, the surgical casualties that exceed the FST capability to a location where they can receive the surgical intervention that they require. This would be the supporting CSH located in the corps forward logistics support area. The second way to mitigate this excess surgical requirement is to increase the capability to provide surgical intervention within each brigade’s area of operation.

### Surgical Requirement--Interim Summary

The 1.1 percent Division Casualty Rate used for TAA 05 is on the bottom of the range of rates for modern armies during the twentieth century.<sup>14</sup> History demonstrates that casualties are not distributed equally over time or between units. Given the 1.1

percent rate FSTs at the brigade level will exceed their surgical capability by between one and eight casualties over a twelve-hour engagement. Given a 1.5 percent rate, which has been a more historically accurate rate, these same FSTs will exceed their surgical capability by between four and thirteen casualties. When considering a 3.0 percent rate due to an unfavorable outcome to a division engagement the excess workload at these FSTs will range from six to twenty-nine casualties.

### Evacuation

The responsibility for moving casualties requiring aeromedical evacuation from an FST collocated with a Forward Support Medical Company (FSMC) to the CSH falls to the Air Ambulance Company in general support (GS) of the division. The basis of allocation (BOA) for GS Air Ambulance Companies is one company for every two and one half divisions supported.<sup>15</sup> Each division will normally receive one Forward Support Medical Evacuation Team (FSMT), composed of three air ambulances. These air ambulances are UH-60 model helicopters. For the purposes of this study the researcher will assume that all three aircraft are fully operational and available to conduct evacuation missions. This assumption is based on the belief that given the critical nature of this Echelon II to Echelon III evacuation the company commander would want to maintain the highest readiness rate possible for each FSMT. If one of the aircraft assigned to a given FSMT becomes non-mission capable, the commander would replace it with an operational aircraft from the company's Area Support Medical Evacuation Squad (ASMS). Given the basis of allocation for GS Air Ambulance Companies, the size of the FSMT, and a 100 percent readiness rate it is reasonable to expect that each FSMC/FST will have one aircraft to evacuate casualties to Echelon III.

For those casualties that require surgical intervention, time is the most significant obstacle to their survival. As “Urgent” casualties these soldiers have wounds that are serious enough that they will die if they do not receive the necessary surgical care within two hours of being wounded. Given this two-hour window, approximately forty-five minutes will have already expired by the time these casualties arrive at the FSMC.<sup>16</sup> The remaining hour and fifteen minutes is available for treatment by the FST or evacuation to a CSH where these casualties can receive the required surgical intervention.

As the Army transitions to a digital and then to an objective force, the battle space for which a division is responsible increases significantly. The division’s increased capabilities are anticipated to be consistent with its increased area of responsibility. Under the Army of Excellence (AOE) a division was responsible for a 100 kilometer by 100 kilometer area. With Division XXI this area of responsibility has grown to 120 kilometers in width and 200 kilometers in depth (see Appendix C). This increase in battle space brings with it an increased evacuation distance from the Forward Support Medical Company (FSMC) to the CSH. The evacuation distance from the FSMC to its supporting CSH has grown from a “most likely” distance of 220 kilometers to a distance of 395 kilometers.<sup>17</sup>

The graphs used in this section reflect the combined evacuation requirement over a specific time period for a given scenario. The times are the same as in the previous section and cover twelve hours of enemy contact. Each time period covers 1.2 hours (72 minutes). Each graph bar is divided to reflect the Urgent Casualties on the bottom and the Priority Casualties on the top. One-half of the Urgent Casualties are expected to be surgical casualties. Each bar reflects the evacuation requirement during that specific time

period. The horizontal bar in each graph reflects the evacuation capability, in number of casualties, for the assets available in a given scenario, such as the twelve-casualty evacuation capability of the complete FSMT. If a graph shows a brigade scenario, it only includes the four-casualty evacuation capability of one aircraft from the FSMT.

As discussed above, the principal airframe for medical evacuation in the division and corps area is the UH-60 helicopter. For the purposes of this study the air speed used for the UH-60 will be 140 knots or 259 kilometers per hour during daylight operations and 120 knots or 222 kilometers an hour during times of limited visibility.<sup>18</sup> Based on the distance from the FSMC to the CSH, a one-way daylight trip would require between forty-eight minutes and one and a half hours, while a daylight round-trip would require between one hour and forty-two minutes and three hours. These ranges take into account both the “most likely” AOE distance and the distances anticipated for digital divisions with an increased area of responsibility.

Assuming one FSMT in support of the division and the expectation that each aircraft will have four casualties on board prior to initiating an evacuation mission, the division can evacuate twelve casualties at a time. Assuming a constant distribution over time and unit and a Division Casualty Rate of 1.1 percent, there are twenty-nine surgical casualties that require evacuation after treatment at the FST. This workload would require eight missions, which would take between five hours and six minutes and nine hours. Even when considering the total requirement of Urgent Casualties, the capability of the FSMT meets the requirement within the division. When the requirement expands to Priority Casualties in addition to the Urgent Casualties then the requirement exceeds

the FSMT’s capability within the twelve-hour battle by thirty-two casualties, or another six air missions.

Even considering the fact that casualties are not equally distributed over time the FSMT’s capability continues to meet the surgical requirement. However, Figure 10 illustrates how this changes when one factors in the division’s total Urgent and Priority Casualty requirements. When only considering the total Urgent Casualty requirement the FSMT’s capability is exceeded during the six hour time period due to the flight time required to fly between the FSMC and the CSH and return to the FSMC. Even with AOE “most likely” day light conditions the aircraft will not return in time to meet the Urgent requirement that would exist between the 7.2 hour and 8.4 hour time periods. This shortfall becomes more serious when the evacuation requirement includes Priority Casualties and forces health care providers to prioritize care for those casualties. This prioritization will raise the potential for an increase in the mortality rate.

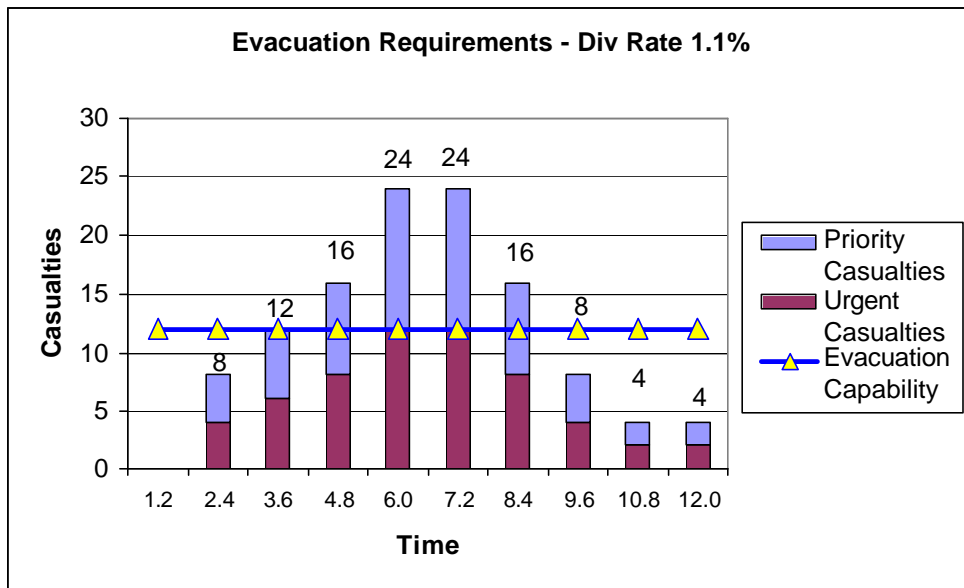


Figure 10

At the brigade level the evacuation situation becomes serious earlier in the battle. Since casualties do not arrive at a constant rate over time, the surgical capability of the FST will be exceeded by one casualty during the 6.0-hour time period. This is important since the one aircraft evacuating casualties from the FSMC/FST to the CSH will not have returned from the Echelon III facility from the mission launched during the 4.8-hour time period. In order to meet only the total Urgent Casualty evacuation requirement the FSMC/FST would require at least two aircraft between hours 6.0 and 8.4. The requirement for two aircraft begins at 3.6 hours for Priority Casualties and increases to four aircraft after 7.2 hours if the casualty evacuation requirements are to be met and still have an aircraft available to begin the evacuation mission during the 8.4 time period.

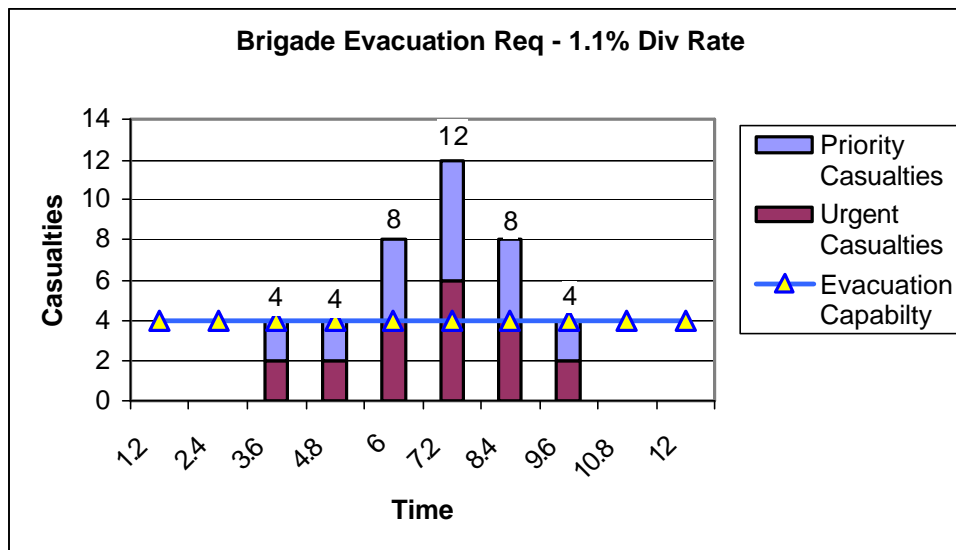


Figure 11

By assuming that casualties will not arrive at a constant rate over time, nor be equally distributed among units, the one aircraft supporting the brigade experiencing the

higher casualty rate is insufficient to meet the evacuation requirement after the first 3.6 hours during a twelve-hour battle. Though the surgical capability of the FST will not be exceeded until hour six, no aircraft to mitigate that shortfall in capability will be available since it is still completing its mission to evacuate the Urgent nonsurgical casualties that arrived between the 3.6 and 6.0 hours. In order to meet the total Urgent evacuation requirement there will need to be three aircraft available during hour six, while four aircraft must be available at the 7.2-hour time period. This takes into consideration the evacuation requirement during the six-hour time period and the requirement that exists during the 7.2-hour time period, prior to the return of the aircraft involved in the previous mission. Figure 12 illustrates that the aircraft requirement significantly increases when Urgent and Priority Casualties are included.

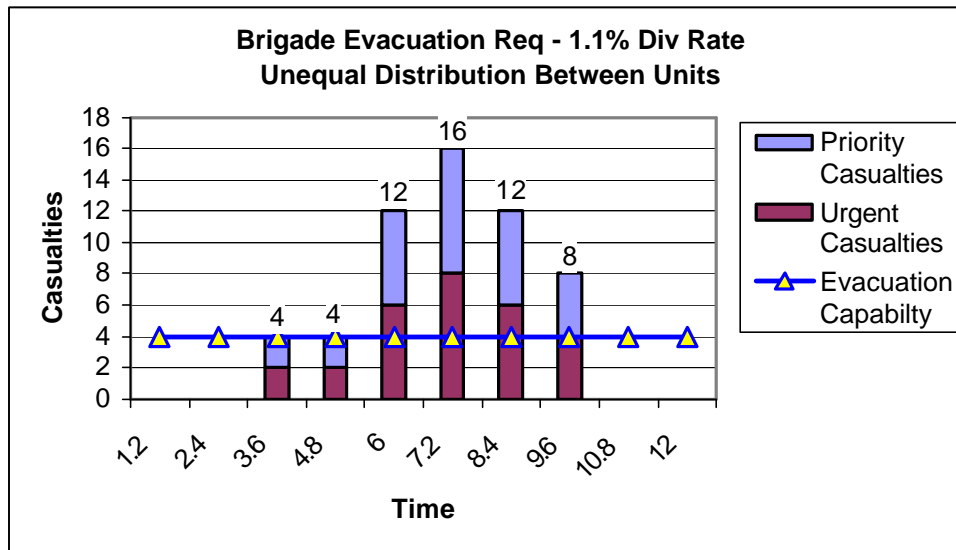


Figure 12

Given both categories of patients, the aircraft requirement increases to five at 7.2 hours to ensure that at least one aircraft will be available to initiate the missions starting at the 8.4 hour time period. Even assuming a 1.1 percent Division Casualty Rate, which Colonel Dupuy has shown to be exceptionally optimistic,<sup>19</sup> the capability of the FST in the brigade that incurs the greatest number of casualties will be exceeded and the aircraft available from the GS FSMT will not be sufficient to mitigate this excess surgical requirement. When considering a more historically accurate Division Casualty Rate for successful twentieth century modern militaries, this problem is further exacerbated.

If the Division Casualty Rate is 1.5 percent the division does not have the capability to treat the total surgical requirement. The excess surgical requirement of twelve casualties in a constant casualty flow environment increases to twelve when casualty flow becomes erratic. In general terms the FSMT should be able to react to this excess surgical requirement since even during the 6.0 and 7.2 hour time periods, the requirement can be met by one aircraft. However, when considering the total number of Urgent Casualties the FSMT is overwhelmed by the start of the 4.8 hour time period since two aircraft will not have completed their previous missions before the next missions must be initiated during the 6.0 hour time period. Figure 13 shows the division would need at least four aircraft to meet its Urgent Casualty requirement during the 6.0 hour time period plus at least one more aircraft to start flying the missions that are required during the 7.2 hour time period. The number of aircraft increases to six during the 6.0 hour time period when the Priority Casualties are added to the evacuation requirement, with at least one additional aircraft to start the 7.2-hour time period missions.

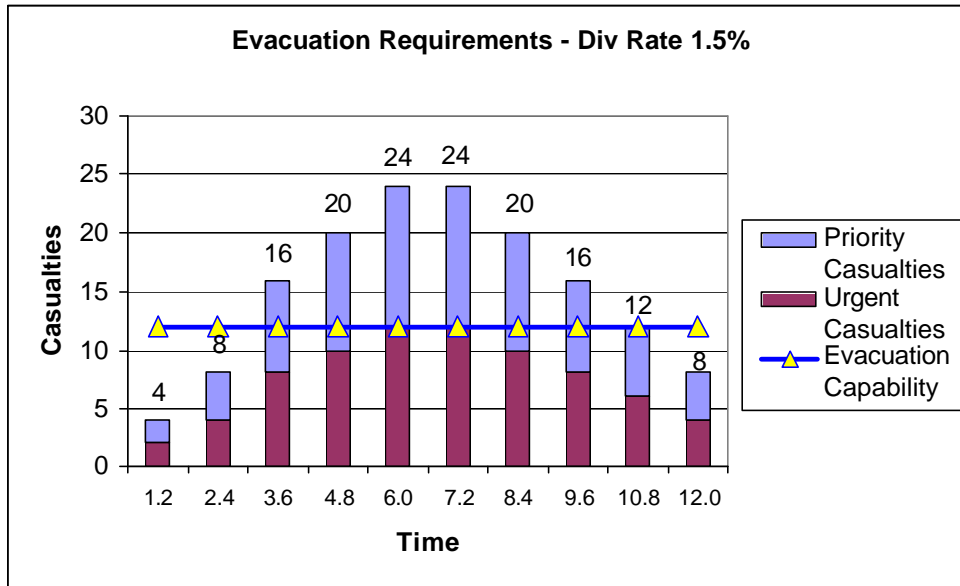


Figure 13

At the brigade level, the situation deteriorates much earlier when considering the Division Casualty Rate of 1.5 percent. Figure 14 shows the brigade situation. Even though the surgical capability of the FST is not exceeded until the start of the 7.2-hour time period the aircraft from the FSMT will exceed its capability to support the brigade by the start of the 4.8-hour time period. This is due to the fact that a round trip evacuation mission will require just over three hours to complete. The aircraft used during the 3.6 hour time period will not have returned in time to evacuate the number of Urgent Casualties expected during the 4.8-hour time period. For this reason, a total of three aircraft would be required to evacuate the expected number of Urgent Casualties during the peak time periods of 6.0 and 7.2 hours. Four aircraft are needed when the anticipated number of Priority Casualties is added to the evacuation requirement.

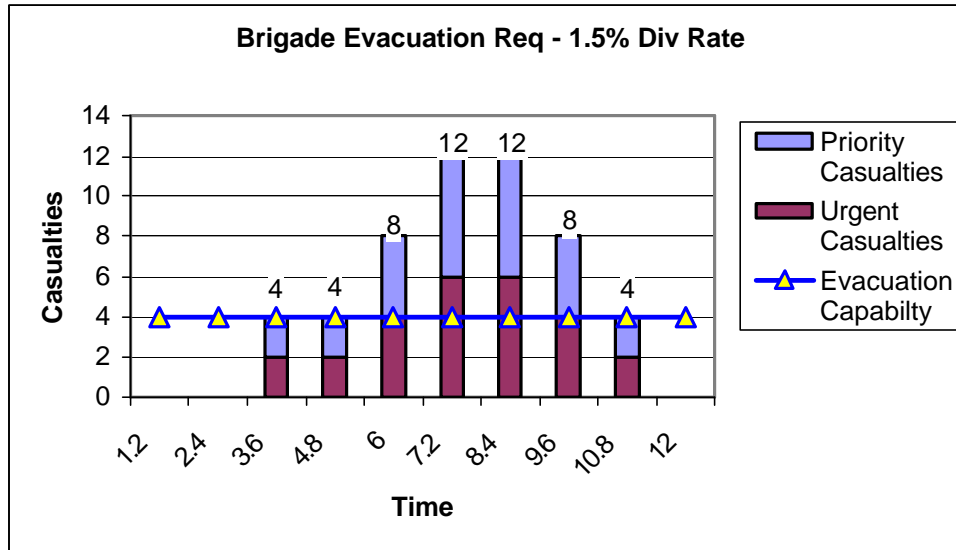


Figure 14

Given a Division Casualty Rate of 1.5 percent, a single maneuver brigade has an evacuation requirement that ranges from minimum of three to a maximum of four aircraft. When all three maneuver brigades are considered, the total division evacuation requirement ranges from more than 60 percent of the air ambulance company to a maximum of 80 percent of the fifteen ship company. The medical evacuation situation worsens in the brigade that experiences an inequitable increase in casualties even though the division still maintains a 1.5 percent casualty rate (figure 15).

As discussed earlier, casualties are not equally distributed between units or over time.<sup>20</sup> In addition to this, smaller units usually experience larger casualty rates than their higher headquarters.<sup>21</sup> Based on this information it is possible to see maneuver brigade casualty rates range from 1.47 percent to 4.40 percent within a division while the overall division casualty rate remains at 1.5 percent.

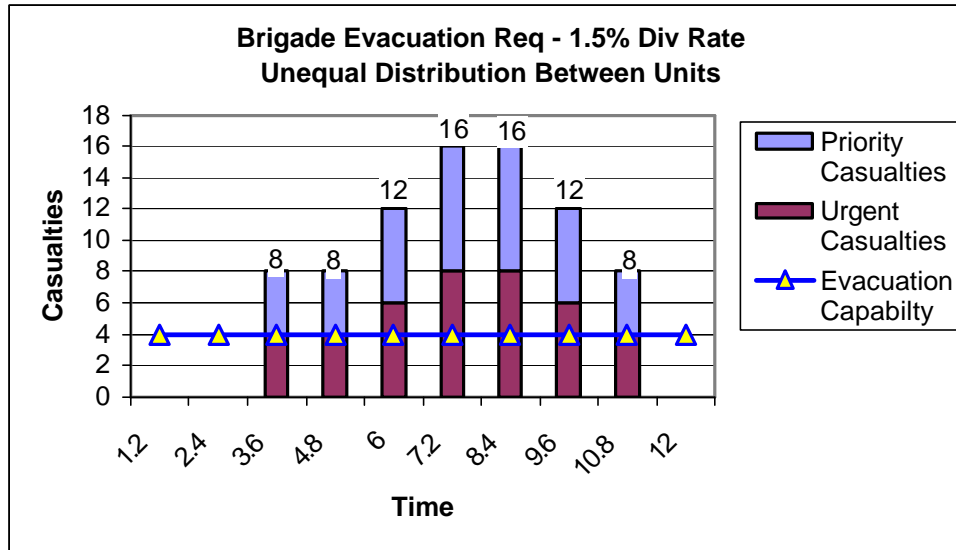


Figure 15

In a brigade that experiences a casualty rate of 4.40 percent the surgical requirement rises from thirteen surgical casualties to twenty, twice the capability of the FST. This FST exceeds its capability at 6.0 hours and continues to have an excess workload through 9.6 hours. In a nondigital division battle space, the aircraft that departed during the 6.0 hour time period would not return in time to evacuate the two surgical casualties that exceeded the team’s capability during the 7.2-hour time period. This is based on a one-way evacuation distance of 220 kilometers and airspeed of 259 km/hour.<sup>22</sup> In a battle space occupied by a digital division the Echelon II to Echelon III evacuation leg increases to 395 kilometers and the aircraft departing during the 6.0 hour time period would not return until half way through the 8.4-hour time period. In a battle space occupied by a digital division this increased distance means that the aircraft would be unable to evacuate a total of four surgical casualties during this twelve-hour engagement. It is likely that these casualties would die from their wounds due to the inability to provide them with timely surgical intervention. When focusing only on the

surgical casualties the brigade would normally need at least two aircraft starting at six hours. This excess surgical workload requires three aircraft to execute the Echelon II to Echelon III evacuation for a digital division due to the expanded battle space. When considering the total Urgent Casualty population combined with the Priority Casualties the aircraft requirements increase to four and five respectively starting at six hours. In a scenario where the division casualty rate climbs to 3.0 percent the situation becomes unmanageable.

At the division level an unsuccessful outcome that results in a 3.0 percent casualty rate, even assuming a constant distribution over time and between units, would exceed by more than twice the capacity of three FSTs. When the distribution over time is no longer constant, the excess workload is forty-eight surgical casualties within the 6.0-hour and 7.2-hour time periods. This is enough excess workload to warrant another whole surgical team. Figure 16 shows the evacuation requirements over time for the division.

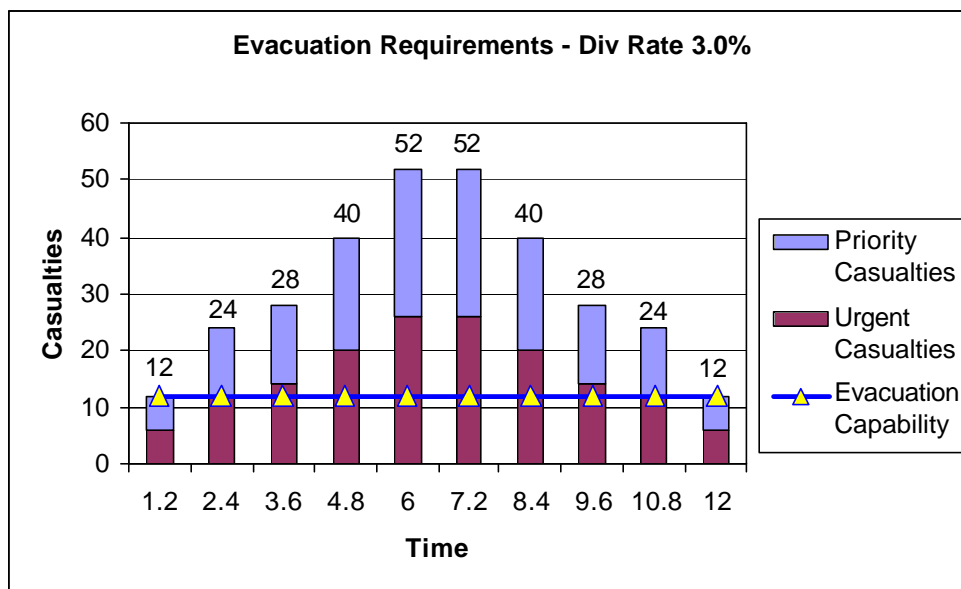


Figure 16

The additional surgical workload during the 6.0- and 7.2-hour time periods is enough to require one additional aircraft to evacuate these casualties to the CSH. When considering the total Urgent Casualty requirement the evacuation requirements would call for an additional FSMT plus one additional aircraft for a total of seven. Thirteen aircraft would be required for evacuation during the peak periods between 6.0 and 7.2 hours. This worst-case scenario starts earlier in the battle when considering the situation at the brigade level.

Figure 17 illustrates the situation at the brigade level when casualty distribution is equal between units. When the division casualty rate is 3.0 percent the brigade rate climbs to 5.86 percent. The surgical capability of the FST in this scenario is exceeded during the 2.4-hour time period. By the time the pulse in the casualty flow peaks, two aircraft will be needed to just accommodate the surgical overload. When considering the total number of Urgent Casualties from the 6.0-hour time period to the 8.4-hour time period the aircraft requirement climbs to three. Two of these aircraft would evacuate the casualties during the 6.0-hour time period, and the third would start the evacuation mission during the 7.2-hour time period. When the Priority Casualties are added to this scenario, the requirement for aircraft during these peak periods increases to five. When examining a scenario where neither time nor casualty distribution by unit is constant, the situation at the brigade level is yet again unmanageable.

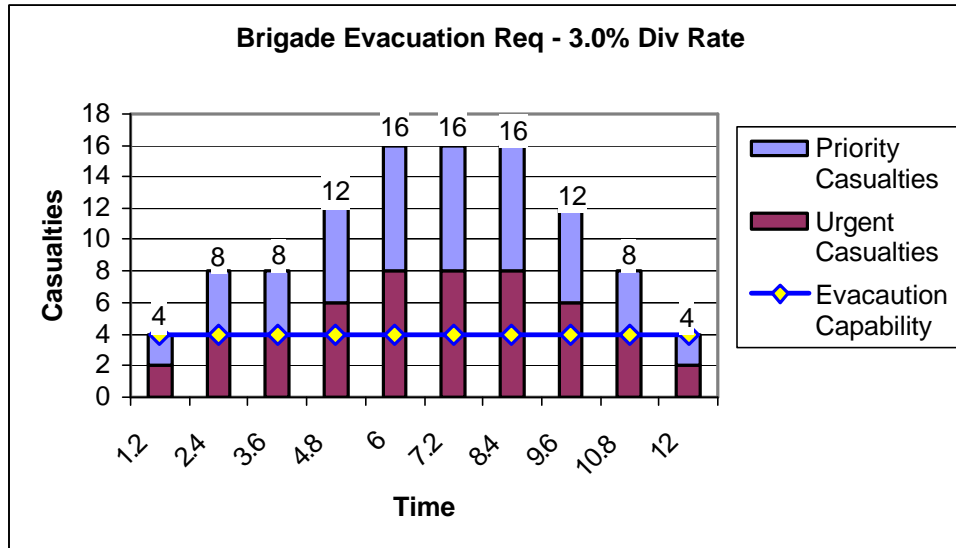


Figure 17

In a scenario that has a division casualty rate as high as 3.0 percent and an unequal distribution of casualties over time and between brigades, it is possible to see one brigade's casualty rate climb to 8.79 percent. In the brigade that is experiencing the 8.79 percent casualty rate is has exceeded its surgical capability by twenty-nine casualties, nearly the capacity of three FSTs. As soon as the 2.4-hour time period the FST becomes overwhelmed. This workload continues to build, by six hours the team is now four casualties beyond its capability. The aircraft requirements for this scenario are reflected in figure 18.

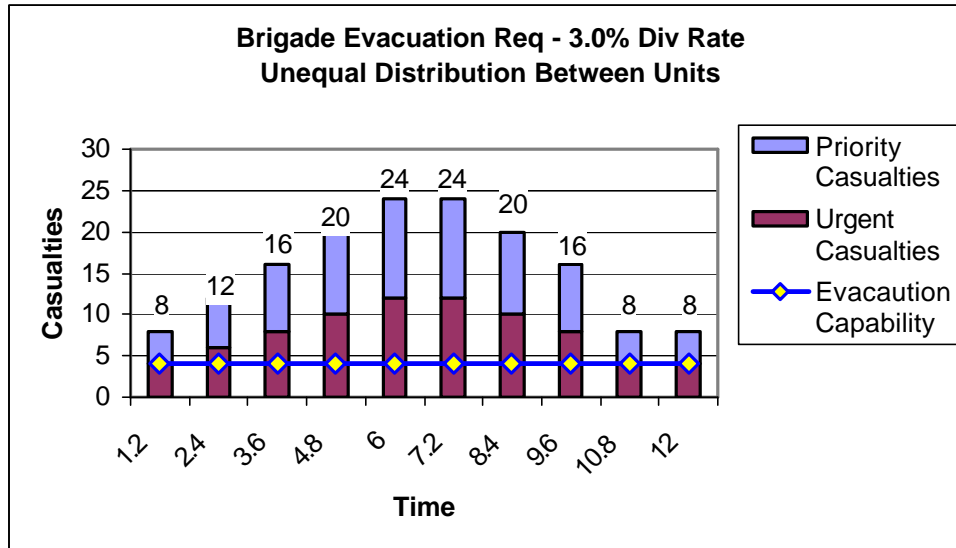


Figure 18

The aircraft requirement for only excess surgical workload is two. As with the other scenarios this requirement is complicated by the requirement to evacuate all Urgent Casualties within their two-hour window in order to minimize their chances of dying of wounds. When the total Urgent Casualty requirement is considered the aircraft requirement in this one brigade increases from two to four during the peak period which again falls between the 6.0-hour time period and the end of the 7.2-hour time period. When the evacuation requirement includes the Priority Casualties the aircraft requirement goes to seven, which exceeds the strength of two FSMTs.

As bad as the brigade situations look at both the 1.5 percent division rate and the 3.0 percent division rate, it is possible for one of the brigades to experience a casualty rate that is reflected by the constant distribution of casualties graph while another brigade in the same division experiences a casualty rate that is reflected by the graph showing the inequitable distribution of casualties by unit. For example, in a 1.5 percent division rate

scenario that assumes a constant distribution of casualties, each brigade will receive thirteen surgical casualties. When the distribution is no longer constant one of the brigades may still receive thirteen surgical casualties while the other two brigades receive seven and twenty respectively. Even with the inequitable distribution of casualties between brigades, the division still experiences a 1.5 percent division casualty rate for that battle.

The Active Component (COMPO 1) Air Ambulance Company force structure for FY 05 reflects sixteen total companies, of which only one is organic to an active force division. The only division that has an air ambulance company organic to it is the 101st Airborne Division (Air Assault). Nine of these companies would be utilized in Direct Support (DS) of the remaining divisions. The BOA for DS Air Ambulance Companies is one per division. The remaining companies would be available for general support roles to divisions as well as theater support. Fifteen additional companies will be in the National Guard (COMPO 2) and three companies in the US Army Reserve (COMPO 3). History has shown that divisions do not receive casualties equally between units nor over time. The history of the twentieth century has shown that modern armies have experienced division casualty rates have ranged from 1.1 percent to as high as 6.6 percent.<sup>23</sup> Given these facts and the division casualty rates used in this study, the additional requirement for GS aircraft just to continue the Echelon II to Echelon III evacuation ranges from 73 percent of a fifteen ship company to 100 percent of company depending on the division casualty rate. These ranges are calculated using airspeed alone and do not include time for loading and unloading casualties nor the time required to refuel the aircraft. This percentage range continues to increase when applying the

evacuation distance that is expected for a digital battlefield. Since the time required to evacuate the extra surgical workload cannot be completely mitigated by using air ambulances the only other option is to increase, or surge, surgical capability at the brigade level.

### Evacuation--Interim Summary

The modern battle space for a digital division has grown from one hundred square kilometers to an area that is 120 kilometers wide and between two hundred and 250 kilometers deep. For planning purposes the UH-60 air ambulance travels at 259 kilometers an hour and will have an evacuation distance of between 220 and 395 kilometers. This means that the evacuation time is between 48 minutes and 1 1/2 hours, which means that an urgent casualty who needs surgical intervention cannot be evacuated to a CSH before he would die from his wounds. The excess surgical workload discussed earlier is further complicated when Urgent and Priority casualties that require evacuation to Echelon III. When these other casualties are incorporated into the evacuation system, a division's airframe requirement grows from a doctrinal allocation of one FSMT, to a complete Air Ambulance Company functioning in a GS role.

### Surge Surgical Capability

Based on the fact that the FSMT that is GS to the division is unable to meet the Echelon II to Echelon III evacuation requirement of excess surgical casualties, the only other option is to surge surgical capability to the required location. Surging capability can be accomplished by three different means: moving additional Forward Surgical Teams from corps into the division; weighting a Brigade Combat Team with more than

one of the teams allocated to the division, while leaving one brigade without a team; or by working the three teams in support of the division past their normal twelve hour duty day.

If a requirement were identified only after the division makes contact with an enemy force, a FST collocated with the supporting CSH would take time to react. Given the best case, a team would probably be transportation by helicopter, to include sling loading its equipment. Discounting the time required to upload its equipment and the need for additional aircraft to completely transport the team and its equipment, it would take the team between forty-eight minutes and one and one-half hours to arrive in the Brigade Support Area (BSA) and another hour to become fully mission capable. Considering only the time to travel the distance and the hour to become operational, it would take between one hour and forty-eight minutes and two and one-half hours for a team to move forward from a CSH to augment a FST collocated with a FSMC. These reaction times exceed the time available to keep a casualty classified as “Urgent” in dying from wounds.

A second option available to the division would be to take one FST from a brigade to reinforce another brigade. This could occur if a team was pulled from a division reserve brigade and reallocated to the division main effort. If, once the reserve was committed, it only incurred a brigade casualty rate of 1.0 percent it would still have a requirement for surgical capability to treat four casualties. These casualties would be unable to get surgical care without being evacuated to the CSH.

The final option considered was to have each team work longer than its doctrinal twelve hour duty day. This option may mitigate some of the excess surgical requirement

depending when casualties arrived at the FSMC. The twelve-hour duty day is a matter of productivity and has been encouraged since at least 1944. The 3rd Army Surgeon Annual report showed that there was a significant degradation in the quality of surgical care if a team was worked past its twelve-hour day.<sup>24</sup> This degradation of the standard of care expected of a surgical team translates to a higher mortality rate for those casualties that require timely, far forward, surgical intervention to save their lives. In addition to the impact during the first day of working a surgical team past its twelve-hour duty day, the fatigue generated by this extended duty will affect the quality of care provided by the same team on successive days. This impact on the quality of care provided would inevitably increase the mortality rate of those cases that do receive treatment.

The current force structure under TAA 05 provides thirteen corps-level Forward Surgical Teams in the Active Component (COMPO 1) and twenty-three teams in the Reserve Component (COMPO 3). Of the COMPO 1 teams there is a clear alignment along corps lines. There are five teams aligned with I Corps, four teams aligned with III Corps, three teams aligned with V Corps, and two teams aligned with the XVIII Airborne Corps. In addition to the two teams aligned with the XVIII Airborne Corps, there are the three teams that are organic to maneuver units within that corps, one each to the 2nd Armored Cavalry Regiment (ACR) (Light), the 82nd Airborne Division, and the 101st Airborne Division.

The BOA used for TAA 05 is the same as the one used currently, one FST per maneuver brigade. Based on the range of surgical casualties when considering historically accurate casualty rates for successful and unsuccessful modern divisions during the twentieth century, as stated by Dupuy, and the inequitable distribution of

casualties over time or between units, the surgical requirement for a division ranges from five to eight FSTs. Given a requirement for no less than five FSTs per division the total COMPO 1 teams would only support two divisions and three additional maneuver brigades or ACRs. The total force structure would support five divisions plus one brigade or ACR. Under an unsuccessful scenario there are not enough FSTs in COMPO 1 to support two divisions in contact. The total structure would only support four divisions plus four brigades or ACRs.

### Summary

Based on the above discussion, it is clear that there is insufficient surgical capability within a digitized division based on historically accurate casualty rates, much less the casualties that would be anticipated under a “worst case” scenario. Due to the expansion of the division’s battle space under the digitized concept, the distance of the evacuation leg is too great to lesson the additional surgical requirement that would be seen if a division’s total battle casualty rate were 1.5 percent, much less 3.0 percent. Even if FSTs were available for forward deployment at the supporting CSH, the expanded battle space and minimum set up time, makes it impossible for a team to react fast enough to meet the additional surgical requirement. Reallocating teams within a division leaves a BCT without surgical support. This lack of support, even assuming a brigade casualty rate of 1.08 percent, realistic for a brigade utilized as the division reserve, would result in five surgical casualties dying of their wounds. Working FSTs past their twelve-hour duty day may mitigate a portion of the excess surgical requirement, depending on when those casualties arrive at the FSMC. The expanded duty day will increase the patient mortality rate during that day and potentially on subsequent days due

to fatigue. None of these potential mitigation options reduce the surgical requirement without increasing the mortality rate. Based on this, other options need to be considered.

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<sup>1</sup>Colonel Donald C. Curry, U.S. Army, Medical Reengineering Initiative (MRI), April 1999 (Briefing given at the Sporario Conference, 1999), slide 5.

<sup>2</sup>Colonel Trevor N. Dupuy, U.S. Army (Retired), *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* (Falls Church: NOVA Publications, 1995), 106.

<sup>3</sup>*Ibid.*, 52.

<sup>4</sup>Department of the Army, FM 8-10-25, *Employment of Forward Surgical Teams, Tactics, Techniques, and Procedures* (Washington, DC: Government Printing Office, 1997), 4-6.

<sup>5</sup>*Ibid.*, 2-1.

<sup>6</sup>*Ibid.*, 4-12.

<sup>7</sup>George W. S. Kuhn, Logistics Management Institute (LMI), CJCS Guide 3161, *CJCS Guide to Battle Casualty Rate Patterns for Conventional Ground Forces* (Washington, DC: Government Printing Office, 1998), 2-1.

<sup>8</sup>Dupuy, 41.

<sup>9</sup>Dupuy, 44.

<sup>10</sup>*Ibid.*, 63.

<sup>11</sup>Major Georgia Jones, US Army, Medical Force Structure/Medical Planning Factors (Presentation used in preparation for TAA 07, File name: Medical BOA\_GB 9910(M), 1999), slide 9.

<sup>12</sup>Dupuy, 102.

<sup>13</sup>Given World Wars I and II, Korea, the battle of Ia Drang in Viet Nam, and Desert Storm, the US has been “unsuccessful” in three of these five “first battles.”

<sup>14</sup>Dupuy, 63.

<sup>15</sup>Jones, slide 29.

<sup>16</sup>Lieutenant Colonel Pat McMurry, US Army, *Building the Force* (LTC McMurry is the Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, File name: Medical TAA Process, 2000), slide 18.

<sup>17</sup>LTC Pat McMurry, U.S. Army, Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, telephone conversation with author at Fort Leavenworth on 27 June 2001; and Department of Logistics and Resource Operations, Command and General Staff College, Force XXI Division Logistics, Sustain the Force, Overview, briefing for Command and General Staff College Class A408--Sustaining the Digitized Division (Briefing, Fort Leavenworth, Kansas, 1996), slide 50. The distance categorized as “most likely” was a product of analysis done by the Medical Plans Section of the ARCENT Staff at the request of LTC McMurry while the Digitized Division distance is from a slide presentation referenced above.

<sup>18</sup>LTC Pat McMurry, U.S. Army, Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, telephone conversation with author at Fort Leavenworth on 27 June 2001. LTC McMurry received this information from the Medical Proponency Branch at Fort Rucker.

<sup>19</sup>Dupuy, 63.

<sup>20</sup>Ibid., 11.

<sup>21</sup>Ibid., 41.

<sup>22</sup>LTC Pat McMurry, U.S. Army, Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, telephone conversation with author at Fort Leavenworth on 27 June 2001. LTC McMurry received this information from the Medical Proponency Branch at Fort Rucker.

<sup>23</sup>Dupuy, 63.

<sup>24</sup>Annual Report, Medical Section, Headquarters Third U.S. Army, page 102/109, file HD 319.1-2, Box 335A, Record Group 112, E 54A, National Archives.

## CHAPTER 5

### CONCLUSIONS, RECOMMENDATIONS, AND SUGGESTIONS FOR FURTHER RESEARCH

The Army Medical Department (AMEDD) has experienced an extended period of budgetary and strength reductions over the last ten years. These reductions have been accompanied recently by a new vision of what the “objective force” Army should look like in the future. This new vision has led to a reorganization of the AMEDD under the Medical Reengineering Initiative (MRI). To meet the requirement to provide far forward surgical intervention, MRI has eliminated the Mobile Army Surgical Hospital (MASH) and replaced it with the Forward Surgical Team (FST). As part of the restructuring under MRI the AMEDD has assumed that the daily division casualty rate will be reduced from 1.5 percent to 1.1 percent. This reduction is based on a number of factors, to include an assumed increase in the effectiveness of future fighting forces, as well as the increased dispersion of units on the future battlefield. The future division battle space has grown from an area that is 100 kilometers wide by 100 kilometers deep to an area that is 120 kilometers wide by 200 kilometers deep.

The purpose of this study was to determine the sufficiency of far forward surgical care in the future medical force structure as it relates to the objective force, specifically the digitized division. The sufficiency of far forward surgical care indicates whether the AMEDD has downsized past the level necessary to treat wounded soldiers requiring timely surgical intervention to save lives on future battlefields.

## Conclusions

The sufficiency of the current and proposed medical force structure under MRI for far forward surgical intervention is difficult to determine. This study shows that it is not possible to determine force structure sufficiency without being able to view and analyze the computer modeling tools used in developing that force structure. With that in mind there are a number of pertinent conclusions that can be made for each of the subordinate research questions, as well as this thesis' primary question.

The first subordinate research question relates to how the employment of FSTs, specifically those co-located in the division area with Forward Support Medical Companies (FSMC), impact the survivability of seriously wounded casualties. Colonel Dupuy demonstrates that 15 percent of all wounded casualties will require medical intervention in the form of surgery to save their lives.<sup>1</sup> Under MRI and Total Army Analysis 2005 (TAA 05) a division daily battle casualty rate of 1.1 percent is used to determine the total number of FSTs that are required in the force structure. The TAA process assumes that casualties are generated equally over time and distributed equally between the units of the division. Based on the historical experience of the 4th Armored Division, it is clear that the TAA process is built upon a false premise. A 1.1 percent division casualty rate produces a surgical workload for the division of twenty-nine casualties, which is within the total capability of the three FSTs that would normally be in support of the division, based on the Basis of Allocation (BOA) rules. When considering the distribution issues discussed above, there is not sufficient surgical capability within the three FSTs.

During a twelve-hour operation, each of the three maneuver brigades generates five, ten and fourteen surgical cases respectively. When considering the inequitable distribution of casualties over time, two of the brigades exceed their respective FST's capability to treat all of its surgical cases, by four and eight cases respectively. In a scenario where the division casualty rate increases to a more historically accurate rate for successful modern armies of 1.5 percent, the brigades generate seven, thirteen, and twenty surgical cases, respectively. Given an inequitable distribution over time, the excess surgical workload by brigade is four, six, and thirteen, respectively. A casualty rate of 3.0 percent is historically accurate for modern armies that have not been successful. The excess workload in such a scenario increases to six, sixteen, and twenty-nine respectively. Regardless of the casualty rate used, there is insufficient surgical capability within the division under the current and future BOA for FSTs. One way to mitigate this shortfall in surgical capability is to evacuate the excess workload to the Combat Support Hospital (CSH) in the corps forward logistics support area (LSA).

Given the above solution, the second subordinate research question relates to the ability of medical evacuation assets to move the excess surgical workload to the CSH in time to save the lives of these casualties. Given the time required to move a casualty from the point of injury through a Battalion Aid Station to a FSMC, there will be approximately one hour and fifteen minutes available to evacuate the casualties that exceed the surgical capability of each FST. To compound this problem, the division battle space has grown significantly under Division XXI with the evacuation distance from the FSMC to the CSH commensurately growing from a "most likely" distance of 220 kilometers to a distance of 395 kilometers.<sup>2</sup>

The anticipated speed of an air ambulance, as determined by the Army Medical Department Center and School (AMEDD C&S), is 140 knots or 259 kilometers an hour during daylight operations.<sup>3</sup> Given the current and future battle space, the evacuation time from the FSMC to the CSH ranges from 51 minutes to an hour and 32 minutes one way. Based on the limited number of aircraft available, as well as the increased evacuation time of the expanded battle space, the use of GS evacuation aircraft will not mitigate the excess surgical workload of the FSTs. The only other option is to increase the capability to provide surgical intervention at Echelon Two.

The last subordinate research question relates to the capability of medical planners to surge additional surgical capability to a point on the battlefield where it is required in time to move or treat seriously wounded casualties. Surging capability can be accomplished by three different means: moving additional Forward Surgical Teams from corps into the division, weighting a Brigade Combat Team (BCT) with more than one of the teams allocated to the division while leaving one brigade without a team, and by working the three teams in support of the division past their normal twelve-hour duty day.

The expanded battle space of a digital division does not allow the movement of additional teams from the corps area into a Brigade Support Area (BSA) within the time available to impact the mortality rate of that BCT. Weighting a BCT with the reserve brigade's FST provides an insufficient increase in capability while eliminating that capability within the reserve brigade. Extending the duty day of the members of a FST quickly negatively impacts on the mortality rate of the cases that are actually treated, as well as having a serious long term impact on that team's quality of care. Surging surgical

capability does not provide sufficient timely capability to mitigate the surgical requirement within the division.

Without being able to analyze the computer models that are used in force structure development, it is difficult to make a definitive determination of whether the reduction in the AMEDD has negatively impacted the sufficiency of current and proposed force structures to provide far forward surgical care. It is clear that the current basis of allocation rules for employing FSTs and Air Ambulance Companies in the general support role used to determine the current and future force structure will not support historically accurate division casualty rates. If the current basis of allocation rules are adjusted to provide sufficient surgical and evacuation assets to meet historically accurate division casualty rates it is probable that the current and proposed force structures will be insufficient to care for those casualties requiring far forward surgical intervention to save their lives.

### Recommendations

Based on the results of this study, the researcher recommends three areas where the AMEDD should take action. The AMEDD needs to reevaluate its Basis of Allocation (BOA) rules, specifically in terms of FSTs and Air Ambulance Companies in a General Support role. Secondly, the AMEDD should reallocate surgical resources within its existing and future force structures to allow for a greater number of FSTs to be available to the force. Finally, the AMEDD must reevaluate the casualty rates that are used to determine the workload that justifies the present and future force structure. The AMEDD must place a greater emphasis on the historical record of this nation in battle and decrease

the emphasis on potential capability that may lead to an increased survivability on a future battlefield.

History has shown that the United States and other great nations have misread the future more often than they have correctly anticipated its outcome. Specifically, more often than not, nations have underestimated the lethality of a future enemy and the battlefield in which it is encountered. These same nations have overestimated the survivability of its own force against that enemy. When one is in the business of saving lives on the field of battle, this error has drastic and permanent ramifications, not only for the soldiers involved, but also for their commanders as they continue the fight.

#### Suggestions for Further Research

There are six areas that, in this researcher's opinion, would warrant further research:

1. Research possible ways to reallocate resources within current force limitations to increase the number of Forward Surgical Teams within the force structure.

2. Research, develop and adopt a casualty planning tool to be used by medical planners at the division level and below. The development and adoption of such a tool will assist in ensuring that surgical requirements at Echelon II are anticipated and planned for. In addition, the treatment plan for these casualties would be resourced and synchronized prior to their arrival at an Echelon II medical treatment facility.

3. Evaluate the current number of Echelon Three and Four hospitals in the force structure as well as the current and future doctrine and potential areas of operations. This would confirm whether the number of hospitals is appropriate within a theater of operations given other possible options for definitive health care. The reduction in the

number of Echelon Three hospitals and the elimination of Echelon Four hospitals, given the capability to move stable patients via tactical and strategic lift back to the Zone of Interior, may provide for sufficient force structure to increase the surgical presence at Echelon Two.

4. Analyze current strength requirements for General and Orthopedic Surgeons to staff the current and future number of Forward Surgical Teams. This would determine if the manning in the different components is even possible, much less what its impact would be on other operations, such as Graduate Medical Education (GME) and manning of other TOE hospitals.

5. Study possible retention and recruiting tools needed to ensure there is the required number of surgeons available to meet the number of Forward Surgical Teams in the current force structure as well as the number teams if the Basis of Allocation rules change. This research would be critical, especially when considering the need for surgeons within the reserve components, in light of the number of FSTs and other medical units residing in that portion of the force structure.

6. Study the historical record of the mobilization of medical professionals in the United States Army, specifically surgical specialists. Analyze this record for possible lessons learned and propose a plan to access this resource pool of medical professionals to staff surgical teams during times of national crisis.

### Summary

Colonel Dupuy provides historically accurate division casualty rates for modern militaries that were involved in combat operations during the twentieth century.<sup>4</sup> In addition to these rates, he provides historical evidence that shows that 15 percent of all

casualties require timely intervention to save their lives.<sup>5</sup> The current and future force structures, as well as the Basis of Allocation, for Forward Surgical Teams are insufficient to ensure that critically wounded soldiers are provided timely surgical intervention. The models used to develop these force structures and basis of allocation are a result of unrealistic assumptions regarding casualty rates on future battlefields. The number of Air Ambulance Companies in the Army is not sufficient to assist in moving the number of casualties that would exceed the capability of one FST in support of a Brigade Combat Team (BCT). This is true even before considering the impacts of the Army's new doctrine and the expansion of the battle space that is now within a division's area of responsibility.<sup>6</sup> Given the shortfall in the number of FSTs available in the force structure, the movement of a team, or teams, from a reserve location in the corps area forward to a BSA to react to an excess of casualties will not solve this problem. Even if the teams were available, the enlarged battle space does not allow for timely movement and establishment in a BSA to impact this problem.

Additional research in afore mentioned areas would provide greater alternatives to the force structure planners as they attempt to build and resource a force for a future battlefield. As shown in this study, it is clear that our current methods do not stand up to historical performance by our own military much less other modern militaries that fought during the twentieth century. Given the historical record of this nation's military in its "first battles," it is imperative that further study and evaluation take place to develop a more accurate method of determining and resourcing the far forward surgical capability that history has demonstrated will be needed to save soldiers lives.

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<sup>1</sup>Colonel Trevor N. Dupuy, U.S. Army (Retired), *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* (Falls Church, VA: NOVA Publications, 1995), 52.

<sup>2</sup>LTC Pat McMurry, U.S. Army, Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, telephone conversation with author at Fort Leavenworth on 27 June 2001; and Department of Logistics and Resource Operations, Command and General Staff College, Force XXI Division Logistics, Sustain the Force, Overview, briefing for Command and General Staff College Class A408, Sustaining the Digitized Division (Briefing, Fort Leavenworth, Kansas, 1996), slide 50. The distance categorized as “most likely” was a product of analysis done by the Medical Plans Section of the ARCENT Staff at the request of LTC McMurry while the Digitized Division distance is from a slide presentation referenced above.

<sup>3</sup>McMurry. LTC McMurry received this information from the Medical Proponency Branch at Fort Rucker.

<sup>4</sup>Dupuy, 63.

<sup>5</sup>Ibid., 52.

<sup>6</sup>Department of Logistics and Resource Operations, Command and General Staff College, Force XXI Division Logistics, Sustain the Force, Overview, briefing for Command and General Staff College Class A408, Sustaining the Digitized Division, (Briefing, Fort Leavenworth, Kansas, 1996), slide 50.

APPENDIX A

4TH ARMORED DIVISION OPERATIONS OVERLAYS

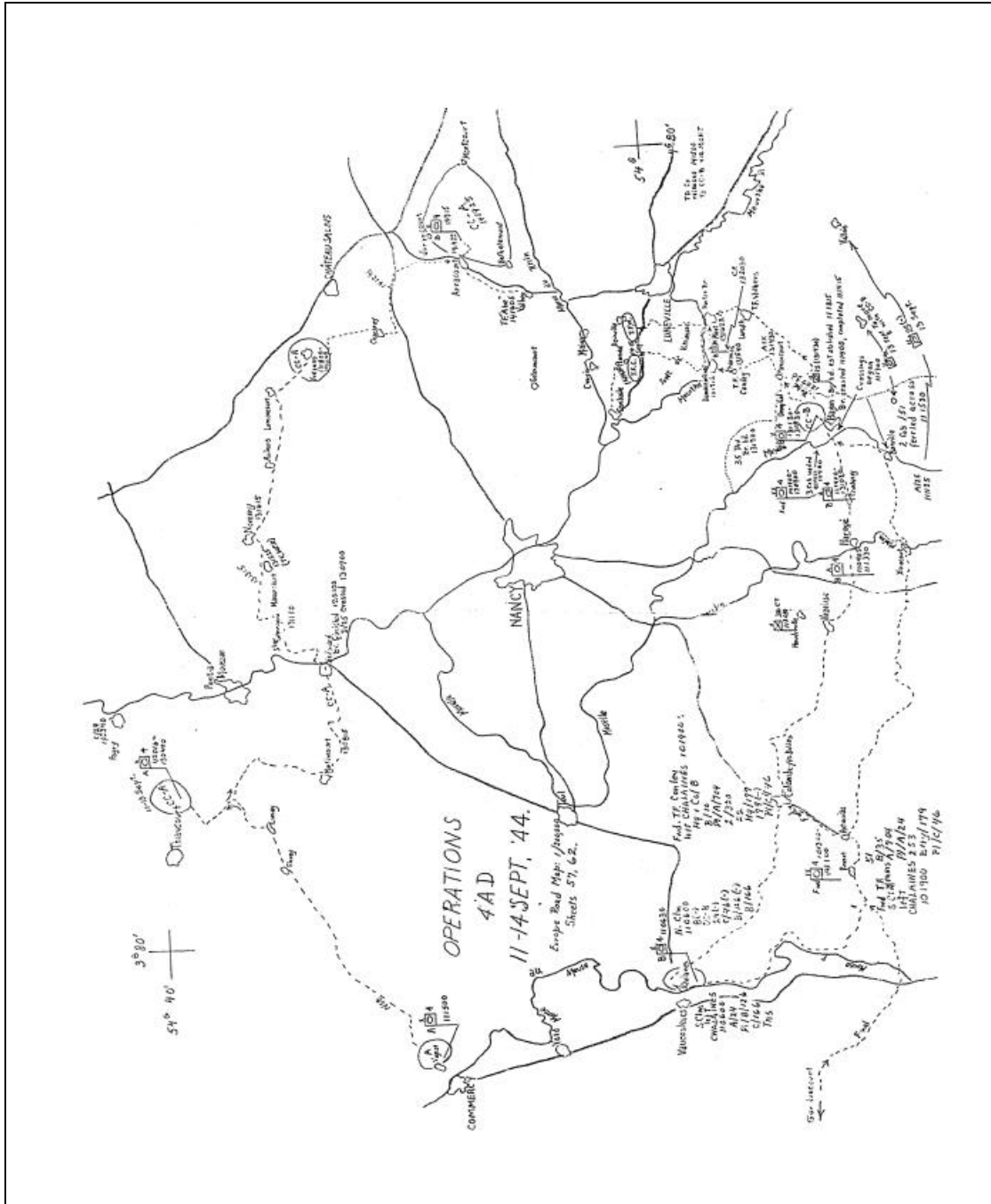


Figure A-1. 4th Armored Division Action, 11-14 September 1944





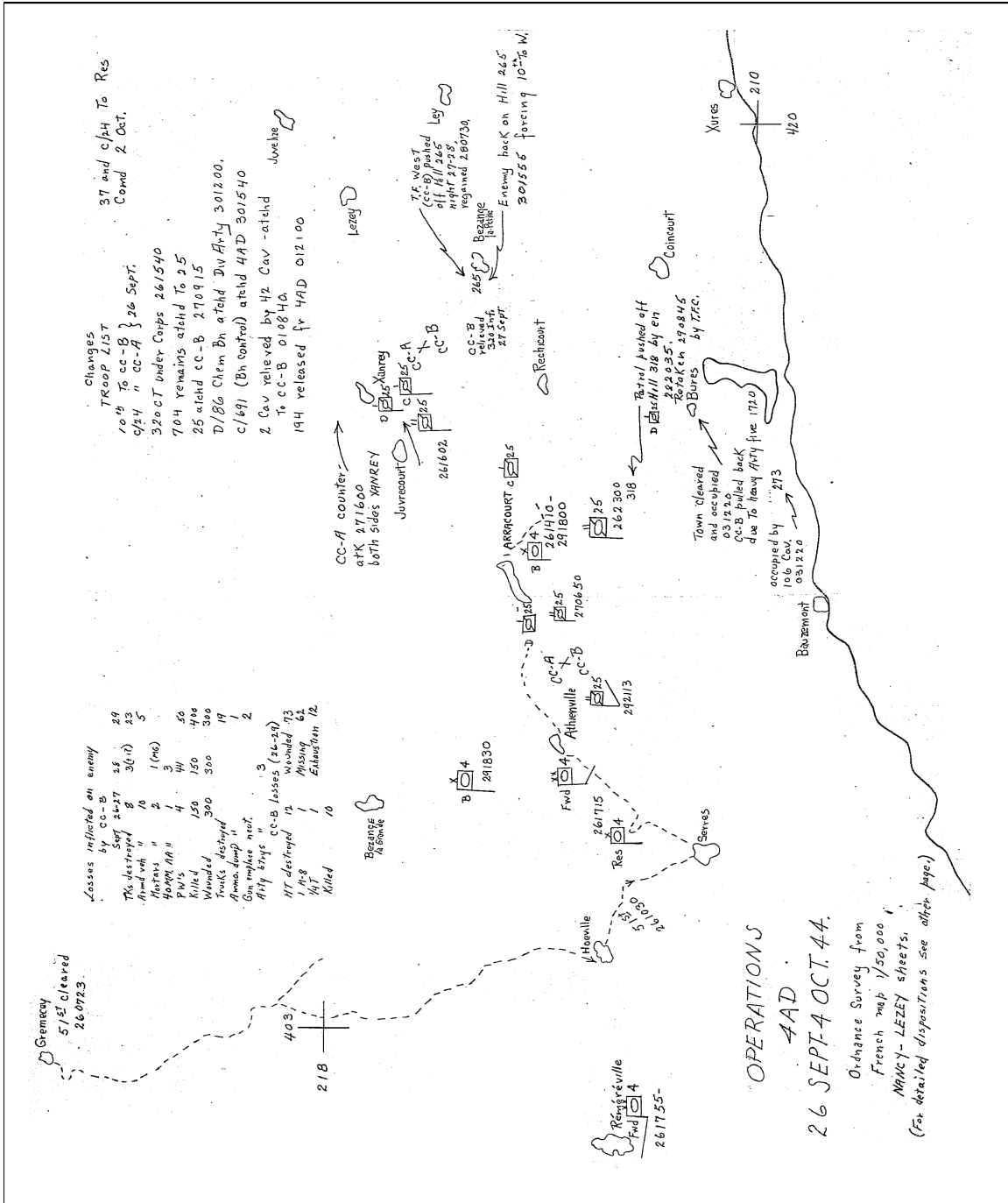
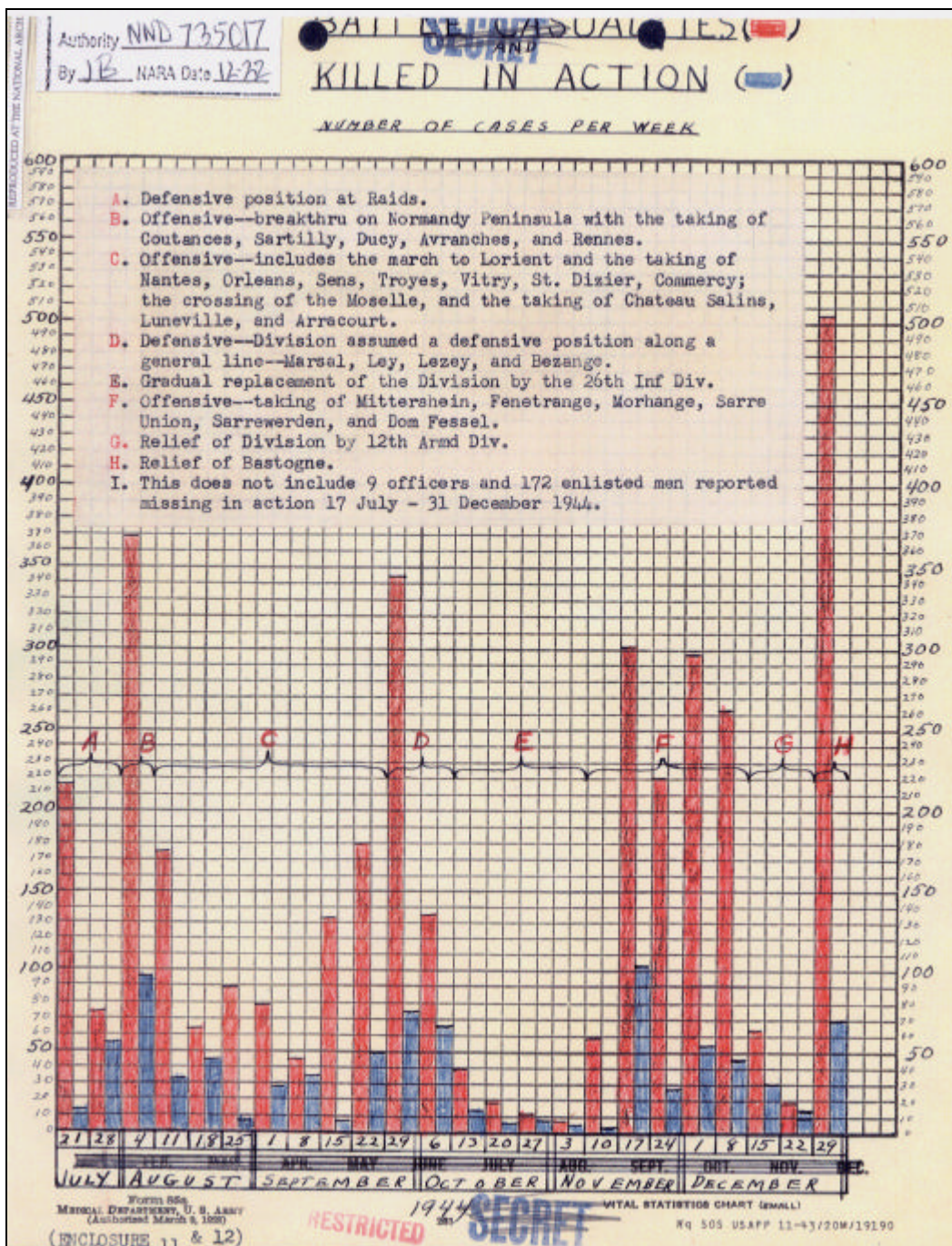


Figure A-4. 4th Armored Division Action, 26 September --4 October 1944, Source: Combat History, 4th Armored Division, 17 July 1944 - 9 May 1945, File 604-0.1, Research Group 407, National Archives.



# APPENDIX C

## 4TH ARMORED DIVISION BATTLE CASUALTY DATA



4th Armored Division Battle Casualties and Killed in Action, 1944. *Source:* Annual Report of Medical Department Activities of the 4th Armored Division for 1944, Headquarters, 4th Armored Division, File HD 319.1-2, Research Group 112, National Archives.

## APPENDIX D

### CALCULATIONS

Total Division Battle Casualties per Day:

Division Strength x Division Daily Casualty Rate = Total Division Battle Casualties per Day

Total Wounded in Action (WIA) per Day:

Total Division Battle Casualties per Day x 85% = Total Daily Division WIA

Total WIA Requiring Far Forward Surgery:

Total Daily Division WIA x 15% = Total Division FST Requirement

SOURCE: Colonel Trevor N. Dupuy, US Army (retired), *Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War* (Falls Church: NOVA Publications, 1995); and Major Bruce Shahbaz, USAR, *Medical Course of Action Tool (M-COAT)*.

APPENDIX E

EVACUATION CALCULATIONS

TABLE 1

UH-60 AIR SPEED

Air Speed UH-60 (km/hr)	Day	Night
BAS - FSMC	204	167
FSMC - CSH	259	222

TABLE 2

DISTANCES FROM FSMC/FST TO CSH

Distance - FSMC to CSH (km)	ARCENT Scenario	
Minimum	150	
Most Likely	220	
Maximum	310	
Digitized Battlefield		395

TABLE 3

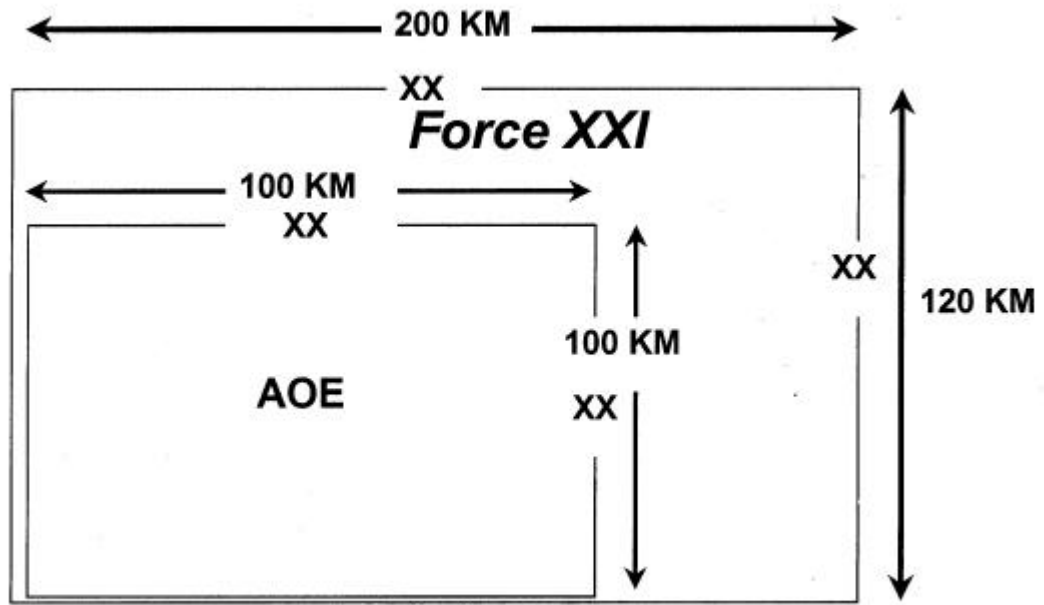
EVACUATION TIMES FROM FSMC/FST TO CSH

Evacuation Time (Hours)	Day	Night
Min -One way time requirement	0.6	0.7
Min - Round trip time requirement	1.2	1.3
ML - One way	0.8	1.0
ML - Round Trip	1.7	2.0
WC - One way	1.2	1.4
WC - Round Trip	2.4	2.8
Digital - One way	1.5	1.8
Digital - Round Trip	3.0	3.6

*Source:* LTC Pat McMurry, US Army, Chief, Force Structure and Analysis Branch, US Army Medical Department Center and School, telephone conversation with the author at Fort Leavenworth, KS, 27 June 2001.

APPENDIX F

FORCE XXI BATTLE SPACE





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