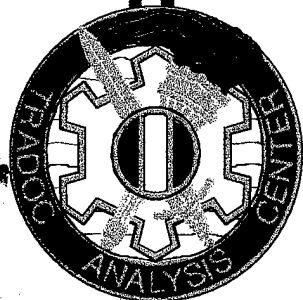
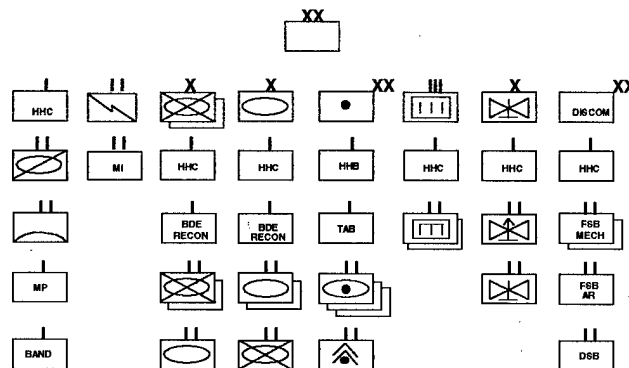


March 1996



FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I FINAL REPORT



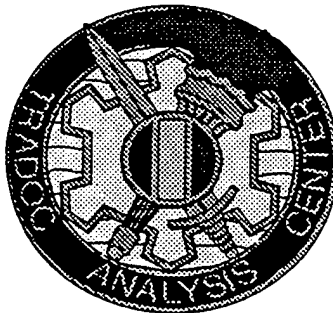
19960905 013

TRADOC Analysis Center
Study and Analysis Center
Study Directorate
Fort Leavenworth, Kansas 66027-2345

TRADOC Analysis Center
Study and Analysis Center
Study Directorate
Fort Leavenworth, Kansas 66027-2345

Force XXI Division Design Analysis: Phase I

Final Report



PREPARED BY:

George C. Prueitt
GEORGE C. PRUEITT, Ph D
LTC, FA
Study Director

CERTIFIED BY:

Michael F. Bauman
MICHAEL F. BAUMAN
SES, USA
Director, TRAC

APPROVED BY:

John E. Miller
JOHN E. MILLER
LTG, USA
DCG, TRADOC

Distribution Statement:
Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE March 1996	3. REPORT TYPE AND DATES COVERED Technical Report Jul 1995 - Mar 1996		
4. TITLE AND SUBTITLE Force XXI Division Design Analysis: Phase I Final Report			5. FUNDING NUMBERS	
6. AUTHOR(S) LTC George Prueitt, MAJ Sherrie George, MAJ Dwayne Hill, MAJ Edward Free, Mr. Steven Schorr, CPT(P) Tom Cioppa, CPT Brendan Sheehan, Ms. Carol Mullen, Mr. Bryson McCool, Mr. Wayne Crews, MAJ Robert Daniels				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Study Directorate TRADOC Analysis Center - Study and Analysis Center ATTN: ATRC-SAS Ft Leavenworth, KS 66027-5200			8. PERFORMING ORGANIZATION REPORT NUMBER Technical Report TRAC-TR-0396	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) TRADOC Analysis Center - Study and Analysis Center ATTN: ATRC-SAS Ft Leavenworth, KS 66027-5200			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Distribution approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The Force XXI Division Design Analysis (DDA): Phase I was conducted to examine a set of alternative division designs developed by the Training and Doctrine Command (TRADOC) Force Design Directorate (FDD). The new TRADOC Pam 525-71, <i>Force XXI Division Operations Concept</i> , served as the context for the design alternatives. The results of this analysis provided support for the Commanding General (CG), TRADOC's Interim Division Design decision. The Interim Division Design selected for further study was the Modernized Heavy (MOD HVY) Division. This report documents the results from the unique combination of qualitative and quantitative methods used in supporting the decision. DTIC QUALITY INSPECTED 3				
14. SUBJECT TERMS Force XXI, division design, simulation, patterns of operations, Modernized Heavy Division			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNLIMITED	

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	
Purpose.....	ES-1
Introduction.....	ES-1
Methodology Overview.....	ES-3
Findings From Supporting Analyses.....	ES-4
MOD HVY Division Development.....	ES-6
Summary of DDA Validation Findings.....	ES-6
Conclusions.....	ES-6
 CHAPTER 1. INTRODUCTION	
1-1. Purpose.....	1
1-2. Background.....	1
1-3. Study Objectives.....	2
1-4. Scope.....	2
1-5. Division Alternatives.....	3
1-6. Scenario Overviews.....	7
1-7. Assumptions.....	12
1-8. Report Layout.....	14
1-9. Summary of Results.....	15
1-10. Summary of Findings and Validation.....	16
 CHAPTER 2. METHODOLOGY	
2-1. Study Methodology Overview.....	19
2-2. Patterns of Operations.....	20
2-3. Supporting Subordinate Analyses.....	21
2-4. Models.....	24
2-5. Methodology Wrap-up.....	26
 CHAPTER 3. RESULTS	
3-1. Introduction.....	27
3-2. Project the Force.....	27
3-3. Protect the Force.....	30
3-4. Gain Information Dominance.....	33
3-5. Set the Battlespace Conditions.....	35
3-6. Conduct Decisive Operations.....	41
3-7. Sustain and Transition the Force.....	46
 CHAPTER 4. SUMMARY OF MAJOR FINDINGS	
4-1. Introduction.....	49
4-2. Findings.....	49
4-3. Other Areas for Further Investigation.....	54
4-4. Modernized Heavy (MOD HVY) Division Development.....	55

	<u>Page</u>
CHAPTER 5. DDA VALIDATION, SUMMARY, AND CONCLUSIONS	
5-1. Introduction.....	57
5-2. Development of the MOD HVY Division.....	57
5-3. Scope for DDA Validation Analysis.....	58
5-4. Assumptions.....	59
5-5. Limitation.....	59
5-6. Spectrum of Scenario Conditions.....	59
5-7. Major Combat Systems Differences.....	61
5-8. Europe (PW96) (Modified).....	61
5-9. SWA 4.2.....	65
5-10. NEA 2.1 (Modified).....	67
5-11. Summary of DDA Validation Findings.....	69
5-12. Conclusions.....	70
APPENDICES	
A. Glossary.....	A-1
B. Front-End Differences Analysis.....	B-1
C. Senior Military Review.....	C-1
D. Division Design Analysis Computer Assisted Map Exercise.....	D-1
E. Brigade Design Analysis.....	E-1
F. Deployability Analysis.....	F-1
G. Combat Service Support Analysis.....	G-1
H. Validation Analysis (Classified).....	H-1
I. Acknowledgments.....	I-1
J. Distribution List.....	J-1

LIST OF FIGURES

<u>No.</u>		<u>Page</u>
ES-1	Modernized Heavy Division.....	ES-6
1-1	Current AOE Division (Armor Heavy).....	3
1-2	Heavy/Light - Small Base (HL-SB) Division.....	4
1-3	Brigade Based Division.....	5
1-4	Modular (MOD) Division.....	6
1-5	Modernized Heavy (MOD HVY) Division (Armor Variant).....	7
1-6	First European Derivative Scenario.....	8
1-7	Second European Derivative Scenario.....	9
1-8	NEA PW95 Scenario (Ambush Phase).....	10
1-9	NEA 2.1 (Modified) Scenario.....	10
1-10	SWA 5.0 Scenario.....	11
1-11	SWA 4.2 Scenario.....	12
1-12	Apportionment of Functions by Patterns of Operations.....	14
1-13	Characteristics of Design Alternatives - By Patterns of Operations.....	16
2-1	Methodology.....	19
3-1	Division Lift Requirements.....	28
3-2	Strategic Deployment.....	29
3-3	Air Defense Artillery Designs.....	31
3-4	Chemical and Engineer Support.....	32
3-5	Military Intelligence Designs and Performance.....	34
3-6	MLRS, Attack Aviation, and Fixed Wing Blue Kills - 2001.....	36
3-7	MLRS, Attack Aviation, and Fixed Wing Blue Kills - 2010.....	37
3-8	FY 2001 Cavalry Investigation from BDA.....	38
3-9	FY 2010 Cavalry Investigation from BDA.....	39
3-10	Lethality - 2001.....	42
3-11	Lethality - 2010.....	43
3-12	Survivability.....	44
3-13	High Intensity Offensive Operations.....	47
3-14	Moderate Intensity Defensive Operations.....	47
5-1	Modernized Heavy Division (Mechanized Infantry Variant).....	57
5-2	Spectrum of Scenario Conditions.....	60
5-3	Major Combat Systems Differences.....	61
5-4	European (PW96) Modified Scenario.....	62
5-5	Decisive Operations for PW96.....	64
5-6	Survivability Results for PW96.....	64
5-7	Primary Combat Systems Losses for PW96.....	65
5-8	Lethality for SWA 4.2.....	66
5-9	Survivability for SWA 4.2.....	67
5-10	Lethality for NEA 2.1 (Modified).....	68
5-11	Survivability for NEA 2.1 (Modified).....	69

LIST OF TABLES

<u>No.</u>		<u>Page</u>
3-1	Cavalry Alternatives Loss Exchange Ratios.....	40
3-2	Blue Tanks and TFVs Tables (Survivability).....	45

ABSTRACT

The Force XXI Division Design Analysis (DDA): Phase I was conducted to examine a set of alternative division designs developed by the Training and Doctrine Command (TRADOC) Force Design Directorate (FDD). The new TRADOC Pam 525-71, *Force XXI Division Operations Concept*, served as the context for the design alternatives. The results of this analysis provided support for the Commanding General (CG), TRADOC's Interim Division Design decision. The Interim Division Design selected for further study was the Modernized Heavy (MOD HVY) Division. This report documents the results from the unique combination of qualitative and quantitative methods used in supporting the decision.

THIS PAGE INTENTIONALLY LEFT BLANK.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I EXECUTIVE SUMMARY

1. Purpose. The Force XXI Division Design Analysis (DDA) - Phase I was conducted to examine a set of alternative division designs, developed by the Training and Doctrine Command (TRADOC) Force Design Directorate (FDD), in the context of the new TRADOC Pam 525-71, *Force XXI Division Operations Concept*, and provide support for the Commanding General (CG), TRADOC's Interim Division Design decision. This report documents the results from the unique combination of qualitative and quantitative methods used.

2. Introduction.

a. Background. As the threat changes, force downsizing and technology enhancements continue to impact the way the Army performs its traditional and nontraditional missions. The Army must redesign the 21st century operating division to facilitate accomplishment of a variety of missions with a reduced active duty base. TRADOC has been charged with redesigning the Warfighting Army into the 21st century, using an iterative cycle of concept definition, requirements review, force design, equipping, training, and experimenting, as described in the Joint Venture Campaign Plan. The DDA will serve as the thread of continuity for the Joint Venture Campaign Analysis. The analysis will be conducted in two phases: (1) Phase I examined the differences in division design alternatives by using qualitative and quantitative analyses, and it was completed in December 1995; (2) Phase II will be from December 1995 through November 1997, with the final division design decision being made in February 1998.

b. Study Objectives.

(1) Can the alternative division designs perform the operations described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*?

(2) Should the Force XXI Division have both heavy and light maneuver forces?

(3) Do the alternative division designs have adequate divisional command and control node structures?

(4) Do the alternative designs increase the degree of modularity in the division?

(5) How are the capabilities of the alternative divisions affected by making them smaller than the current AOE heavy divisions?

c. Scope. Some of the major factors affecting the analysis included:

(1) The division operated in the context of the TRADOC Pam 525-71, *Force XXI Division Operations Concept*.

(2) Alternatives. The three initial division design alternatives were the current Army of Excellence (AOE), Heavy/Light - Small Base (HL-SB), and Brigade Based divisions. During the course of the study, the Modular Division (MOD) was developed as a fourth alternative. As a result of the supporting analyses, a fifth design, the Modernized Heavy Division (MOD HVY), was recommended to CG, TRADOC as the Interim Division Design.

(3) Force Years. The analysis was performed for two force years. The near-term time period is force year (FY) 2001, and the far-term time period is FY 2010. The combat systems in the force years reflect near term and objective technological capability. The near term force year provided insights on how today's force capabilities, with minimal technology insertions, are affected by organizational changes, while the far term provided insights on the synergistic effects of force structure changes and higher technology systems.

(4) Scenarios. The Force XXI divisions are anticipated to operate in regions where there are combinations of close and open terrain. Accordingly, the following scenarios were used:

(a) European derivative scenarios. Three scenarios based on European-type terrain were used in Phase I. For constructive simulation, the scenario being developed for PRAIRIE WARRIOR 1996 (PW96) was used to portray two Force XXI divisions, in a single corps, attacking a hypothetical, high technology opposing force. A modification of that PW96 scenario was also used for the validation analysis. A Battle Command Training Program (BCTP) developed scenario was used for the CG, TRADOC "How to Fight" seminars.

(b) NEA scenarios. The Mobile Strike Force (MSF) scenario from PW95 was used in the Senior Military Review (SMR). The validation analysis used a modified version of NEA 2.1.

(c) SWA scenarios. TRADOC Standard Scenarios were used in both the SMR (SWA 5.0), and the validation analysis (SWA 4.2).

d. Assumptions. Assumptions were made to ensure the designs could be modeled accurately and fought according to the proposed doctrine. Some of the critical assumptions were:

(1) The redesigned divisions are appropriately tailored to METT-T (mission, enemy, terrain, troops, and time available) conditions, regardless of the basic division's construction. If the circumstances required a specific force mix (either composite, pure heavy, or pure light) the division would be task-organized to do that. The division staff emphasis is on battle command, capable of applying any mix of forces to the demands of the mission.

(2) The redesigned divisions are anticipated to perform mid-to-high intensity combat operations, against enemies that have low-to-high technological capabilities.

(3) The divisions operate in areas that have combinations of open and restrictive terrain.

(4) The Force XXI division operates within the context of a corps (not autonomously) and certain basic capabilities exist at corps and echelons above corps (EAC). Supporting assets

from corps can be made available, depending on METT-T conditions. In the design process, it is very possible for some functions, and consequently some units, to migrate from the division to echelons above division (EAD), and it is also possible that some of these migrating units may go from the active component (AC) to reserve component (RC), thus downsizing the AC.

3. Methodology Overview. The analysis used both qualitative and quantitative methods. The qualitative, or "intellectual" based methods used military judgment and other force design approaches, while the quantitatively, or "analytical" based approaches included simulations and more typical comparative analyses. On the "intellectual" side, analyses started with the initial alternative designs, developed from FDD's subject-matter experts (SME) and the proponent schools, and examined how those designs could meet the task requirements identified in the division operations concept. Insights also sought to capitalize on the "How to Fight" seminars that were being conducted in parallel to the analyses. On the "analytical" side, constructive simulations were used by multiple analytical agencies to compare the division design alternatives.

a. **Patterns of Operations.** The six patterns described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*, were used as the basis for the comparative analyses of how the division will organize and fight. White papers were developed for each patterns during the "How-to-Fight" seminars. The six patterns are: (1) project the force, (2) protect the force, (3) gain information dominance, (4) set the battlespace conditions, (5) conduct decisive operations, and (6) sustain and transition the force.

b. **Analytical Events.**

(1) **Front-End Differences Assessment.** A Front-End Differences Assessment was performed to identify the major design differences in the three initial alternatives, and that assessment was used as selection criteria for the scenarios analyzed in the time available.

(2) **Senior Military Review (SMR).** The SMR was an exercise conducted with participation by four retired general officers and representatives from the Command and General Staff College (CGSC), the Army War College (AWC), the Concepts Analysis Agency (CAA), the Louisiana Maneuvers Task Force (LAM-TF), the Battle Command Training Program (BCTP) office, the Battle Laboratory Integration and Technology for Combat Developments (BLITCD) Directorate, FDD and TRAC. The participants looked at specific operational situations that would potentially highlight differences, both positive and negative, in the various designs. The exercise culminated in a consensus building discussion that detailed strengths and weaknesses of the designs, and recommended changes that could bring out the best characteristics of each alternative. This effort directly led to the development of the fourth alternative, the Modular Division (MOD) design, which incorporated most of those recommendations.

(3) **Computer-Assisted Map Exercise (CAMEX).** The CAMEX exercised and evaluated the alternative division designs in the context of the new concepts described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*. CAMEX is a two-sided "man-in-the-loop" simulation that uses computer-based movement, engagement, and attrition. All actions are keyed by human decisions. The PW96 scenario used FY 2001 (most likely enemy technological

capabilities) and FY 2010 (worst case enemy (high technology, but limited numbers of the highest technology systems)) OPFOR.

(4) Brigade Design Analysis (BDA). The BDA provided quantitative analysis of brigade level unit designs in the context of TRADOC Pam 525-71, *Force XXI Division Operations Concept*. It used high resolution constructive simulations to analyze specific brigade sub-issues in support of the DDA. A European brigade-level meeting engagement was used, where Blue forces (force years 2001 and 2010) were represented by a near-term mechanized infantry brigade facing a technologically sophisticated opposing forces (OPFOR) (force year 2010).

(5) Deployability analysis. The deployability analysis assessed the deployability issues relating to the Force XXI Division Design structure.

(6) Combat Service Support (CSS) analysis. The CSS analysis quantitatively and qualitatively assessed the capability of the CSS concept and design to support and sustain the division design alternatives. The quantitative analysis was based on consumption data generated from the Operations Logistics Planner (OPLOGPLN) model. The qualitative analysis was based on responses to structured questionnaires, and it used the Mobile Strike Force (MSF) 95 CSS concept and prototype structure as a point of comparison.

(7) Validation analysis. After the results of the preceding analyses were briefed to the CG, TRADOC, additional analysis was directed to compare the recommended MOD HVY Division and the AOE Division. The two alternatives were analyzed in a spectrum of warfighting scenarios, using the Vector-in-Commander (VIC) corps level constructive simulation.

4. Findings From Supporting Analyses.

a. Issue: Ability to generate overwhelming combat power.

(1) **Finding:** The divisional armor strength for the interim division design should be more along the lines of the AOE division than the alternative designs.

(2) **Finding:** The IFV strength for the interim division design should be built along the structure of four companies per mechanized infantry battalion.

b. Issue: AGS inclusion to infantry brigades.

(1) **Finding:** The inclusion of AGS in the infantry brigade contributed to the mobility differential problems between infantry, mechanized, and air assault forces within a single brigade. This adversely affected their synchronization and degraded their mutual support.

(2) **Finding:** On the basis of the employment examined, AGS as an infantry brigade organic asset is not a good idea, and it is preferable to place AGS at the corps.

c. Issue: Aviation role and deep fires mix.

(1) **Finding:** One AHB is the minimum level of divisional attack aviation capability, for divisional deep strike capability and mission flexibility for support to the close fight.

(2) **Finding:** The aviation brigade needs a minimum of one assault helicopter battalion to conduct the missions required by the division.

d. *Issue: Mix of field artillery systems and command and control structure.*

(1) **Finding:** The direct support (DS) field artillery units should remain as DIVARTY assets and not be organic to the maneuver brigades.

(2) **Finding:** Each maneuver brigade needs a DS field artillery battalion.

(3) **Finding:** The division needs at least a battalion of MLRS and a TAB, to support the close and counterfire battles.

e. *Issue: Cavalry mix and echelon.* This issue looked at both mix of divisional cavalry and brigade scout assets and cavalry asset configuration (air and/or ground).

(1) **Finding:** The division needs cavalry with both air and ground units.

(2) **Finding:** The brigade cavalry/reconnaissance unit should be, at most, a company sized element. There will be continued assessment of the cavalry issue in Phase II.

f. *Issue: Air defense capability and requirement.*

Finding: In the presence of rotary or fixed wing threat, at least one complete ADA battalion is needed to provide coverage to the division, and to integrate additional corps assets.

g. *Information dominance.* The Division Operations Concept is developing "Gain Information Dominance" as an emerging, and increasingly important pattern of operation. The questions of how and with what assets does the division attain information dominance must be answered. However, at this stage, they can be answered only in the most preliminary forms.

Finding: The MI battalion of the AOE division design appears adequate to support "gain information dominance", but the RISTA battalion lacks sufficient assets to support the brigade and division commanders.

h. *Area for further investigation.* CSS and sustainment. Phase I analyses attempted to determine if the division designs were sustainable. Some preliminary quantitative data was gathered from the CSS analysis, with additional qualitative insights from the SMR and CSS analysis participants. However, the Division CSS Concept and force structure design are undergoing extensive development and re-design. Detailed analysis in this area is absolutely essential. Consequently, the CSS questions need extensive evaluation in Phase II.

5. MOD HVY Division Development. The supporting analyses identified characteristics that would be desirable in the Interim Division Design, and TRADOC FDD used them to develop the MOD HVY Division, see figure ES-1. When presented to CG, TRADOC, he directed that additional analyses, the DDA Phase I Validation Analysis, compare the recommended MOD HVY Division to the AOE heavy division in a spectrum of warfighting scenarios. This spectrum varied corps augmentation to the division, the type of operation being conducted, the OPFOR, and the air superiority condition. The Vector-in-Commander (VIC) corps level constructive simulation was used to compare and contrast the MOD HVY division with the AOE Division.

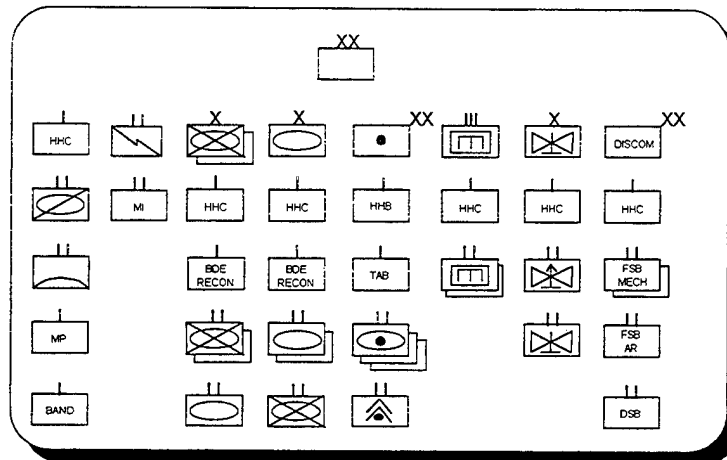


Figure ES-1. Modernized Heavy Division.

6. Summary of DDA Validation Findings.

- a. The MOD HVY and AOE Divisions had comparable levels of mission success across the spectrum of scenarios examined.
- b. The differences in quantities of divisional systems created some variations in tactical employment, but there were no overall differences in Blue force outcomes.
- c. Corps augmentation is critical to either division design in high intensity combat operations. When the corps provides appropriate augmenting forces, it mitigates the differences between the AOE Division and the Modernized Heavy Division.
- d. The larger quantity of MLRS in the Modernized Heavy Division provided more effective counterfire capability and, subsequently, a more efficient cannon artillery capability.

7. Conclusions.

- a. The MOD HVY Division can perform the operations described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*.
- b. The MOD HVY Division is suitable for further analysis and experimentation as the Interim Division Design.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I
CHAPTER 1
INTRODUCTION

1-1. Purpose. The Force XXI Division Design Analysis (DDA) - Phase I was conducted to examine a set of alternative division designs, developed by the Training and Doctrine Command (TRADOC) Force Design Directorate (FDD), with support from the various proponent schools, in the context of the new, draft TRADOC Pam 525-71, *Force XXI Division Operations Concept*. The analysis was provided as support for the Commanding General (CG), TRADOC's Interim Division Design decision. This decision was moved from June 1996 to December 1995, and this report documents the unique combination of qualitative and quantitative methods used in the brief time available. This analysis is developed as a two-phased effort and, while many issues have been answered definitively in Phase I, there are also many others that require more investigation. These areas for future research are being identified for Phase II.

1-2. Background.

a. As threat changes, force downsizing, and technology enhancements continue to impact the way the Army performs its traditional and nontraditional missions, the Army must redesign the 21st century operating division, along with its subordinate and parent organizations, to facilitate accomplishment of a variety of missions with a reduced active duty base. As a focal point of Force XXI, the Director, Joint Venture, will design the objective Force XXI Division and identify its associated supporting requirements by February 1998.

b. TRADOC has been charged with redesigning the Warfighting Army into the 21st century, using an iterative cycle of concept definition, requirements review, force design, equipping, training, and experimenting, as described in the Joint Venture Campaign Plan. The DDA will serve as the thread of continuity for the Joint Venture Campaign Analysis.

c. The analysis is being conducted in two phases.

(1) Phase I. The first phase (documented by this report) examined the differences in the different division design alternatives by using qualitative and quantitative analyses. This phase was completed in December 1995. The analysis focused at the division echelon, but gave full consideration to the brigade echelon differences found in the Brigade Design Analysis.

(2) Phase II. The second phase of the analysis will be from December 1995 through November 1997. The final division design decision will be made in February 1998. During this phase, the organizational "building blocks" of the interim division design will be analyzed and refined. Some of the investigations will stem from the Phase I analysis, while other investigations will be in response to specific issues from the branch proponents.

1-3. Study Objectives. The objectives of the Phase I study were to examine the differences in the different division design alternatives by using qualitative and quantitative analyses to provide support for the CG, TRADOC's Interim Division Design decision. The major objectives were:

- a. Can the alternative division designs perform the operations described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*?
- b. Should the Force XXI Division have both heavy and light maneuver forces?
- c. Do the alternative division designs have adequate divisional command and control node structures?
- d. Do the alternative designs increase the degree of modularity in the division?
- e. How are the capabilities of the alternative divisions affected by making them smaller than the current AOE heavy divisions?

1-4. Scope. The terms of reference affecting the Interim Division Design decision helped structure the analysis.

- a. The Force XXI division designs will be applied to all divisions (active and reserve components) except the airborne, air assault, and light divisions.
 - b. The analysis is performed for two force years. The near-term time period is force year (FY) 2001, and the far-term time period is FY 2010. Accordingly, the systems used by the various designs reflects those force years and are detailed in annex 4, appendix D. The purpose for using two force years is the near term provided insights on how the capabilities of today's force are affected by organizational changes, with minimal technology insertions, while the far term provided insights on the synergistic effects of force structure organization in combination with higher technology systems. This approach was necessary because of the varying degrees of acquisition and performance risks associated with some of the projected systems.
 - c. The threat capabilities were varied to cover the spectrum of mid-to-high technological capabilities for different scenarios. This provided a robust analysis of how well the Force XXI Division could accomplish its assigned missions.
 - d. The division operated in the context of the TRADOC Pam 525-71, *Force XXI Division Operations Concept*.
 - e. With the operational concept, tasks, and anticipated environments, there was a need to define the design concept for each division alternative.
- (1) By design concept, this refers to the division-based or brigade-based approaches. Analysis focused on the division, but the division is a middle echelon -- affected by what is done (command and capability-wise) at corps, and what is done by its component brigades.

(2) The first design task was an apportionment exercise of functions at echelons. This determined what was primarily expected to occur at corps versus division versus brigade. As the primary responsibilities for each function were identified for each echelon, the initial determinations were made to identify the type, number, and placement of units needed to perform those functions.

(3) Another design task which was consistent with the parallel effort for combat service support (CSS) concept development, was the determination of the necessary size and degree of redundancy for CSS.

(4) At the same time, consideration was given to three external factors: (1) the potential need to downsize the active component (AC), (2) how, where, and at what level of capability that technology would enhance the objective Force XXI division, and (3) how the change in world situation affects the threat (which would generate hypothetical opposing forces (OPFOR) for analysis).

1-5. Division Alternatives. The three initial division design alternatives were the current Army of Excellence (AOE), Heavy/Light - Small Base (HL-SB), and Brigade Based divisions. During the course of the study, a fourth alternative, the Modular Division (MOD) was developed. As a result of the analysis, a fifth alternative, the Modernized Heavy Division (MOD HVY), was recommended to CG, TRADOC as the Interim Division Design. The MOD HVY design was then examined against the AOE in a validation analysis. Due to timing and degrees of development, some alternative designs were not available for every analytical event.

a. AOE Division. There are different types of AOE division structures (armor and mechanized infantry). Figure 1-1 shows an AOE Division (Armor Heavy).

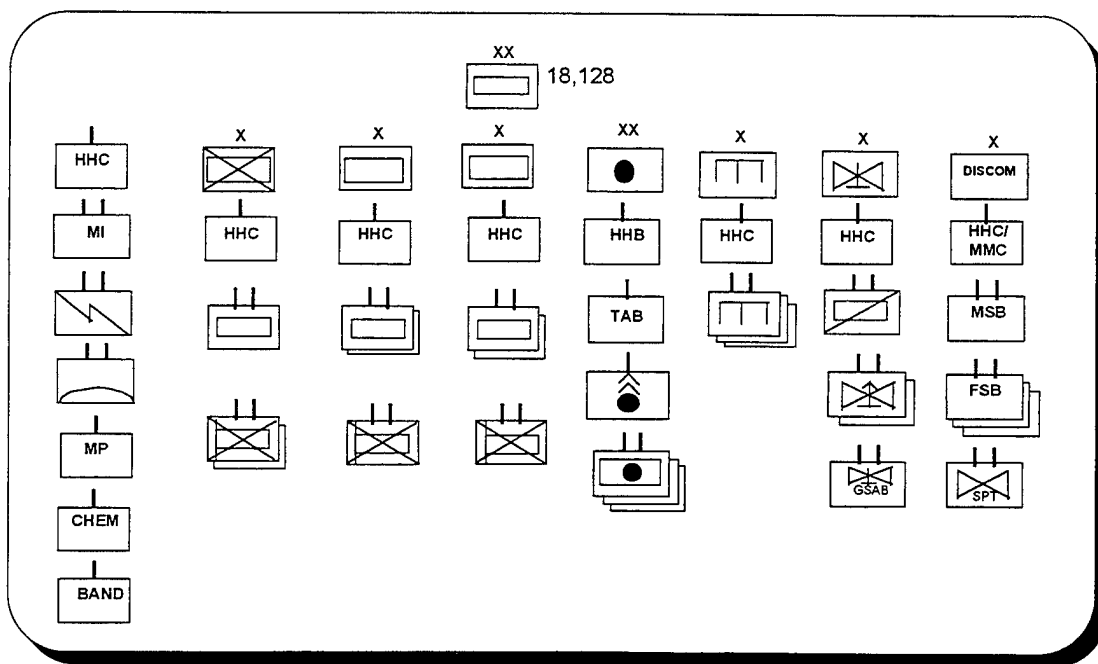


Figure 1-1. Current AOE Division (Armor Heavy)

(1) The current AOE structure was primarily developed to meet a particular threat, the former Soviet Union. The division design gives it the capability for decisive operations with limited deep operations capability.

(2) The tank and mechanized infantry battalions each have four line companies.

(3) Each brigade has a direct support artillery battalion. There is a 1X9 (1 battery with 9 launchers per battery) multiple launch rocket system (MLRS) battery.

b. HL-SB Division. The principle characteristics of this division are the mix of mounted (heavy) and dismounted (light) units within the same force structure. The division design gives it the capability for decisive operations, with limited deep operations capability. In this design alternative, the principle maneuver organizations are the brigades. Figure 1-2 shows the HL-SB Division.

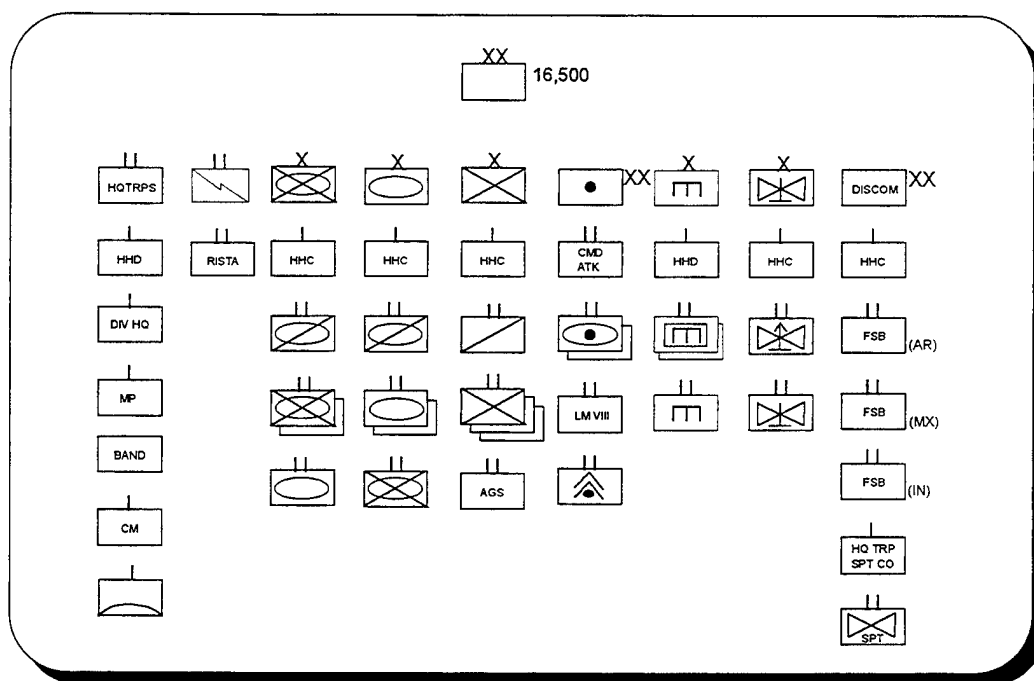


Figure 1-2. Heavy/Light - Small Base (HL-SB) Division

(1) Each brigade has a headquarters and headquarters company (HHC) (with organic military intelligence assets), cavalry squadron with reconnaissance and security mission capabilities, and a mix of armor and infantry battalions.

(2) The tank and mechanized infantry battalions differ from AOE battalions, as they have three line companies, instead of four. The infantry brigade has three infantry battalions and one battalion of armored gun systems (AGS). Each brigade has a cavalry squadron for reconnaissance and security missions.

(3) Each brigade, whether armor, mechanized infantry, or infantry, has a direct support artillery battalion. However, in the area of MLRS, the HL-SB increases the MLRS organization from a 1X9 battery (AOE) to a 3X6 battalion.

(4) In the area of attack aviation capability, the division has one attack helicopter battalion which is a reduction from the two battalions authorized in AOE heavy divisions.

c. Brigade Based Division. This division is designed to have the flexibility to perform missions across the spectrum of conflict in any type of terrain. The Brigade Based Division attains this capability through the assignment of specifically required brigade force packages. Figure 1-3 shows the Brigade Based Division.

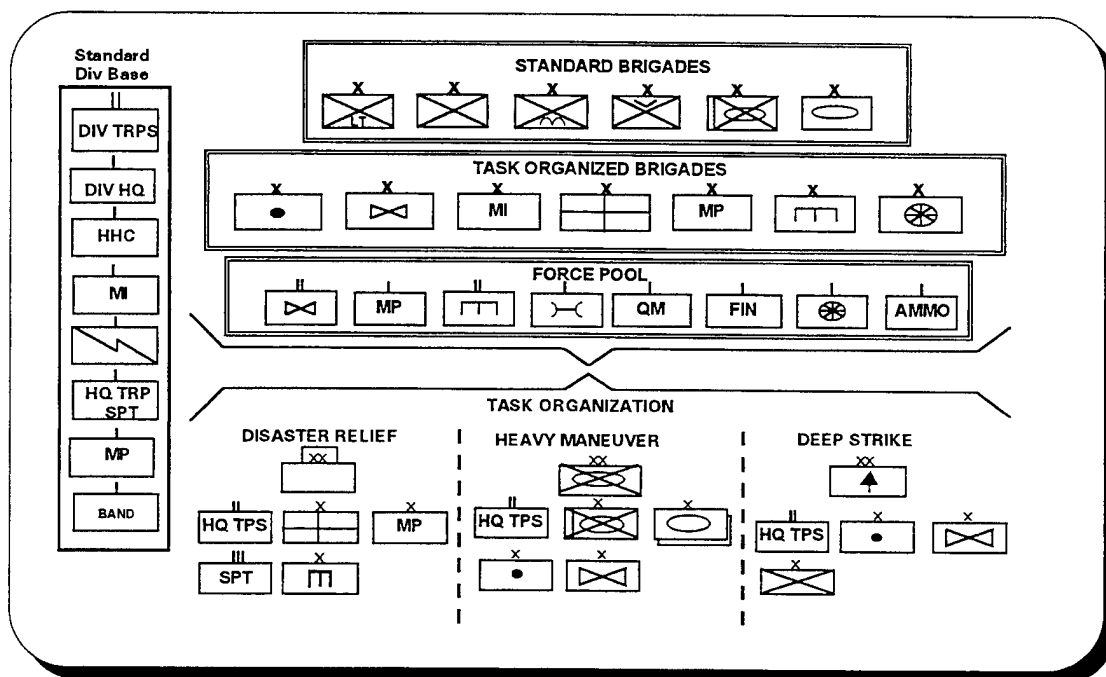


Figure 1-3. Brigade Based Division

(1) Under this concept, the division echelon is focused on battle command, and it is capable of commanding a variety of subordinate brigade-sized units. The brigades come as "self-contained" packages that have some of the AOE combat support (CS) and combat service support (CSS) elements (which are typically found in the division) embedded in the brigade.

(2) When comparing the combat capabilities of the maneuver brigades in this design with those in the HL-SB design, it can be seen that the numbers of systems are nearly identical. This similarity exists because the battalion "building blocks" are the same for both designs.

(3) This division can conduct offensive, defensive, and retrograde operations (similar to AOE). Furthermore, the Brigade Based Division can conduct operations other than war (OOTW) with the appropriate brigade mix.

d. MOD Division. The division design gives it the capability for decisive operations, with limited deep operations capability. The division is organized around its brigades which are capable of independent operations. This design has the fewest number of soldiers. The MOD Division is shown in Figure 1-4.

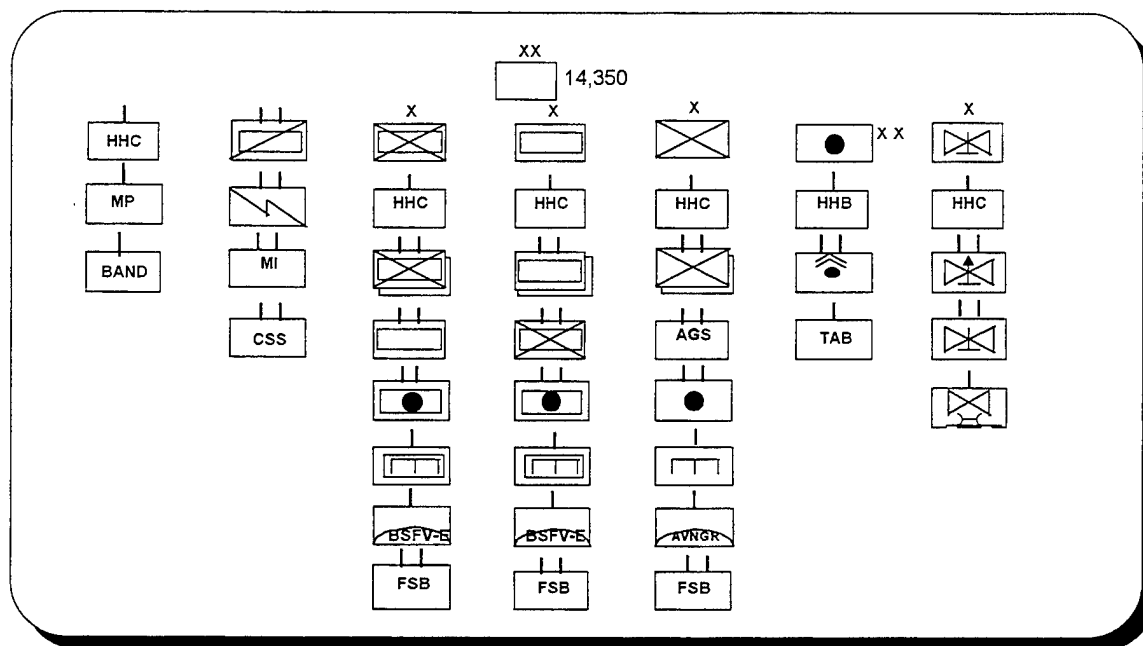


Figure 1-4. Modular (MOD) Division

(1) The division contains an armor, mechanized infantry, and infantry brigade each with its own artillery, engineer, air defense artillery (ADA) and support units. This allows the brigades to conduct independent and autonomous missions in support of the division concept of operation.

(2) The MLRS battalion is similar to the HL-SB design with a 3X6 configuration. Additionally, the aviation brigade has one attack helicopter battalion.

e. MOD HVY Division. This design captures the strong points of each of the previous designs. This design is capable of decisive operations, with limited deep operations capability. It maintains a heavy configuration similar to the AOE design. The MOD HVY Division has either two armor and one mechanized infantry brigades or two mechanized infantry and one armor brigades. This design is shown in Figure 1-5.

(1) The battalions for the mechanized infantry and armor brigades each have four line companies. Each brigade has its own ground cavalry troop for reconnaissance and security missions.

(2) The engineer brigade has only two battalions of three line companies each, instead of the three battalions with only two line companies. The absence of a third battalion

The diagram displays a collection of symbols used in the game, organized into columns. The symbols are as follows:

- Column 1:** HHC, MI, lightning bolt, wave, MP, BAND.
- Column 2:** X, HHC, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 3:** X, HHC, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 4:** X, HHC, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 5:** HHB, TAB, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 6:** X, HHC, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 7:** X, HHC, HHC, HHC, HHC, HHC, HHC, HHC.
- Column 8:** DISCOM, HHC/MVC, DSB, FSB, SPT.

Additional symbols shown at the top right include "XX" and "15,744".

(3) The aviation brigade has one attack helicopter battalion and one assault helicopter battalion.

(4) Each maneuver brigade has a direct support artillery battalion. The division also has a 2X9 MLRS battalion.

a. European derivative scenarios. Two scenarios based on European-type terrain were used in Phase I. The first scenario was used during the Division Design Analysis Computer Assisted Map Exercise (CAMEX), and the second scenario was used during the validation analysis.

(a) Mission. The 57th Infantry Division (ID) (Mechanized) (M) attacks in zone to defeat the Army Artillery Group (AAG), Army Group Rocket Artillery (AGRA), 11th Motorized

Rifle Division (MRD), and 15th Tank Division (TD) of the 1st Biscaynian Corps. On order, reconstitute and attack elements of the 2nd Biscaynian Corps.

(b) Basic approach (Figure 1-6). This scenario takes place in five phases. During Phase I, the division conducts a movement to contact and begins the deep battle. In Phase II, the division crosses the Elbe at an undefended location. In phase III, the division defeats the 11th MRD. In Phase IV, the division defeats the 15th TD. During Phase V, the division reconstitutes and prepares to attack the 2 Biscaynian Corps.

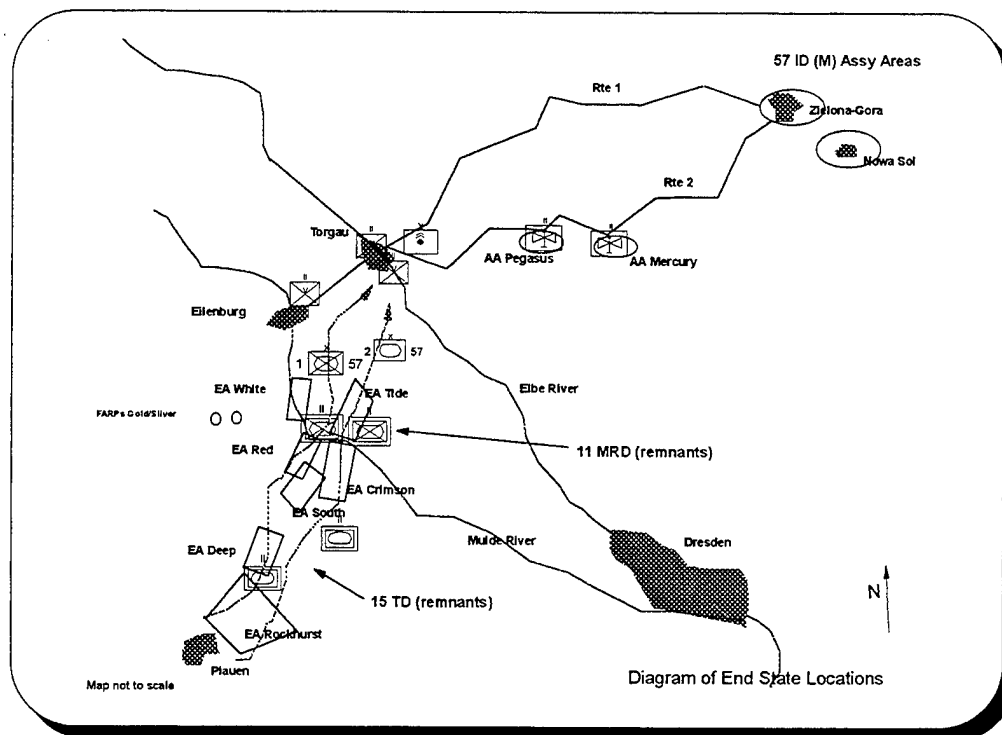


Figure 1-6. First European Derivative Scenario

(2) Second European derivative scope. The Europe (PW96) (Modified) scenario is a mechanized infantry division in simultaneous attack of a moving enemy (AOME) and was examined using the force-on-force simulation, Vector-in-Commander (VIC). This scenario uses a two-division U.S. corps attacking to defeat two threat corps. FY 2010 is used for both the U.S. corps and threat.

(a) Mission. The 57th ID (M) attacks in zone to defeat the 11th MRD and 15th TD of the 1st Biscaynian Corps. On order, reconstitute and attack elements of the 2d Biscaynian Corps.

(b) Basic approach (Figure 1-7). This scenario takes place in five phases. Phase I is the movement to the assembly areas. Phase II is the Elbe River crossing. Phase III is the deliberate attack. Phase IV is the battle handover. Phase V is the destruction of the 11th MRD.

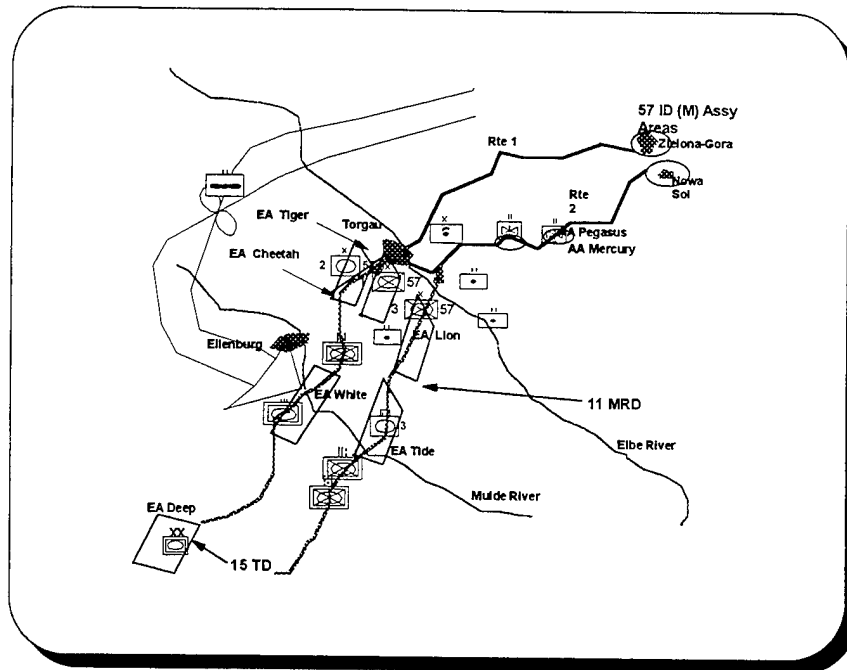


Figure 1-7. Second European Derivative Scenario

b. Northeast Asia (NEA) scenarios. The Mobile Strike Force (MSF) scenario used in PW95 was used in Phase I during the Senior Military Review (SMR) (detailed in appendix C). A modified version of NEA 2.1 was used in the validation analysis.

(1) NEA PW95 scope. The NEA PW95 scenario is a MSF in simultaneous AOME in Pacific Command's (PACOM) theater. This scenario uses a U.S. corps with joint assets attacking to defeat one threat corps. FY 2010 is used for both the U.S. corps and threat. The MSF is task organized with an armor brigade, a light infantry brigade, an aviation brigade, and a division artillery (DIVARTY). The opposing forces were an operational exploitation force (OEF) which consisted of nine brigades (six mechanized infantry brigades, an armor brigade, and two field artillery brigades).

(a) Mission: On order the MSF attacks as the Joint Forces Land Component Commander (JFLCC) operational reserve to destroy 12th Mechanized Corps (OEF) in the vicinity of the Koksan/Chorwon valleys to deny the 2nd Army Group (AG) reinforcement.

(b) Basic approach. This scenario takes place in five phases. Phase I is a reconnaissance that incorporates the use of special operations force teams, air cavalry assets, and unmanned aerial vehicles (UAVs) to watch enemy movement. Phase II positions the attack assets--ground elements and air assault elements. Phase III (Figure 1-8) is the simultaneous ambush of the threat throughout the depth of his deployment. Phase IV is the exploitation where all remnants, battalion-sized or larger, are destroyed by attack aviation. Phase V is the reconstitution and repositioning.

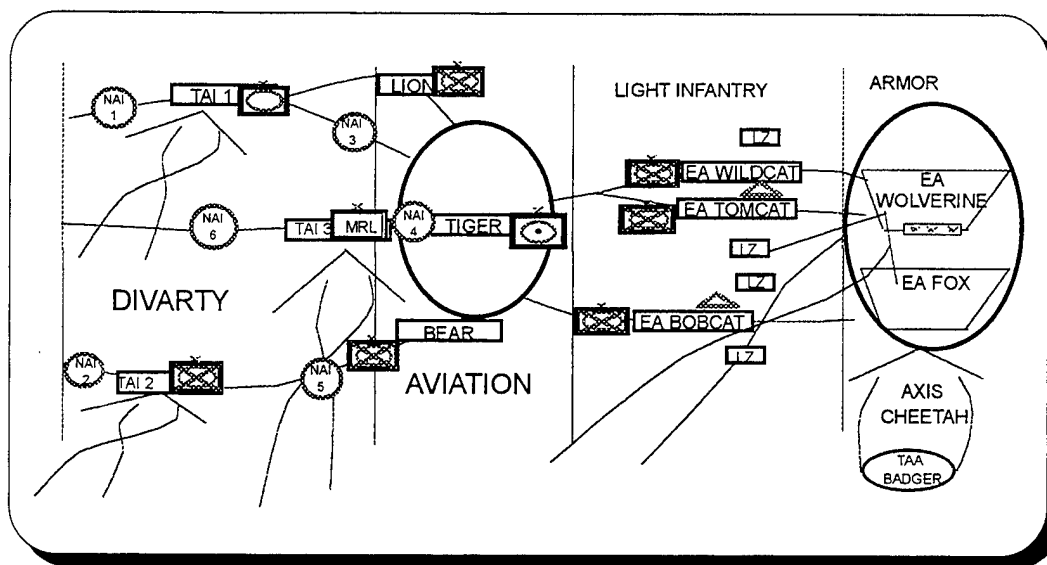


Figure 1-8. NEA PW95 Scenario (Ambush Phase)

(2) NEA 2.1 (Modified) scope. This scenario has a mechanized infantry division defending against three infantry divisions and an armored regiment and was examined using the force-on-force simulation, VIC. FY 1999 is used for both the U.S and threat.

(a) Mission. The division defends in sector to defeat remnants of a threat corps and follow-on forces. On order the division conducts a rearward passage of lines.

(b) Basic approach (Figure 1-9). The division defends with one mechanized brigade and one armor brigade forward and one mechanized brigade back. Appendix H contains the detailed classified scenario.

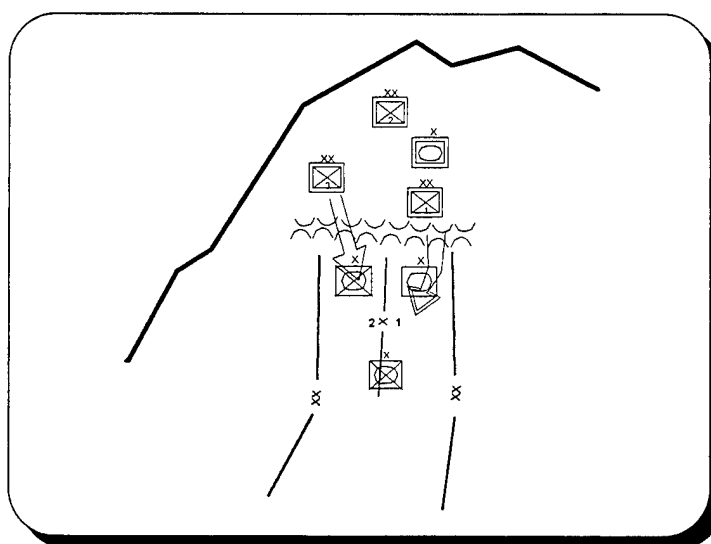


Figure 1-9. NEA 2.1 (Modified) Scenario

c. Southwest Asia (SWA) scenarios. SWA 5.0 was used in the Phase I SMR, and SWA 4.2 was used in the validation analysis.

(1) SWA 5.0 scope. The scenario depicts a joint early entry defense in Central Command's (CENTCOM) theater. This scenario pits a FY 2001 joint heavy/light division and a portion of corps artillery against a FY 2006 mechanized corps of eight divisions. At the time of the attack, the U.S. forces in country consisted of two light infantry brigades, one armor brigade, an aviation brigade, a DIVARTY, a marine expeditionary unit (MEU), and an attack helicopter battalion.

(a) Mission. The division conducts a defense to defeat and halt a threat corps attack at least 60 kilometers short of a port.

(b) Basic approach (Figure 1-10). The defense is fought in three phases. Phase I is the reconnaissance to detect and target second echelon threat divisions. Deep fires are provided by joint air and ground assets. Phase II is the covering force mission commanded by the aviation brigade, which is task organized to include one armor battalion as the ground force. Phase III is the defense which involves positioning the two light infantry brigades forward, on favorable terrain, dominating the strategic assets. The division counterattack force is the armor brigade (-), consisting of one armor battalion and one mechanized infantry battalion.

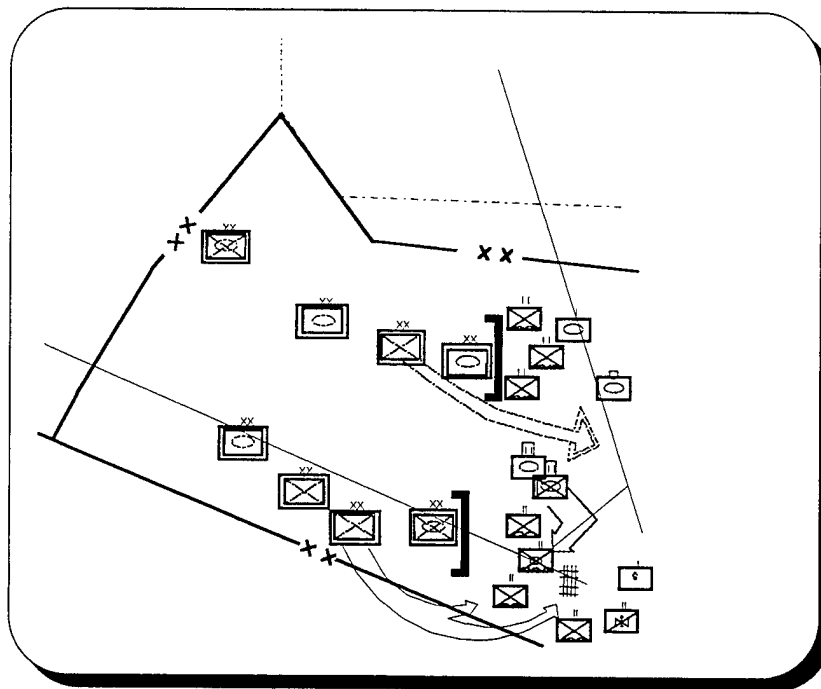


Figure 1-10. SWA 5.0 Scenario

(2) SWA 4.2 scope. This scenario depicts a conflict in CENTCOM's theater. It describes a 1999 U.S. heavy corps of three heavy divisions and two armored cavalry regiments (ACRs) attacking to defeat a 2004 threat provisional army.

(a) Mission. On order the armored division advances, following a mechanized division through the gap of penetration, attacking to seize two objectives. On order, support an armored division's passage of lines.

(b) Basic approach (Figure 1-11). The battle is fought under four phases. Phase I is the reconnaissance phase where the corps commander uses sensors to detect and target threat forces. Phase II is establishing conditions for decisive operations. Phase III is the attack. Phase IV consists of reconstitution and preparing for continued offensive operations. A more detailed explanation of this scenario is in Appendix H.

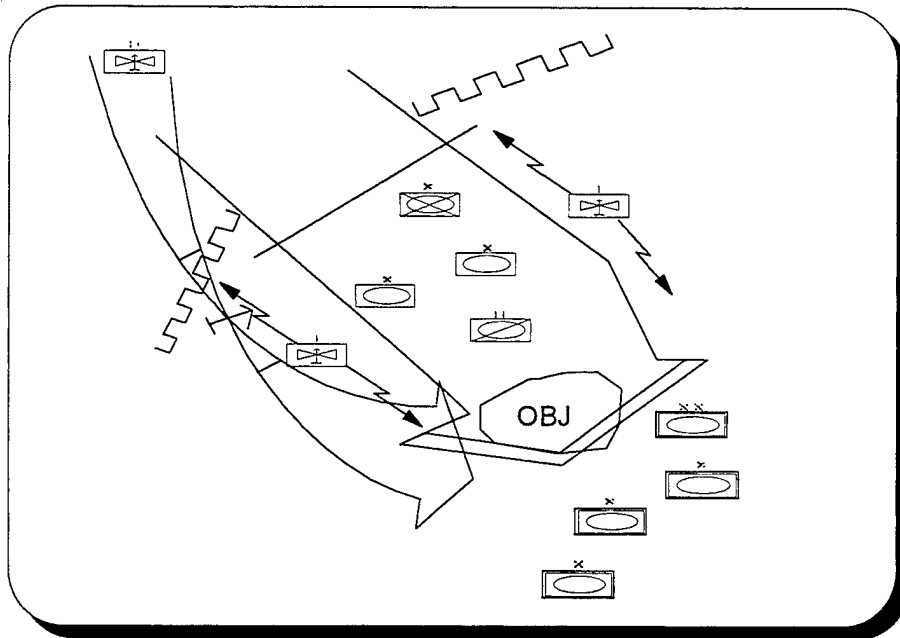


Figure 1-11. SWA 4.2 Scenario

1-7. Assumptions. Certain assumptions were made to ensure the different division designs could be modeled accurately and fought according to the proposed doctrine. These assumptions also permitted the best estimates of possible threat scenarios and systems.

a. The redesigned divisions are appropriately tailored to METT-T (mission, enemy, troops, terrain and weather, and time available) conditions, regardless of the basic division's construction. The division will always fight with the appropriate forces. To make clear that regardless of the design (for example, heavy/light composite forces), if the circumstances required a specific mix (either pure heavy, or pure light) the division would be task-organized to do that. This, in effect, puts the emphasis on the division staff to be battle command oriented, capable of applying any mix of forces to the demands of the mission.

b. The redesigned divisions are anticipated to perform mid-to-high intensity combat operations, against enemies that have low-to-high technological capabilities.

c. The redesigned divisions operate in areas that feature combinations of open and restrictive terrain.

d. The scenarios used are representative of likely situations for employment of the Force XXI division.

e. The near term (approximately 2001) alternative division designs will be equipped with systems identified in the 97-01 POM. The far term (approximately 2010) designs will be equipped with systems that are representative of projected capabilities for that time frame and are technically feasible. These systems are listed in Appendix D, Annex 3.

f. Battle staff structure and CSS structures will be equally effective across all alternative division designs and, therefore, will be held constant resulting in one set of comparisons against the AOE structures.

g. The Force XXI division operates within the context of a corps (not autonomously) and certain basic capabilities exist at corps and echelons above corps (EAC). Supporting assets from corps can be made available, depending on METT-T conditions. This is important, because in the design process, it is very possible for some functions, and consequently some units, to migrate from the division to echelons above division (EAD). It is further possible that some of these migrating units may go from AC to reserve component (RC) as part of the design process (thus downsizing the AC).

h. In developing the division design, various analytic techniques are used to estimate certain unit capabilities based on the types, numbers, and systems of those units. However, other capabilities had to be assumed, because detailed information was not available in that functional area (for example, the CSS area, which is undergoing its own parallel concept development), or because it is heavily dependent on some future technology (for example, military intelligence (MI) organizations to support types and quantities of UAVs). These estimated and assumed capabilities then become the interim division design.

i. The division design alternatives assumed that the division operated in the context of a corps, but to develop the design efficiently, it was necessary to apportion the functions at echelons by the patterns of operations.

(1) Figure 1-12 was used as a guide for the division designs. During the course of the FDD workshops, discussions were to address if the division was expected to plan and execute all aspects of the patterns of operations. Through the discussions -- this breakdown was developed. The figure mirrors the assumption that the division operates within the context of a corps.

(2) The next step in the intent of this chart lies in resourcing the designs. The assignment of a "star" to an echelon for a particular pattern implies that the echelon has the resources needed to accomplish the tasks associated with those patterns. A "diamond" implies that augmentation is usually required to do those tasks. Most notable in this breakdown is the "diamond" under the division for set the battlespace conditions. As will be seen, this affects the

resourcing of the attack helicopter battalion (AHB) and the multiple-launch rocket system (MLRS) in the division, since those assets are primarily allocated for the close combat fight -- vice the deep (or long-range battle). This is not intended to say that subordinate assets cannot or will not be used in support of a higher headquarters' plan (division MLRS for set conditions, division cavalry for gain information dominance/protect the force, etc.).

	Joint	Corps	Div	Bde
Project the Force	☆	◇	◇	◇
Protect the Force	☆	◇	◇	◇
Gain Info Dominance	☆	◇	◇	◇
Set the Conditions	☆	☆	◇	◇
Decisive Operations	☆	☆	◇	◇
Sustain and Transition	☆	☆	◇	◇

☆ Echelon has the capabilities and assets to handle both planning and execution of functions.

◇ Develops supplementary plans to support higher HQ, uses organic assets to execute those plans, and **may** receive augmentation (additional assets and / or products) from higher echelon.

Figure 1-12. Apportionment of Functions by Patterns of Operations

1-8. Report Layout. This report is the capstone of the Phase I analyses consisting of the basic report and appendices which clarify and expand upon contributing study efforts.

a. Basic report. The report consists of five chapters and integrates the DDA process, results, and findings.

(1) Chapter 1 (this chapter) provides an overview of the DDA - Phase I analysis.

(2) Chapter 2 describes the methodology and various models used to conduct the study.

(3) Chapter 3 presents the results by the pattern of operations.

(4) Chapter 4 presents the major findings for work leading to the recommended division design.

(5) Chapter 5 presents DDA validation, summary, and conclusions.

b. Appendices. The appendices discuss the methods, results, and findings of contributing analytical efforts.

(1) Appendix A is the glossary.

- (2) Appendix B is the Front-End Differences Analysis conducted by TRAC.
- (3) Appendix C is the SMR conducted by TRAC and Vector Research Institute (VRI).
- (4) Appendix D is the detailed explanation of the CAMEX done by TRAC in evaluating the division alternatives.
- (5) Appendix E is the Brigade Design Analysis (BDA) completed by TRAC-White Sands Missile Range (TRAC-WSMR).
- (6) Appendix F is the deployability analysis done by the Military Traffic Management Command-Transportation Engineering Agency (MTMC-TEA).
- (7) Appendix G is the CSS analysis conducted by TRAC-Fort Lee.
- (8) Appendix H is the classified portion of the validation analysis.
- (9) Appendix I is the acknowledgment of the various contributors to this final report.
- (10) Appendix J is the distribution listing of this final report.

1-9. Summary of Results. The patterns of operations discussed in TRADOC Pam 525-71, *Force XXI Division Operations Concept* are used in the assessment of the advantages and disadvantages of each division alternative.

a. Figure 1-13 is used to provide an assessment of each alternative's ability to support specific elements of the patterns of operations. There is absolutely no intent to say that a particular area of investigation is tied solely to a specific pattern of operation. Many of these areas can be spread over several patterns.

b. The convention used in Figure 1-13 is a "star" if that design has a potential capability advantage for an element under a pattern of operation; a "circle" if there is neither an advantage nor disadvantage in capability; and a "rectangle" if there is a potential disadvantage in capability. The assigned symbols are an assessment of the particular design's capability to meet the specific requirements of each pattern of operation.

c. The key point is that the analysis was not planned to be a comparison of a fixed set of alternatives, but, rather, to be an analysis of how well certain functions could be performed by the various designs with the intent of pulling the strengths of the alternatives into an "evolving" design. The details of these results are in Chapter 3. These results, and the subsequent analyses and findings, were the basis for developing the recommended Interim Division Design, the Modernized Heavy Division.

Pattern	Area	AOE	HL-SB	Bde base	MOD	Comments
Project the Force	Strategic	○	○	○	○	No major differences
	Intra-theater	○	□	□	□	Mobility differential (hvy/lt/aast)
Protect the Force	ADA	○	○	□	□	Absence of battalion HQs
	Engineer	○	○	○	□	Reduction from Bns to Cos
	Chemical	○	○	☆	□	Size
Information Dominance Set Conditions	MI	○	□	○	○	MI Co vs MI battalions
	Cavalry	○	□	□	○	No Air Cavalry
	Field Artillery	○	☆	○	☆	Organic MLRS Bn (+HIMARS)
	Aviation	☆	○	☆	○	Two Attack Helicopter Bns
Decisive Operations	Armor	☆	□	□	□	Total armor strength in division
	Infantry	☆/○	☆/○	☆/○	□/□	IFV strength / Dismount strength
	FA / Aviation	○	○	○	○	AHB/MLRS launchers trade-offs
Sustain & Transisiton	CSS	○	○	□	○	No DISCOM

☆ Potential advantage in capability.
 ○ Neither advantage nor disadvantage in capability.
 □ Potential disadvantage in capability.

Figure 1-13. Characteristics of Design Alternatives - By Patterns of Operations

1-10. Summary of Findings and Validation.

a. Findings. These findings are derived from the various supporting analyses (described in detail in section 2-3).

(1) For mid-to-high intensity combat, the armor strength under the HL-SB and MOD divisions appears insufficient. Continue the assessment of division total and armor battalion tank strengths in Phase II.

(2) The infantry battalion organizations (mechanized and non-mechanized) need four companies (with three platoons per company). Continue further investigation in Phase II to determine if the fourth company is a line company (with a need to address the dismount problem) or an anit-tank company (for both mechanized and non-mechanized battalions).

(3) The AGS should be a corps asset rather than be in the infantry brigade.

(4) The aviation brigade needs a minimum of one attack helicopter battalion and one assault helicopter battalion (for infantry lift and/or logistics lift).

(5) The division artillery headquarters is needed for the planning and integration of fires, and one direct support artillery battalion is needed for each brigade. The division needs one MLRS battalion (of at least 18 launchers) to support the close fight and joint suppression of enemy air defense (JSEAD). A target acquisition battery (TAB) is needed for the counterfire battle.

(6) The division cavalry requires both air and ground elements. Air cavalry is needed for mission flexibility, and ground cavalry is needed for continuous screening capability in non-contiguous operations.

(7) The brigade cavalry / reconnaissance unit should be, at most, troop size elements. Continue the assessment in Phase II for reconnaissance versus cavalry missions and / or possible deletion based on the availability and quality of the relevant common picture (e.g., from UAVs and digitization).

(8) In the presence of a rotary or fixed wing threat, the division needs at least a complete battalion of direct support (DS) air defense artillery (ADA) (and more under stressful conditions) with assets for integration, coordination, and dissemination of early warning information. Continue the assessment in Phase II.

(9) Engineer requirements were not specifically addressed in Phase I and will be evaluated in Phase II.

(10) The division MI assets should be at least a battalion. The reconnaissance, intelligence, security, and target acquisition (RISTA) battalion is inadequate for divisional support and should be discarded.

(11) The division support command (DISCOM) with a headquarters, three forward support battalions (FSBs), and one division support brigade (DSB) should have continued investigation in Phase II.

(12) Continue investigation of the combined arms brigades in Phase II.

b. Validation. These findings are derived from the validation analysis described in Chapter 5 and Appendix H.

(1) The Modernized Heavy and AOE Divisions had comparable levels of mission success across the spectrum of scenarios examined.

(2) The differences in quantities of divisional systems created some variations in tactical employment, but there were no overall differences in Blue force outcomes.

(3) Corps augmentation is critical to either division design in high intensity combat operations. When the corps provides appropriate augmenting forces, it mitigates the differences between the AOE Division and the Modernized Heavy Division.

(4) The larger quantity of MLRS in the Modernized Heavy Division provided more effective counterfire capability and, subsequently, a more efficient cannon artillery capability in all scenarios.

c. This analysis, in total, supports using the MOD HVY Division as the Interim Division Design and its further refinement and experimentation during Phase II.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I

CHAPTER 2

METHODOLOGY

2-1. Study Methodology Overview. Diverse methods were used to conduct these analyses to ensure the most accurate information was captured to reflect the different division designs capabilities. "Intellectual"-based methods using military judgment, force design subjective comparison, and other qualitatively-oriented approaches and more typical "analytical," or quantitatively-based, approaches including simulations and comparative analyses were used. Figure 2-1 shows the methodology.

a. On the "intellectual" side, analyses started with the initial alternative designs, developed from FDD's subject-matter experts (SME) and the proponent schools, and examined how those designs could meet the task requirements being identified in the division operations concept. Insights were sought to capitalize on the "How-to-Fight" seminars that were being conducted in parallel to the analyses, seeking to incorporate as much task resolution as possible, and framing how the future division would be employed.

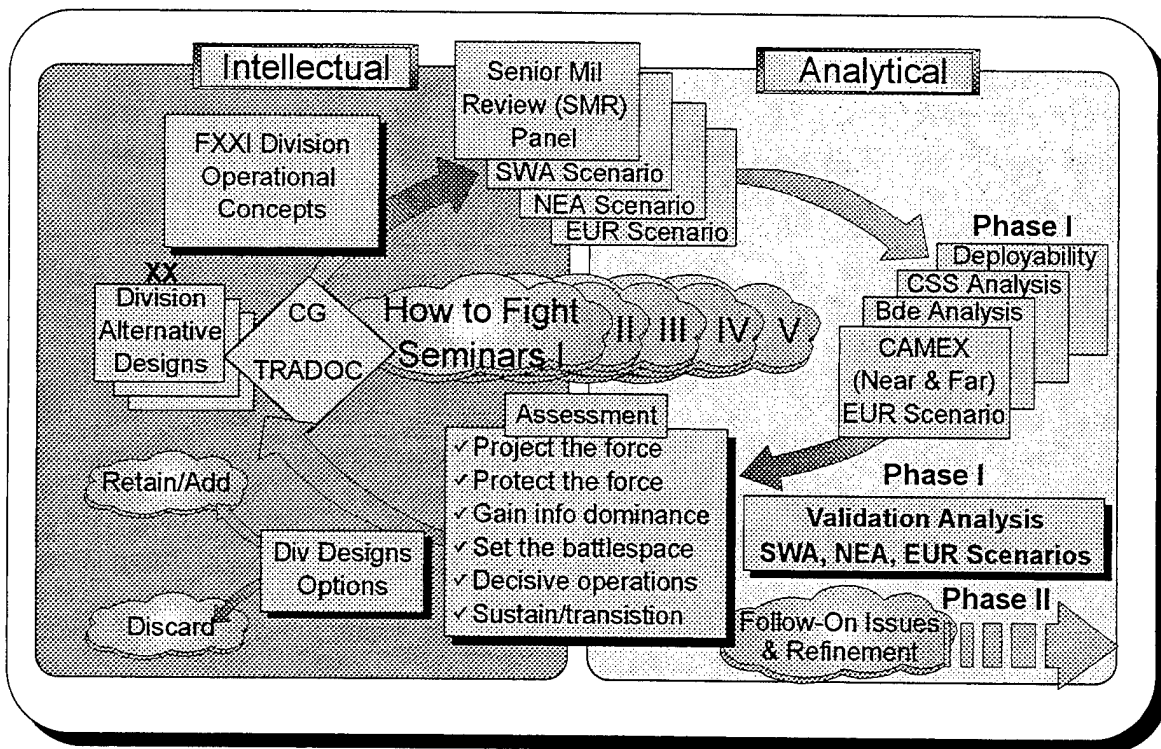


Figure 2-1. Methodology

b. On the analytical side, constructive simulations and computer models were used by multiple analytical agencies to assess and compare the division design alternatives. Both simulations and wargames were used to gain insights into the capabilities of the different designs. These analyses are described in paragraph 2-3.

2-2. Patterns of Operations. There are six patterns of operations which will influence how the division will organize and fight. White papers were developed for each of the patterns of operations from the "How-to-Fight" seminars. The six patterns are project the force, protect the force, gain information dominance, set the battlespace conditions, conduct decisive operations, and sustain and transition the force. These patterns were used to assess and compare the different division alternatives.

a. Project the force. Force projection is the military instrument of power projection and its primary purpose is to deter threats to U.S. interests. Force projection is the deployment, sustainment, employment, and redeployment of military forces from the Continental United States (CONUS) or other locations for missions spanning the operational continuum. The characteristics of force projection are deployability, capability for decisive victory, versatility, expandability, and sustainability. In summary, the Force XXI design must provide the Army with the capability to rapidly project a strategic, versatile, agile, and lethal force to dictate the tempo of future operations.

b. Protect the force. Force protection are the measures taken to conserve the fighting potential of a force. Force protection can be effected by reducing the probability and minimizing the effects of enemy action on personnel, equipment, and critical facilities. For Force XXI, the co-equal goals of the force protection system become protect the force and maintain an advantage in operational tempo. Force protection measures include warning the force, reducing enemy targeting effectiveness, reducing the effectiveness of enemy action, enhancing personnel, equipment, and critical facility survivability, and permitting rapid recovery and restoration of combat power. Force protection begins during peacetime and continues throughout the duration of any military operation. The force protection system is flexible and is responsive to the situation and the commander's needs.

c. Gain information dominance. Information dominance is the degree of information superiority that allows the possessor to use information systems and capabilities to achieve an operational advantage in a conflict or to control the situation in operations short of war, while denying those capabilities to the adversary. Information dominance is achieved through a vast range of activities that can be grouped under the title of Information Operations. At the division level, the four major activities are constructing the information battlespace, protecting friendly information and the command and control (C2) system, collecting and producing intelligence, and attacking the enemy's C2 system. Information dominance is a delta: the difference between the aggregate of information to each of two opposing military commanders. Information dominance is a temporary tactical condition achievable through a deliberate process of establishing viable commander's critical intelligence requirements (CCIRs) and dramatically compressing the time devoted to the tactical decision-making process.

d. Set the battlespace conditions. Shaping the battlespace consists of setting the conditions for decisive campaigns, battles, engagements or military operations other than war and to protect the force. It includes all active measures that facilitate the commander's ability to freely apply combat power. The minimum conditions that a commander must achieve are those that permit his forces to dominate the enemy at the decisive point(s). What makes its application

unique to Force XXI operations are the battle dynamics and technology's potential to enhance their implementation. The battle dynamics allow commanders to employ force in expanded, radical ways - at times, places and with lethality that the enemy cannot anticipate or control. In Force XXI operations the objective is to shape the battlespace so that decisive operations are greatly facilitated or rendered unnecessary.

e. Conduct decisive operations. Decisive operations is the preeminent function within the six operational patterns of Force XXI operations. The decisive force must be capable of producing, integrating, and orchestrating all of the required effects determined to cause decision. Decisive operations are full-dimension operations and require the precise integration and application of combat power and combat multipliers throughout the enemy formation in depth and in all dimensions to quickly defeat him. This includes the coordination and integration of precision strikes and deep fires. The Force XXI Division defeats or destroys the enemy by a combination of moving and striking. The most compelling innovation is the classical distinction between offense and defense disappears in favor of an offensive framework for all operations.

f. Sustain and transition the force. The underpinnings of Force XXI logistics are to accent the relative importance CSS functions which will be performed in the next century. CSS units and organizations for the Force XXI Division will be composite and multifunctional, be modular in structure to facilitate force tailoring, have a smaller concentrated foot-print due to wide dispersion and high mobility profile, be fully digitized from data source to command posts, the distribution management will be centralized for planning and execution at brigade command and higher, and material and movement management activities will be merged. The battlefield dynamics of Force XXI dictate that the CSS functions be reengineered to sustain the maneuvers' capability for lethality, operational tempo, sustainability, and survivability.

2-3. Supporting Subordinate Analyses. The analysis was not limited to a single analytical event, but consisted of a series of integrated efforts with the purpose of finding what appears to work "best." Instead of selecting one alternative from a fixed set, the alternatives were allowed to evolve and determinations of what worked "best" were made. Input to this analyses included a front-end differences analysis, SMR, man-in-the-loop (CAMEX) simulation, BDA, CSS analysis, and deployability analysis. The Phase I analysis was capstoned with the validation analysis using closed-form simulation. The details of these analyses are in appendices B-H.

a. Front-End Differences Assessment. A Front-End Differences Assessment was performed to identify the major design differences in the three initial alternatives (AOE, HL-SB, and Brigade Based), and that assessment was used to select the limited number of scenarios that could be analyzed in the time available. The alternative designs evolved continually during the study, while the differences presented in this report are a "snapshot" of the designs as of October 1995. The detailed Front-End Differences Assessment is in appendix B.

(1) To support the Phase I analysis, this Front-End Differences Assessment was provided to ensure the critical design differences were identified, suitable methodologies were developed for determining the magnitude of those differences, and analyses of those differences were accomplished in time to support the appropriate design decisions.

(2) The scenarios used throughout this Phase I analysis were deemed to be sensitive to design characteristics and the CG, TRADOC guidance for anticipated operational environment.

b. Senior Military Review (SMR). The first major analytic exercise was the Senior Military Review. The division designs examined during the SMR were the AOE, HL-SB, and Brigade Based designs, and it is documented in appendix C.

(1) A three-day exercise was conducted with participation by four retired general officers and representatives from the Command and General Staff College (CGSC), the Army War College (AWC), the Concepts Analysis Agency (CAA), the Louisiana Maneuvers Task Force (LAM-TF), the Battle Command Training Program (BCTP) office, the Battle Laboratory Integration, Technology, and Concepts Directorate (BLITCD), FDD, and TRAC.

(2) This was a structured qualitative exercise, using selected scenarios (SWA, Mobile Strike Force (MSF) 95, Prairie Warrior (PW) 96) and task organizations. The situations did not always precisely match the basic division designs, because part of the exercise was to specifically evaluate how the division design alternatives would be tailored to meet the METT-T conditions.

(3) The participants looked at specific operational situations that would potentially highlight differences, both positive and negative, in the various designs. The exercise culminated in a consensus building discussion that detailed strengths and weaknesses of the designs, and recommended changes that could bring out the best characteristics of each alternative.

(4) This directly led to the development of the fourth alternative, the Modular Division (MOD) design, which incorporated most of those recommendations.

c. Computer-Assisted Map Exercise (CAMEX). The purpose of CAMEX was to exercise and evaluate alternative division designs in the context of the new employment concepts described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*.

(1) CAMEX is a "man-in-the-loop" simulation that uses computer-based movement, engagement, and attrition. All actions are keyed by human decisions, and it used the AOE, HL-SB, and MOD divisions.

(2) The Brigade Based Division was not wargamed. A detailed examination of the Brigade Based and HL-SB Division finds that they have nearly identical numbers of major combat systems. It was decided that the low resolution wargame would be insensitive to any differences, so the Brigade design was not used in its original form. However, the MOD design has many of the brigade based characteristics, and it was used as a replacement.

(3) The participants of CAMEX were representatives from the Force XXI proponent offices at the schools and BLITCD.

(4) The PW96 scenario was used. A near-term 2001 OPFOR (most likely technology capabilities) and a far-term 2010 OPFOR (worst case technology enemy (high technology, but

limited numbers of the highest technology systems)) were used against a near-term and far-term Blue force respectively.

(5) All division alternatives accomplished the mission with varying degrees of success in this scenario. A detailed explanation of findings and results is in appendix D.

d. Brigade Design Analysis (BDA). The purpose of the BDA, conducted by TRAC-WSMR, was to provide quantitative analysis of brigade level unit designs in the context of TRADOC Pam 525-71, *Force XXI Division Operations Concept*. The analysis was conducted using high resolution constructive simulations (Combined Arms and Support Task Force Evaluation Model (CASTFOREM)) to perform analysis of specific brigade sub-issues in support of the DDA.

(1) The scenario used was a European brigade-level meeting engagement where Blue forces (force year (FY) 2001 and FY 2010) were represented by a near-term mechanized infantry brigade facing a technologically sophisticated OPFOR (FY 2010).

(2) This analysis focused on maneuver units in a close fight and examined the "Conduct Decisive Operations" pattern of operation. Specific questions addressed included:

- (a) the sufficiency of organic assets to generate overwhelming combat power,
 - (b) the utility of brigade cavalry squadrons, and
 - (c) the appropriate mix of direct fire, indirect fire, and attack aviation systems.
- (3) A detailed explanation of the findings and results is in appendix E.

e. Deployability analysis. The purpose of the deployability analysis conducted by the Military Traffic Management Command-Transportation Engineering Agency (MTMC TEA) was to assess the deployability issues relating to the Force XXI Division Design structure.

(1) For SWA, the AOE used a four division corps, with an armored cavalry regiment (ACR), plus corps "slice" units, and other echelons above division (EAD) and theater assets. The HL-SB used four divisions and all appropriate EAD assets. The MOD also used four divisions and appropriate EAD assets.

(2) For NEA, the AOE used a four division corps, but assumed that one of the divisions was forward deployed, requiring the AOE case to move the remaining three divisions. The HL-SB and MOD deployed three additional divisions and all appropriate EAD assets.

(3) There were no major changes in force deployment requirements. The detailed findings and results are in appendix F.

f. Combat Service Support (CSS) analysis. The purpose of the CSS analysis, conducted by TRAC-Fort Lee, was to quantitatively and qualitatively assess the capability of the CSS concept and design a CSS structure to support and sustain the division design alternatives.

(1) The quantitative analysis was based on consumption data generated from the Operations Logistics Planner (OPLOGPLN) model.

(2) The qualitative analysis used the Mobile Strike Force (MSF) 95 CSS concept and prototype structure as a point of comparison and collected responses to questionnaires regarding structure. Final definition of the CSS organizations will be completed when the interim division design (less CSS) is determined.

(3) A detailed explanation of findings and results is in appendix G.

g. Validation analysis. After the results of the preceding analyses were briefed to the CG, TRADOC, additional analysis was directed for comparisons between the recommended MOD HVY Division and the AOE Division.

(1) The intent was to analyze the recommended MOD HVY Division in a spectrum of warfighting scenarios using VIC to compare and contrast its performance with the AOE Division.

(2) There were no significant differences found between the MOD HVY and AOE Divisions. The detailed findings and results are in Chapter 5 and appendix H.

h. In all analyses, efforts were oriented on evaluation by the patterns of operations -- with specific subissues for each pattern and each exercise. The results of those assessments led to adding/retaining certain capabilities in the division designs or to delete some aspects.

i. The ending result of the Phase I analysis is not a typical solution (selecting one alternative from a fixed set), but a comparative-based evolution of capabilities within the designs, and a determination of what appears to work "best." This lays the foundation for more detailed analysis of those integrated capabilities, the Interim Division Design, in the Phase II analysis.

2-4. Models. Models used included:

a. Vector-in-Commander (VIC). VIC is an automated corps- and division-level force-on-force simulation. It is a fast-running analytical tool capable of evaluating operational concepts, tactics, and doctrine. VIC is deterministic, event-sequenced, Lanchester equation-based, and represents all major battlefield functions. It is written in SIMSCRIPT II.5 and executes on SUN or Hewlett-Packard computers. For Blue forces, the normal level of resolution is maneuver and artillery battalions, air defense batteries, cavalry troops, and helicopter companies. Red maneuver forces are represented to battalion level. Special units (i.e., supply convoys, engineer assets, and fixed-wing aircraft) can be represented at higher resolution. VIC-automated C2 is influenced by a unit's evaluation of its tactical situation based on perceived

information. Unit actions and reactions are based on tactical decision rules embedded in the model which are modified for each scenario.

b. Transportability Analysis Reports Generator (TARGET). The TARGET unit deployability model merges unit equipment authorization data from TRADOC's Table of Organization and Equipment (TO&E) Master File with the equipment item data from the U.S. Army Forces Command's (FORSCOM) Computerized Movement Planning and Status System (COMPASS) Equipment Characteristics File (ECF). The TARGET program determines the unit deployment data required for strategic mobility planning, resulting in unit deployment data and sortie requirements.

c. CASTFOREM. CASTFOREM is a high resolution, two-sided, force-on-force, stochastic combined arms, combat simulation model. The model uses digitized terrain, an extensive representation of visibility conditions (such as weather, smoke, and dust) to portray the obscuration of a realistic battlefield both in day and night. The model portrays a detailed representation of maneuver forces, communications, target acquisition and firing events. Model resolution is at the individual weapon system level (i.e., tanks, armored personnel carriers, artillery, unmanned aerial vehicles, helicopters, or dismounted infantry fire teams).

d. VIC modules subset for CAMEX. CAMEX is a "man-in-the-loop" model and is most useful as a discussion driver. The coarse data produced by this model enabled gamers to compare the results of various courses of action. This model lacks the resolution to provide a definitive measure of system on system performance. CAMEX is a low resolution model which aggregates combat results. Analysts, gamers, and tacticians can use this tool to conduct a rapid study of a course of action (COA) without an intricate programming of action/reaction commands.

(1) The most important aspect of the CAMEX was its use in reporting characteristics of the "gain information dominance" pattern of operations. In the CAMEX wargame, each side is given a perception of the opponent's disposition and movement. The quality of the generated perception is dependent on the reconnaissance and surveillance planning. Force actions and maneuvers are man-generated decisions initiated from perception updates. In prior CAMEX studies, division staffs have typically operated with approximately four hour (game time) decision cycles. With digitization, sensor updates, common relevant pictures, and digitized passing of combat orders, the Blue forces were assumed to have a 50-75% reduction in decision cycle time. This permitted more frequent adjustment to OPFOR actions. Since information operations is critical to Force XXI, and at this time, this sort of representation was only possible through a CAMEX-type wargame, it was the best possible tool for this Phase I analysis.

(2) There were several capabilities which, because of model limitations, had to be played off-line. These capabilities included: chemical use, unconstrained logistics, wide area minefields, and bridge destruction. Some capabilities, such as air defense against unmanned aerial vehicles (UAVs), could not be played at all. Since gamers had to manually input each alternative, human error was introduced and the scenarios were not exactly the same. The CAMEX model is capable of representing units to battery and company level.

(3) In maneuver operations, CAMEX can maneuver task forces in various combat formations. As in real life, the mobility of a system is dictated by the terrain, obstacles, and maneuver formation chosen. Indirect fires are represented in direct support, general support, and counterfire roles. The intelligence picture supplied to the surrogate staff included a perceived battlefield based upon the division and echelon above division reconnaissance and security plan. Fixed wing representations included both close air support and air interdiction. Ground combat was replicated through VIC modules using Lanchester-based attrition algorithms.

e. Operations Logistics Planner (OPLOGPLN). The OPLOGPLN system is a computer program created by the Combined Arms Support Command (CASCOT) to calculate estimated consumption of ammunition, petroleum, oil, and lubricants (POL), and other classes of supply. Units are created from standard requirements codes (SRCs) and their associated line item numbers (LINS). These units are then grouped into task organizations which are assigned to an order. Requirements are calculated using logistical planning factor data for specific theater, combat intensity, and warfighting posture inputs.

2-5. Methodology Wrap-up. The methodology involved the analyses described and the evolving Force XXI Division Operations Concept. All analyses considered the CG, TRADOC's "How to Fight" seminars, as the seminars identified specific areas of emphasis. The emphasis areas were categorized by, and, consequently, the analytic assessments are based on, the patterns of operations. The quantitative and qualitative approaches were used to find the strengths and weaknesses of each alternative, and the results follow in Chapter 3. The strengths of the alternatives were eventually combined to form the MOD HVY design.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I
CHAPTER 3
RESULTS

3-1. Introduction. This chapter presents results of the division design analysis organized around the six patterns of operations. The layout and notation used in the supporting charts is explained. The box that appears at the bottom of each chart will indicate, with a blackened dot, which of the analytic events provided the data that is presented on the slide (CAMEX (near) gaming, CAMEX (far) gaming, Senior Military Review (SMR), Brigade Design Analysis (BDA), Military Traffic Management Command Transportation Engineering Agency (MTMC TEA) analysis, and Combat Service Support (CSS) analysis. The abbreviations seen: (AOE (Army of Excellence), HL-SB (Heavy/Light - Small Base), and MOD (Modernized)) note the respective alternatives that were included in the analyses. Due to the time of development and characteristics differences, some designs were not included in each analysis.

3-2. Project the Force. Force projection is the act of deploying Army elements from the continental United States (CONUS) or forward areas to the contingency theater. The modular design of Force XXI units is assumed to speed the process of force tailoring and packaging. This is intended to provide planners with pre-tailored combat, combat support (CS), and CSS packages supportable as modular units. Force XXI division deployment may be opposed or unopposed.

a. Division lift requirements.

(1) In the "Project the Force" deployability analysis performed by MTMC-TEA, the air and sealift requirements were determined for the alternative designs and their corps "slice" elements (those combat support (CS) and CSS assets typically associated with divisional support). The analyses used the AOE heavy (HVY) and light divisions (LT) to establish comparative upper and lower bounds, and examined the HL-SB and MOD alternatives. At the time this analysis was initiated, the Brigade Based design was not sufficiently defined, either in divisional or corps terms, to be available for analysis.

(2) The results in figure 3-1 show that even though the HL-SB alternative has only two heavy brigades and one infantry brigade (compared to three heavy brigades in AOE), there is only a slight difference in sealift requirements (18 versus 16 ships). The addition of three brigade cavalry squadrons and an armored gun system (AGS) battalion almost completely offset any reduction offered by going from 3 to 2 heavy brigades (including the downsizing of the armored (AR) battalions (58 to 45 tanks)). When there are smaller armor and mechanized battalions as in the MOD design, and the brigade cavalry is removed, then some meaningful reductions in lift are observed.

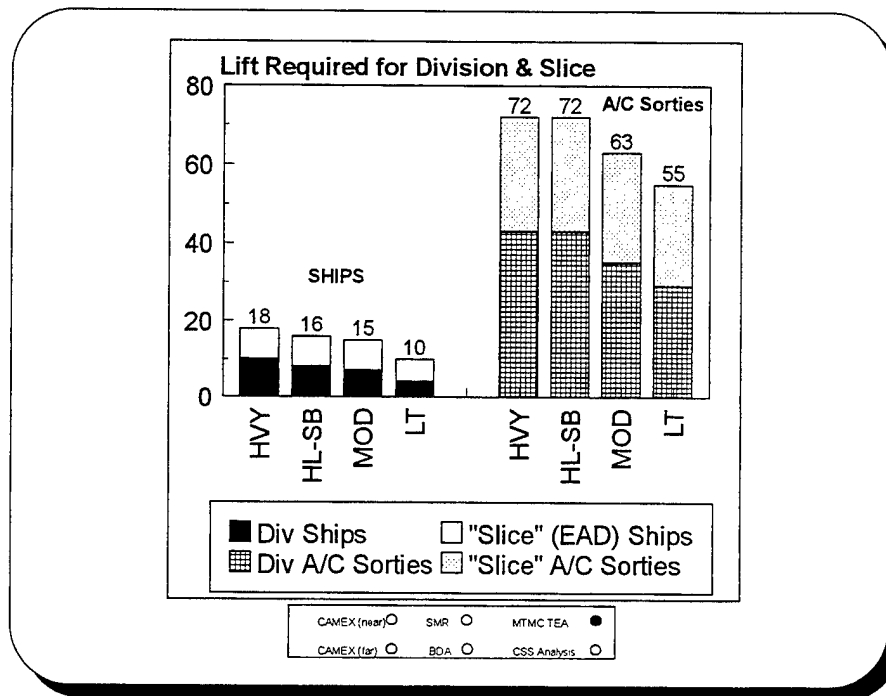


Figure 3-1. Division Lift Requirements

(3) The analysis also highlights that when units are shifted from division to corps, as with the HL-SB direct support (DS) air defense artillery (ADA) battalion, those assets still are to be accounted for in the "slice." Shifting those spaces may bring the count in the division down, but as a force requirement, it still must be deployed. If better deployability is desired, downsizing is what has to occur.

b. Strategic deployment.

(1) The analysis is expanded from the division "box" to a force packaging requirement. Two deployment scenarios are examined: Southwest Asia (SWA) and Northeast Asia (NEA). The SWA case uses a commander-in-chief (CINC) requirement of four AOE divisions. The AOE divisions include:

- 24th Infantry Division (ID) (HVY)
- 1st Cavalry Division (HVY)
- 2d ID (HVY)
- 25th ID (LT)

Additionally, an armored cavalry regiment (ACR) corps "slice" and other corps and EAC assets are included. The lift requirements are shown in figure 3-2, with a closure period of 75 days, driven by the sealift requirement. For the HL-SB design, the CINC requirement -- number of heavy brigades, light brigades, etc. -- was held as constant, and it was determined that four HL-SB divisions were needed to meet that requirement. No meaningful differences in the designs are found. In fact, when just the division share of the 156 and 155 ships, respectively, is examined, each design used exactly 64 ships to move just the divisions. The MOD design, providing the same number and types of brigades, also deployed four MOD divisions and, because those are smaller divisions, created some reduction in the number of ships and aircraft sorties.

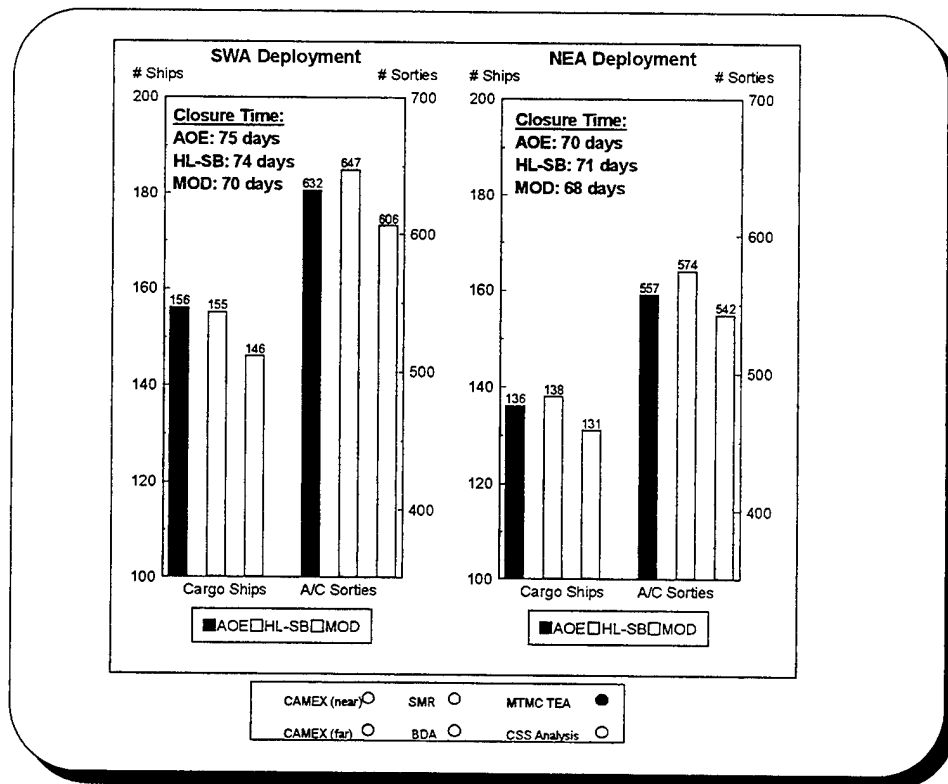


Figure 3-2. Strategic Deployment

(2) For the NEA scenario, the same AOE four division force package is used, but this time it is assumed that one division (2d ID) was already forward positioned, so two heavy (24th ID, 1st Cavalry Division) and one infantry (25th ID) division had to be deployed. The HL-SB and MOD designs each send three of their types of divisions to join the forward unit. Again, there is no real difference in the lift requirements. From a strategic deployability perspective, the designs are equivalent.

c. Modularity and tailorability. Along with deployability, modularity and tailorability are considered as being associated with Project the Force. Here, experience and military judgment of our SMR and CAMEX participants provided qualitative (intellectual) assessments of the alternatives.

(1) For the AOE structure, the participants in both exercises agreed that with four line companies in each armor and mechanized infantry battalion, this design was most flexible/tailorable for the maneuver brigades. However, as the converse of that argument, it was also deemed to be the least agile in terms of ability to disperse its units for survivability, and then mass its units for decisive operations. It also has the largest personnel requirement.

(2) For the HL-SB structure, the three line companies in the armor and mechanized infantry battalions was felt to have reduced the tailorability of the force. On the other hand, the high-mobility, artillery rocket system (HIMARS) battery was attractive for its ability to improve early force packaging (being C-130/C-141 transportable). Also, the participants noted, as this was the first time a DS function (and the unit) was moved from division to corps, that the loss of habitual relationships may create some loss in effectiveness. Here, the DS ADA battalion is moved from division to corps, affecting the DS batteries that typically train and maneuver with the brigades.

(3) For the MOD design, the participants observed that by training as a combined arms team with smaller maneuver battalions, this alternative was the most modular (at brigade echelon) and the most agile. Further, since it trains and deploys as a combined arms brigade, it was felt that this alternative would be the quickest to "stand up" combat power upon arrival in theater (as brigade-size increments). The drawback to this design was perceived to be its difficulty to incrementally weight the battle. In its concept description, this design is focused on the internal organization of the brigades and did not permit cross attachment of units from one brigade to another. As a result, combat power is committed in brigade-sized bites.

3-3. Protect the Force. The division commander's first concern will be the security of the force. This will be true throughout all stages of the operation, from deployment into theater, through decisive combat, and redeployment to CONUS or other staging areas. The tools the Force XXI commander will use to ensure this protection include Intelligence Preparation of the Battlefield (IPB), ADA, deception techniques, survivability techniques, and the employment of tactical units organized, trained, and equipped for reconnaissance and security.

a. Air defense artillery designs and performance. This analysis is based on the CAMEX near- and far-term gaming. In the near-term, the principle air threat was rotary wing, and in the far-term, it was both fixed and rotary wing (a direct reflection of the scenario assumptions for air superiority and air parity). A CAMEX limitation was ADA versus UAVs. Counter reconnaissance contributions by ADA against UAVs should deny the enemy information on friendly locations and, thereby, help unit survivability. Unfortunately, this could not be represented in the CAMEX.

(1) Alternative designs were examined, and figure 3-3 shows the number of systems in the task-organized division. The AOE division had systems corresponding to two heavy and one light brigades. The HL-SB division had no organic assets (at the time of the analysis), but had a DS battalion provided by corps. The MOD division systems had organic assets. Additional corps ADA was given to each division when corps field artillery (FA) and aviation assets were attached to the division. In the FY 2001 scenario, all designs suffered some losses to threat helicopters and none to OPFOR fixed wing (FW) aircraft (due to Blue air superiority). Due to the level of resolution of the CAMEX air defense module and the changes in Blue and OPFOR tactical employments, it cannot be said that there are meaningful differences in the FY 2001 ADA results. For FY 2010, based on the level of resolution, no meaningful comparisons of differences in ADA performance can be assessed. However, in this far-term scenario, for every alternative, OPFOR FW was the largest killer of Blue systems. In fact, the quantity of Blue losses in each FY 2010 design is unacceptable. This indicates that all of these designs need additional ADA augmentation when the condition of air parity exists, especially when the OPFOR has significant air-to-ground capability.

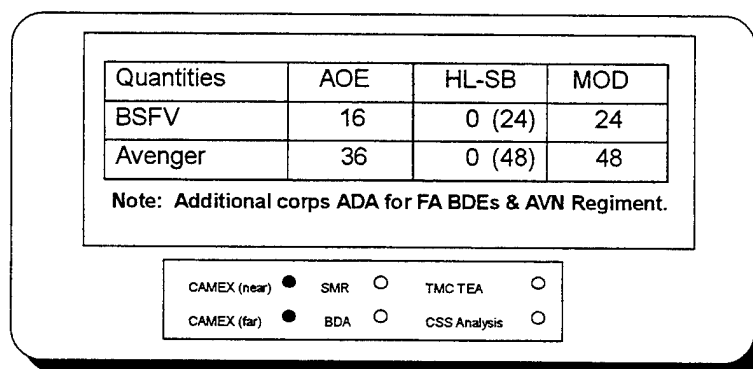


Figure 3-3. Air Defense Artillery Designs

(2) While there were no real differences in losses, there were some trends from the wargaming. First, for AOE, it was felt that the support was adequate, as it provided a battery to each brigade and one general support (GS) battery to division base. However, the size and number of batteries available precluded cross-attachment of air defense assets to weight the brigade with the division main effort. The organic DS battalion staff was felt to be a major contributor to the forward area air defense (FAAD) command, control, communication, and intelligence (C3I) and Army airspace command and control (A2C2) effort in the division, and was capable of supporting the division staff planning in those areas. This was deemed especially important for integrating other ADA assets that may be operating in the division area.

(3) The HL-SB alternative, with DS ADA assets provided from corps, provided more systems than AOE, but there was concern over designation of who/how the FAAD C3I and A2C2 functions would be handled across the division area (and maintaining continuity of ADA coverage at key locations would require a designated headquarters for coordination, i.e., the crossing sites). Under the AOE design, many of the ADA C2 coordination tasks are performed by the ADA DS battalion staff. Under HL-SB, without an organic DS battalion staff, it was felt that this function would have to be performed by the division staff, thereby increasing the coordination load on that staff. Also, being non-organic, there is no inherent division support command (DISCOM)

support for the ADA systems, so CSS support must come from corps, which could pose a potential problem.

(4) For the MOD design, the same numbers of systems in the HL-SB corps DS ADA battalion are present, but the batteries are assigned to the three maneuver brigades and the division headquarters, without an ADA battalion headquarters. This organization provides the largest quantity of organic ADA systems, but the absence of a battalion staff was felt to be a large problem. Again, as with HL-SB, FAAD C3I and A2C2 falls on the division staff and ADA early warning would be difficult, if not an impossibility, without the battalion staff to pass information. It was felt that the larger batteries (than AOE) would provide limited weighting capability to the division, by being able to cross-attach a platoon from one maneuver brigade to another.

(5) The importance of the ADA battalion is clearly METT-T dependent. As stated for the 2010 analysis, the largest killer of Blue systems was OPFOR fixed-wing and the quantity of Blue killed, some would say, is unacceptable, but that was a scenario with a sophisticated air threat and a condition of air parity. On the other hand, in the 2001 analysis, there were a few losses to threat helicopters and none to OPFOR fixed wing. So, the summary statement of needing at least a DS ADA battalion is dependent upon the presence of an air threat. For Phase II, the question of adequacy in the face of varying threats will be examined in more detail.

b. Chemical and engineer support. For "Protect the Force" chemical and engineer analysis, findings are based on the qualitative responses of the CAMEX and SMR participants, as the level of resolution in the CAMEX is not sufficient for quantitative measurements of engineer and chemical contributions. In Phase II, this work will be followed with more detailed investigations.

(1) The types and quantities of organic division engineer units is shown in figure 3-4. The AOE and HL-SB designs have engineer brigades (the HL-SB being heavier than AOE), while the MOD design does not have a complete battalion.

Asset	AOE	HL-SB	MOD
EN BDE HQ	✓	✓	
Size DS EN Unit in:			
Armor BDE	BN	BN	CO
Mech Infantry BDE	BN	BN	CO
Infantry BDE	CO	BN	CO
# DS CM companies	1	1	0

CAMEX (near)	●	SMR	●	TMC TEA	○
CAMEX (far)	●	BDA	○	CSS Analysis	○

Figure 3-4. Chemical and Engineer Support

(a) In assessing their capabilities, the AOE design was deemed adequate, except for situations where the infantry brigade was in a defensive posture. Here, because the infantry brigade has only a DS company, additional assets would be needed (from outside the brigade, either divisional, or corps). The HL-SB design, with the largest amount of DS assets, is structured consistent with the Engineer Restructuring Initiative (ERI). Under the MOD design, with only a company per brigade, the support was deemed inadequate (from participant qualitative analysis) for continuous offensive operations. Further, the two battalions (from HL-SB) that have been removed, have not migrated to corps, but have been deleted from the total force structure.

(b) Additionally, in overall perspective, the MOD design was also found deficient because it did not have a C2 structure that would facilitate additional attachments of engineer assets from corps (there is no engineer brigade headquarters to integrate the EAD battalions). Under this design concept, the division engineer staff section would have to be increased to accommodate all planning, integration, and coordination of engineer activities.

(c) Previous studies have shown that at least two DS companies would be needed to support breaching and mine clearing operations for each brigade (Engineering Restructuring Initiative and TRAC input to Engineer School Force Structure Examination).

(d) Another area of concern is maintaining the main supply routes (MSR), particularly for non-contiguous operations. More analysis is required in Phase II to better resolve this area.

(2) In the area of chemical units, the AOE and HL-SB structures have chemical companies, while the MOD does not have a company. In the MOD design, the chemical company migrates to corps, and the division staff was enlarged with chemical personnel for planning and dissemination of early warning.

(a) Under the AOE design, the chemical company is oriented for NBC (nuclear, biological, and chemical) decontamination/reconnaissance (decon/recon). It has smoke capability, but augmentation from corps is needed for large area smoke operations.

(b) Under the HL-SB design, the emphasis shifts from NBC operations to smoke operations. This design has three times as much smoke capability as AOE. This will support offensive operations and denial of enemy acquisition of friendly information. However, the tradeoff is the large area decontamination capability passes to corps. This design has some NBC reconnaissance capability.

(c) Under the MOD design, the division is dependent on corps for smoke/decon/recon operations. The enhanced staff should be able to support planning operations, but support will be needed for execution.

(3) Chemical and engineer support are heavily METT-T dependent. They must be evaluated in greater detail in Phase II.

3-4. Gain Information Dominance. Battlefield success depends on the ability to use informational advantage to enable friendly forces to identify changing battlefield conditions and respond accordingly. Digital connectivity improves the change-response process by enabling near instantaneous report of change and response effects to the decision maker. Commander decisions (based on these reports), issuance of orders, and subordinate actions can then flow together -- becoming nearly simultaneous events.

a. Military intelligence designs and performance. The "Gain Information Dominance" pattern is used to present the findings for the military intelligence designs. The observations of the CAMEX and SMR participants were used as the basis of the analysis, as this is another area where it is difficult to capture quantitative data. The participants identified how well, or how poorly, they felt the designs were resourced to support information operations. Figure 3-5 presents the types and quantities of systems in each of the respective designs.

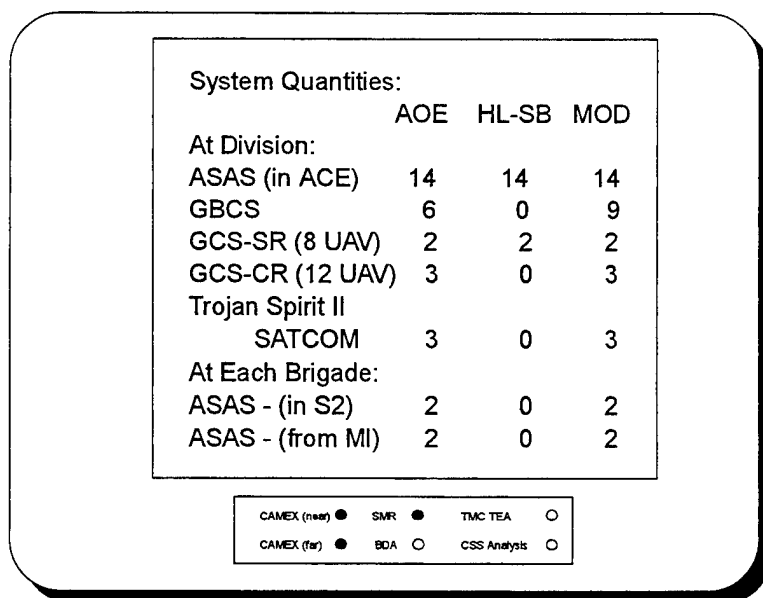


Figure 3-5. Military Intelligence Designs and Performance

(1) During the CAMEX, the division staff made detailed reconnaissance and surveillance plans that allocated assets to specific operations. During the course of the war game, the staff adapted the plan in response to enemy action/reactions. The timeliness of the staff's responses were geared to the support/information updates they received.

(2) Under the AOE design with an organic MI battalion, the division staff felt there were ample assets for planning and executing the operations. This was consistent with the SMR analysis.

(3) The HL-SB design, with only an MI company in the reconnaissance, intelligence, surveillance, and target acquisition (RISTA) battalion, was judged as totally inadequate for information operations by both SMR and CAMEX participants. While the division staff is supported with all-source analysis system (ASAS) workstations, it does not have ground-based

common sensors (GBCS), to bring in sensor updates; it does not have unmanned aerial vehicle-close range (UAV-CR) support; nor Trojan Spirit II satellite communications support; and, perhaps most important, it does not allow for any ASAS capability at the brigade level. This absence will preclude the brigade commander from integrating/interrogating intelligence sources for his specific area of operations.

(4) The MOD design, with an MI battalion that is nearly identical to the AOE design, is sufficient. In this design, there is an increase (from six to nine) in GBCS. For Phase II, it is necessary to investigate if those extra three systems are required (also requires additional analysis of the Advanced Quick Fix (AQF) EH-60 helicopter since the GBCS and AQF are netted and work together). If the additional GBCS are to support an intelligence capability while units are on the move, then the GBCS may be worth retaining.

(5) Overall, the AOE MI battalion structure is more robust than the RISTA battalion when supporting information dominance operations for the division. Also, even though there was not a specific issue, the CAMEX participants noted that the aviation brigade and the DIVARTY could benefit from UAV resources (a platoon-sized element). The aviation brigade could use the UAVs to augment the air cavalry by performing "economy-of-reconnaissance" missions, freeing scout helicopters to the higher priority missions. The DIVARTY could use the UAVs to augment the reconnaissance and surveillance plan, dedicating those resources to named areas of interest/target areas of interest (NAI/TAI).

3-5. Set the Battlespace Conditions. The *Force XXI Division Operations Concept* calls for the division to begin shaping the battlefield through simultaneous, precision strikes throughout the depth of its battlespace so that decisive operations are greatly facilitated or rendered unnecessary. This condition is characterized by spatially extended violent attacks by precision fires, dynamic obstacles, deception, and friendly maneuver which will overwhelm the enemy's capability to react and set the stage for decisive operations. This pattern was used to give insights for artillery (especially MLRS), attack aviation, and U.S. Air Force (USAF) support for the AOE, HL-SB, and MOD alternatives.

a. Near-term (force year (FY) 2001) results. The results in figure 3-6 come from the CAMEX FY 2001 exercise and recap the division designs tested.

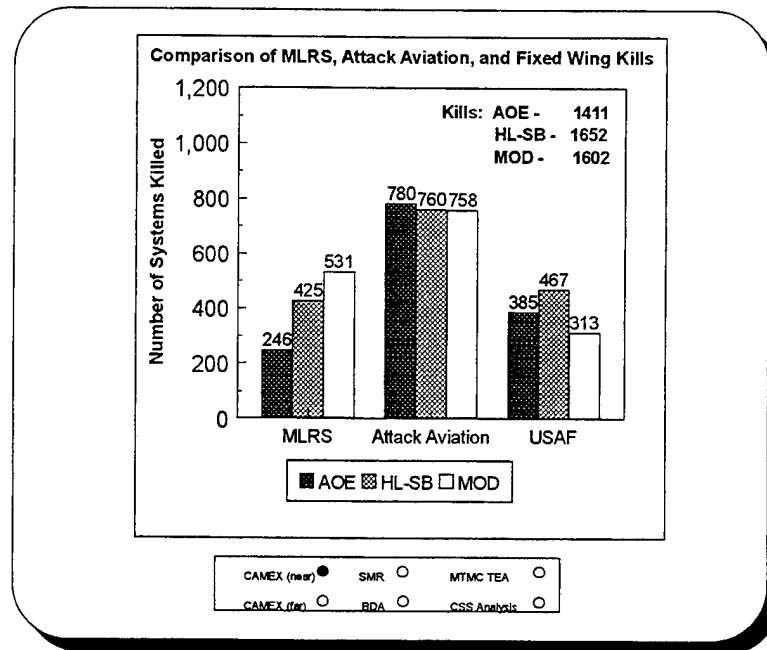


Figure 3-6. MLRS, Attack Aviation, and Fixed Wing Blue Kills - 2001

(1) Recall that the FY 2001 CAMEX used an OPFOR that had large quantities of low-to-medium technology systems. Its systems were T-72 and BMP-2 vintage, with many towed artillery systems, while Blue was M1A1, M2A2, M109A6 vintage systems. A condition of Blue air superiority was assumed. Blue did not have the Army tactical missile system (ATACMS) Block II/IIA. In this war game, the different alternative designs applied their forces in varying patterns to shape the battle space. Each alternative had a close maneuver/fight phase, and the HL-SB and MOD alternatives had longer close fights than the AOE case.

(2) The AOE results show that this design used its two divisional attack helicopter battalions to do most of the shaping of the battlefield. The divisional AHBs were used in coordination with the three attack helicopter battalions (AHB) in the corps attack regiment. USAF and MLRS also contributed to this part of the battle.

(3) The HL-SB design had only one organic AHB, but it had a 3x6 MLRS battalion (no HIMARS in FY 2001). There was not much shift in attack aviation kills, even though the HL-SB went from two to one AHBs in the division (or five to four total). Discussions with war game participants revealed that four AHBs were probably sufficient for this operation. The MLRS kills, on the other hand, appeared to increase tremendously, more than proportionate with the increase in launchers. Investigation found that the magnitude of the differential is more attributable to the prolonged close fight than it is to more launchers for "set the conditions." An additional point was the need to use an attack helicopter company to perform some air cavalry missions (route reconnaissance, escort for air assault, and screen for the infantry brigade). This affected the planning flexibility available to this option.

(4) The MOD alternative has the same number of MLRS launchers and AHBs as the HL-SB alternative, but differences are seen in kill distribution. However, when the USAF fixed-wing kills are factored in, the total number of kills between HL-SB and MOD are nearly the same. This "target stealing" is a reflection of the different methods used to shape the battle space, which would be expected in an interactive gaming environment.

(5) Looking across the alternatives, the AOE case had the fewer kills by these systems than either the HL-SB or MOD alternatives. Investigation found that the AOE case, having heavier armor forces, conducted a short, intense close fight. The HL-SB and MOD, with smaller armored forces, had longer battles. In both these cases, the combined kills for both MLRS and USAF are much greater than the AOE design reflecting increased support to a longer fight.

(6) As an overall observation from this FY 2001 CAMEX, it appears that the division needs at least one MLRS battalion and one AHB. These two internal assets of the division give the division commander the best combination to "set the battlespace conditions" by fixing the enemy's center of gravity.

b. Far-term (FY 2010) results. Figure 3-7 shows the CAMEX results from the FY 2010 war game. For this scenario, air parity and an OPFOR that has limited quantities of the highest technology systems, and large quantities of T-80, BMP-3, etc., type systems existed. Blue had the same basic structure, but also had high-mobility, artillery rocket systems (HIMARS) in the HL-SB design, and Army tactical munitions (ATACMS) Block II in all alternatives. To keep the scenario reasonable, Blue was limited to 100 Block II ATACMS during this 15 hour battle.

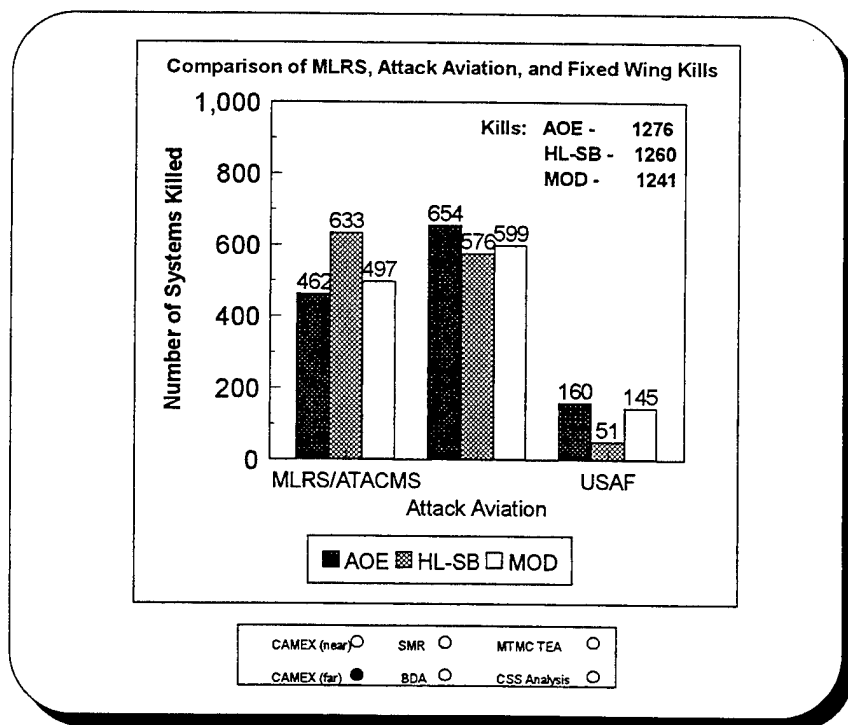


Figure 3-7. MLRS, Attack Aviation, and Fixed Wing Blue Kills - 2010

(1) The results in figure 3-7 present trends that best typify the changes in system quantities. For example, AOE has the fewest organic division MLRS launchers (1x9 battery), MOD is next with a 3x6 battalion, and HL-SB has the most systems with a 3x6 MLRS battalion and a HIMARS battery (1x6). The number of corps assets (two FA brigades with two (3x9) MLRS battalions and one 155mm battalion) and their kills are included in the results. The MLRS/ATACMS kill columns mirror the trend (HL-SB most, MOD next, and AOE least). However, some of the magnitude of the HL-SB result is from "target stealing," as seen when the USAF contribution is included. The attack aviation results show that AOE has the most AHB kills, with HL-SB and MOD nearly equal. The fact, in the HL-SB design, that an attack helicopter company had to be diverted to do air cavalry operations also seems to appear in the slight reduction in the number of kills, although a better explanation may be that the presence of air cavalry enabled the MOD design to more efficiently use the AHB.

(2) From the FY 2010 results, regarding Blue kills of OPFOR, it appears that one divisional AHB and one MLRS battalion are sufficient, especially with the addition of ATACMS Block II/IIA. The ATACMS Block II/IIA have tremendous impact on the battlefield. The ATACMS Block II/IIA were in the corps field artillery brigades, not in the division MLRS units. The differences seen in comparisons of FY 2001 and FY 2010 MLRS ATACMS lethality contributions are primarily reflections of the addition of Block II/IIA. For every design alternative, MLRS/ATACMS were critical to mission success.

c. Cavalry investigation. The results in Figures 3-8 (FY 2001) and 3-9 (FY 2010) are from the BDA and its investigations of the brigade cavalry squadrons. For this analysis, a European meeting engagement scenario was used. The OPFOR was equipped with FY 2010 systems (T-80U, BMP-3, etc.), and Blue forces were equipped with FY 2001 equipment (M1A1, M2A2, M109A6, etc.) and FY 2010 equipment (M1A2, M2A3, Crusader, etc.). The Blue force was a mechanized infantry brigade from the AOE, HL-SB, and Brigade Based alternatives. The MOD design was not developed in time for this analysis. The mechanized infantry brigades had ground cavalry squadrons in the HL-SB and Brigade Based designs; the AOE mechanized infantry brigades did not.

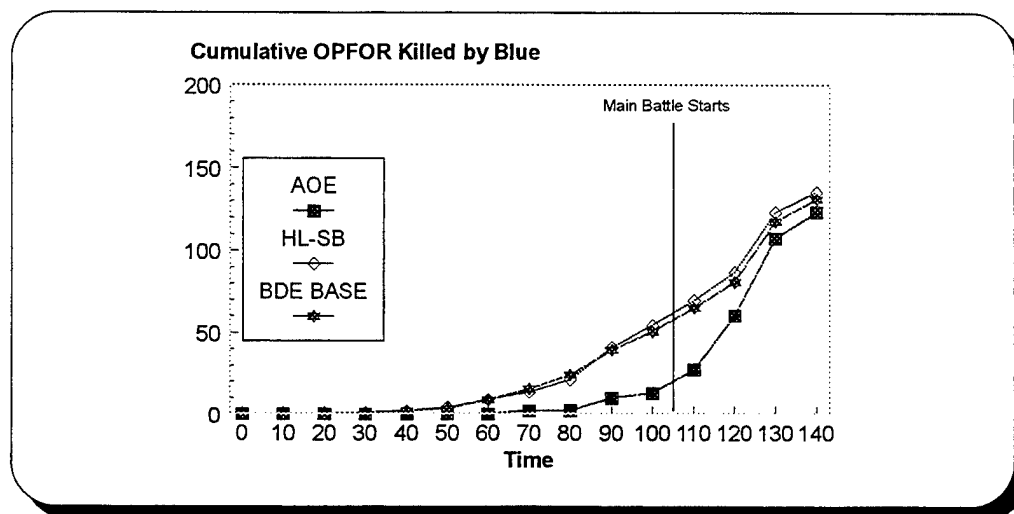


Figure 3-8. FY 2001 Cavalry Investigation from BDA

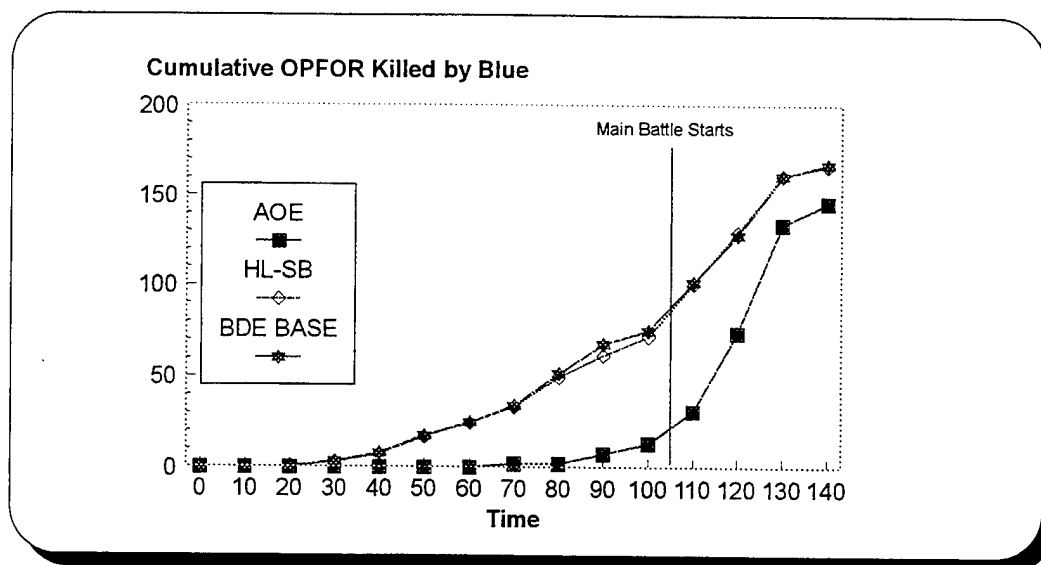


Figure 3-9. FY 2010 Cavalry Investigation from BDA

(1) The results show that the presence of cavalry in the HL-SB and Brigade Based alternatives greatly increased the number of OPFOR systems killed in the early stages of the battle, reaching a maximum difference in kills (over AOE) at the 100-105 minute mark of the battle, or just prior to the start of the main (close) battle. At the time of the main battle, Blue had achieved 16 kills (14% of the total kills) in the AOE alternative. However, in the HL-SB and Brigade Based alternatives, 58 and 55 kills (43% and 46% of the total kills), respectively, had occurred. These additional effects, over what was achieved in the AOE alternative, were due primarily to the brigade cavalry squadron's ability to call in more artillery fire missions sooner.

(a) Table 3-1 shows that the loss exchange ratios (LERs) for FY 2001 are about the same at the end of the battle for the three alternatives, but the results are also misleading. There are significant differences between the cavalry (HL-SB and Brigade Based) and non-cavalry (AOE) alternatives. The increase in scout assets in the HL-SB and Brigade Based alternatives resulted in a considerable increase in effects prior to the start of the main battle. The friendly kills and losses in the AOE alternative prior to the start of the main battle were minimal (losses consisted mainly of scout vehicles) because of the small number of scout resources. Kills and losses are greater prior to the start of the main battle for the HL-SB and Brigade Based alternatives because the cavalry was significantly involved and with greater numbers than the AOE alternative. The end of battle results show how the AOE heavy forces closed the LER gap.

Table 3-1. Cavalry Alternatives Loss Exchange Ratios (LER)*

Force Year	AOE	HL-SB	Brigade Based
At start of main battle:			
2001	$\frac{13.0}{4.7} = 2.77$	$\frac{54.4}{30.2} = 1.80$	$\frac{50.5}{24.1} = 2.10$
2010	$\frac{13.0}{14.6} = 0.89$	$\frac{71.5}{38.4} = 1.86$	$\frac{74.7}{31.7} = 2.36$
At end of battle			
2001	$\frac{123.3}{155.7} = 0.79$	$\frac{135.4}{169.1} = 0.80$	$\frac{131.1}{153.4} = 0.85$
2010	$\frac{145.7}{134.2} = 1.09$	$\frac{166.5}{126.4} = 1.32$	$\frac{167.4}{120.9} = 1.38$

$$*LER = \frac{\text{OPFOR Killed}}{\text{Blue Losses}}$$

(b) There are more pronounced differences for the LERs at the end of the battle in FY 2010. Although the HL-SB and Brigade Based alternatives have similar end of battle LERs (1.32 and 1.38, respectively), the AOE alternative was notably different (end of battle LER of 1.09). Again, the Blue kills and losses in the AOE alternative prior to the start of the main battle were minimal because of the limited number of scout vehicles. The difference in FY 2010 was that, overall, the AOE alternative did not kill as many threat systems and had poorer survivability than the HL-SB and Brigade Based alternatives. This prevented the AOE alternative from closing the LER gap from the start of the main battle to the end of the main battle as it did in FY 2001.

(c) The cavalry alternatives (HL-SB and Brigade Based) reflect much higher kill rates than the AOE design. However, the drawback to this, the reason why the LERs are not higher for the cavalry designs, is that the cavalry designs are incurring greater losses. The losses are primarily artillery systems (due to a more intense counterfire battle) and cavalry vehicles. The cavalry vehicle vulnerability is due to the lack of sensor standoff capability against the FY 2010

enemy -- the T-80U has about equal sensor capability. During the course of the battle, only about 60 percent of the cavalry vehicles survive, but they do permit increases in the number of tank and IFV survivors. In the main battle, time constraints precluded refinement of cavalry tactics. Consequently, emphasis on, and insights from, the cavalry results are more appropriate for the early phase of battle (prior to the close fight).

(2) This analysis provided additional insights, although very brief, on the potential gains provided by the Force XXI objective technology systems. Both the Blue 2001 and Blue 2010 forces had a common FY 2010 enemy. The FY 2010 Blue systems included upgraded M1A2s, M2A3s, Cavalry Fighting Vehicles (CFVs), and Crusaders, whereas the FY 2001 Blue systems were M1A1s, M2A2s, high mobility multi-purpose wheeled vehicles (HMMWVs), and M109A6s. From table 3-1, the AOE alternative had a 38% LER increase from FY 2001 to FY 2010 at the end of the main battle, the HL-SB alternative had a 65% LER increase, and the Brigade Based alternative had a 62% LER increase. The Blue upgraded systems increased both the lethality and the survivability of the mechanized infantry brigade in each of the alternatives.

(3) Overall, this analysis showed that additional sensors are beneficial, but a vulnerable, cavalry squadron size element may not be the best design to provide this sensor capability. For Phase II this assessment will continue to evaluate a brigade reconnaissance troop as the unit to provide that capability. The consideration for non-continuous, distributed operations indicates that the brigade may need such a capability to support information dominance, force protection, and economy of force operations.

3-6. Conduct Decisive Operations. The goal of Force XXI divisions is to conduct decisive operations at the time and place of its choosing to overextend and destroy the enemy. Decisive operations are achieved by near simultaneous striking of the enemy at multiple, critical points throughout his depth.

a. Near-term (FY 2001) lethality results. For this CAMEX effort, all the alternatives accomplished the mission. After the "set the conditions" phase, all alternatives performed a close maneuver battle. The AOE design, having the heaviest armor force, had a short, intense battle, while the HL-SB and MOD designs had longer battles. Figure 3-10 shows the HL-SB and MOD designs have a larger number of Red kills than AOE; however, because the LERs for the designs are all nearly the same (3.6, 3.6, 3.7) this means those designs also lost more systems than the AOE case. Investigation, as previously mentioned, found that the HL-SB and MOD designs had more MLRS kills than AOE. This was also a result of the longer close fight. A look at the cannon artillery kills, steadily increasing from AOE to HL-SB to MOD, is a direct representation of the differences in duration of the close battle.

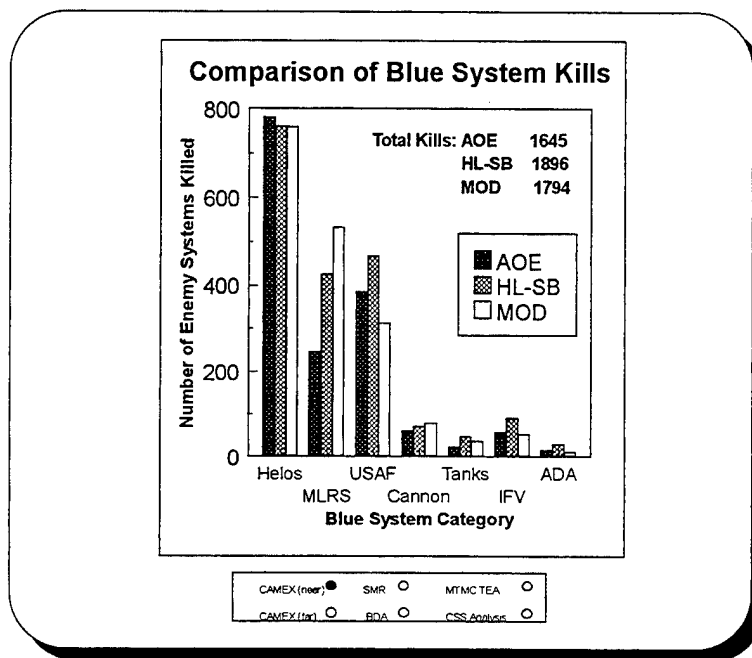


Figure 3-10. Lethality - 2001

(1) In planning and executing the battle, there was a heavy dependence on MLRS in the HL-SB and MOD designs to "offset" the reduction in divisional AHBs (two to one) and the reduced number of tanks in the armor battalion (58 to 45). The reduction in AHBs was not a serious impact, as stated early, as corps augmentation precluded any deficiencies in capability. The reduction in armor battalion size likewise reduces the total number of tanks in the division. The overall reduction in tanks was not enough to cause the designs (HL-SB and MOD) to lose the battle, but the designs did incur serious losses as they did not generate "overwhelming" combat power.

(2) Overall, it was found that the division needed at least one AHB and one MLRS battalion to be successful in his battle. Additionally, the armor battalion size and division armor strength appears insufficient in the HL-SB and MOD designs.

b. Far-term (FY 2010) lethality results. Figure 3-11 shows the results for "Conduct Decisive Operations" in the CAMEX FY 2010 battle. Here, Blue was given the precision guided munitions capability provided by ATACMS Block II/IIA. The supply available to the division was limited to 100 Block II/IIA missiles.

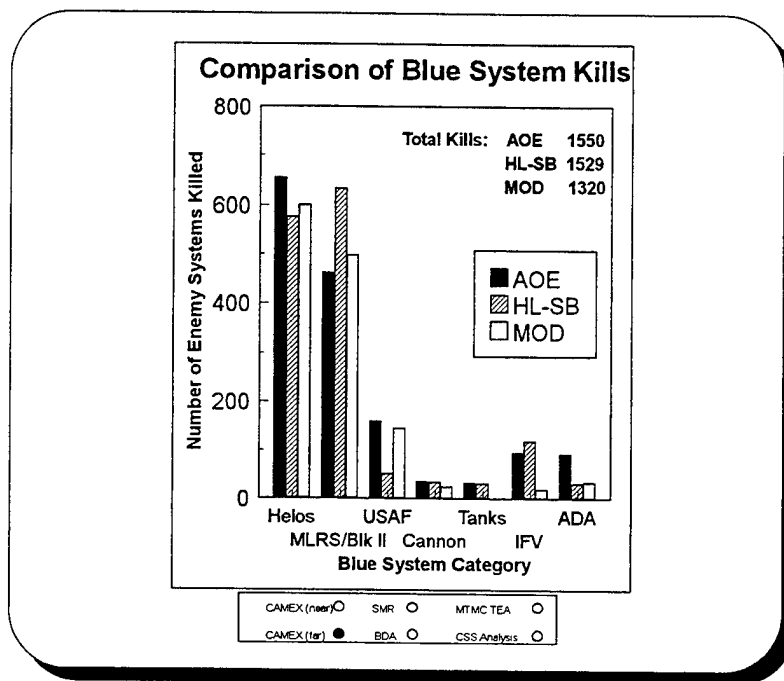


Figure 3-11. Lethality - 2010

(1) All alternatives again accomplished the mission; however, there was a major difference in how it was accomplished in this time frame (versus 2001). Here, fires performed the decisive operations instead of close maneuver. The brigades maneuvered and positioned themselves for a close fight -- engaging reconnaissance units and lead elements of the motorized rifle regiments (MRR) -- but they were not required to execute that final maneuver. This outcome was consistent with the new division operations concepts.

(2) As the total numbers of kills and LERs (AOE had the biggest LER with 4.6, followed by the HL-SB with 4.4, and the MOD with 3.9) are examined, the AOE and HL-SB outcomes are nearly identical, with some drop off for the MOD design. As shown in the "Set the Conditions" pattern of operation, the AOE case used AHBs to get the largest numbers of kills. As part of its operations, a divisional AHB was used to provide early support to the infantry brigade, because it had fewer MLRS systems positioned to support with long-range fires. The HL-SB made the best use of MLRS/HIMARS systems -- successfully off-setting the reduction of one AHB. The MOD design results appear to be consistent with the system densities as well.

(3) The key observation was that using ATACMS Block II/IIA enabled the division to mass the munitions' effects instead of massing forces. The ATACMS Block II/IIA (fired by the MLRS batteries from corps in support of the division) gave the division a better opportunity to strike the enemy's killing systems deeper and prevent more of a close fight. The MLRS firing

Block II/IIA accounted for either the highest or second highest number of kills in each alternative. Using the ATACMS Block II/IIA to fire deep precluded the division having to mass forces to achieve the same result. The nature of the fight also supports the need for at least one AHB and one battalion of MLRS. This combination of division and corps MLRS and AHBs achieved over 70% of the kills in each alternative.

c. Survivability. The other critical aspect of "Conduct Decisive Operations" is the survivability of the force. Figure 3-12 presents Blue force survivability, with an emphasis on "resiliency," or the amount of heavy maneuver forces remaining/available for follow-on operations after the CAMEX battles. Orienting the bar graphs, black is the number of tanks and white is the number of infantry fighting vehicles (IFV) in the mechanized infantry battalions (M3A, CFVs, future scout vehicle (FSV), and high-mobility, multi-wheeled vehicles (HMMWV) are not included). Bar clusters are presented for both FY 2001 and FY 2010. The AOE design had the most surviving tanks and IFVs to conduct follow-on operations. The tables in Figure 3-13 show the varying numbers of systems each alternative started with.

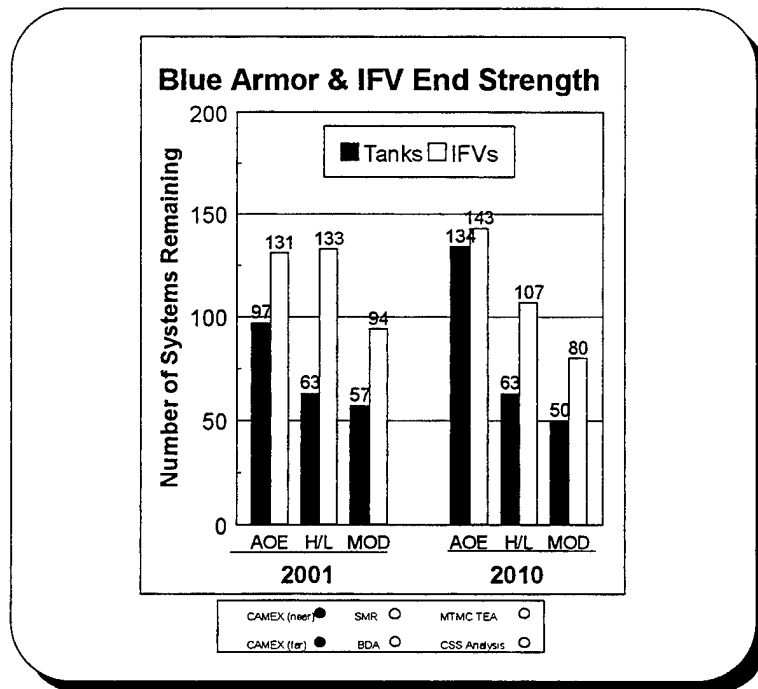


Figure 3-12. Survivability

(1) Table 3-2 shows that the FY 2001 AOE starts and ends with the most M1A1s and M2A2s. Examining the combined M1A1/M2A2 losses reveals that the alternative designs lost 108, 107, 100 combined systems for AOE, HL-SB, and MOD, respectively. The smaller initial quantities in HL-SB and MOD created a less overwhelming force in the close fight, causing longer battles than AOE. As a result, the improvements that HL-SB and MOD had in setting the conditions (recall that their increased numbers of MLRS caused increased numbers of kills) could not be capitalized by their smaller-sized armored forces. As the attrition is fairly equivalent across alternatives, the remaining forces are decidedly weaker for follow-on operations. With only 135 tanks initially in the division's armor battalions, the HL-SB and MOD designs do not appear capable for high-intensity operations. The number of IFVs in HL-SB appears a good number, perhaps even disproportionate, especially when compared to the number of tanks (also, AOE and HL-SB have AT companies).

Table 3-2. Blue Tanks and IFVs Tables (Survivability)

2001	Tanks			IFVs		
	AOE	HL-SB	MOD	AOE	HL-SB	MOD
Initial #	174	135	135	162	168	126
% Surviving	56%	47%	42%	81%	79%	75%

2010	Tanks			IFVs		
	AOE	HL-SB	MOD	AOE	HL-SB	MOD
Initial #	174	135	135	174	168	126
% Surviving	78%	47%	37%	82%	64%	63%

Note: Each alternative was task-organized to METT-T conditions and fought a similar task organization of one mechanized infantry brigade, one armored brigade, and one infantry brigade.

(2) In the FY 2010 case, the losses incurred by HL-SB and MOD are nearly identical; each lost approximately 133 M1A2/M2A3 systems. The AOE case survived better, as it was able to more effectively mass power for the maneuvers into position. In this force year, none of the designs had to execute a final close maneuver, but each had to position itself by fighting some lead elements of the 11th MRD. In this positioning, the AOE case also had two AHBs to support its movements into position, while HL-SB and MOD had only one divisional AHB. Again, ATACMS Block II/IIA and AHBs provided the decisive operations.

(3) While OPFOR air (fixed- and rotary-wing) and artillery made for fairly consistent amounts of Blue losses, the amount of armored forces available for further operations is clearly less in the HL-SB and MOD designs. Thereby, the note of emphasis is that the division armored strength needs to be more than the HL-SB and MOD when operations are at the high-intensity end of the spectrum of conflict.

d. Tempo of operations. Participant observations (from CAMEX and SMR) gave insights into tempo of operations. The first concerns are with dependencies on EAD lift assets.

The AOE design had a task-organized infantry brigade and, for the air assault operations, it received accompanying corps aviation assets. The HL-SB and MOD designs had an organic infantry brigade, but had to have the same external lift assets to move organic units. Further, the HIMARS, AGS, and brigade cavalry needed USAF assets to move. (In the scenario, they deployed to an airfield under the Patriot air defense umbrella.) Those corps assets had to remain with division, in case of emergency extraction, until link-up operations could occur. A serious problem would have occurred had the HL-SB and MOD designs required emergency extraction because USAF lift assets were not retained.

(1) Concerns were raised over the mobility differential problem. There were difficulties at division level in synchronizing the heavy and infantry brigades. This included the "dash" to link up with the air assault operations and subsequent moves by the infantry brigade when the heavy brigades passes forward. This difficulty was magnified within the infantry brigade, as we tried to synchronize air assault elements (infantry battalions), infantry elements (light cavalry), and heavy elements (AGS). In "leap-frogging" forward, the initial movement of AGS and HIMARS used USAF assets, but after that, they were pushed to keep up with air assault elements.

(2) The use of air cavalry was important in this scenario. The AOE and MOD designs used the air cavalry to screen at depth (critical to the infantry brigade, once air assaulted) and escort the air assault operations. The HL-SB was forced to divert an attack helicopter company to perform those missions. This reduced the available attack assets for close combat operations.

(3) The major conclusions resulting from the analysis were:

(a) Move HIMARS and AGS to corps, to come down as attachments, when missions are required;

(b) Structure the division as heavy or infantry divisions and cross-attach as needed (this causes the weakness in division dismount capability to resurface); and

(c) Retain the division air cavalry capability.

3-7. Sustain and Transition the Force. Sustainment is continuous throughout operations and is key to sustained tempo. Total Asset Visibility provides the force visibility over materiel and supplies from alert through deployment and into tactical operations. There is no discernible break between decisive operations, reconstitution, and if necessary, redeployment.

a. Figures 3-13 and 3-14 address "sustain and transition the force." This is a preliminary analysis, in the sense that the CSS concept and structures have not been completely defined.

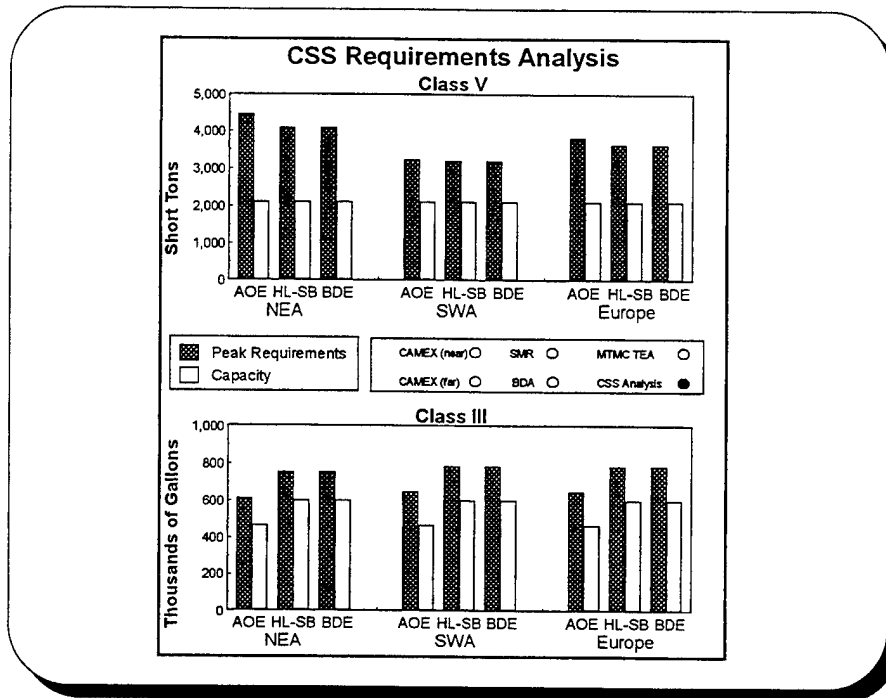


Figure 3-13. High Intensity Offensive Operation

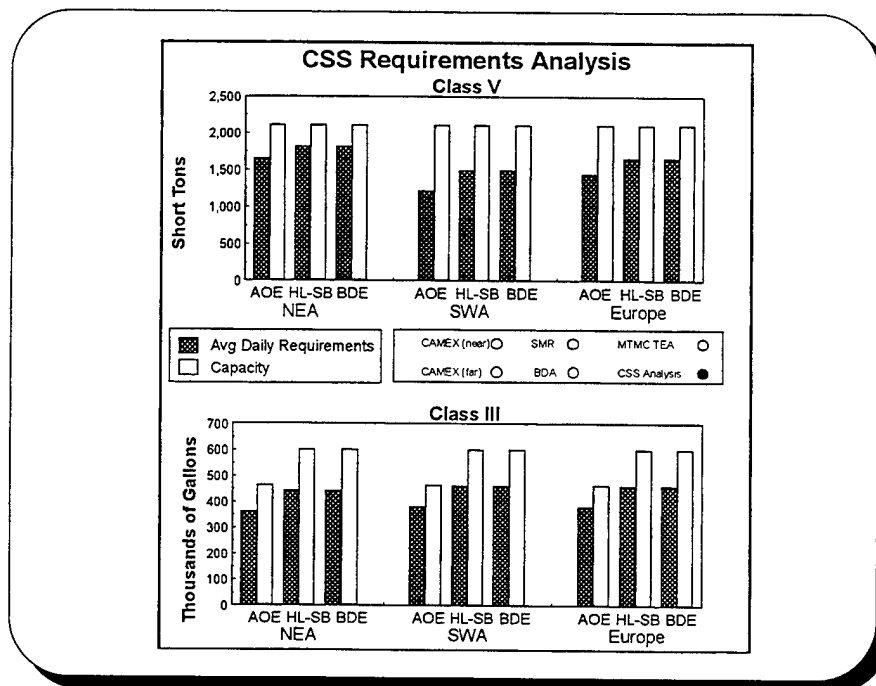


Figure 3-14. Moderate Intensity Defensive Operation

b. In this early analysis, the centralized CSS concept is followed and the proposed logistics structures in each of the three division designs was used to determine their CSS capacities for classes III and V. The CSS planning factors in the OPLOGPLN model were used to determine the average daily requirements for peak operations in a high-intensity offensive operation (Figure 3-13) and the average daily requirements for a moderate intensity defensive operation (Figure 3-14).

c. Figure 3-14 shows that the division's peak daily requirements exceeds its lift capacity for all designs in all three theaters examined (SWA, NEA, Europe). This can be offset, depending upon the number of supply "turns" the CSS structure can make. The assumed numbers are three turns per day in Europe, two per day in SWA, and once a day in NEA. This would indicate a potential problem in NEA. However, when looking at the average daily requirements in the defensive operation, all alternatives have surplus capacity in all theaters. Again, these computations will be reevaluated in greater detail in future Force XXI analyses, as the CSS concept is finalized and the CSS design structures are refined.

d. Another part of the CSS analysis was a survey of senior CSS members. This survey generated an overwhelming response that the division needed a DISCOM to manage the throughput and all other CSS operations (because the Brigade Based and MOD designs did not have a DISCOM). They also reflected that they were most comfortable with the most familiar designs, preferring AOE, HL-SB, and Brigade Based, in that order. Again, this will be analyzed in greater detail.

e. The results of the preceding quantitative and qualitative analysis presented in this chapter were used to develop the major findings presented in Chapter 4.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I
CHAPTER 4
SUMMARY OF MAJOR FINDINGS

4-1. Introduction. This chapter provides a detailed discussion of the findings and observations from the Phase I analysis. Recommendations for further research are also provided. The findings are provided with the following items of information: (a) description of the Force XXI division design principle or tasks, and identification of the principal sources of information, (b) a listing of the specific finding, and (c) discussion of key results supporting that finding.

4-2. Findings.

a. *Ability to generate overwhelming combat power.* The first findings address the design principle associated with the determination of whether the alternative division designs can generate overwhelming combat power for the "conduct decisive operations" pattern of operation. This question is primarily oriented to close combat operations, and secondarily to long range fires. The CAMEX and BDA provided quantitative data, while CAMEX and SMR participants provided qualitative insights.

(1) **Finding:** The divisional armor strength for the interim division design should be more along the lines of the AOE division, with further investigation in Phase II for exactly how to apportion those units.

Discussion. The CAMEX resiliency results (Figure 3-11) show that although the HL-SB and MOD division designs accomplish their assigned missions, they do not have sufficient armor combat power for follow-on missions. These designs have the same number of armor battalions as the AOE design, but the armor battalions in these new designs have only 45 tanks (versus 58 in the AOE battalions), resulting in fewer total tanks. This difference was highlighted in comments by CAMEX and SMR participants, with the consensus being that high intensity combat operations are more appropriate for heavier armored forces. Another data source, the BDA results in Figure 3-8, show that the AOE mechanized infantry brigades did better in the main battle portions of the scenario, effectively "closing the performance gap" created by the brigade cavalry in the "set the conditions" stage. The heavier armor capability of the AOE design was fundamental in this result. The perceived divisional armor shortfall in the HL-SB and MOD designs can be addressed by either increasing the number of tanks in the battalions, or by increasing the number of armor battalions in the division.

(2) **Finding:** The IFV strength for the interim division design should be built along the structure of four companies per mechanized infantry battalion. A determination of whether those four companies should be all "line" companies, or three "line" companies and an anti-tank company is deferred for further research in Phase II. Complete resolution of this question must consider the desired divisional dismounted infantry capability, balance of anti-armor capability, and projections for future anti-armor weapons systems.

Discussion. The resiliency results also showed that the HL-SB and MOD division designs have approximately the same IFV survival rates; however, the lower initial quantity in the

MOD division left insufficient numbers to conduct follow-on missions. The reduction in divisional IFV strength is attributable to two factors, smaller mechanized infantry battalions (41 M2s in the MOD division's battalions, versus 54 for AOE, and 56 for HL-SB), and the deletion of the anti-tank companies (with 14 M3s in each company). Overall, it appears that four mechanized infantry companies provides an appropriate balance of infantry and armor forces.

b. *AGS inclusion to infantry brigade.* The next findings address the design task to determine if the AGS was an appropriate addition to infantry brigades. There are many missions for the AGS, and this analysis focused on offensive operations (versus augmentation of infantry forces in purely defensive operations). The CAMEX provided quantitative results, and the CAMEX and SMR participants provided qualitative results.

(1) **Finding:** The "mixture" of air assault, AGS, and infantry forces within one brigade is inappropriate for continuous operations, as it can adversely affect the tempo of operations.

Discussion. This question was dominated by concerns over operational employment in offensive operations. The consensus of the CAMEX and SMR participants was that there are tremendous mobility differential problems that must be addressed in the infantry brigades of the HL-SB and MOD division designs. For the offensive operations examined, the infantry brigades of the new designs had to coordinate forces that were simultaneously light infantry (in blocking positions), air assault infantry, and heavy (AGS) units, all within the same brigade. The AGS, while designed for air drop from a strategic perspective, is not designed for air assault. It's too heavy for helicopter transport. For the operational maneuver capability desired in these designs, the AGS can only keep pace if USAF assets and landing sites are available. Once initially positioned, the brigade must coordinate air assault movements, AGS movement, and infantry movement.

(2) **Finding:** On the basis of employment examined, AGS as an infantry brigade organic asset is not a good idea. A better allocation would place the AGS at the corps, where it can be mission tasked when appropriate.

Discussion. The CAMEX provided only limited lethality results for the infantry brigades, both with and without AGS. The nature of the infantry fight, due to terrain and visibility considerations, had the brigades engaging the armored OPFOR forces with TOW missile systems and forward positioned infantrymen with Javelin missile systems, due to better engagement range and probability of kill than AGS. Further, many of the AGS losses were due to artillery fired precision guided missiles (PGMs) (far-term FY 2010 results). Therefore, while the employment of the AGS was consistent with the division operations concept, the scenario did not "showcase" the capabilities of the AGS.

c. *Aviation role and deep fires mix.* This design task covers several related areas: What are the capabilities desired in the division aviation brigade (including attack aviation, assault aviation, and general lift aviation)? With consideration given to the attack aviation capabilities, what mix of other divisional long range fires systems was desired? The CAMEX provided both quantitative and qualitative data for these questions.

(1) **Finding:** One AHB is the minimum level of divisional attack aviation capability, for divisional deep strike capability and mission flexibility for support to the close fight.

Discussion. When comparing the CAMEX results for the AOE and HL-SB divisions, the "Set the conditions" data, figures 3.6 through 3.8, show that the "tradeoff" of one AHB for additional MLRS/HIMARS is about even. (The total number of OPFOR killed are approximately the same for the two division designs, while they have differing numbers of AHBs and MLRS/HIMARS.) It must be noted that corps-fired ATACMS Block II was the primary artillery system that made up the lethality capability difference created by one less AHB. Further investigation was made of the types and numbers of aviation missions performed by the AHBs. To support the close fight, the AHBs performed missions as escorts for the air assault forces, anti-armor/fire support for the infantry brigade, air cavalry screening for the infantry brigade, and reaction to surprise enemy armor maneuver.

(2) **Finding:** The aviation brigade needs a minimum of one assault helicopter battalion to conduct the missions required by the division.

Discussion. The need for lift is apparent for the air assault operations, in fact, even with the increased size of the assault aviation battalion in the HL-SB and MOD division designs (45 versus 30 UH-60 aircraft), support from corps aviation was needed for brigade level operations. In these new designs, the division can lift an infantry battalion with a single lift, but not the entire infantry brigade. Setting that requirement aside, momentarily, there is also a need for the lift capability to support the forward positioning of forward arming and refueling points (FARPs) for the divisional AHBs, and on occasion, when the FARPs also have to support corps AHBs.

d. *Mix of field artillery systems and command and control structure.* This design task was to determine the mix of artillery systems needed for the close fight, to support the long range fight, and how to allocate those systems for mission assignment. Quantitative data was taken from CAMEX and the BDA, while the SMR and CAMEX provided qualitative insights.

(1) **Finding:** The direct support (DS) field artillery units should remain as DIVARTY assets and not be organic to the maneuver brigades.

Discussion. The MOD division design is based on the combined arms brigade concept, where the direct support artillery is organic to the brigade (versus the division artillery (DIVARTY) in the AOE and HL-SB division designs). The SMR participants commented that changing the allocation from DIVARTY to field artillery organic to the brigade would require development of entirely new methods for mission tasking. In effect, the subordinate brigades were being given assets, but the tasking authority for those assets needed to be at the next higher echelon. The SMR and CAMEX participants shared the view that this change could potentially limit the division's flexibility to mass fires, since the maneuver brigade commanders (instead of the DIVARTY commander) becomes responsible for unit positioning.

(2) **Finding:** Each maneuver brigade needs a DS field artillery battalion.

Discussion. The present and planned DS artillery units for mechanized forces was accepted as correct. However, questions remain concerning what the infantry brigade DS system should be. The M119 (105mm) is the prime candidate, because of its light weight and air assault

capabilities, but it was very ineffective against the OPFOR in near-term (FY 2001) CAMEX. This was due to the OPFOR being predominantly armored forces. The far-term (FY 2010) CAMEX experimented with using the advanced towed cannon artillery system (ATCAS), to take advantage of the 155mm family of munitions. This wargame showed ATCAS is much more effective against this type of enemy. However, the air assault operations used for offensive maneuvers in this operation required dedicated allocation of corps medium lift assets, as the ATCAS, with full complement of ammunition, requires a CH-47, or bigger, aircraft for movement.

(3) **Finding:** The division needs at least a battalion of MLRS and a TAB, to support the close and counterfire battles.

Discussion. The near-term (FY 2001) CAMEX, far-term (FY 2010) CAMEX, and BDA scenarios all show that the division needs not only one MLRS battalion, but there are enough armored targets to warrant allocation of additional assets from corps. ATACMS Block II/IIA is clearly a dominant capability. When Block II/IIA is not available, the additional MLRS contributes to the effectiveness of the counterfire battle, thereby increasing the survival of Blue cannon artillery. The greater survival of Blue cannon artillery allows greater effects from cannon-fired sense and destroy armor munitions (SADARM) in destroying threat armor, which, in turn, increases the survival of Blue maneuver forces. The magnitude of the counterfire battle also supports the continued use of a target acquisition battery (TAB). Both in the near-term (FY 2001) CAMEX and BDA, artillery was the biggest OPFOR killer.

e. *Cavalry mix and echelon.* The next task was to determine the appropriate mix of divisional cavalry and scout assets, how to configuration the cavalry assets (air and/or ground), and which echelons should be provided with those cavalry/scout assets. The CAMEX and BDA provided quantitative data, and CAMEX also provided qualitative insights.

(1) **Finding:** The division needs cavalry with both air and ground units.

Discussion. The CAMEX and SMR participant observations provided the key insights for this area. The CAMEX's "attack of a moving enemy" scenario highlighted the Force XXI Division's dependence on aerial reconnaissance and security operations. Under the AOE and MOD division designs, the air cavalry troops of the division cavalry performed route reconnaissance, screening for the infantry brigade, and escort missions for the air assaults. The HL-SB division, with brigade ground cavalry squadrons and no air cavalry troops anywhere in the division, AH-64 companies were diverted to do those high priority missions typically done by the air cavalry. The CAMEX and SMR participants felt the importance of the screening mission for the infantry brigade could not be understated. As a result, the number of OPFOR kills by the HL-SB division's AHB diminishes, even below the level of the MOD division's AHB (because the MOD division has division air cavalry). The CAMEX participants also found that the non-contiguous operations required ground cavalry to maintain prolonged, continuous screening missions.

(2) **Finding:** The brigade cavalry/reconnaissance unit should be, at most, a company sized element. There will be continued assessment of the cavalry issue in Phase II and the brigade cavalry's potential interaction with other RISTA assets

Discussion. The BDA cavalry results (Figure 3-8) show that the addition of cavalry to the mechanized infantry brigade provided additional sensors for target acquisition and greatly enhanced the number of artillery kills. The peak contribution occurs prior to closing with the enemy for the final maneuver operations. However, while the brigade cavalry is effective, it also sustains high losses. The losses occur in both ground cavalry systems and artillery systems lost on a heavier counterfire battle. Critical to this type of operation (with the sophisticated OPFOR represented) is the need for sensor stand-off capability for the ground cavalry systems. The SMR participants noted that the brigade cavalry is a good idea for a near-term force, but may not be needed with the development of an effective relevant common picture. From an overall perspective, a squadron sized cavalry element for each maneuver brigade is attractive, especially for the distributed operations described by the Division Operations Concept. However, when considering both the contribution made by a company sized element (in a pure reconnaissance role) and the need to reduce the size of the division, it may be concluded that a company sized element is more appropriate.

f. *Air defense capability and requirement.* The next task is to determine the amount of ADA required to provide sufficient protection to the division. CAMEX provided both the quantitative and qualitative data for this issue. This area was found to be extremely situationally dependent, and the data from the CAMEX air defense modules are very rough approximations. As a result, the CAMEX participant insights were very important.

Finding: In the presence of rotary or fixed wing threat, at least one ADA battalion is needed to provide coverage to the division. The FAAD C3I, A2C2, and integration of additional assets from corps requires a dedicated staff element. The CAMEX participants recommended a DS battalion headquarters as an alternative.

Discussion. Figure 3-3 described the differences in quantities of ADA systems. For the AOE and MOD division designs, the systems were organic assets. For the HL-SB division, the systems were a corps augmentation. The MOD division had the greatest quantities of systems, but it did not have a battalion headquarters and staff. While there were numerical differences, there were no appreciable differences in the number of systems killed by Blue ADA. Far-term (FY 2010) CAMEX results, with its air parity scenario condition, show that fixed wing was the OPFOR's best killer. In fact, the quantities of Blue systems lost, for all division designs, are probably unacceptable. The numbers of ADA weapons systems in each of the division designs, at approximately one equivalent battalion, is inadequate for this wargame. However, in the near-term (FY 2001) CAMEX and BDA, the condition of Blue air superiority reduces the overall OPFOR air threat to primarily rotary wing systems. In these conditions, one ADA battalion was probably sufficient.

The CAMEX participants also noted that coordination of the expected multitude of air defense assets within the division area would require a dedicated battalion headquarters, and could not be adequately handled by a division staff section. The integration of DS assets, ADA assets with corps units provided to the division, TBM defense systems, and air defense early warning were felt to require a DS ADA battalion HQs, so the MOD division design was accepted as a feasible solution. Due to model resolution, no investigation of ADA against UAVs was conducted, but it is expected that the counter-RISTA contributions will enhance overall force survivability.

g. *Information dominance.* The Division Operations Concept is developing "Gain Information Dominance" as an emerging, and increasingly important pattern of operation. The fundamental questions of how and with what assets does the Force XXI Division attain information dominance must be answered. However, at this stage of development, they can be answered only in the most preliminary forms. The findings for this area are based on comparisons of quantities of intelligence and sensor systems, and qualitative insights from the SMR and CAMEX participants.

Finding: The MI battalion of the AOE division design appears adequate to support "gain information dominance", but the RISTA battalion lacks sufficient assets to support the brigade and division commanders.

Discussion. The AOE and MOD division designs have comparable numbers of assets, as each uses an MI battalion to support these operations. The HL-SB design has a RISTA battalion, with only one organic MI company to provide those functions. The comparative systems inventory, Figure 3-5, shows that the RISTA battalion has insufficient MI assets to support gaining information dominance. The RISTA battalion does not provide any ASAS capability to the maneuver brigade commanders for interrogation/integration intelligence for their specific areas of operation. The RISTA battalion structure also fails to provide the brigades with UAV capability. It also fails to provide the HL-SB division with satellite communications (SATCOM) capability. The CAMEX and SMR participants each concluded that the RISTA battalion, with only an MI company was inadequate, but the AOE and MOD division structures appear adequate. It was noted that a detailed review of the assets in these MI battalions should be accomplished, to maintain efficient support to this area of increasing importance. As an example, the MOD division increases the number of GBCS from six (in an AOE MI battalion) to nine. The CAMEX participants felt that six systems were probably adequate for operations.

4-3. Other Areas for Further Investigation.

a. CSS and sustainment. Phase I analyses attempted to determine if the division designs were sustainable. Some preliminary quantitative data was gathered from the CSS analysis, with additional qualitative insights from the SMR and CSS analysis participants. However, the Division CSS Concept and force structure design are undergoing extensive development and re-design. A large portion of the division force structure reduction is dependent on changes to the CSS structure. Detailed analysis in this area is absolutely essential. Concerns also exist for program funding for CSS enablers (although this will not be addressed in Phase II). Consequently, the CSS questions need extensive evaluation in Phase II.

b. Combined arms brigades. One of the Force XXI Division design principles is to enhance the flexibility, agility, tailorability, and modularity in the division. The SMR participants noted that combined arms brigades, through training and habitual association, are more easily dispersed (for survivability) and massed (for decisive operations) than division based brigades, per the AOE type of design. This makes a combined arms based division more "agile" than a comparable AOE type division. However, the combined arms brigades generate a new family of problems for massing effects and forces. Some of the new questions are:

- How do you task the subordinate unit's assets?
 - How do you incrementally weight the battle?
 - What is the force capability closure profile for deployment / early entry operations? (Is it better to deploy a brigade team, or a cross-section of division-wide assets?)
- Where appropriate, phase II will provide further investigation in these areas.

4-4. Modernized Heavy (MOD HVY) Division Development. These analyses (from the Front-End Differences Assessment, SMR, CAMEX near and far-term simulations, BDA, deployability analysis, and CSS analysis) were used to identify characteristics that would be desirable in the Interim Division Design. As a result of these analyses, the TRADOC Force Design Directorate developed the Modernized Heavy Division (MOD HVY). When presented to CG, TRADOC, he directed that additional analyses, the DDA Phase I Validation Analysis, compare recommended MOD HVY Division to the AOE heavy division in a spectrum of warfighting scenarios. The Vector-in-Commander (VIC) corps level constructive simulation was used to compare and contrast the MOD HVY division with the AOE Division. These validation results are contained in Chapter 5 and appendix H (classified) of this report.

THIS PAGE LEFT INTENTIONALLY BLANK

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I **CHAPTER 5** **DDA VALIDATION, SUMMARY, AND CONCLUSIONS**

5-1. Introduction. The findings from the supporting analyses, detailed in chapter 4, were used by TRADOC-FDD to develop the Modernized Heavy (MOD HVY) Division, which became the recommended Interim Division Design. In December 1995, CG, TRADOC, directed additional analysis to compare the performance characteristics of the recommended MOD HVY Division with an AOE Heavy Division. The intent was to exercise and analyze the recommended MOD HVY Division in a spectrum of warfighting scenarios, using the Vector-in-Commander (VIC) corps-level constructive simulation to compare and contrast its performance against the AOE Division.

5-2. Development of the MOD HVY Division. The findings from the supporting analyses in chapter 4 were directly implemented in the development of the MOD HVY Division, shown in Figure 5-1, as follows (recommendations for Phase II study are not repeated):

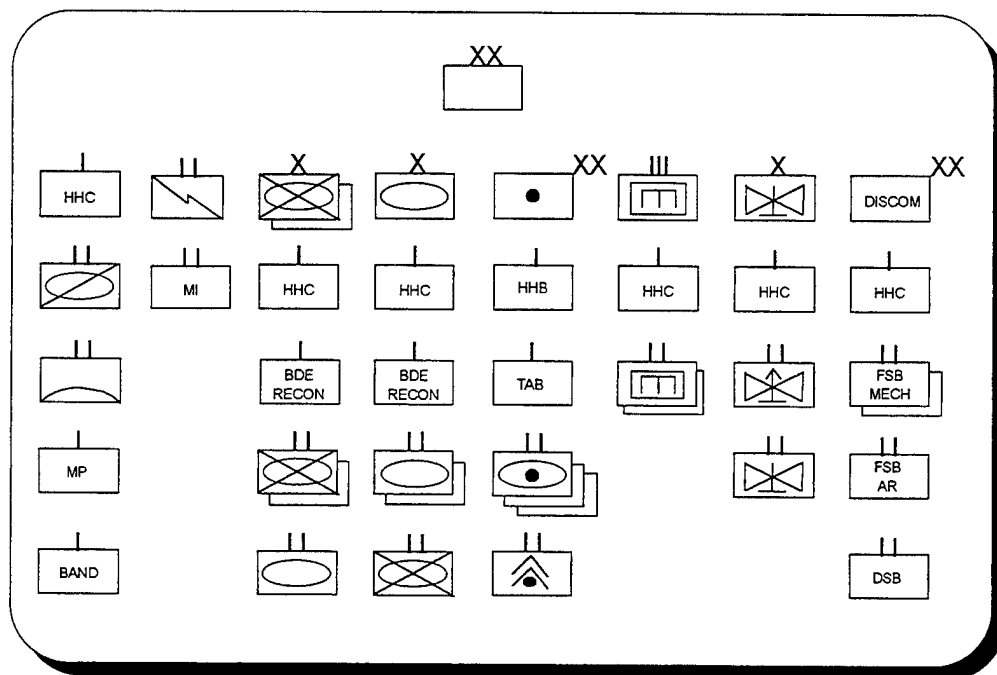


Figure 5-1. Modernized Heavy Division (Mechanized Infantry Variant)

a. **Finding:** For mid-to-high intensity combat, the armor strength under the HL-SB and MOD divisions appears insufficient. **Action:** The MOD HVY Division uses armor battalions with 58 tanks each (same as AOE), but they do not have mortar platoons.

b. **Finding:** The infantry battalion organizations (mechanized and non-mechanized) need four companies (with three platoons per company). **Action:** The MOD HVY Division uses

mechanized infantry battalions with four "line" companies, no anti-tank company, and with a nine-tube mortar platoon.

c. **Finding:** The AGS should not be in an infantry brigade. **Action:** The MOD HVY Division is a pure heavy division.

d. **Finding:** The aviation brigade needs a minimum of one attack helicopter battalion and one assault helicopter battalion (for infantry lift and/or logistics lift). **Action:** Comment adopted.

e. **Finding:** The division artillery headquarters is needed for the planning and integration of fires, and one direct support artillery battalion is needed for each brigade. The division needs one MLRS battalion to support the close fight, counterfire, and joint suppression of enemy air defense (JSEAD). A target acquisition battery (TAB) is needed for the counterfire battle. **Action:** Comment adopted.

f. **Finding:** The division cavalry requires both air and ground elements. Air cavalry is needed for mission flexibility, and ground cavalry is needed for continuous screening capability in non-contiguous operations. **Action:** Comment adopted.

g. **Finding:** The brigade cavalry / reconnaissance unit should be, at most, troop size elements. **Action:** Brigade reconnaissance troops included.

h. **Finding:** In the presence of a rotary or fixed wing threat, the division needs at least a complete battalion of direct support (DS) air defense artillery (ADA) (and more under stressful conditions) with assets for integration, coordination, and dissemination of early warning information. **Action:** A DS ADA battalion is included.

i. **Finding:** Engineer requirements were not specifically addressed in Phase I. **Action:** Division engineer group based on six "line" companies (using three battalions of two companies each, or two battalions of three companies each).

j. **Finding:** The division military intelligence (MI) assets should be at least a battalion. The reconnaissance, intelligence, security, and target acquisition (RISTA) battalion is inadequate for divisional support and should be discarded. **Action:** Division MI battalion included.

k. **Finding:** The division support command (DISCOM) with a headquarters, three forward support battalions (FSBs), and one division support brigade (DSB) are proposed as support for the new Force XXI CSS Concept. **Action:** Comment adopted.

5-3. Scope for DDA Validation Analysis. Due to the limited time available to accomplish the validation analysis, the effort focused on examining the major differences in "performance characteristics", between the MOD HVY and AOE alternatives. This focused the validation on the last study objective listed in chapter 1, "How are the capabilities of the alternative divisions affected by making them smaller than the current AOE heavy divisions?" All other study

objectives had been addressed in the findings from the supporting analyses. VIC was the primary analytical tool for the validation analysis. The factors that defined the scope of the analysis were:

- a. Modernized Heavy Division and AOE Heavy Division were the two alternatives compared.
- b. The wargaming scenarios used to compare the alternatives were Northeast Asia (NEA) 2.1 (Modified), Southwest Asia (SWA) 4.2, and Europe (Prairie Warrior 96 (PW96)) (Modified).
- c. The alternatives employed both near-term and objective equipment technologies.
- d. The amount of corps augmentation provided to the division was varied from scenario to scenario.
- e. The "performance characteristics" that were used to compare the division alternatives were lethality, survivability, and operational employment of the divisions' assets.

5-4. Assumptions. The following assumptions were made to identify factors that are either felt to have equal impacts on the alternatives, or could not be adequately represented in the VIC simulation's level of resolution.

- a. Effective CSS was accomplished, regardless of design.
- b. Digitization enhanced capabilities were implicit in both alternatives.
- c. Echelons above division (EAD) sensor suites and intelligence products were the same for both alternatives.
- d. Small variations in troop strength (CSS changes) or engineer force structure (combat engineer variations) would not create major changes in battle results.
- e. The Modernized Heavy Division had the quantities of major combat systems identified in the 12 Dec 95 "How to Fight" briefing.

5-5. Limitation. The time constraint did not permit the development of a unique set of scenarios, based entirely on the new TRADOC Pam 525-71, *Force XXI Division Operations Concept*. Of the scenarios used in the validation analysis, only the PW 96 scenario has been developed under this operations concept. Because the analysis needed to address a spectrum of scenario conditions, the "off-the-shelf" SWA and NEA scenario products were used to complete the comparison of the alternatives (even though they were developed under Airland Operations Concepts).

5-6. Spectrum of Scenario Conditions. In the phase I analysis, specific division alternative sensitivities to differences/changes in force structure design were frequently mitigated by corps assets augmenting divisional units. In planning the validation analysis, three separate scenarios

were used to bound the potential contribution corps assets could provide. The diversity of the resultant scenarios increased the robustness of the comparative analysis.

a. Figure 5-2 shows, by scenario, the type of combat operation Blue is conducting, the Blue force year (to define Blue technological capabilities), the level of threat technology, the principal corps augmentation to the division, and the air superiority condition.

	EUR (PW96 Modified)	SWA 4.2	NEA 2.1 (Modified)
Type of operation	AOME*	offensive	defensive
Blue force year	2010	~1999	~1999
Threat technology	High	Moderate	Low-to-Moderate
Principle corps augmentation in the scenario	1 FA Bde (to Div), 2 FA Bdes (at corps), Attack Rgt (2 AHBs), EN bridging units, ADA Bn, sensors and intel products	2 FA Bdes (to Div), 2 FA Bdes (at corps), Attack Rgt (3 AHBs), ADA Btry, sensors and intel products	1 MLRS Bn
Air space condition	Blue superiority	Blue superiority	Air parity

*AOME = attack of a moving enemy

Figure 5-2. Spectrum of Scenario Conditions

b. Scenario overviews. Three scenarios were used to conduct the comparative analysis. The scenarios were of significant diversity and missions to adequately stress the division alternatives.

(1) The Europe (PW96) (Modified) scenario is a mechanized infantry division in simultaneous attack of a moving enemy (AOME). This scenario equipped the Blue force with Force XXI objective technologies, fighting an OPFOR equipped with high technology systems (T-80U, BMP-3 vintage systems). This scenario uses a two division corps, so the available corps augmentation is less than the "usual" corps augmentation. The division receives only one FA brigade, instead being allocated the planned for two FA brigades. The corps attack helicopter regiment is reduced to two AHBs, instead of three AHBs, limiting the assets available to respond to the division. The USAF has attained air superiority.

(2) The SWA 4.2 scenario had an armored division as the main effort of a corps deliberate attack. This battle engages a fully deployed corps (three heavy divisions, two armored cavalry regiments (ACRs), and full compliment of corps assets). As the corps main effort, the armored division receives full corps augmentation, to include access to assets of the divisions held in reserve. The Blue force is equipped with near-term systems, and the OPFOR is equipped with T-72, BMP-2 vintage systems. The USAF has attained air superiority.

(3) The NEA 2.1 (Modified) scenario had a mechanized infantry division defending against three infantry divisions and an armored regiment. This scenario is intended to represent a

short notice contingency operation in Korea. The 2d Infantry Division's two heavy brigades are deployed in country, and the only out-of-country assets that can be deployed in time are one heavy brigade and a corps MLRS battalion. These assets were deployed from prepositioned (PREPO) afloat equipment sets. The Blue force is equipped with near-term equipment. While the OPFOR predominantly uses large quantities of low technology equipment (T-55 vintage), he is equipped with some precision munitions capability (both in large caliber MRLs and mortars).

5-7. Major Combat Systems Differences. Prior to wargaming the alternatives, the numbers of units and quantities of major combat systems were compared. These comparisons were to ensure that each alternative was properly employed in each of the respective scenarios, and to ensure that the mission tasks to subordinate units were feasible. There were differences in the organizations (primarily in reconnaissance units) and the quantities of major combat systems (with increases and decreases).

a. Figure 5-3 shows the quantity differences in major combat systems between the MOD HVY Division (armor division variant) and an AOE Armored Division.

System	AOE	MOD HVY	Difference
M1A1	317	317	0
M2A2	232	232	0
M3A2:			
Division Cavalry	41	66	+25
AT Companies	56	0	-56
AH-64	48	24	-24
155mm SP How	72	54	-18
MLRS	9	18	+9
120mm mortars	60	33	-27
HMMWV (BDE scouts)	0	60	+60

Figure 5-3. Major Combat Systems Differences

b. Engineer brigade. The supporting analyses reported in Chapter 3 did not address the engineer force structure in detail. As the result of a requirements review external to the DDA Phase I, the MOD HVY Division was designed with a combat engineer brigade having three direct support battalions, consisting of two line companies in each (this was modified after the validation analysis, to become two direct support battalions of three line companies each). The AOE Heavy Division had a combat engineer brigade with direct support battalions consisting of three line companies in each.

5-8. Europe (PW96) (Modified). This scenario will be used in the Command and General Staff College Prairie Warrior exercise. It is an unclassified training scenario developed under the auspices of TRADOC Pam 525-71, *Force XXI Division Operations Concept*. A brief description is provided:

a. Scenario. The battle consisted of five phases, as illustrated in Figure 5-4.

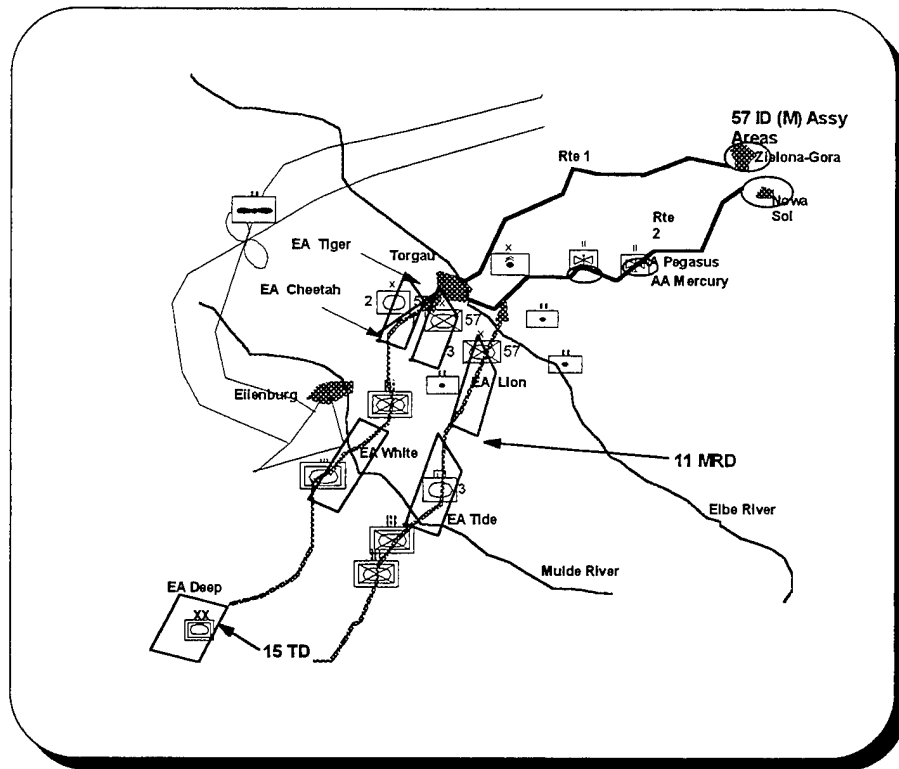


Figure 5-4. Europe (PW96) Modified Scenario

(1) The division mission consisted of the 57 Infantry Division Mechanized (M) attacking 130500Jul05 in zone to defeat the 11 MRD (motorized rifle division) and 15 TD (tank division) of the 1st Biscaynian Corps. On order, reconstitute and attack elements of the 2d Biscaynian Corps.

(2) Phase 1: (Movement) The 57 ID moved its two (AOE) / one (MOD HVY) divisional and two corps AHBs to assembly areas Pegasus and Mercury. The division's 3rd Brigade maneuvered to the Elbe River.

(3) Phase 2: (Elbe River Crossing) Army Tactical Missile System (ATACMS) and corps AHBs engaged the 15th TD in engagement area (EA) Deep. The 1st and 2nd Brigades crossed the Elbe River at Torgau and Belgern.

(4) Phase 3: (Attack) Multiple Launch Rocket Systems (MLRS) & two (AOE) / one (MOD HVY) AHB(s) engaged the Tank Regiment of 11th MRD in EA White.

(5) Phase 4: (Battle Handover) One battalion of 3rd Brigade defended against the lead motorized rifle regiment (MRR) of the 11 MRD. 1st & 2nd Brigade counterattacked into the remnants of that MRR and the Tank Regiment. An armor task force (TF) from 3rd Brigade conducted an economy of force mission in EA Tide.

(6) Phase 5: (Destroy 11 MRD) 3rd and 2nd Brigade moved to battle positions around EA Lion and defended against remnants of the eastern 1st and 2nd MRR.

b. Employment differences. Although both alternatives successfully accomplished the mission, there were differences in how they executed the mission tasks and in their conduct of decisive operations.

(1) In planning and fighting the battle, the AOE alternative used corps ATACMS Block I/II/IIA assets and the corps Attack Regiment (two AHBs), against the second echelon 15th TD, and corps and division MLRS fires and the two divisional AHBs against the first echelon 11th MRD. During the battle, when the two divisional AHBs attacked the 11th MRD, the division was halted and then engaged by corps MLRS units firing precision munitions. The simultaneous attack-in-depth used fires for the decisive operation.

(2) MOD HVY also attacked the 15th TD with ATACMS Block II and the Attack Regiment, but had only one divisional AHB to use with its MLRS against the 11th MRD. The 11th MRD was attrited, but not halted. Because the 11th MRD was not halted, its units moved through the engagement area before the corps MLRS battalions fired MSTAR (MLRS strategic artillery rocket) munitions. This OPFOR maneuver required the MOD HVY division to fight a close fight as the final decisive operation.

c. Results. The lethality and survivability performance of both alternatives were compared to determine if appreciable differences existed.

(1) Lethality. The Decisive Operations lethality results, in Figure 5-5, show several points. First, lethality results for both the USAF and Division + "slice" units each show greater contributions in the MOD HVY alternative than in the AOE alternative. These are indicators of the longer battle, and more intense close fight in the MOD HVY case. In the MOD HVY battle, there were more opportunities for those systems to affect the outcome. In another point, the figure shows a difference in the contributions made by corps assets. Here, there is a greater contribution in the AOE case, than in the MOD HVY case. The corps assets committed against the 15th TD were the same in both battles, but the larger corps contribution in the AOE case is attributable to the success of corps MLRS battalion fired MSTAR munitions against the 11th MRD. Again, this was possible because the 11th MRD was halted by the divisional AHBs and MLRS.

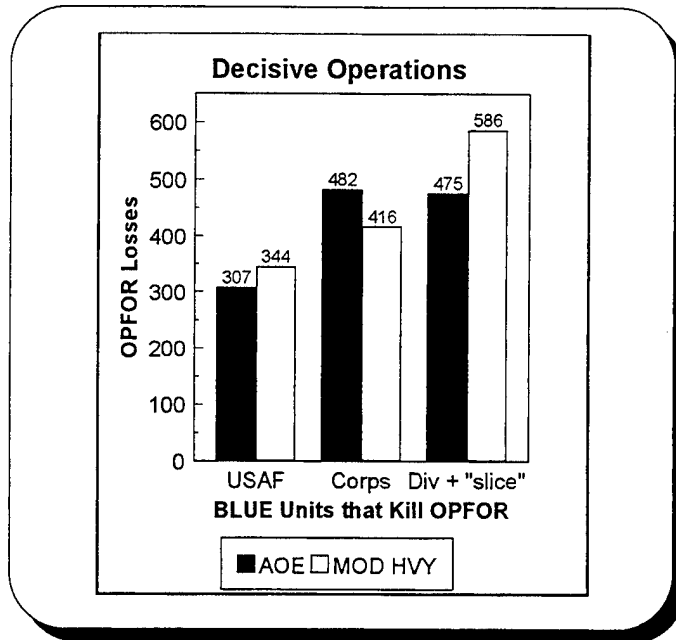


Figure 5-5. Decisive Operations for PW96

(2) Survivability. There were 17% more tank losses in the MOD HVY Division because of the increased close battle. Otherwise, as Figure 5-6 shows, there were no meaningful systems survivability differences between the two alternatives.

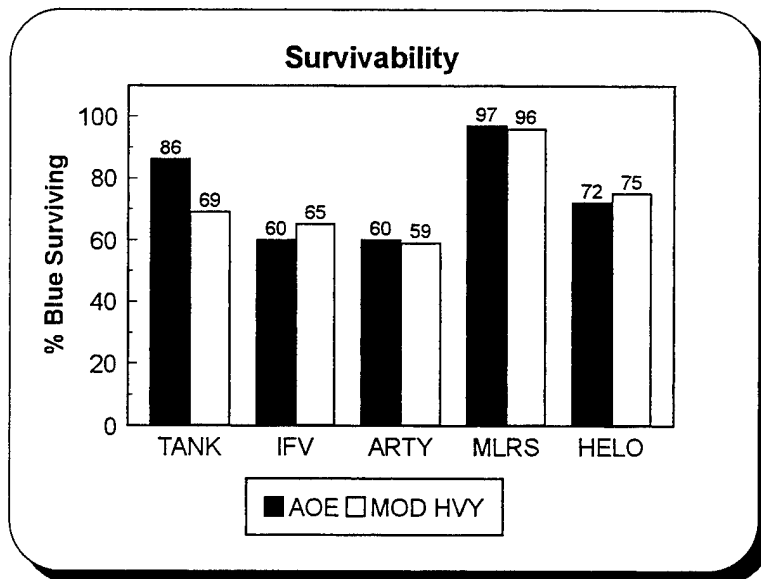


Figure 5-6. Survivability Results for PW96

(3) Loss Exchange Ratios (LERs). The LERs for the primary combat systems of tanks, infantry fighting vehicles (IFVs), artillery, air defense, and helicopters were 4.4 for the AOE Division and 4.5 for the MOD HVY Division. Figure 5-7 shows the MOD HVY killed slightly more OPFOR systems than the AOE case, but also incurred slightly more losses. Only minor differences were present in the end state of the battle between the two alternatives.

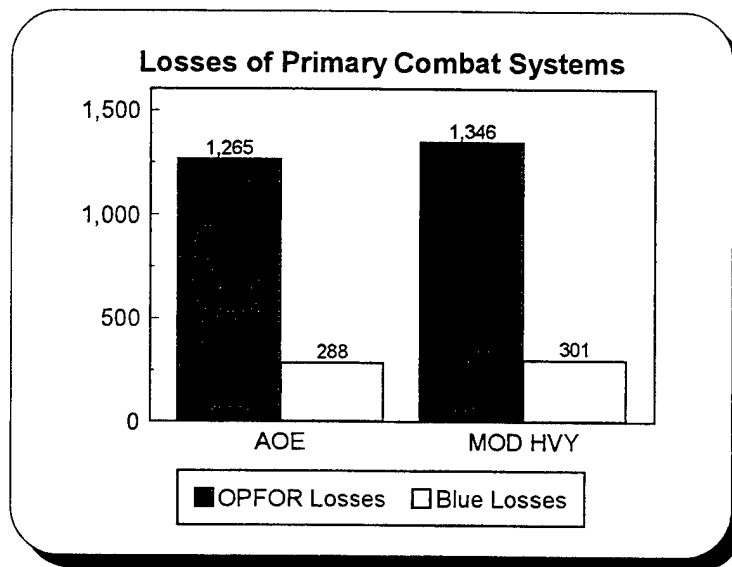


Figure 5-7. Primary Combat Systems Losses for PW96

5-9. SWA 4.2. SWA 4.2 is a standard TRADOC scenario which is classified. Appendix H (classified) contains the detailed explanation of the scenario, the operational concept, and the classified results.

a. **Employment differences.** Both division alternatives successfully accomplished the mission.

(1) The division operated in the context of a full corps (three heavy divisions, two armored cavalry regiments (ACRs), etc.). Strong corps augmentation greatly mitigated the effects of differences in quantities of divisional major combat systems.

(2) The MOD HVY division cavalry squadron, being larger than the AOE division cavalry, enhanced the exploitation of the attack. The division was able to press the attack more quickly than the AOE case.

(3) More MLRS was available for the counterfire battle in the MOD HVY Division (an 18 launcher battalion versus a 9 launcher battery). The additional MLRS provided the division with a greater counterfire capability, which increased the survival of Blue cannon artillery and allowed for increased cannon lethality (with SADARM) against threat armored vehicles. The MOD HVY did incur slightly more artillery system losses than the AOE case, due to the increase in artillery usage.

b. Results. There were no meaningful lethality or survivability differences between the two alternatives.

(1) Lethality. There were no meaningful differences in the battle end state. The AOE corps had a total of 2,875 kills while the MOD HVY corps had 2,894 kills. As shown in Figure 5-8, there are minimal differences in the quantities of OPFOR losses of major combat systems. The results for just the divisions' contributions to their respective corps fights show that the MOD HVY divisional assets killed a few more OPFOR systems than the AOE divisional systems (558 versus 533), but the overall effects were mitigated by the contributions of EAD assets.

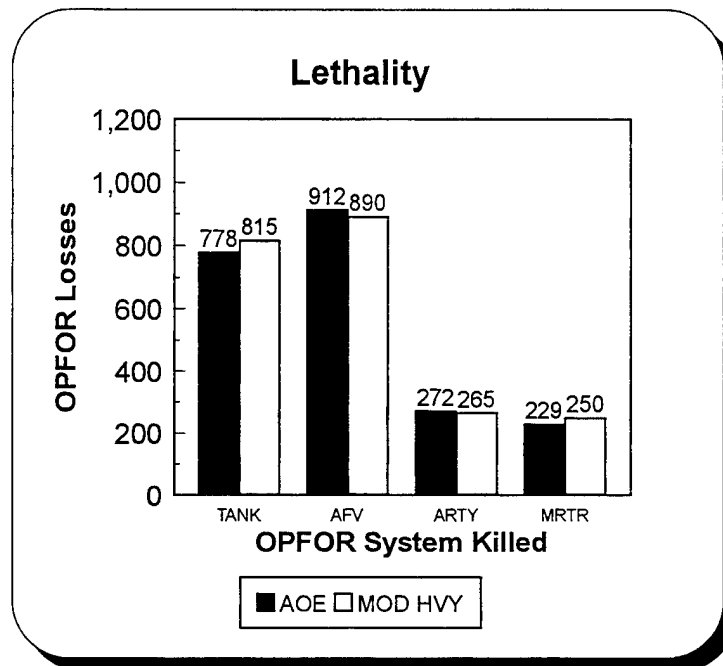


Figure 5-8. Lethality for SWA 4.2

(2) Survivability. Figure 5-9 shows that the alternatives did not have meaningful differences in the losses to divisional combat systems. The AOE division lost 407 primary combat systems, while the MOD HVY division lost 395 primary combat systems. The larger division cavalry of the MOD HVY design provided slight improvements in division cavalry lethality and maneuver battalion survivability. Since there were greater numbers of the division cavalry, they destroyed more opposing forces (OPFOR) which directly improved the maneuver battalions' survivability. However, the larger cavalry force also sustained greater losses, minimizing the differences in the division totals.

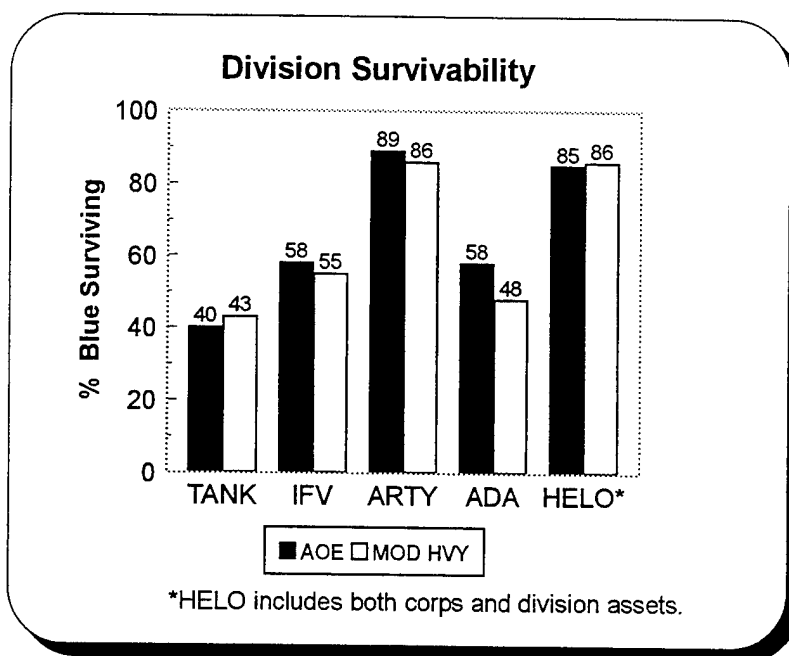


Figure 5-9. Survivability for SWA 4.2

5-10. NEA 2.1 (Modified). NEA 2.1 is a standard TRADOC scenario which is classified. For this analysis, the scenario was modified to include all units of the division designs and the limited corps augmentation. Appendix H (classified) contains a detailed explanation of the scenario, operational concept, and the classified results.

a. Employment differences. This scenario requires the defending Blue division to defeat a first echelon OPFOR corps, and be prepared to defeat his follow-on forces, a second echelon corps. Here, after destroying the first echelon corps, neither division alternative had sufficient strength to defeat the second echelon corps. More EAD artillery augmentation is needed before either alternative can successfully accomplish the mission.

b. Lethality. The scenario was dominated by the artillery battle. The increased MLRS in the MOD HVY Division created some changes in the battle.

(1) More MLRS increased the effectiveness of the Blue counterfire battle. Figure 5-10 shows the MOD HVY alternative had more kills of both OPFOR cannon and MRL artillery systems.

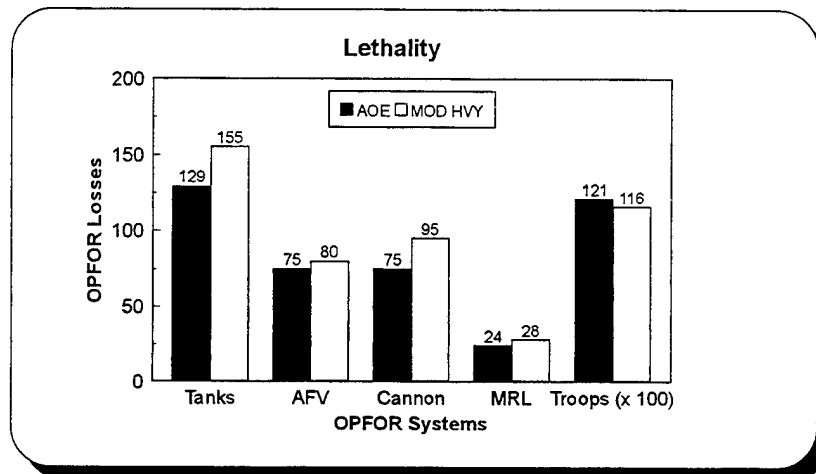


Figure 5-10. Lethality for NEA 2.1 (Modified)

(2) In the MOD HVY design, the additional MLRS provided a greater counterfire capability which increased the survival of Blue cannon artillery. This in turn enabled Blue cannon artillery to increase its effectiveness against OPFOR tanks using SADARM. This accounted for most of the increase (from 129 to 155) in OPFOR tank losses.

(3) In this scenario, the mission, enemy, terrain, troops, and time available (METT-T) conditions (for type of enemy, amount of air defense, and terrain) caused the AHBs to be used primarily for fire support (versus an anti-armor role). Consequently, the additional AHB in the AOE division could not be exploited.

b. Survivability. The increase in MLRS systems of the MOD HVY design resulted in survivability improvements for the division. As shown in Figure 5-11, the MOD HVY was able to use its MLRS to achieve more artillery kills of OPFOR artillery, which enhanced Blue infantry fighting vehicle (IFV) survivability by 7%. Further, as the OPFOR committed more artillery against MLRS, it had fewer resources to expend against other systems. This especially enhanced the survivability of Blue ADA systems.

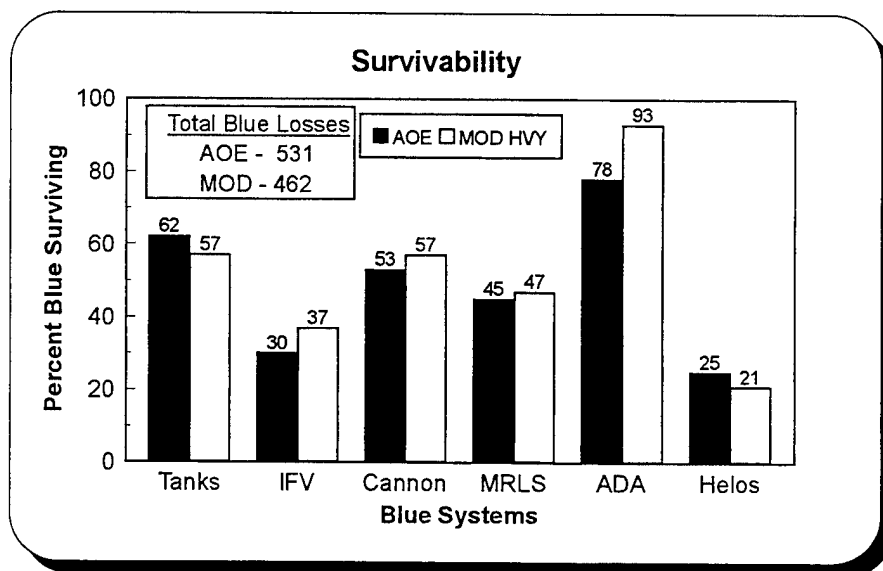


Figure 5-11. Survivability for NEA 2.1 (Modified)

5-11. Summary of DDA Validation Findings. There were several findings gained by comparing the two alternatives.

a. The MOD HVY and AOE Divisions had comparable levels of mission success across the spectrum of scenarios examined.

b. The differences in quantities of divisional systems created some variations in tactical employment, but there were no overall differences in Blue force outcomes.

c. Corps augmentation is critical to either division design in high intensity combat operations. When the corps provides appropriate augmenting forces, it mitigates the differences between the AOE Division and the Modernized Heavy Division.

d. The larger quantity of MLRS in the Modernized Heavy Division provided more effective counterfire capability, increasing the survival of Blue artillery and, subsequently, allowing a more efficient cannon artillery capability in all scenarios.

5-12. Conclusions.

a. The MOD HVY Division can perform the operations described in TRADOC Pam 525-71, *Force XXI Division Operations Concept*.

b. The MOD HVY Division is suitable for further analysis and experimentation as the Interim Division Design.

APPENDIX A

GLOSSARY

THIS PAGE INTENTIONALLY LEFT BLANK.

GLOSSARY

AAG	Army Artillery Group
AC	active component
ACR	armored cavalry regiment
ADA	air defense artillery
AF	Air Force
AGRA	Army Group Rocket Artillery
AGS	armored gun system
AHB	attack helicopter battalion
AOE	Army of Excellence
AOME	attack of a moving enemy
ASAS	all-source analysis system
ATACMS	Army Tactical Missile System
A2C2	Army airspace command and control
AWC	Army War College
BCTP	Battle Command Training Program
BDA	Brigade Design Analysis
BLITCD	Battle Laboratory Integration, Technology, and Concepts Directorate
CAMEX	computer assisted map exercise
CASCOM	Combined Arms Support Command
CASTFOREM	Combined Arms and Support Task Force Evaluation Model
CCIR	commander's critical intelligence requirement
CENTCOM	Central Command
CGSC	Command and General Staff College
CG	Commanding General
CINC	commander-in-chief
COA	course of action
COMPASS	Computerized Movement Planning and Status System
CS	combat support
CSS	combat service support
C2	command and control
C3I	command, control, communications, and intelligence
DDA	Division Design Analysis
DISCOM	division support command
DIVARTY	division artillery
DS	direct support
DSB	division support brigade
EAC	echelon above corps
EAD	echelon above division
ECF	Equipment Characteristics File

EEA	essential elements of analysis
ERI	Engineering Restructuring Initiative
FAAD	forward area air defense
FDD	Force Design Directorate
FORSCOM	Forces Command
FSV	future scout vehicle
FW	fixed wing
FY	force year
GBCS	ground-based common sensors
GS	general support
HHC	headquarters and headquarters company
HIMARS	high-mobility artillery rocket system
HL-SB	Heavy/Light-Small Base Division
HMMWV	high-mobility multi-wheeled vehicle
HVY	heavy
ID	Infantry Division
IFV	infantry fighting vehicle
JFLCC	Joint Forces Land Component Commander
JSEAD	joint suppression of enemy air defense
LAM	Louisiana Maneuvers
LER	loss exchange ratio
LIN	line item number
LT	light
M	mechanized
METT-T	mission, enemy, troops, terrain and weather, and time available
MEU	marine expeditionary unit
MI	military intelligence
MLRS	multiple-launch rocket system
MOD	Modular Division
MOD HVY	Modernized Heavy Division
MRD	Motorized Rifle Division
MRR	Motorized Rifle Regiment
MSF	Mobile Strike Force
MSR	main supply route
MSTAR	MLRS smart tactical rocket
MTMC	Military Traffic Management Command
MTMCTEA	Military Traffic Management Command Transportation Engineering Agency

NAI	named area of interest
NBC	nuclear, biological, and chemical
NEA	Northeast Asia
OOTW	operations other than war
OPCON	operational control
OPFOR	opposing forces
OPLOGPLN	Operations Logistics Planner
POL	petroleum, oil, and lubricants
POM	programmed objective memorandum
PW	Prairie Warrior
RC	reserve component
RISTA	reconnaissance, intelligence, surveillance, and target acquisition
SADARM	sense and destroy armor munitions
SME	subject matter expert
SMR	Senior Military Review
SRC	standard requirement codes
STONS	short tons
SWA	Southwest Asia
TAA	tactical assembly area
TAB	target acquisition battery
TAI	targeted area of interest
TARGET	Transportability Analysis Reports Generator
TD	Tank Division
TF	task force
TOE	table of equipment
TPFDL	time-phased forced deployment list
TRAC	TRADOC Analysis Center
TRADOC	Training and Doctrine Command
UAV	unmanned aerial vehicle
UAV-CR	unmanned aerial vehicle - close range
U.S.	United States
VIC	Vector-in-Commander
VRI	Vector Research Institute
WSMR	White Sands Missile Range

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX B

FRONT-END DIFFERENCES ASSESSMENT

Disclaimer: The alternative division designs evolved during analysis. This assessment was based upon a snapshot of the designs as of 1 October 1995.

Table of Contents

	<i>Page</i>
1. Purpose	B- 5
2. Background. Division re-design guidance	B- 5
3. Alternative division designs	B- 5
4. Identifications of differences that should be analyzed through constructive simulation	B- 5
5. Identification of differences that should be analyzed by means other than constructive simulation	B-14
6. Issues	B-16
7. Resolution of division operational concept	B-16
8. Conclusion	B-16

List of Figures

	<i>Page</i>
Figure 1. Heavy/Light - Small Base Division	B- 6
Figure 2. Brigade Based Division	B- 8

List of Tables

	<i>Page</i>
Table 1. Comparison of major Combat Systems for Alternative Designs	B- 9
Table 2. Comparison of major Combat Systems for AOE Units	B- 10
Table 3. Task Organization Comparisons	B- 11

Front-End Differences Assessment

1. Purpose. The Force XXI Division Design Analysis is being performed in two phases. Phase I supports the Interim Division Design selection, and Phase II then continues until the Final Division Design Decision. To support the Phase I analysis, this Front-End Differences Assessment is provided to ensure the critical design differences are identified, suitable methodologies are developed for determining the magnitude of those differences, and analyses of those differences are accomplished in time to support the appropriate design decisions.

2. Background. The current US Army of Excellence (AOE) structure was primarily developed to meet a particular threat, the former Soviet Union. With the change in the world order, and the subsequent downsizing of the US Army, it is necessary to examine if, and how, the organizations in the US Army should be modified to provide the most efficient force possible. Accordingly, CG, TRADOC has given the following guidance:

- a. The division organization will be the focus of the re-design effort.
- b. The re-design effort will include all divisions except those with unique mission designs (the two light infantry divisions, the airborne division, and the air assault division).
- c. The re-design effort will focus on operations that fall in the mid-to-high intensity portion of the spectrum of combat operations. (Operations, such as Haiti, Rwanda, etc., will most often fall to the light infantry divisions).
- d. The terrain these divisions must operate in will most likely include areas featuring combinations of close and open terrain (such as most of Europe, Bosnia, and many portions of the Middle East and Africa). Further, it is anticipated the future divisions will operate in non-contiguous battlefields, without clearly defined front, rear, and flank areas.
- e. These divisions will be appropriately tailored to meet the METT-T conditions. Regardless of the basic design of the division, any future deployed force package will have the proper forces to meet the requirements of the contingency mission. (For example, a division deployed to fight in the open terrain of SWA would be an armor heavy division.)
- f. The design of the division must support a force projection Army. It must be rapidly tailorable, to include the capability of pre-deployment task organization.
- g. The design should maximize the potential of digitization of systems within its organic units.
- h. The divisions of the future will continue to operate in the context of a corps.
- i. The exact missions and functions performed at the different echelons of organization are under review. However, the divisions will use the operational concept described in TRADOC Pam 525-XX (draft, dated 19 August 1995) Force XXI Division Operations Concept.
- j. The Interim Division Design will be one of the new alternatives, and analysis of that design will continue until the Final Design Decision.

3. Alternative division designs. Note: The alternative division designs evolved during analysis. This assessment was based upon a snapshot of the designs as of 1 October 1995.

- a. AOE divisions. This analysis will use the force structure that exists in today's AOE divisions as its base case(s). However, comparisons between alternative designs and AOE divisions will

not be made one-for-one. The fundamental concept that deployed Force XXI divisions will be tailored to meet specific METT-T conditions precludes the direct comparisons of the basic division designs under totally general conditions. Further, for the "heavy" divisions that are the focus of the re-design effort, there are different types of AOE division structures (armor and mechanized infantry). Under the assumption the division that fights (real world or simulation) is tailored to METT-T conditions, it is unrealistic to suppose that a Heavy/Light Small Base Division (as described below) would be blindly plugged into a situation requiring, say, a division with two mechanized infantry brigades and one armor brigade (today's mechanized infantry division). Either of the new division design alternatives would be tailored to meet the conditions.

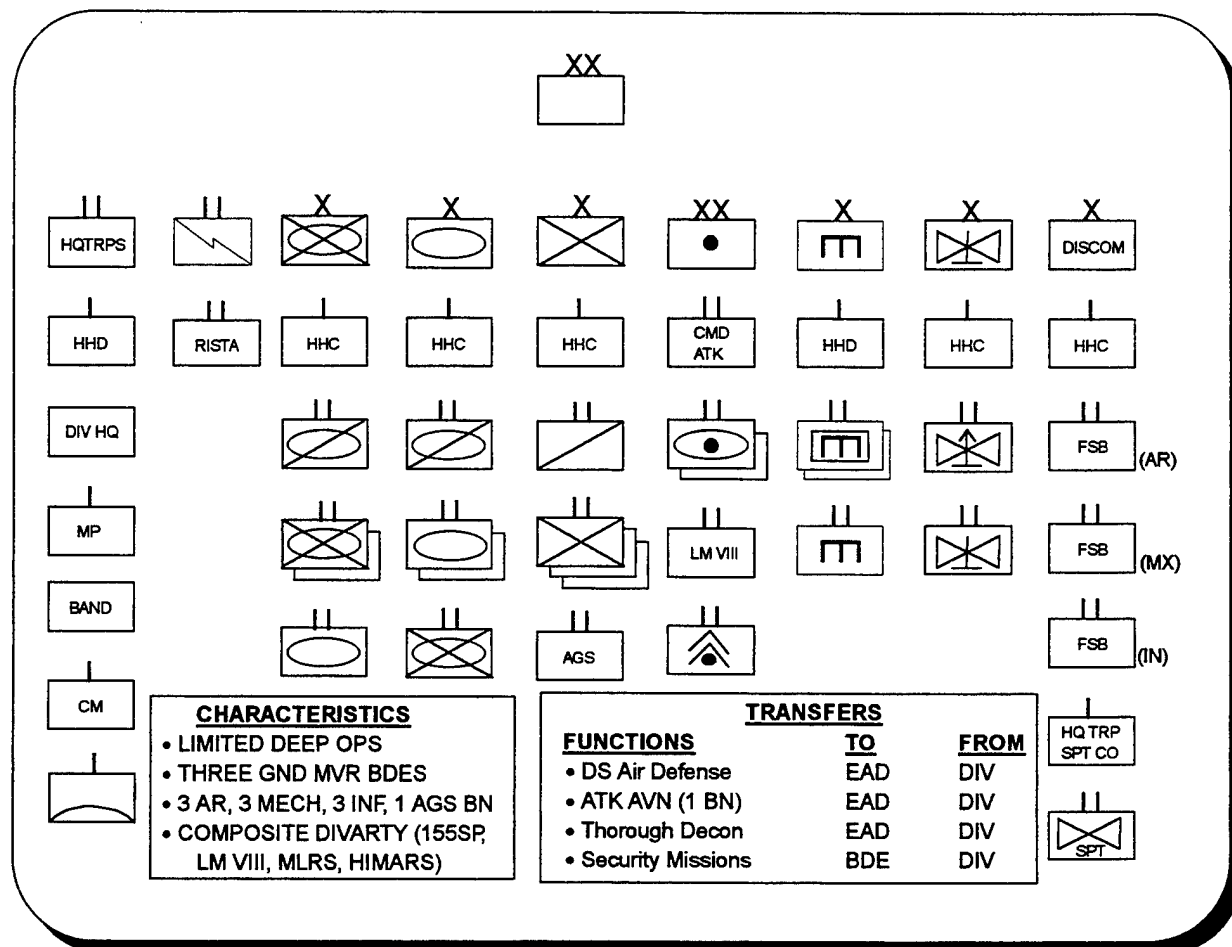


Figure 1. Heavy/Light - Small Base Division

b. Heavy/Light - Small Base division. The division, shown in figure 1, is designed to be more flexible and more modular than today's AOE division. The principle characteristics of this division are the mix of mounted (heavy) and dismounted (light) units within the same force structure. The division design gives it the capability for decisive operations, with limited deep operations capability. In this design alternative, the principle maneuver organizations are the brigades. Each brigade has an HHC (with organic MI assets), cavalry squadron with reconnaissance and security mission capabilities, and a mix of armor and infantry battalions.

The tank and mechanized infantry battalions differ from AOE battalions, as they have three line companies, instead of four. The armor battalions have a total of 45 tanks, which is down from the 58 tanks in an AOE battalion. The mechanized infantry battalions, because they have increased the number of platoons in a company from three to four, have nearly the same number of IFVs, 56, as the AOE mechanized infantry battalions, 54. The infantry brigade has three infantry battalions and one battalion of AGS. Each brigade has a cavalry squadron for reconnaissance and security missions. Consideration of non-linear, non-contiguous operations led to the addition of these cavalry units to the brigades.

The quantity of field artillery systems in this design differs only slightly from the AOE divisions. Each brigade, whether armor, mechanized infantry, or infantry, has a direct support artillery battalion. For the near term, this is to be 3x8 M109A6 155mm SP howitzers for the armor and mechanized infantry, and a light TBD caliber for the infantry brigade. For future designs, a 3x6 Crusader battalion is to be the direct support artillery system for the armor and mechanized infantry brigades. The heavy brigades direct support artillery systems are the same for the new, modular alternatives and the AOE divisions. However, in the area of MLRS, the Heavy/Light division increases the MLRS organization from a 1x9 battery (AOE), to a 3x6 battalion. This increases the total number of MLRS launchers from 9 to 18 the Heavy/Light division also includes a 1x6 HIMARS battery for early deployment force packaging. In the area of attack aviation capability, the division has one attack helicopter battalion of 15 AH-64 and 9 RAH-66. This is a reduction from the two battalions authorized in AOE heavy divisions. However, the overall impact of this change is somewhat mitigated, because the required fill for attack helicopter battalions is two, but the authorized fill is one. Therefore, there is a difference in total numbers of battalions, but the magnitude of that disparity will be lessened in fielding the force.

c. Brigade Based division. The Brigade Based design, shown in figure 2, is designed to provide the division with the flexibility to perform missions across the spectrum of conflict in any type of terrain. The Brigade Based division attains this capability through the assignment of specifically required brigade force packages. Under this concept, the division echelon is focused on battle command and it is capable of commanding a variety of subordinate brigade-sized units. The brigades come as "self-contained" packages that have some of the AOE CS and CSS elements (which are typically found in the division) embedded in the brigade. The remaining CS and CSS elements are moved to separable, task organized brigades, or moved to corps and EAC levels. These elements, when needed, are drawn from the force pool in specific task organized packages. For the most part, the major differences between this design and the Heavy/Light - Small Base division is the determination of whether specific elements are organic to the brigades, or to the divisions.

This design focuses the division echelon on battle command, and seeks to disencumber the division base by leveraging the operational support structures at EAD. When comparing the combat capabilities of the maneuver brigades in this design with those in the Heavy/Light - Small Base division design, it can be seen that the numbers of systems are nearly identical. This

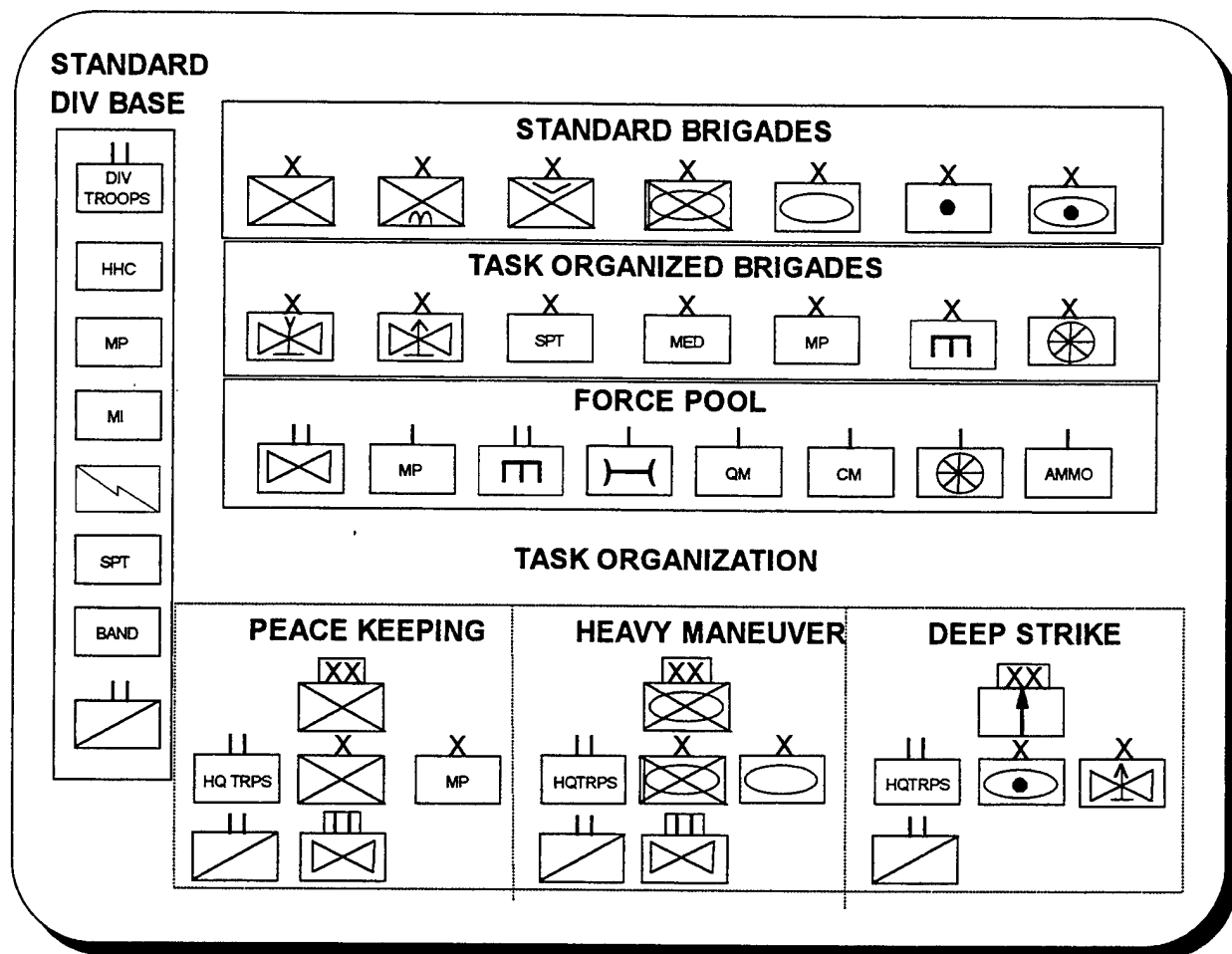


Figure 2. Brigade Based Division

similarity exists because the battalion "building blocks" are the same for both designs. However, making the brigades self-contained, modular packages, creates levels of functional redundancy in the CS and CSS areas. For a specified force package (say one requiring armor, mechanized infantry, and infantry brigades), this results in the overall personnel strength of a Brigade Based division being larger than that of the Heavy/Light - Small Base division design, with no accompanying increase in combat capability.

4. Identification of differences that should be analyzed through constructive simulation.

a. Differences in combat systems for the Brigade Based division and Heavy/Light - Small Base division. Tables 1 and 2 list the quantities of major combat systems in the brigades of the alternative designs. There are minimal differences in the types and numbers of major combat systems between the Heavy/Light - Small Base division and Brigade Based divisions, due to the fact that the brigade "building blocks" are composed of identical armor, mechanized infantry, and infantry battalions. The differences are in the support packages that become part of the "modular package" of the self contained brigade.

Table 1. Comparison of major Combat Systems for Heavy/Light - Small Base and Brigade Based Designs							
System	Div Cav	Mech Bde	AR Bde	In Bde	Avn Bde	Div Arty	Div Troops
M1 MBT		63	108				
AGS				77			
M2 BfV		112	56				
M3 CFV/FSV(H)		55	65				60
HMMWV/FSV(L)		20	10	47			
Dismounts		600	300	1,248			
M109A6/Crusader		*	*			48	
DS (Lt Bde)				*		18	
MLRS						18	
HIMARS						6	
ITV/LOSAT		24	12				
TOW				36			
AH-64					15		
RAH-66					9		24
Avenger							12
BSFV							
MANPADS							6
120mm Mortars		18	9				
81mm Mortars				12			

* Note: Under the Brigade Based design, the DS artillery units are organic to the brigades. The heavy brigades have 24 M109 howitzers and the infantry brigades have 18 towed howitzers. Under the Heavy/Light - Small Base design, all artillery is in the DIVARTY.

Table 2. Comparison of major Combat Systems for AOE Units							
System	Heavy Div Cav	Mech Bde	AR Bde	In Bde	Avn Bde	Div Arty	Div Troops
M1 MBT	27	58	116				
AGS		108	54				
M2 BFV		116	58				
M3 CFV/FSV(H)	40						
HMMWV/FSV(L)		30	30				
Dismounts		616	308	1,770			
M109A6/Crusader						72	
M119 (DS)						54	
MLRS						9	
HIMARS							
ITV/LOSAT		24	12				
TOW				12			
AH-64					30		
RAH-66	24				18		
Avenger							36
BSFV							24
MANPADS							
120mm Mortars		18	18				
81mm Mortars				12			

b. Table 3 lists the major combat systems organic to the alternative designs (including the base case AOE divisions), when the divisions are task organized to meet a particular threat. The task organizations depicted are mechanized infantry division, armor division, and a composite division (armor, mechanized infantry, and infantry brigades). The following observations can be made:

(1) When the alternative divisions are task organized as mechanized infantry and armor divisions, several trends exist. The number of main battle tanks is decreased by about 10 percent (from AOE to alternative). However, the new alternative designs have a factor of four increase in the number of scout vehicles. This is directly attributable to the inclusion of a cavalry squadron in each brigade. Another difference is the alternative designs have more organic MLRS/HIMARS than the AOE divisions. In aviation, the AOE divisions have more AH-64 and RAH-66 platforms than the new designs, attributable to the decrease in the number of attack helicopter battalions from two to one. The new designs have different amounts of organic ADA, whether Avenger or

BSFV. The Heavy/Light - Small Base division design has an ADA battery, while the Brigade Based division has an ADA battery in each brigade. The AOE division has an ADA battalion as a direct support element. The new designs also have fewer total numbers of 120mm mortars, due to the armor battalions deleting their requirements for this system.

Table 3. Task Organization Comparisons						
	Mech Div (2 MX + 1 Ar)		Ar Div (2 Ar + 1 MX)		Composite Div	
System	Alt Design	AOE	Alt Design	AOE	Alt Design	AOE
M1 MBT	234	259	279	317	171	201
AGS					77	
M2 BFV	280	270	224	216	168	162
M3 CFV/FSV(H)	235	37	245	37	180	37
HMMWV/FSV(L)	50	90	40	90	77	60
Dismounts	1,500	1,540	1,200	1,232	2,148	2,694
M109A6/Crusader	72	72	72	72	48	48
DS (Lt Bde)					18	18
MLRS	18	9	18	9	18	9
HIMARS	6		6		6	
ITV/LOSAT	60	60	48	48	36	36
TOW					36	12
AH-64	15	30	15	30	15	30
RAH-66	33	42	33	42	33	42
Avenger	12	36	12	36	12	36
BSFV		24		24		24
MANPADS	6		6		6	
120mm Mortars	45	54	36	54	27	36
81mm Mortars					12	12

(2) For the light infantry division requirement, a comparison of differences is more problematic than practical. Under the design assumptions described above, the two light infantry divisions in the active component are not to be affected by this division re-design. Consequently, if there is a mission requirement for a light infantry division, one of those two divisions will be used, regardless of the design of the six divisions being reviewed. If there is a need for an additional (if the airborne and air assault divisions are excluded) light infantry division, the Heavy/Light division and the Brigade Based alternative can provide the force requirement, but the AOE alternative does not have existing forces to accomplish that task. The AOE alternative would require one of the mechanized infantry divisions to task organize with another heavy division, to obtain three mechanized infantry brigades. Then, that task organized unit would have to deploy without its infantry fighting vehicles. Because this is not an intended utilization of the re-designed forces, comparisons of light infantry division alternatives will not be made.

(3) When task organizing an AOE mechanized infantry division to give it a composite, or Heavy/Light mission capability, one mechanized infantry brigade is replaced by an infantry brigade through task organization. Some of the differences mentioned in b.(1), above, reappear. When comparing the task organized AOE mechanized infantry division to the Heavy/Light division, the following differences exist: the alternative division has approximately 10 percent fewer tanks than the task organized AOE division; the new alternative has organic AGS support (77 systems) for its light infantry, while the AOE does not; the new design has much more ground reconnaissance capability than the AOE structure (160 more future scout vehicles); the AOE structure has more dismounted infantry; the new design has more MLRS/HIMARS than the AOE structure; and the AOE structure has more attack aviation assets. The mission requirement for composite forces creates the greatest number of differences between new and AOE designs, and they will be investigated with simulation gaming.

c. In comparing both alternative designs to AOE designs, one obvious change is the deletion of the AOE division cavalry squadron and the addition of three brigade ground cavalry squadrons. This significant change is driven by the requirement to operate in non-contiguous battlefields. This change affects both the division and the brigade at the tactical level. It requires changes in tactics, planning for the collection and use of reconnaissance information, security operations, and timeliness of information. Use of constructive simulations are planned for analysis of this change. This change will require both high and low resolution gaming. Further, it also requires that different tactics are used for AOE and new alternative divisions, because there are more units and a large difference in the reconnaissance capabilities at the brigade level. (This is more important to the subsequent discussion of timelines.)

d. Another change is the reduction from two attack helicopter battalions to one. This may, or may not impact gaming, depending upon the assumption of what happens to those attack helicopter battalions. Assuming the battalions are pooled as a corps-level asset, and if it is further assumed that mission requirements dictate that the corps commander OPCON one attack battalion back to the division, then there is no effective change. However, if the corps commander chooses to use the "new" attack helicopter regiment to weight the battle, there would most likely be appreciable changes. Constructive simulation is planned to investigate this difference.

e. Another change is in the type and number of artillery systems. The AOE mechanized infantry division has 72 M109A6 155mm SP howitzers and 9 MLRS launchers. Each AOE heavy brigade has a 3x8 direct support battalion. The new division alternatives also have 3x8 direct support battalions for the heavy brigades, when the howitzers are M109A6s. These are reduced to 3x6 battalions when the artillery systems are upgraded to Crusader. For MLRS there is a change from 9 MLRS launchers to 18 MLRS launchers plus 6 HIMARS launchers. The critical question for analysis of these differences is how augmentation by corps assets will be accomplished. If the corps structure is fixed for both AOE and alternative division designs, then the performance of the new division designs will reflect an increased capability. This will be due to an increase in the total number of systems engaged in the corps area. If the total number of field artillery systems in theater is constant for all alternatives (fewer corps assets available to the new designs) then the difference will be minimized. The minimization occurs because artillery is not held in reserve, so whether the assets belong to division or corps, the systems will be used. Any differences that do appear will most likely be due to differences in the task organization (timing and types of missions) of the EAD artillery assets supporting the division mission.

One area that may reflect a difference concerns the presence of HIMARS in the alternative designs, and its absence in the AOE design. In the proper scenario, the deployability of HIMARS should give the modular division and the Brigade Based division an advantage over the AOE division. A "proper scenario" is one that is sensitive to early entry capabilities.

f. Another difference affects the tactical employment of maneuver units at the battalion level. In the Heavy/Light division and Brigade Based division, the armor and mechanized infantry battalions have three line companies. Because the AOE divisions have four companies per battalion, the battalion tactics may need to be different. Further, because the armor battalions in the new alternatives do not have organic mortars, the fire support available to cross attached mechanized infantry companies will be affected. The mechanized infantry battalions have increased their number of organic mortars from 6 to 9, to allow for one 3 mortar section to be cross attached with each line company. However, this is still less than the 6 mortars in the AOE armor battalions. Analysis of the differences in armor and mechanized infantry battalions should be done in constructive simulation.

Another difference exists in the construct of the companies in the battalions. The AOE mechanized infantry and armor battalions "match up" (same number of cross attachable elements - size of platoons, number of platoons, number of companies) with:

	vehicles	PLTs	CO HQ	COs	BN HQ	TOTAL
IN	(((4	* 3)	+ 2)	* 4)	+ 2	= 58
AR	(((4	* 3)	+ 2)	* 4)	+ 2	= 58

However, the alternative designs have mismatched numbers of platoons:

	vehicles	PLTs	CO HQ	COs	BN HQ	TOTAL
IN	(((4	* 4)	+ 2)	* 3)	+ 2	= 56
AR	(((4	* 3)	+ 2)	* 3)	+ 3	= 45

These differences mean that the tactics employed for the base case must be different than the alternative cases, regardless if brigade or battalion resolution.

g. Another difference between the AOE divisions and the alternative designs is in the area of organic ADA systems. Comparison of the numbers of organic ADA systems in the AOE "heavy" divisions (armor or mechanized infantry) and the new alternatives show differences in the number of available systems. For the situation requiring a composite task organization (division with armor, mechanized infantry, and infantry brigades), the Heavy/Light division has a composite ADA battery with 12 Avenger and 6 MANPADS systems. For the same situation, using the Brigade Based design, there are 16 BSFV, 20 Avenger, and 22 MANPADS. The AOE heavy divisions have an ADA direct support battalion with 24 BSFV and 36 Avenger. These differences could lead to an immediate presumption that operational performance will be affected whenever there is a meaningful air threat. However, analysis of ADA capability requires that one of two possible assumptions about the supporting corps forces be made.

(1) Assuming that the structure of the corps forces is the same for AOE and the new alternative designs, fewer systems implies a risk decision. If a new alternative division design is deployed to a contingency theater where METT-T dictates that the ADA capability necessary to protect the force is at the level associated with the AOE design, then additional systems and units must be provided from corps. Thus, the overall operating capability for all designs is equal, but the flexibility remaining at corps is reduced, because they have been required to provide assets to the subordinate divisions. If the METT-T conditions dictate that ADA capabilities at the level of the Heavy/Light division is the requirement, then the alternative designs make more efficient use of the ADA systems.

(2) Assuming that the structure of the corps forces is different for the alternatives, and that the total amount of ADA systems in the contingency theater is the same for all alternatives (smaller amount of corps assets for AOE than for new alternative designs), then it no longer implies a risk decision, but a command and control problem. The amount of protection to be provided to the division is the same for all alternatives; however, this will require different amounts of coordination for the various alternatives.

5. Identification of differences that should be analyzed by means other than constructive simulation.

a. Differences in MI/RISTA organizations. The AOE divisions and the new alternatives differ in the structure of their MI, or RISTA organizations. The current AOE divisions have a MI battalion as part of the division troops. For the new division design alternatives, the division troops include a RISTA battalion. This new organization includes an MI company, but also

reconnaissance elements similar to a divisional cavalry organization. As the value of reconnaissance is not the strong point of the constructive simulations, this will be best analyzed by another method. Along similar lines, the Information Operations organization is currently too immature to provide assessment of differences by constructive simulation.

b. Differences in modularity. For the DDA, MTMC Transportation Engineering Agency is providing a detailed deployability analysis. However, as an early assessment, there are unique characteristics in each design. The Force XXI divisions will be part of a force projection Army, and as such, they must be rapidly tailorable to specific missions required by METT-T conditions. With a CONUS based force, it is imperative that the Force XXI divisions have the capability for early deployment of lethal systems. Also, propositioned equipment (including propositioned afloat) will be available to the divisions. For a contingency operation requiring rapid deployment of forces, the following considerations are made, comparing each of the alternative designs to the current AOE structure:

(1) AOE divisions compared to Heavy/Light - Small Base Divisions. For the AOE divisions, early deployment would routinely be followed by heavy forces. This will generally require units from a light division (light infantry or airborne infantry) to make the early deployment, with follow-on forces from a heavy division being deployed as quickly as transportation assets permit. The heavy forces will prioritize the deployment of its systems, to build combat power as quickly as possible. However, with multiple AOE divisions, coordination may be needed to prioritize the deployment of assets between the divisions involved. Upon arrival in theater, the units would most likely remain as separate divisions, but not necessarily. Assets could be task organized under a single division flag. In either case, coordination between the dissimilar units must be made to ensure success. For the Heavy/Light divisions, this kind of deployment would be handled within the division structure. The light infantry brigade would most likely lead the early deployment, to be followed by heavy brigades. Within the division, systems and units would be prioritized for deployment, reducing the need for external coordination. Further, upon arrival in theater, the units would fall under their normal divisional command and control structure.

(2) AOE divisions and the Brigade Based design. For the Brigade Based design, the division is always to be task organized to meet METT-T conditions. Consequently, this design may be the easiest to identify for mission requirements, but the nature of its design may make it the most difficult to deploy. Within both of the division based alternatives, the capability exists for the division to prioritize which systems, or units go first. This frequently leads to partial unit fills in the contingency theater. Under the Brigade Based design, the brigades deploy as brigade packages, and depending upon the amount of transportation assets available, this could lead to a more sequential buildup of combat power than the division based designs. This comparison requires an assessment of the ability to stand up a brigade combined arms team, versus prioritized selection of division-wide assets for special task force employment.

c. Training.

(1) Heavy/Light - Small Based Division. There is a need for increased emphasis on heavy / light training integration at the division level. Past experiences with heavy / light training exercises

within a brigade have exposed a number of special training, sustainment, and employment considerations. Building a composite division raises that problem to an even higher level of difficulty. Another area is the need to increase training in task organization between divisions. The need to task organize prior to deployment means that more training emphasis will need to be placed in this area. Lastly, there is a need for standard brigade and division standard operating procedures, to facilitate task organization requirements.

(2) **Brigade Based design.** There is a need for standardized training and performance standards US Army - wide. The mission to task organize for deployment may require division headquarters to link-up with brigades from anywhere in the CONUS. Hence, it is imperative that all brigades of a particular type have the same staff functional interfaces. Similarly, execution of operational procedures must be consistent from brigade to brigade, to ensure proper utilization and overcome the loss of habitual relationships.

d. **Items not reflected in constructive simulation.** Both the CSS and Battle Staff structures for the design alternatives will be analyzed as independent efforts, then "overlaid" onto the interim division design. The CSS concept and support structure are undergoing concurrent redesign. The forward support battalions (logistic battalion) will be tailored to the type of brigades being supported. For the Brigade Based alternative, it will belong to the brigade, vice the divisions in the other two designs. For battle command, the division design alternatives are not being developed with distinct Battle Staff structures.

6. Issues. To focus the DDA, a set of critical issues were identified, with a dendritic breakdown. See Appendix A, Force XXI Division Design Analysis Issues and Sub-Issues.

7. Resolution of division operational concept. There are several areas of the division operational concept that must be resolved before the designs can be fully analyzed. These areas are concerned with definition of functions by echelon. Some of the conceptual areas are:

a. **Resolution of Deep Operations.** "How deep is the division expected to operate?" "What is the desired mix of FA and aviation systems?" "What is the corps role in deep operations?"

b. **Resolution of reconnaissance and security responsibilities.** Besides the tactical employment (mentioned above), the handling of the intelligence.

c. **Information operations and digitization.** Area very immature.

8. Conclusion. DDA will have constructive simulation to support the interim Division Design decision. Further, much more simulation will be required in Phase II, as the selected design is refined (plus sensitivity analyses). The branch proponents have each provided a number of alternative designs for their respective units; however, those were developed independently of the efforts of other branch proponents. Consequently, a large amount of high resolution investigation is anticipated for the later stages of this analysis.

APPENDIX C.
SENIOR MILITARY REVIEW

This page intentionally left blank.

Table of Contents

EXECUTIVE SUMMARY.....	C-7
1.0 INTRODUCTION.....	C-15
1.1 SEMINAR PURPOSE.....	C-15
1.2 BACKGROUND.....	C-15
1.2.1 DIVISION DESIGN ANALYSIS OVERVIEW.....	C-15
1.2.2 DESCRIPTION OF ALTERNATIVE DIVISION DESIGNS.....	C-17
1.3 SUMMARY.....	C-24
2.0 METHODOLOGY.....	C-25
2.1 PROCEDURES.....	C-25
2.2 PATTERNS OF OPERATION.....	C-25
2.3 SCENARIOS.....	C-27
2.3.1 SOUTHWEST ASIA SCENARIO.....	C-27
2.3.2 PRAIRIE WARRIOR 1996 EUROPEAN SCENARIO.....	C-28
2.3.3 PRAIRIE WARRIOR 1995 MOBILE STRIKE FORCE NORTHEAST ASIA SCENARIO.....	C-30
3.0 ASSESSMENT OF ALTERNATIVES.....	C-33
3.1 MODERNIZED ARMY OF EXCELLENCE DIVISION.....	C-33
3.1.1 STRENGTHS.....	C-33
3.1.2 WEAKNESSES.....	C-33
3.2 HEAVY/LIGHT-SMALL BASE DIVISION.....	C-34
3.2.1 STRENGTHS.....	C-34
3.2.2 WEAKNESSES.....	C-34
3.3 BRIGADE-BASED DIVISION.....	C-35
3.3.1 STRENGTHS.....	C-35
3.3.2 WEAKNESSES.....	C-35
4.0 FINDINGS AND CONCLUSIONS.....	C-37
5.0 RECOMMENDATIONS.....	C-39

6.0 THE WAY AHEAD.....	C-41
6.1 DEFINE CORPS FUNCTIONS.....	C-41
6.2 APPLY CONSTRAINTS TO THE DIVISION DESIGN PROCESS.....	C-41
6.3 DEFINE DIVISION COMMAND RELATIONSHIPS AND STAFF FUNCTIONS.....	C-42
6.4 EXAMINE RECONNAISSANCE AND SECURITY FUNCTIONS.....	C-42
6.5 FIXING THE ENEMY.....	C-42
ANNEX A: STRENGTHS AND WEAKNESSES OF THE MODERNIZED AOE DIVISION.....	C-43
ANNEX B: STRENGTHS AND WEAKNESSES OF THE HEAVY/LIGHT-SMALL BASE DIVISION.....	C-45
ANNEX C: STRENGTHS AND WEAKNESSES OF THE BRIGADE-BASED DIVISION.....	C-47
ANNEX D: SUMMARIZED RESULTS FOR THE SOUTHWEST ASIA SCENARIO.....	C-49
ANNEX E: SUMMARIZED RESULTS FOR THE PRAIRIE WARRIOR 1996 EUROPEAN SCENARIO.....	C-53
ANNEX F: SUMMARIZED RESULTS FOR THE PRAIRIE WARRIOR 1995 NEA MOBILE STRIKE FORCE SCENARIO.....	C-57
ANNEX G: GLOSSARY.....	C-61

List of Exhibits

<u>Exhibit</u>	<u>Title</u>	
ES-1	Modernized Army of Excellence Heavy Division(Armor Variant).....	C-8
ES-2	Heavy/Light-Small Base Division.....	C-9
ES-3	Brigade-Based Division.....	C-9
1-1	Division Design Analysis Overview.....	C-16
1-2	Alternatives Considered.....	C-17
1-3	Alternative Concepts.....	C-18
1-4	Modernized Army of Excellence Heavy Division.....	C-19
1-5	Heavy/Light-Small Base Division.....	C-20
1-6	Brigade-Based Division.....	C-22
2-1	Prairie Warrior 1996 European Scenario.....	C-28
2-2	Prairie Warrior 1996 European Scenario (Concluded).....	C-29
2-3	Prairie Warrior 1995 Mobile Strike Force NEA Scenario.....	C-30

THIS PAGE INTENTIONALLY LEFT BLANK.

EXECUTIVE SUMMARY

INTRODUCTION

This report documents the discussions, decisions, and recommendations of the Division Design Analysis Senior Military Review, a subject matter expert seminar held at TRAC Headquarters at Fort Leavenworth, Kansas 3-5 October 1995.

Following introductory material, the process followed in the seminar will be discussed. This discussion will include both a description of how the seminar was conducted as well as the categories of issues addressed and the scenario contexts in which issues were evaluated. Next, assessments of each of the three division design alternatives are summarized in turn followed by the resulting findings, conclusions, and recommendations. Finally, the report covers the seminar's thoughts on significant issues and concerns that the Division Design Analysis process must address in the coming months. The report is concluded with seven appendices containing detailed information.

The Senior Military Review was a seminar held to develop qualitative assessments of the division design alternatives. These assessments will provide part of the Division Design Analysis input to the interim design decision scheduled for December. The assessments required an understanding the division operational concept and an evaluation of each design's suitability within the context of that concept. Part of what was desired as a product of the assessments was possible changes to the three candidate designs and improvements to the overall process of redesigning the division.

DESCRIPTION OF ALTERNATIVE DIVISION DESIGNS

The key differences to look for as each alternative is described in detail are:

- The degree of modularity built into subordinate units,
- The size of the division base, and
- What parts of the division are standardized and what parts are meant to be tailored in a contingency.

Modernized Army of Excellence (AOE) Division

Exhibit ES-1 depicts the familiar AOE heavy division. Note the elements of the DISCOM, the DIVARTY, and the rest of the division base.

Heavy/Light - Small Base Division

Before describing the first new design, an outline of the ideas behind that design would be appropriate. The Heavy/Light - Small Base Division is designed with modularity throughout its structure and with a division base of reduced size and capability. In addition, it is designed to function as a part of a joint or combined force. The deep attack of the division base have been

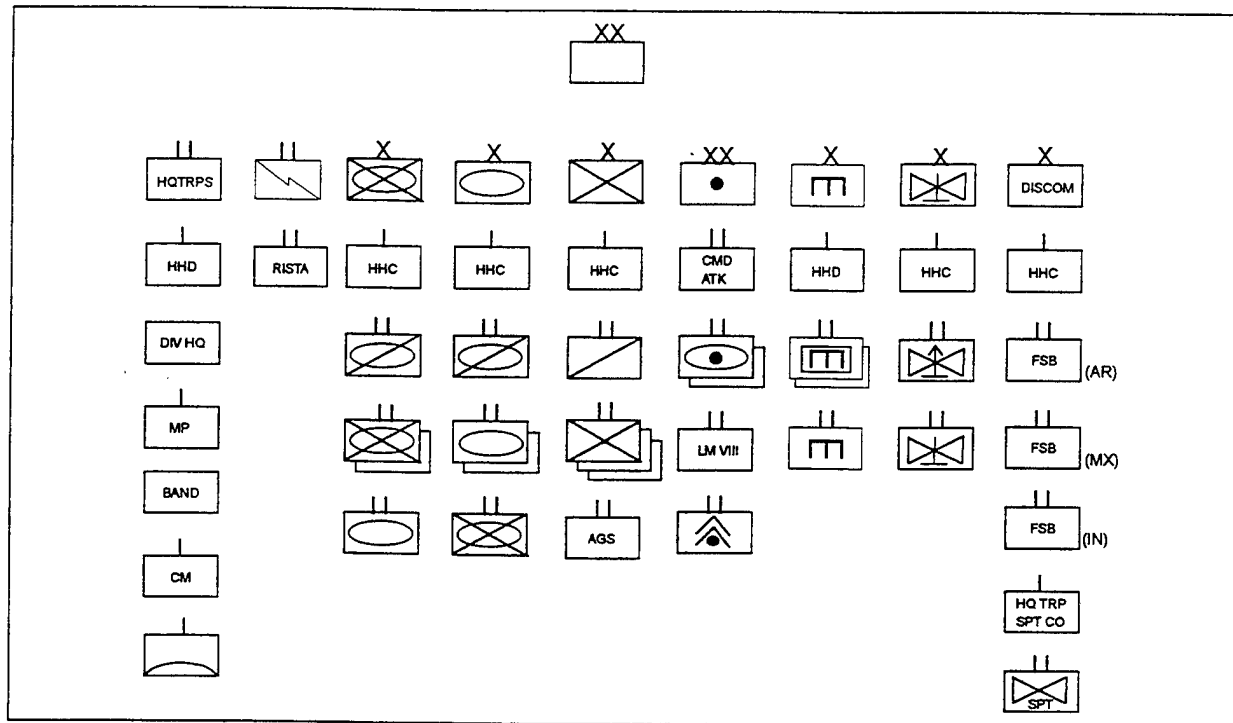


Exhibit ES-2. Heavy/Light-Small Base Division

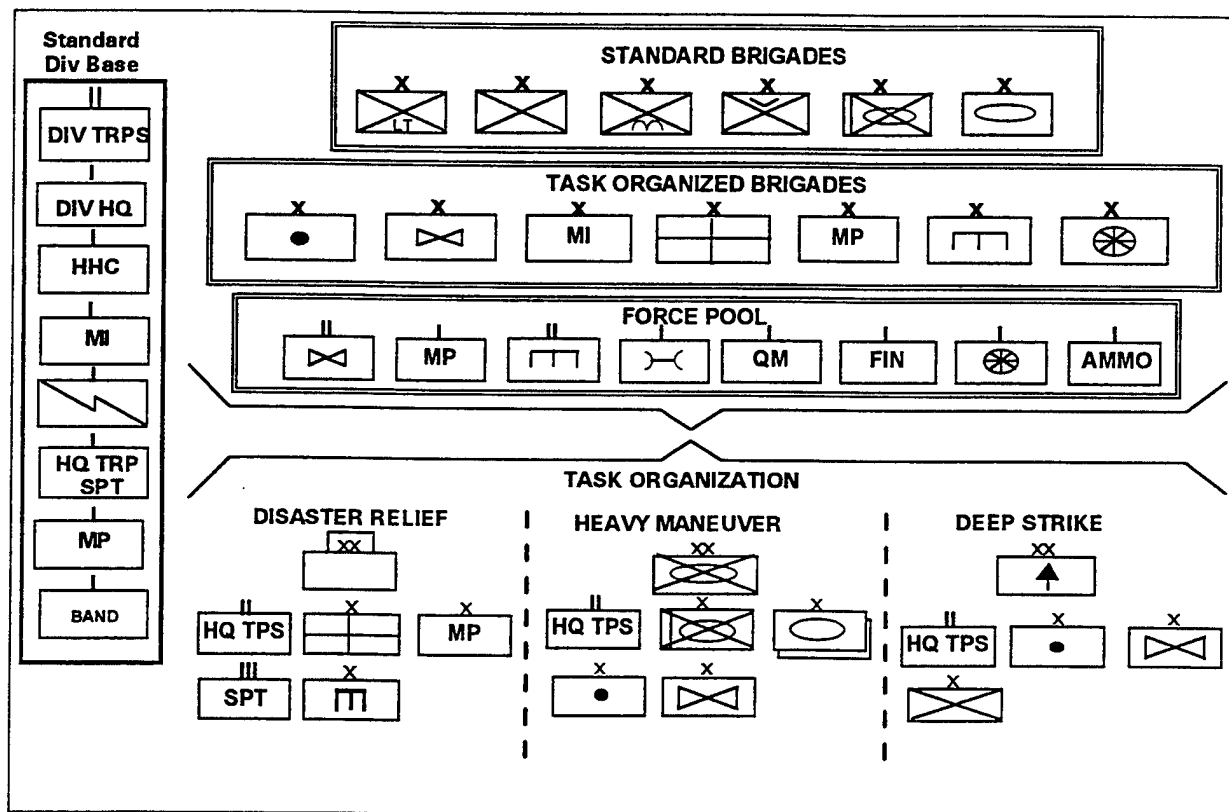


Exhibit ES-3. Brigade-Based Division

METHODOLOGY

Next we will begin to look at the Senior Military Review itself by summarizing the methodology followed in the conduct of the seminar.

Procedures

As has been mentioned, the Senior Military Review was conducted in a seminar format involving individuals and organizations representing a wide range of expertise and experience. The seminar consisted of general sessions, with all participants meeting together, as well as group sessions with the seminar divided into four panels, and participants met with one of the retired general officers for discussions. The general sessions provided briefings of interest to all participants. Panel discussions provided a smaller forum in which participants evaluated the three alternatives in the context of three specified scenarios. The evaluations followed the direction of issues developed ahead of time consistent with the Force XXI patterns of operation. The seminar concluded with a consensus-producing final general session.

General (Ret) Foss	General (Ret) Maddox
General (Ret) Burba	LTG (Ret) Wakefield
AWC	HQ, TRADOC
BCTP	LAM TF
CAA	TRAC
CGSC	VRI
FDD	
<i>Seminar Participants</i>	

Patterns of Operation

The Army's Force XXI initiative seeks to take advantage of the potential offered by enhanced information on the battlefield of the Twenty-first Century. Digitization will play a key role in enhancing the information on that battlefield increasing the commander's ability to see the battlefield. The result will be a heretofore impossible capability to synchronize combat power. This kind of improvement is achievable in the wide range of "patterns of operations" taken from TRADOC Pamphlet 525-71, Force XXI Division Operations.

SCENARIOS

Southwest Asia Scenario

This derivative of the TRADOC standard scenario Southwest Asia 5.0 looks at a contingency operation where two airborne brigades and one armor brigade (-), are used in defensive operations in SWA. For purposes of this examination, this was modified to use two light infantry brigades and one armor brigade. The light infantry brigades included a company of AGS for reinforcing fires.

Prairie Warrior 1996 European Scenario

This scenario was selected because it includes many of the characteristics described by CG, TRADOC for typical future contingency areas. The scenario is being developed to support Prairie Warrior 1996. After the December 1995 Interim Division Design decision, the 4th

Infantry Division will configure its division and brigade staffs to emulate the interim design. In this configuration, 4ID will participate in Prairie Warrior 1996.

In the scenario, the division, configured with an armor brigade, a mechanized infantry brigade, an infantry brigade, an aviation brigade, a DIVARTY and two corps field artillery brigades, attacks a motorized rifle division and a tank division in the vicinity of the Elbe River. Depicting the division in the context of a larger corps operation, the focus of this scenario was the integration of heavy and light forces at the division level, vice within the brigade, in a situation with close and open terrain. The key conceptual areas were how well the division could shape the battlespace and conduct decisive operations.

Prairie Warrior 1995 Mobile Strike Force Northeast Asia Scenario

The mobile strike force is not a fixed organization, but a concept. It is a vehicle used to investigate new technologies, organizations, and concepts. During the Mobile Strike Force 95 study, a deep simultaneous ambush scenario was selected for investigation. The scenario was set in Northeast Asia. The opposing forces were an operational exploitation force (OEF) which consisted of nine brigades. There were six mechanized infantry brigades, an armor brigade, and two field artillery brigades.

The mobile strike force mission was to destroy the OEF to prevent their reinforcement of the first echelon army group. To accomplish this, the mobile strike force was task organized with an armor brigade, a light infantry brigade, an aviation brigade, and a DIVARTY. The mobile strike force also had a lift aviation brigade, an engineer brigade, and a standard division slice of CSS elements. The division troops included a regimental aviation squadron, and an MI battalion with UAVs. However, the battalions in this organization were not typical AOE battalions as they varied in the number of major combat systems.

ASSESSMENT OF ALTERNATIVES

Modernized Army of Excellence Division

Strengths. The AOE heavy division was designed for a specific purpose: a protracted defense in Europe. This design purpose dictates many of its characteristics. Its strengths include: first, *flexibility* in maneuver units — the maneuver units were made to be taken apart; second, *redundancy* in combat power (e.g., four maneuver companies rather than three) and in support functions (e.g., overlap in functions in maneuver battalions with that in support units; this design has the best reconnaissance capability at the division level); third, a force that *fights well in the big division-level, contiguous operations* expected in Europe; and last, it is *excellent for massing fires* at the division level.

Weaknesses. The weaknesses of this design in many ways mirror the strengths. While strong in the contiguous fight, this division has *difficulty tailoring support functions* as is necessary for a non-contiguous fight. These functions need modularity. In many cases, when a support unit is pulled apart to support individual maneuver elements, what is left has very little capability.

The division maneuvers well, but its support does not. Further it lacks the ability to reconfigure its support quickly in response to changes on the battlefield. This lack of responsiveness coupled with the extra burden of redundant capabilities greatly reduce the division's *agility* in combat. The organization does not naturally develop *confidence in supporting elements*. The maneuver commander owns some support, but not all. There is overlap between the functions the maneuver commander owns and those provided to him. The maneuver unit does not necessarily establish a habitual relationship with all support provided to it.

Opportunities for *economies of support* have not been fully explored in this design. The overlap and redundancies in support functions are no longer affordable, or necessary.

Finally, the redundancies mean extra weight, making the division *difficult to deploy*. Born of a time when much more of the force was forward deployed, lift is always a constraint for this division design in the force projection army.

Heavy/Light – Small Base Division

Strengths. With the Heavy/Light – Small Base Division, we begin to see changes from the familiar AOE design which alter the division's strengths and weaknesses. Some *redundancy of combat capability remains, and this continues to facilitate tailoring* — though not as much as with the AOE division. The result is a division with great flexibility; it is appropriate for a variety of missions. The possibilities for *economies in support functions* have been touched on in this design; it is slightly better in this regard than the AOE division. The division base, as its name implies, is smaller. Some firepower has been retained at division — notably MLRS and attack aviation. These capabilities allow the division to buy time while waiting for support from corps.

Weaknesses. The reductions in the division base eliminated too much *air defense and intelligence* in the judgment of the seminar. This weakness is fixable. As is sometimes the case, the retention of the firepower capabilities mentioned as a strength may also be a weakness should these capabilities not be needed. The *mobility differential* between the heavy brigades and the light brigade were seen to be a significant problem for this design. The seminar was concerned that the mix of two heavy brigades and one light brigade would be inappropriate for some situations. If setting conditions requires the engagement of one of the heavy brigades, as has been the case in some wargames, then the remaining maneuver force of one heavy brigade and one light brigade is severely limited in its close combat capability. Finally, implementing this design *removes heavy brigades from the total force*. If each of the current heavy divisions is replaced with one of these divisions, one heavy brigade in each of the current heavy divisions is replaced by a light brigade.

Brigade-Based Division

The Brigade-Based Division is characterized by rather significant strengths and weaknesses.

Strengths. This design provides a force *organized and trained for the brigade-level fight*. While some additional tailoring might be necessary, the brigade unchanged is probably a good solution to most combat problems.

The Brigade-Based Division has improved *agility* in the sense that it can respond quickly to changing situations. Further, the division has the ability to operate non-contiguously through its fairly autonomous brigade-sized elements.

The idea of *economy of support functions* is explored most fully in this design. The DISCOM headquarters is eliminated along with some of the elements of the DISCOM. However, the degree of redundancy that remains between support units in combined arms brigades and support functions in maneuver battalions in those brigades was not yet fully defined in this design. Similarly, the DIVARTY headquarters was eliminated. The seminar uniformly supported the general trend of looking for economies in support functions.

This design *deploys well* for two reasons. First, it naturally quickly stands up the combined arms element appropriate for most early entry operations, the brigade. Second, in any situation requiring brigade-sized deployments, this design delivers the deploying organization with less effort. This brigade trains together in peacetime and requires little tailoring before deployment.

Weaknesses. The weaknesses of this design are significant. First, in reducing the division base in this design, *commanders of CS and CSS functions at the division level were eliminated*.

This makes it *difficult to mass combat power* at the division level. Brigade-level fights are easier, but much of the mechanism for controlling a multi-brigade fight has been eliminated.

It is also *difficult to reinforce* with combat multipliers in changing battlefield conditions with this design. Augmentation from corps can be given directly to brigade, but would be difficult to control at the division level.

Next, this design would not necessarily be easy to tailor below the brigade level. The result is a design that *lacks flexibility*. Modularity is just as important with this design as in the others. It must be easy to move battalions and their support between brigades.

Adopting this alternative will create a massive *change in how the Army structures staff training* for every echelon battalion and above. The Army will have to rethink how it assigns missions and tasks to subordinate units and how it conceptually masses effects across the division. This is less a weakness of the design than a note about what must be done to implement it.

Finally, the seminar judged that the lack of *reconnaissance capability at the division level* was a serious deficiency. While there is a ground cavalry squadron at the brigade level, a feature the AOE division does not have, there is no cavalry at the division level. Further, there is no air cavalry at either level.

FINDINGS AND CONCLUSIONS

None of the design alternatives can be recommended without modifications, and the start point for making changes should not be the AOE design. Built for a different time and purpose, the AOE design is not affordable today. Further, the Army must change and be seen as changing. Retention of even the old name does not serve Force XXI well. It is *time to move beyond AOE*. Both alternatives to AOE offer important characteristics, but *neither is acceptable without modification*.

RECOMMENDATIONS

Having concluded that a new design must be developed and the AOE design must be abandoned, the seminar recommends integrating the *best qualities of the Heavy/Light Small Base and the Brigade-Based Divisions*. These best qualities include retention of the idea of a *small division base* and retention of the *combined arms brigades*. These and *other modifications* are necessary to produce an acceptable division design.

The seminar defined its recommendations in terms of modifications to one of the alternatives to AOE, choosing the Heavy/Light – Small Base Division as the point of departure. Modifications recommended for the Heavy/Light – Small Base Division include:

- Apply the concept of *combined arms brigades* to this design.
- *Change the maneuver brigades* in the division from two heavy and one infantry to three heavy brigades — consider the possibility of an infantry brigade at corps.
- *Reexamine the division base*. Ensure that redundancy in support and combat support functions is completely eliminated; the "small base" can be made smaller. However, the ADA capability at division level has to be beefed up; one battery is not enough.
- Consider *redefining division controls* for combat multipliers at brigade and division. Applying the combined arms brigades to this design could introduce the problem of controlling fires and support at the division level seen in the brigade-based design.
- Finally, ensure that a minimal capability to keep the division lethal and survivable until corps augmentation arrives is retained in the division: an attack helicopter battalion and a MLRS battalion.
- MI capability, one company in the RISTA battalion, is totally insufficient for "gaining information dominance."

1.0 INTRODUCTION

This report documents the discussions, decisions, and recommendations of the Division Design Analysis Senior Military Review, a subject matter expert seminar held at TRAC Headquarters at Fort Leavenworth, Kansas 3-5 October 1995.

Following introductory material, the process followed in the seminar will be discussed. This discussion will include both a description of how the Senior Military Review seminar was conducted as well as the categories of issues addressed and the scenario contexts in which issues were evaluated. Next, assessments of each of the three division design alternatives are summarized in turn, followed by the resulting findings, conclusions, and recommendations. Finally, the report covers the seminar's thoughts on significant issues and concerns that the Division Design Analysis process must address in the coming months. The report is concluded with seven appendices containing more detailed information.

1.1 SEMINAR PURPOSE

The Senior Military Review was a seminar held to develop qualitative assessments of the division design alternatives. These assessments will provide part of the Division Design Analysis input to the interim design decision scheduled for December. The assessments required an understanding the division operational concept and an evaluation of each design's suitability within the context of that concept. Part of what was desired as a product of the assessments was possible changes to the three candidate designs and improvements to the overall process of redesigning the division.

Qualitative evaluations by appropriate experts were necessary for two reasons: at this point in the overall design process, when many specific design issues are not yet decided, quantitative assessments were impossible; and were they possible, there was not enough time before the December decision for detailed simulations. Such simulations will come later in the design analysis. The seminar was convened and participants invited with this need for qualitative analysis in mind.

1.2 BACKGROUND

1.2.1 DIVISION DESIGN ANALYSIS OVERVIEW

As indicated schematically in exhibit 1-1, the Senior Military Review (SMR) is one small part of a major effort underway to redesign the Army's heavy divisions. As a part of Phase I of the Division Design Analysis, the SMR provides qualitative assessments to support one decision in the overall process.

In Phase I of the Division Design Analysis, TRAC and the TRADOC Force Design Directorate developed several ideas for possible division designs. Those ideas were reduced to three in number, and then the three ideas were developed into designs. As the refinement of the design of subordinate elements of the division continues, the range of alternatives must be narrowed to one to facilitate further force design work.

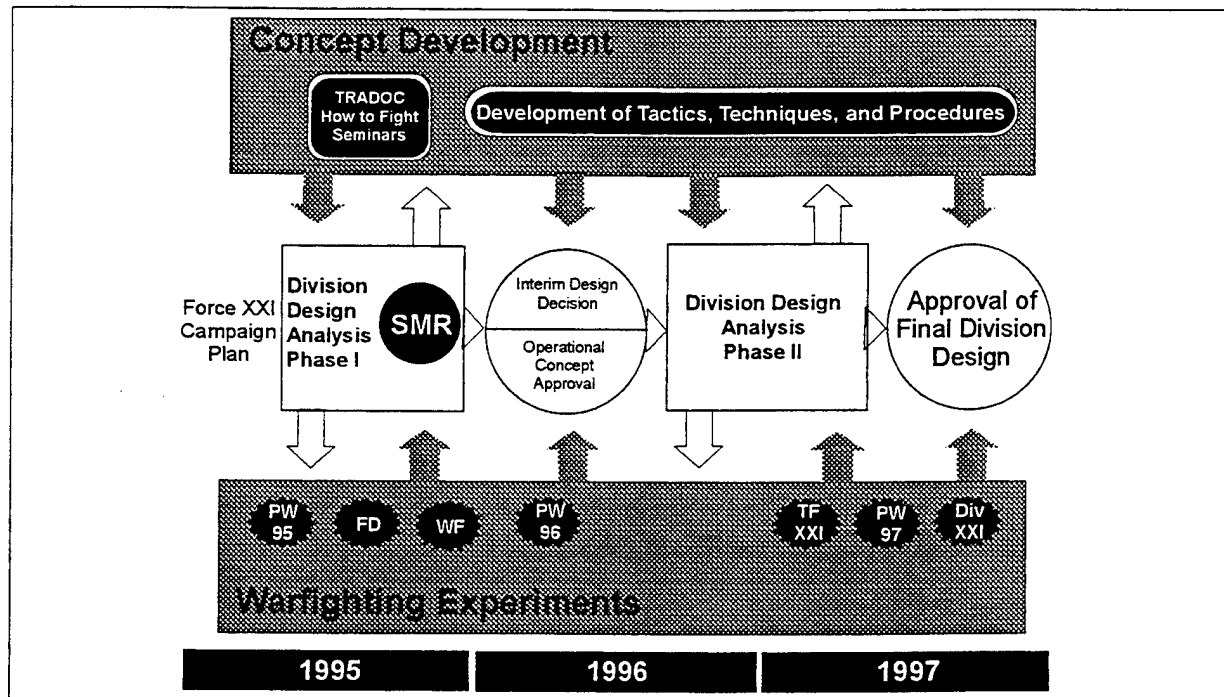


Exhibit 1-1. Division Design Analysis Overview

The Senior Military Review was developed to contribute to the selection of an "interim division design" scheduled for the IPR in December of this year. This interim design will be the organization for the 4th Infantry Division, functioning as the Army's Experimental Force (EXFOR). Phase II of the Division Design Analysis will focus many analyses at every echelon of this organization to refine the design further.

Work on concepts for the division parallels the Division Design Analysis. This effort will produce the operational concept for the division, to be approved in December, as well as the logistics concept and eventually the tactics, techniques, and procedures for the division.

Much has already been learned from warfighting experiments, such as Prairie Warrior 1995 (PW 95) and Focused Dispatch (FD). Warrior Focus (WF) is planned for the near future. Reliance on exercises will continue past the selection of the interim design, as indicated with Prairie Warrior 1996 (PW 96), Task Force XXI (TF XXI), Prairie

Warrior 1997 (PW 97), and Division XXI (Div XXI). That design will be subjected to a series of experiments with the division configuration changing as the process goes forward. In the final experiment, the EXFOR, configured according to the final design, will participate in the Division XXI exercise. This will occur in November 1997, before final approval of the design for the future division in January/February of 1998.

1.2.2 DESCRIPTION OF ALTERNATIVE DIVISION DESIGNS

The division design alternatives evaluated by the seminar were developed to serve purposes well beyond the seminar itself. They were developed with two ideas in mind:

- First, they were to describe a range of alternatives to ensure that a wide range of design ideas was considered.
- Second, they were to provide a framework or mechanism for analyzing unit designs throughout TRADOC; for applying technology to force designs so key to the Force XXI process; and for the development and eventual application of tactics, techniques, and procedures (TTP).

In an overall sense, the alternatives had to stand the tests of feasibility, acceptability, and suitability to be useful.

The range of designs for the division originally considered is outlined in exhibit 1-2. Force designers originally identified the eleven alternatives described by their concepts in the left column. These ranged from the current heavy division design to designs in which there were no divisions or in which there were no brigades. Early in Phase I, the Division Design Analysis deferred from further consideration five of the eleven alternatives on the basis of acceptability or feasibility. The current status of the alternatives is listed in the center column. Of the six remaining alternatives, three, indicated by highlighting boxes, were selected for further analysis in Phase I. Part of the reasoning in selecting these three alternatives was how the analysis of each would expand the Army's knowledge of division designs. This knowledge base is shown in the right column. The arrows show how analysis of specific alternatives would contribute to the

CONCEPT	STATUS	KNOWLEDGE BASE	
Division-based Force (No corps)	Deferred-Acceptability		
Modernized AOE Heavy	Based Case	L Series TOE	
ALBF Based Case	Continue as Alternative	Airland Operations	←
Modular Standard Base	Continue as Alternative	2 ID/NG ID	←
Modular Small Base	Recommended-Phase I		←
Unique-mission Division	Continue as Alternative		←
Brigade-based Division	Recommended-Phase I	ALB-F (H)	←
Robust Battalion Structure	Deferred-feasibility	ROAD Division	←
Brigade-based Force (No Division)	Deferred-acceptability		←
Skip Echelon Division (No Bn/Plt)	Deferred-acceptability	Pentomic Division	
Skip Echelon Division (No Bde/Co)	Deferred-acceptability	Pentomic Division	

Viable Alternatives

Exhibit 1-2. Alternatives Considered

understanding of others. It was the three highlighted alternatives that the Senior Military Review evaluated over the course of three days.

There is considerable range in the concepts underlying these three Phase I designs as shown schematically in exhibit 1-3. The amount of change involved in the three alternatives goes from virtually none for the fully modernized version of the AOE heavy division, to rather significant change necessary to carry out a brigade-based design. The modular division-small base design lies somewhere between those extremes.

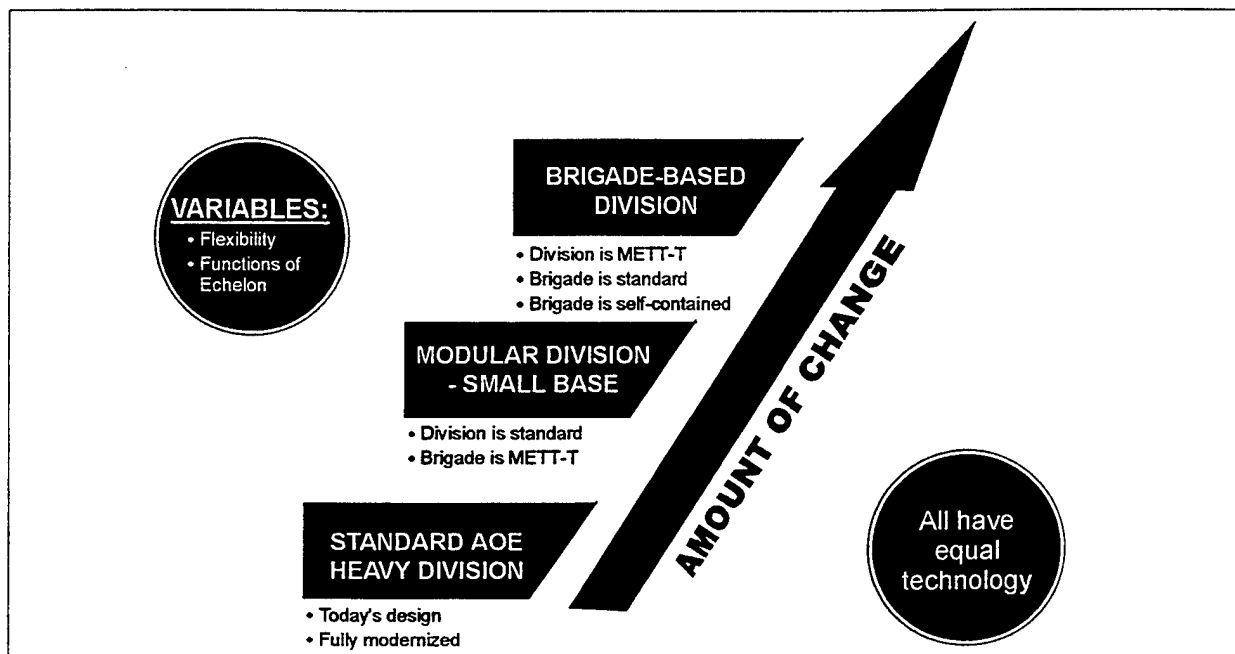


Exhibit 1-3. Alternative Concepts

It is important to understand that for the purposes of this evaluation, the three designs are considered to have equal technologies. This means that what is assessed in comparing the three alternatives are the functions represented by units and how those units relate to one another in a command and control sense. The seminar did not evaluate the systems or technology used by the functions in each alternative. Specifics of technologies will evolve as the designs of individual units are completed in the continuing Division Design Analysis. Further, the operational concept calls for extensive task organizing prior to a division's deployment to a contingency area. This means that a division would be carefully tailored to fit the situation, no matter what its design. For this reason, the seminar did not evaluate how many of each possible weapon system each design contained. The presumption being that the division would be tailored to contain the right number of key systems.

The key differences to look for as each alternative is described in detail are:

- The degree of modularity built into subordinate units;
- The size of the division base; and
- What parts of the division are standardized and what parts are meant to be tailored in a contingency.

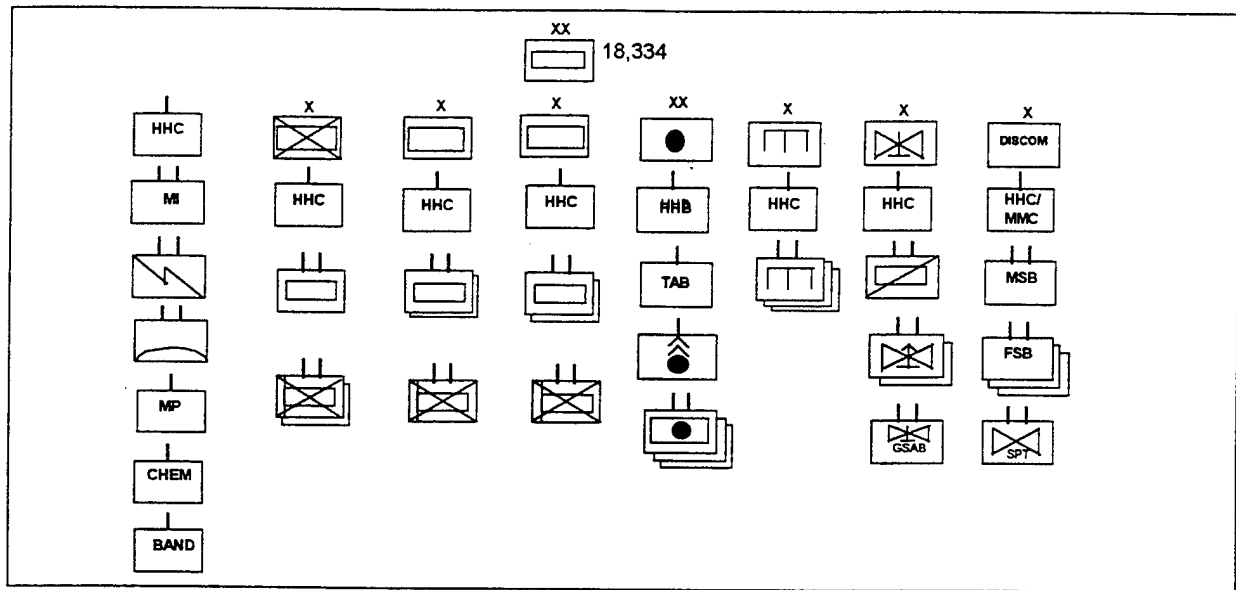


Exhibit 1-4. Modernized Army of Excellence Heavy Division

Modernized Army of Excellence (AOE) Division. Exhibit 1-4 depicts the familiar AOE heavy division. Note the elements of the DISCOM, the DIVARTY, and the rest of the division base. What is shown is an armor division with two armor brigades and one mechanized infantry brigade. The equivalent schematic for a mechanized infantry division would show two mechanized infantry brigades and one armor brigade.

Heavy/Light - Small Base Division (HL-SB). Exhibit 1-5 schematically depicts the organization of the HL-SB design. This division is designed to be a more flexible, more modular construct than today's AOE division.

The principal characteristics of this division are the mix of mounted (heavy) and dismounted (light) units within the same force structure. The division design gives it the capability for decisive operations with limited deep operations capability. In this design alternative, the principal maneuver organizations are the brigades. Each brigade has an HHC, cavalry squadron with reconnaissance and security mission capabilities, and a mix of armor and infantry battalions.

The armor and mechanized infantry battalions differ from AOE battalions as they have three line companies instead of four. The armor battalions have a total of 45 tanks, down from the 58 tanks in an AOE battalion. The mechanized infantry battalions, because the number of platoons in a company is increased

Functions as part of a joint or combined force under a corps or ARFOR

Limited deep attack and air assault capability

Habitual association of heavy and light forces

Requires tailoring for other than maneuver missions

Capable of offensive, defensive, and retrograde operations

Suited for operations in mixed terrain

Early entry packages can be tailored from organic assets

Moves in brigade packages

Requires secure POD, but can provide early entry forces

Heavy/Light-Small Base Division Concept

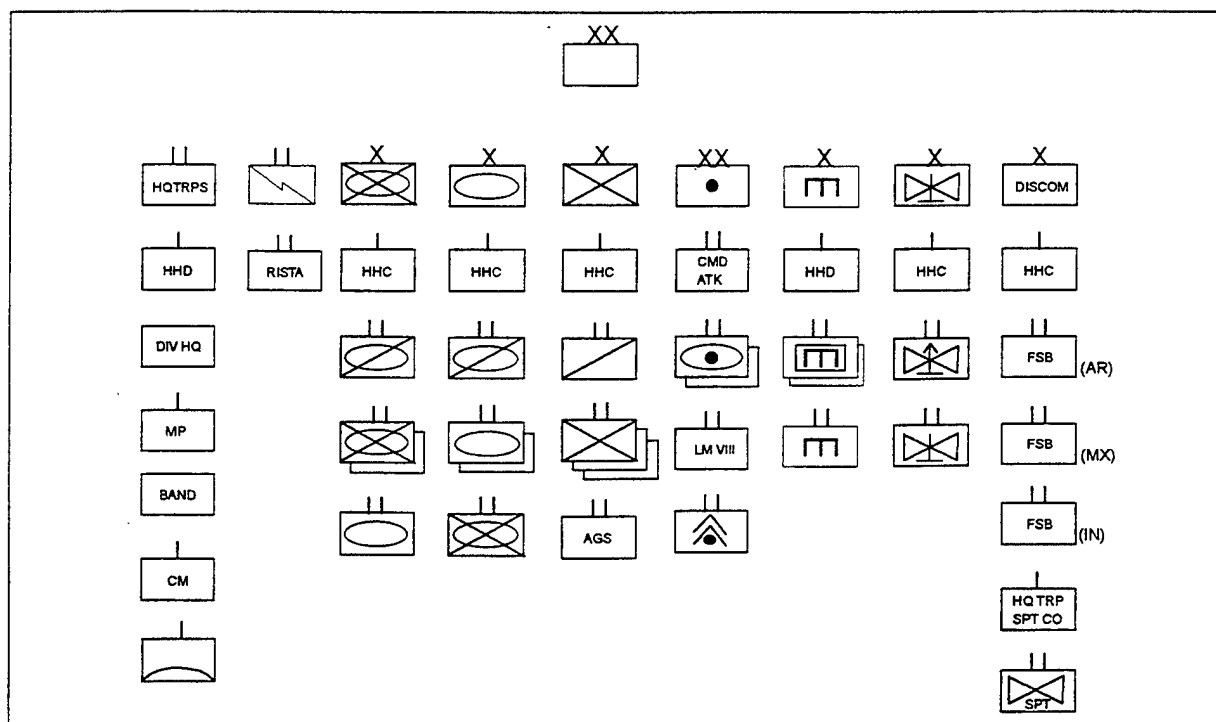


Exhibit 1-5. Heavy/Light-Small Base Division

from three to four, have nearly the same number of IFVs, 56, as the AOE mechanized infantry battalions, 58. The infantry brigade has three infantry battalions and one battalion of AGS.

The non-linear, non-contiguous nature of the perceived future operating environment has led to the recognition of increased reconnaissance and security requirements. To meet this need, each brigade has a cavalry squadron for reconnaissance and security missions.

Each brigade has a ground cavalry squadron with two troops. In the heavy brigades, the troops have two platoons of Future Scout Vehicles and two platoons of tanks. In the light infantry brigades, the platoons have Future Scout Vehicles and AGS. There is no air cavalry element in this design.

The quantity of field artillery systems in this design differs only slightly from the AOE divisions. Each brigade, whether armor, mechanized infantry, or infantry, has a direct support artillery battalion. For the near term, this is a 3x8 M109A6 155mm SP howitzer battalion for the armor and mechanized infantry. The infantry battalions will be supported by a light system of a caliber yet to be determined. For future designs, a 3x6 Crusader battalion will be the direct support artillery system for the armor and mechanized infantry brigades. The heavy brigades' direct support artillery systems are to be the same for the new, modular alternatives and the AOE divisions. However, in the area of MLRS, the modular division increases the MLRS organization from a 1x9 battery (AOE) to a 3x6 battalion. This increases the total number of MLRS launchers from 9 to 18. The modular division also includes a 1x6 HIMARS battery for early deployment force packaging. In the area of attack aviation, the modular division has one attack helicopter battalion of 15 AH-64s and 9 RAH-66s. This is a reduction from the two battalions authorized in the AOE heavy divisions.

The DISCOM in this alternative is designed like the AOE division DISCOM except that it does not have a main support battalion. It has a forward support battalion habitually supporting each maneuver brigade, including the aviation brigade. A support company is added to support the headquarters troops battalion, RISTA battalion, and portions of the signal battalion. The DISCOM implements the distribution concept. A major issue for this alternative is the centralizing of nearly all CSS functions in FSB-type battalions.

Brigade-Based Division. The third design under consideration is the Brigade-Based Division alternative.

The Brigade-Based Division alternative is a flexible force that fights as a part of a joint or combined force under the command of a corps or ARFOR commander. It is designed to have the flexibility to perform missions across the spectrum of conflict in any type of terrain. The division has this capability because the division echelon is focused on the command of a variety of subordinate brigade-sized units and those units are assigned to the division to meet a variety of force package requirements. The brigades come as "self-contained" packages that have some of the CS and CSS elements typically found in the AOE division embedded here in the brigade. The remaining CS and CSS elements are moved to separable, task organized brigades or moved to corps and EAC levels. These elements, when needed, are drawn from a force-wide pool established in the active and reserve components.

Can function as part of a joint or combined force or under command of a corps

Division echelon focused on battle command of a variety of brigades

Capable of offensive, defensive, retrograde operations; and OOTW with appropriate brigade mix

Division easily tailored for METT-T

Moves in brigade packages

Station for training; task organize for combat

Division capability based on assigned brigades

Brigade-Based Division Concept

Representation of the Brigade-Based Division organization must necessarily be in a format different from the other two alternatives. Exhibit 1-6 provides such a representation. On the top right are three groups of units in the force, and on the bottom right are three possible configurations of the division for contingencies. Other configurations are of course possible; the three shown are merely illustrative. The three groups of units on the top right depict what would be available in the active and reserve components to tailor the division for the mission. Note the very constrained division base on the far left of the exhibit.

Some of the specific elements that go into various brigade "packages" are listed below. The listing does not include task organized brigades nor elements for the force "pool."

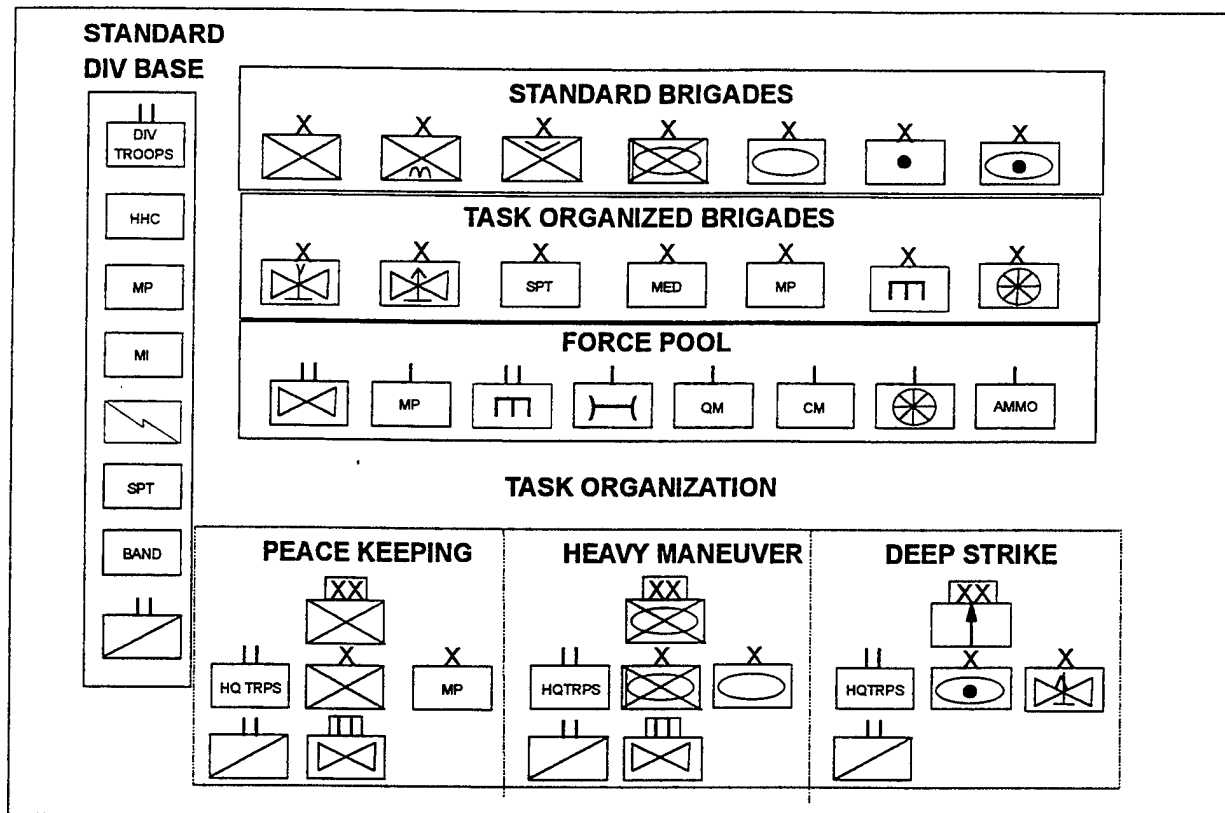


Exhibit 1-6. Brigade-Based Division

Mechanized Infantry Brigade

Brigade Headquarters
 Brigade Cavalry Squadron
 Armor Battalion
 Mechanized Infantry Battalion (x2)
 FA Battalion (155mm SP)
 Engineer Battalion (Heavy)
 Chemical Company
 MP Company (Heavy)
 BSFV-E/Avenger Battery
 MI Company (Heavy)
 Forward Support Battalion (Heavy)
 Signal Company

Infantry Brigade

Brigade Headquarters
 Brigade Cavalry Squadron
 Light Armor (AGS) Battalion
 Infantry Battalion (x3)
 FA Battalion (TBD caliber)
 Engineer Battalion (Light)
 Chemical Company
 MP Company (Light)
 Avenger Battery
 MI Company (Light)
 Forward Support Battalion (Infantry)
 Signal Company

Armor Brigade

Brigade Headquarters
Brigade Cavalry Squadron
Armor Battalion (x2)
Mechanized Infantry Battalion
FA Battalion (155mm SP)
Engineer Battalion (Heavy)
Chemical Company
MP Company (Heavy)
BSFV-E/Avenger Battery
MI Company (Heavy)
Forward Support Battalion (Heavy)
Signal Company

Division Base

Division Headquarters
Headquarters and Headquarters Detachment
MP Company (GS)
Avenger Battery
MI Company
Headquarters Troop Support Company
HHC, DISCOM
Division Signal Battalion
FA Command Headquarters
Chemical Company
Band

Aviation Brigade (Attack)

HHC
Attack Helicopter Battalion (x2)
Aviation Battalion (GS)
Avenger Battery

Aviation Brigade (Assault)

HHC
Attack Helicopter Battalion (Lift) (x2)
Aviation Battalion (GS)
Avenger Battery

Under this concept, divisions will receive priorities for mission planning, receive brigade force package mixes based on those priorities, and train against most likely mission requirements. Forward-deployed divisions will be able to focus more closely on likely missions, while CONUS-based divisions will have a wider range of possible missions. The major differences between this design and the modular division is the determination of whether specific elements are organic to the brigades or to the divisions.

This design focuses the division echelon on battle command and seeks to disencumber the division base by leveraging the operational support structures at EAD. When comparing the combat capabilities of the maneuver brigades in this design with those in the HL-SB design, it can be seen that the numbers of systems are nearly identical. This similarity exists because the battalion "building blocks" are the same for both designs. However, making the brigades self-contained, modular packages creates levels of functional redundancy in the CS and CSS areas. For a specified force package (say one requiring armor, mechanized infantry, and infantry brigades), this results in the overall personnel strength of a brigade-based division being larger than that of the modular division design with no accompanying increase in combat capability.

1.3 SUMMARY

The AOE heavy division has three heavy brigades comprising both armor and mechanized infantry battalions. The mix of battalions varies from one brigade to another with the division total being five armor and four mechanized infantry. An aviation brigade controls aviation assets. The DIVARTY controls fire support. The division was designed to have a significant deep attack capability.

The HL-SB, designed to have a smaller division base than the AOE division, with modularity built into its structure throughout, has two heavy and one light brigades comprising three armor, three mechanized, three infantry, and one AGS battalions. This design has brigade cavalry squadrons. The aviation brigade is retained from the AOE design, but the brigade has less capability. The ability to conduct long-range fires is reduced in this design.

The Brigade-Based Division exhibits a standard division base of an HHC, an MP company, an MI company, a support company, and the division band. Brigades are attached to the largely command and control division headquarters based on the situation. Brigade designs are standardized but are modular and can be task organized from a pool of specialized units placed in the force for that purpose.

Modernized AOE Heavy Division

- 3 Heavy Brigades
- 5 Armor, 4 Mechanized Battalions (Armor Division) or
- 5 Mechanized, 4 Armor Battalions (Mechanized Division)
- Aviation Brigade
- DIVARTY
- Deep Attack Capability

Heavy/Light-Small Base Division

- 2 Heavy, 1 Light Brigades
- 3 Armor, 3 Mechanized, 3 Infantry, 1 AGS Battalions
- Brigade Cavalry or Reconnaissance Squadrons
- Limited Deep Attack Capability

Brigade-Based Division

- Standard Division Base
- Brigades Attached Based on METT-T
- Brigades standardized, but task organized from a force pool

Summary of Alternatives

2.0 METHODOLOGY

Next we will begin to look at the Senior Military Review itself by summarizing the methodology followed in the conduct of the seminar.

2.1 PROCEDURES

As has been mentioned, the Senior Military Review was conducted in a seminar format involving individuals and organizations representing a wide range of expertise and experience. The seminar consisted of general sessions, with all participants meeting together, as well as group sessions in which the seminar divided into four panels and participants met with one of the retired general officers for discussions. The general sessions provided briefings of interest to all participants. Panel discussions provided a smaller forum in which participants evaluated the three alternatives in the context of three specified scenarios. The evaluations followed the direction of issues developed ahead of time consistent with the Force XXI patterns of operation. The seminar concluded with a consensus-producing final general session.

General (Ret) Foss	General (Ret) Maddox
General (Ret) Burba	LTG (Ret) Wakefield
AWC	HQ, TRADOC
BCTP	LAM TF
CAA	TRAC
CGSC	VRI
FDD	

Seminar Participants

2.2 PATTERNS OF OPERATION

The Army's Force XXI initiative seeks to take advantage of the potential offered by enhanced information on the battlefield of the Twenty-first Century. Digitization will play a key role in enhancing the information on that battlefield increasing the commander's ability to see the battlefield. The result will be a heretofore impossible capability to synchronize combat power. This kind of improvement is achievable in the wide range of "patterns of operations" taken from TRADOC Pamphlet 525-71, Force XXI Division Operations. These patterns provided the basis for the seminar's evaluation of the design alternatives, and we will explore each briefly in succeeding paragraphs.

Project the force
Protect the force
Gain Information dominance
Shape the battlespace
Conduct decisive operations
Sustain and transition to future operations

Force XXI Patterns of Operations

The **project-the-force** pattern of operation involves the movement of forces from peacetime location to a contingency area. It involves not only the deployment but also the planning that starts with receipt of the mission. Under the operational concept for the Force XXI division, division forces will be tailored prior to deployment, with specific task organizations, as appropriate.

Force XXI focuses on improving information quality and quantity on the battlefield. The resulting increased and shared situational awareness will help to **protect the force**. Additional

protection results with the ability to operate with increased dispersion while retaining the ability to mass combat power quickly.

Gaining information dominance is key to the Force XXI concept. The division of the future must be able to recognize changes on the battlefield and react to those changes faster than the enemy. To do this, the control and flow of information between computers must be considered part of the "space" where the battle is waged. This means that potential enemies will strive to gain information dominance, and the division of the future must be capable of defending against attacks on its own information flow. The division must maintain enhanced situational awareness. Finally, the seminar noted that not all of the force will be digitized. Current procurement objectives will not digitize all of the active component let alone the reserve component. Allies and coalition partners likewise will not be able to reap the benefits of full digitization. The current efforts to redesign the division and to change the way that division fights so as to take full advantage of the potential of digitization must not lose sight of the fact that everybody on the future battlefield will not be digitized. Interfaces between digital and analog systems may be the critical points on the battlefield for information flow.

The Force XXI operations will rely increasingly on **shaping the battlespace** through fixing the enemy and destroying him at long range and less on close operations. Reconnaissance and surveillance play key roles in such operations. The division fixes enemy centers of gravity in such a Force XXI operation using precision fires, dynamic obstacles, deception, and friendly maneuver.

The division of the Twenty-first Century will still conduct **decisive operations**. A key improvement in this area will be in the division's ability to strike the enemy at more than one critical point in a coordinated, near-simultaneous fashion. This part of the tactical fight will be enabled and enhanced by the following characteristics:

- digital situational awareness;
- reconnaissance and security operations;
- near-instantaneous transmission of terrain reconnaissance data;
- active and passive measures to safeguard friendly forces;
- maintaining tactical dispersion;
- operations aimed at gaining or denying the enemy critical information;
- highly mobile firepower platforms;
- establishing dynamic sensor-to-shooter linkages;
- advanced target acquisition and fire control systems;
- active and passive vehicle protection; and

- embedding logistical packages within maneuver formations.

Enhanced information capabilities will enable the future division to **sustain itself and transition to future operations** so that tempo is maintained. The key elements of this capability will be total asset visibility, modularity of support functions to facilitate rapid tailoring, and improvements in logistics and personnel functions as a direct result of digitization. This will result in smooth transitions between decisive operations, reconstitution, and possible redeployment.

2.3 SCENARIOS

During the seminar, the division design alternatives were examined in the context of three scenarios. Each scenario was selected and refined to provide insight on particular issues and operational characteristics. The three scenarios were: Southwest Asia, Prairie Warrior 1996 Europe, and Prairie Warrior 1995 Mobile Strike Force Northeast Asia. Although forced entry is a possible mission, that was not examined during the panel discussions. For each of these scenarios, it was assumed that the deploying forces were unopposed during entry, and have access to air and sea ports of debarkation. However, the scenarios differ in the amount of build-up time available prior to conflict initiation.

2.3.1 SOUTHWEST ASIA SCENARIO

This derivative of the TRADOC standard scenario Southwest Asia 5.0 looks at a contingency operation where two airborne brigades and one armor brigade (-), are used in defensive operations in SWA. For purposes of this examination, this was modified to use two infantry brigades and one armor brigade. The infantry brigades included a company of AGS for reinforcing fires.

In this derivative scenario, an aggressor nation once again becomes a significant military power. This aggressor nation rebuilds its military forces and attacks a small friendly nation, with the intent of continuing its attack into a larger friendly nation. It was assumed that intelligence estimates of clear strategic warning of attack were as short as five to seven days. Prior to deployment, terrorist attacks on some prepositioned assets precluded their use. The armor brigade is the result of prepositioned equipment in the smaller friendly nation. Due to weather problems, reinforcements, consisting of USMC and Army PREPO afloat, to the friendly nations were delayed. The aggressor nation, in using lessons learned from Desert Shield/Desert Storm, attacks at C+10, including the using of chemical agents in their attack. At the time of the attack, the U.S. forces in country consisted of two light infantry brigades, one armor brigade, an aviation brigade, a DIVARTY, a marine expeditionary unit, and an attack helicopter battalion. The DIVARTY consisted of two 3x6 105mm DS battalions, a 3x8 155mm DS battalion, a 1x9 MLRS battery, and a target acquisition battery. The aviation brigade consists of an attack helicopter battalion and an assault helicopter battalion.

The defensive operation is conducted in three phases: a deep fight, a covering force, and a defense. Deep fires are provided by joint air and ground assets. The covering force battle is commanded by the aviation brigade, which is task organized to include one armor battalion as the ground force. The defense involves positioning the two light infantry brigades forward, on favorable terrain, dominating the strategic assets. The division counterattack force is the armor

brigade (-), consisting of one armor battalion and one mechanized infantry battalion. In this phase, the attack helicopter battalion and marine AH-1s form the division reserve.

This scenario provided an opportunity to investigate the force projection capabilities of the alternative division designs with an emphasis on early establishment of lethality in combat systems capabilities.

Due to classification considerations, a scenario sketch is not included in this report. For further information, contact TRAC directly.

2.3.2 PRAIRIE WARRIOR 1996 EUROPEAN SCENARIO

This scenario was selected because it includes many of the characteristics described by CG, TRADOC for typical future contingency areas. The scenario is being developed to support Prairie Warrior 1996. After the December 1995 Interim Division Design decision, the 4th Infantry Division will configure its division and brigade staffs to emulate the interim design. In this configuration, 4ID will participate in Prairie Warrior 1996.

In this scenario, shown in the schematic in exhibit 2-1, the terrain is from the European land mass, but the continent is re-configured as a hypothetical island with redrawn international boundaries. The country of Biscaynia contains most of France. Donaulia consists of portions of southern Germany and most of the Belgium-Netherlands area. Baltonia has portions of northern Germany and Denmark. Vistulia has portions of Poland. Vistulia is also the country with closest political ties with the U.S. The threat, or "opposing forces," is also hypothetical and designed to cover the desired spectrum from low to high technologically capable forces, including third dimensional threat. As a result, the level of conflict ranged from mid- to high-intensity. The

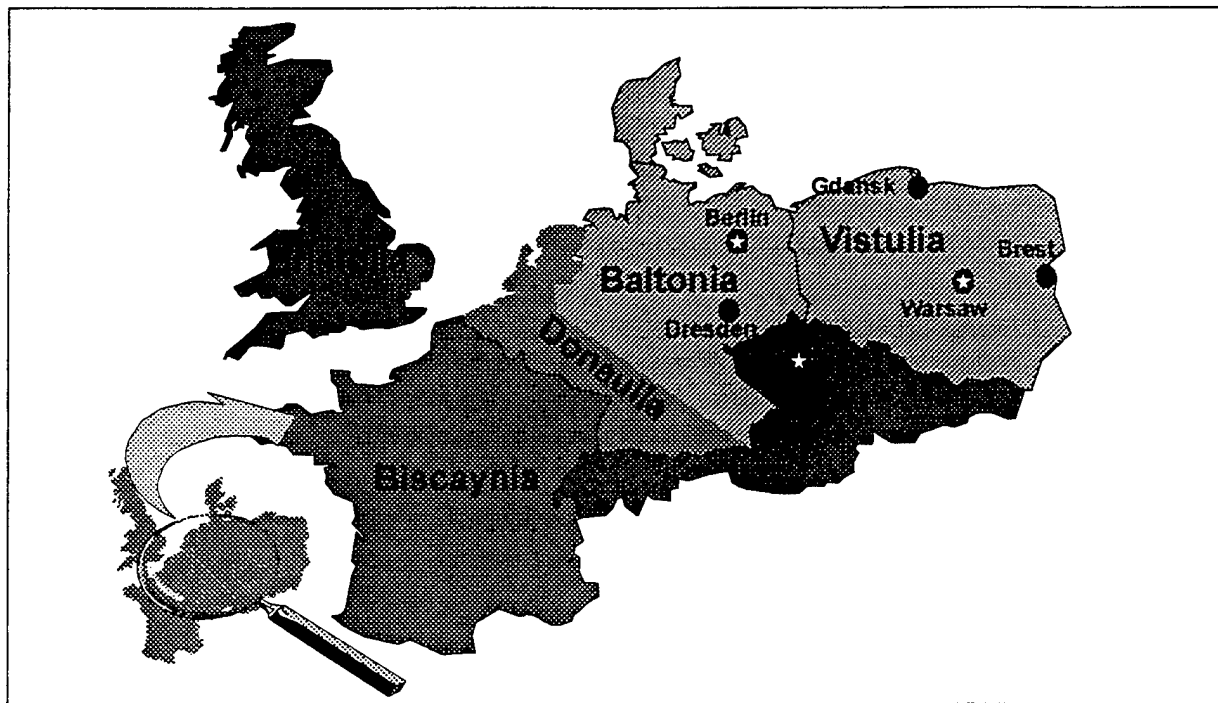


Exhibit 2-1. Prairie Warrior 1996 European Scenario

terrain provided the desired combination of close and open terrain, requiring the use of heavy and light forces. The combination of terrain and opposing forces created the possibility of non-linear, even non-contiguous operations.

This scenario was to represent a fully developed contingency operation where the force XXI divisions were deployed in sufficient time to permit the use of a full complement of corps assets. As a result, how well the division accomplished the following tasks were evaluated:

- gain information dominance;
- mass the effects of lethal and non-lethal systems to shape the battlespace; and
- destruction of the enemy through the simultaneous application of the effects of fires and maneuver from multiple directions.

The 4th Infantry Division, configured as one of the Force XXI divisions in III Corps, was the focus of the scenario, as it attacked to destroy the 1st Biscaynian Corps. The decisive operation occurred in the vicinity of Potsdam.

In the scenario, the division, configured, as shown in exhibit 2-2, with an armor brigade, a mechanized infantry brigade, a light infantry brigade, an aviation brigade, a DIVARTY and two corps artillery brigades, attacks a motorized rifle division and a tank division. Part of a larger corps operation, the scenario entails the initial phase depicted in exhibit 2-2 followed by further combat across the Elbe River.

The focus of this scenario was the integration of heavy and light forces at the division level, vice within the brigade, in a situation with close and open terrain. The key conceptual areas were how well the division could shape the battlespace and conduct decisive operations.

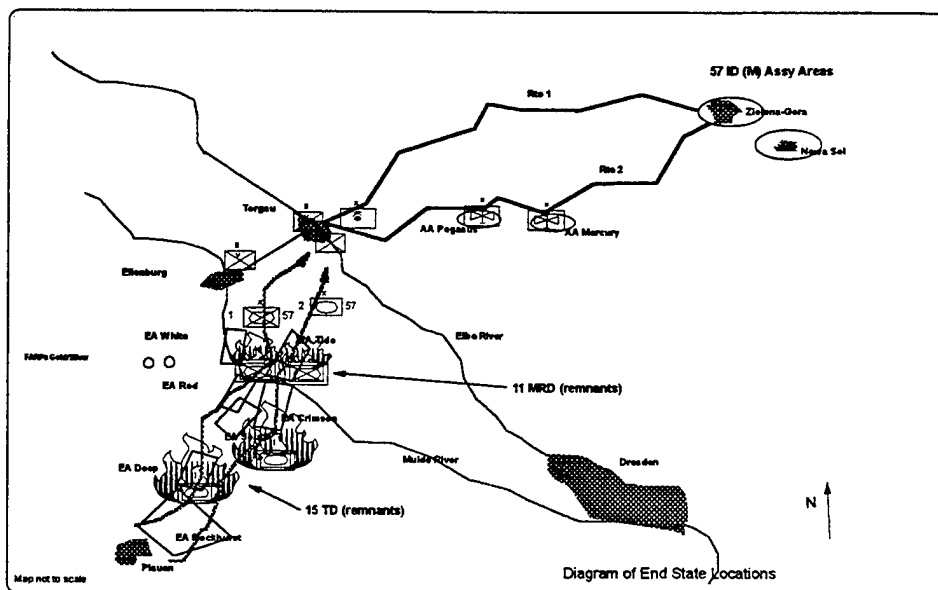


Exhibit 2-2. Prairie Warrior 1996 European Scenario (Concluded)

2.3.3 PRAIRIE WARRIOR 1995 MOBILE STRIKE FORCE NORTHEAST ASIA SCENARIO

The mobile strike force is not a fixed organization, but a concept. It is a vehicle used to investigate new technologies, organizations, and concepts. During the Mobile Strike Force 95 study, a simultaneous ambush scenario was selected for investigation. The scenario, depicted in exhibit 2-3, was set in Northeast Asia. The opposing forces were an operational exploitation force (OEF) which consisted of nine brigades. There were six mechanized infantry brigades, an armor brigade, and two field artillery brigades. The OEF was equipped with a relatively unsophisticated armor capability. The OEF mission was to move from vicinity of a city representing Pyongyang to reinforce a first echelon army group's bridgehead northeast of Seoul. The OEF moved only at night and used hide positions during the daylight hours. It took thirty hours for the first brigades to move from their start position to the bridgehead area.

The mobile strike force mission was to destroy the OEF to prevent their reinforcement of the first echelon army group. To accomplish this, the mobile strike force was task organized with an armor brigade, a light infantry brigade, an aviation brigade, and a DIVARTY. The mobile strike force also had a lift aviation brigade, an engineer brigade, and a standard division slice of CSS elements. The division troops included a regimental aviation squadron, and an MI battalion with UAVs. However, the battalions in this organization were not typical AOE battalions as they varied in the number of major combat systems.

The operation was conducted in five phases: (1) phase 1 was a reconnaissance that incorporated the use of special operations force teams, air cavalry assets, and UAVs to watch the enemy movement; (2) phase 2 positioned the attack assets--ground elements and air assault elements; (3) phase 3 was the simultaneous ambush of enemy throughout the depth of his deployment; (4) phase 4 was the exploitation where all remnants battalion sized or larger were destroyed by attack aviation, close air support, and air interdiction; and (5) the final phase was

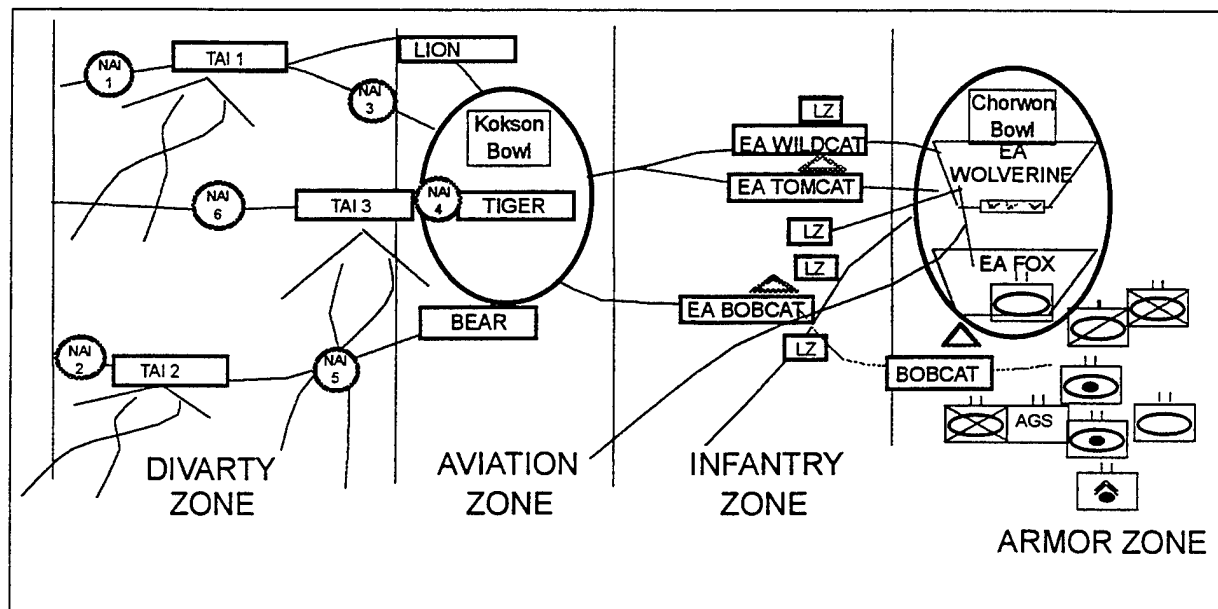


Exhibit 2-3. Prairie Warrior 1995 Mobile Strike Force NEA Scenario

reconstitution and repositioning. Exhibit 2-3 depicts the layout of the engagement areas and friendly units committed to each area.

This scenario was selected because it was an excellent vehicle for investigation of modularity, flexibility, and task organization issues. In the course of the Mobile Strike Force study, the force was very successful. As executed, the mobile strike force was approximately 30,000 soldiers, and its representation did not perfectly fit any of the alternatives. Therefore, the seminar was given a particular mission and force and discussed how well any of the alternative designs could replicate that task organization. The focus was on the relative ease of organization and employment.

This page intentionally left blank.

3.0 ASSESSMENT OF ALTERNATIVES

Next the report will focus on assessments made of each division design alternative. The format for reporting these assessments will be to summarize the seminar's consensus of the strengths and weaknesses of each design one design at a time.

3.1 MODERNIZED ARMY OF EXCELLENCE DIVISION

3.1.1 STRENGTHS

The AOE heavy division was designed for a specific purpose: a protracted defense in Europe. This design purpose dictates many of its characteristics. Its strengths include: first, flexibility in maneuver units the maneuver units were made to be taken apart; second, redundancy in combat power (e.g., four maneuver companies rather than three) and in support functions (e.g., overlap in functions in maneuver battalions with that in support units; this design has the best reconnaissance capability at the division level); third, a force that fights well in the big division-level, contiguous operations expected in Europe; and last, it is excellent for massing fires at the division level.

Flexibility
Redundancy
Strongest in contiguous fight
Massing at division level

Modernized AOE Division Strengths

3.1.2 WEAKNESSES

The weaknesses of this design in many ways mirror the strengths. While strong in the contiguous fight, this division has difficulty tailoring support functions as is necessary for a non-contiguous fight. These functions need modularity. In many cases, when a support unit is pulled apart to support individual maneuver elements, what is left has very little capability.

Support outside of the contiguous fight
Agility
Confidence in support
Non-economy of support
Not very deployable

Modernized AOE Division Weaknesses

The division maneuvers well, but its support does not. Further it lacks the ability to reconfigure its support quickly in response to changes on the battlefield. This lack of responsiveness coupled with the extra burden of redundant capabilities greatly reduce the division's agility in combat.

The organization does not naturally develop confidence in supporting elements. The maneuver commander owns some support but not all. There is overlap between the functions the maneuver commander owns and those provided to him. The maneuver unit does not necessarily establish a habitual relationship with all support provided to it.

Opportunities for economies of support have not been fully explored in this design. The overlap and redundancies in support functions is no longer affordable or necessary.

Finally, the redundancies mean extra weight making the division difficult to deploy. Born of a time when much more of the force was forward deployed, lift is always a constraint for the force projection army.

3.2 HEAVY/LIGHT — SMALL BASE DIVISION

3.2.1 STRENGTHS

With the HL-SB Division, we begin to see changes from the familiar AOE design which alter the division's strengths and weaknesses.

Some redundancy of combat capability remains, and this continues to facilitate tailoring — though not as much as with the AOE division.

The result is a division with great flexibility; it is appropriate for a variety of missions. The possibilities for economies in support functions have been touched on in this design; it is slightly better in this regard than the AOE division. The division base, as its name implies, is smaller. Some firepower has been retained at division — notably MLRS and attack aviation. These firepower capabilities allow the division to buy time while waiting for support from corps.

Redundancy allows tailoring
Economies of support functions
Firepower capabilities to buy time until supported
Heavy/Light-Small Base Division Strengths

3.2.2 WEAKNESSES

The reductions in the division base eliminated too much air defense and intelligence in the judgment of the seminar. This weakness is fixable : either add the appropriate units to the division or make that type of support routinely available from corps. Providing the support from corps

should be done only after a thorough examination of all functions at the division and corps level. As is sometimes the case, the retention of the firepower capabilities mentioned as a strength may also be a weakness should these capabilities not be

needed. The mobility differential between the heavy brigades and the light brigade were seen to be a significant problem for this design. The seminar was concerned that the mix of two heavy brigades and one light brigade would be inappropriate for some situations. If setting conditions requires the engagement of one of the heavy brigades as has been the case in some wargames, then the remaining maneuver force of one heavy brigade and one light brigade is severely limited in its close combat capability. Finally, implementing this design removes heavy brigades from the force. If each of the current heavy divisions is replaced with one of these divisions, one heavy brigade in each of the current heavy divisions is replaced by a light brigade.

Air defense and intelligence insufficient
Firepower capabilities to buy time until supported
Mobility differentials
Removes heavy brigades from force
Heavy/Light-Small Base Division Weaknesses

3.3 BRIGADE-BASED DIVISION

The Brigade-Based Division is characterized by rather significant strengths and weaknesses.

3.3.1 STRENGTHS

This design provides a force organized and trained for the brigade-level fight. While some additional tailoring might be necessary, the brigade unchanged is probably a good solution to most combat problems.

The Brigade-Based Division has improved agility in the sense that it can respond quickly to changing situations. Further, the division has the ability to operate non-contiguously through its fairly autonomous brigade-sized elements.

Pre-designed decisive combat force
Agility
Economy of support functions
Stands up brigade-level combat power
Easiest to deploy in brigade packages

Brigade-Based Division Strengths

The idea of economy of support functions is explored most fully in this design. The division base is reduced to its smallest, and redundancies between echelons are virtually eliminated. The seminar uniformly supported this general trend.

This design deploys well for two reasons. First, it naturally quickly stands up the combined arms element appropriate for most early entry operations, the brigade. Second, in any situation requiring brigade-sized deployments, this design delivers the deploying organization with less effort. This brigade trains together in peacetime and requires little tailoring before deployment.

3.3.2 WEAKNESSES

The weaknesses of this design are significant. First, in reducing the division base in this design, the headquarters of CS and CSS functions at the division level were eliminated.

This makes it difficult to mass combat power at the division level. Brigade-level fights are easier, but much of the mechanism for controlling a multi-brigade fight has been eliminated.

It is also difficult to reinforce with combat multipliers in changing battlefield conditions with this design. Augmentation from corps can be given directly to brigade, but would be difficult to control at the division level.

No commander of support functions
Difficult to mass combat power
Difficult to reinforce
Lacks flexibility to changing conditions
Staff training
Division-level reconnaissance missing

Brigade-Based Division Weaknesses

Next, this design would not necessarily be easy to tailor below the brigade level. Modularity is just as important with this design as in the others. It must be easy to move battalions and their support between brigades.

Adopting this alternative will create a massive change in how the Army structures staff training for every echelon battalion and above. The Army will have to rethink how it assigns missions and tasks to subordinate units and how it conceptually masses effects across the division. This is less a weakness of the design than a note about what must be done to implement it.

Finally, the seminar judged that the lack of reconnaissance capability at the division level was a serious deficiency. While there is a ground cavalry squadron at the brigade level, a feature the AOE division does not have, there is no cavalry at the division level. There is no air cavalry at either level.

4.0 FINDINGS AND CONCLUSIONS

None of the design alternatives can be recommended without modifications and the start point for making changes should not be the AOE design. Built for a different time and purpose, the AOE design is not affordable today. Further, the Army must change and be seen as changing. Retention of even the old name does not serve Force XXI well.

Time to move beyond AOE

Neither alternative to AOE acceptable without modification

Development of another design is necessary

Seminar Findings and Conclusions

Both alternatives to AOE offer important characteristics, but neither is acceptable without modification. The Brigade-Based Division design gives the ability to quickly generate combat power and gives the best tailorability. It appears to be the best structure for rapid application of brigade-level combat power. These important characteristics must not be lost in subsequent design efforts. However, it lacks the structure to easily control the division-level fight. The Heavy/Light - Small Base Division structure, while it lacks the appealing characteristics of the of the brigade-based design, it retains command and control capability in the division base which allows the massing of combat power at division level and control of the division-level fight when necessary. This design however, while avoiding the complete elimination of the division base in the Brigade-Based Division, has not eliminated as much as might be possible.

The Brigade-Based Division is appealing but risky. The HL-SB Division is less risky but must incorporate some of the appealing characteristics of the Brigade-Based Division as well as other changes.

This page intentionally left blank.

5.0 RECOMMENDATIONS

Having concluded that a new design must be developed and the AOE design must be abandoned, the seminar recommends integrating the best qualities of the HL-SB and the Brigade-Based Divisions. These best qualities include retention of the idea of a small division base and retention of the combined arms brigades. These and other modifications are necessary to produce an acceptable division design.

Integrate best qualities of

- Heavy/Light-Small Base Division
- Brigade-Based Division

Retain small base

Retain combined arms brigades

Make other modifications

Recommendations

The seminar defined its recommendations in terms of modifications to one of the alternatives to AOE, choosing the modular small base design as the point of departure. Modifications recommended for the HL-SB Division include:

Combined arms brigades (with modularity)

3 Heavy brigades (consider light brigade at corps)

Reexamine the division base

Redefine division and brigade controls

Include firepower capabilities to buy time until supported

Recommended Modifications to Heavy/Light-Small Base Division

- Apply the concept of combined arms brigades to this design. Structure fixed brigades similar to the concept developed for the Brigade-Based Division. Ensure that modularity is built into the brigade and its support structure to make it as easy or natural to task organize the brigade as it will be the division. In developing the brigade structure, eliminate redundancy in the support structure.
- Change the maneuver brigades in the division from two heavy and one light to three heavy brigades — consider the possibility of an infantry brigade at corps. Having three heavy brigades overcomes the problem of a difference in mobility among the maneuver brigades.
- Reexamine the division base. Ensure that redundancy in support and combat support functions is completely eliminated; the "small base" can be made smaller. However, the ADA capability at division level has to be beefed up; one battery is not enough. A battalion, either in the form of an organic unit or DS from corps, is required.
- Consider redefining division controls for combat multipliers at brigade and division. Applying the combined arms brigades to this design could introduce the problem of controlling fires and support at the division level seen in the brigade-based design. Artillery, intelligence, and CSS functions will now be organic to the brigade but must be integrated at division. It may be necessary to redefine how missions are assigned to artillery assets, for instance.

- Finally, ensure that a minimal firepower capability is retained in the division: an attack helicopter battalion and a MLRS battalion. This gives the division commander the capability to buy time while waiting for corps assets in the face of unanticipated enemy action.
- MI capability, one company in the RISTA battalion, is totally insufficient for "gaining information dominance."

6.0 THE WAY AHEAD

The group raised a number of concerns that require further analysis or suggest changes in how the analysis might be done.

6.1 DEFINE CORPS FUNCTIONS

No discussion of the organization of the division is possible without first deciding on which functions will be at the corps echelon. Over the years, we have decided that the division will rarely operate at the operational level. Consequently, we have taken a lot of capability out of the division and placed it at corps. The corps will always task organize at least the early entry forces. With these ideas in mind, the seminar developed the following list of functions appropriate for corps as a start point for the process of deciding what should be done at the division level:

- Fire support, including counterfire, long-range fires to shape the battlespace (will not normally support the close battle), and JSEAD.
- Aviation, including deep operations to set conditions (Attack helicopters, lift necessary for air assault operations, logistics lift, and reinforcement of the tactical battle (surge capability).
- Operational intelligence, including sensor suites and all-source integration.
- Combat service support – sustainment beyond 60 days.
- Force protection, including HIMAD and TMD.
- Personnel and finance.
- Operational mobility – assuming the division is responsible for accomplishing a tactical mission within the context of the corps as the operational force, the corps should provide the assets required to move the division.
- Tactical maneuver elements for use as the corps reserve and for deep attack.
- Joint fires – the corps is an integrator and allocator.

6.2 APPLY CONSTRAINTS TO THE DIVISION DESIGN PROCESS

These constraints must be clearly articulated to and felt by the entire force design system. The constraints must not be arbitrary but should directly express the Army's interests and limitations. Two possibilities for constraints were suggested as illustrative. First, lift, expressed in terms of the requirement to move a division and in terms of how quickly the division can stand up combat power in the contingency theater, is a possible constraint provided it adequately expresses the concerns of Army leadership. Second, a possible constraint is the number of

maneuver battalions the leadership requires to be in the active component. This last element could provide the basis for joining the division redesign process with the effort underway to restructure the reserve component. This could be done by building modularity into the division with consideration of the possibility that some modular components might best be in the reserve component in peacetime.

6.3 DEFINE DIVISION COMMAND RELATIONSHIPS AND STAFF FUNCTIONS

A need exists for a clear definition of command relationships and staff functions at the division consistent with how the new design develops. The following specific areas were of particular concern.

- Fix responsibilities for long-range fires.
 - ▶ What is done at each echelon?
 - ▶ What capabilities must be at the division level?
- Evaluate MI functions: What capability is needed at each echelon?
- Fix combat service support functions.
 - ▶ What responsibilities should be at each echelon?
 - ▶ What capabilities must be at the division level?
 - ▶ Reduce redundancies in current structure.

6.4 EXAMINE RECONNAISSANCE AND SECURITY FUNCTIONS

The reconnaissance and security functions came up repeatedly in panel discussions and in general sessions. Non-contiguous operations make them particularly important, and how they will be handled must be decided before the division is designed. Their performance, in light of the “gain information dominance” pattern, is critical to the division’s success or failure.

6.5 FIXING THE ENEMY

The concept of fixing the enemy with fire and obstacles (and minimum maneuver forces) warrants a closer look. If the mix of light and heavy forces of the HL-SB Division is abandoned, this is a less critical issue.

ANNEX A: STRENGTHS AND WEAKNESSES OF THE MODERNIZED AOE DIVISION

The AOE heavy division was designed for a specific purpose: a protracted defense in Europe. This design purpose dictates many of its characteristics, characteristics that we see in today's post-Cold War environment as both strengths and weaknesses.

STRENGTHS

The maneuver units in this design come as close as anything to the modularity now being discussed for new designs. The maneuver units, at least, are inherently flexible. They were designed to ease task organizing for the mission at hand; the maneuver units were made to be taken apart.

This division was designed to have excess capability or redundancy in both combat power and support functions. For example, there are four maneuver companies rather than the expected three in each maneuver battalion. Likewise, the support functions in maneuver battalions overlap those in support units. These redundancies make the AOE division a robust one, particularly in the rather stable, slow-moving battlefield for which the division was designed.

The AOE heavy division provides a force that fights well in the big division-level, contiguous campaign expected in Europe. It fights best as a division, and so long as that kind of fight is anticipated, the AOE heavy division has significant advantages. It has a lot of firepower and the capability to coordinate it at the division level.

Functional training in peacetime is a strength for this design. It has the centers of functional expertise at the division level to coordinate and manage training for functional specialties.

WEAKNESSES

The weaknesses of this design in many ways mirror the strengths.

While strong in the contiguous fight, this division has difficulty tailoring support functions as is necessary for a noncontiguous fight. These functions need modularity. Often, when a support unit is pulled apart to support individual maneuver elements, what is left has very little capability. It cannot provide support to all elements in noncontiguous operations.

The division maneuvers well, but its support does not. Further, it lacks the ability to reconfigure its support quickly in response to changes on the battlefield. Insufficient organic lift for support functions can constrain the division's ability to move quickly.

The organization does not naturally develop confidence in supporting elements. The maneuver commander owns some support but not all. There is overlap between the functions the maneuver commander owns and those provided to him. The maneuver unit does not necessarily establish a habitual relationship with all support provided to it.

This design does not fully explore opportunities for economies of support. The overlap and redundancies in support functions are no longer affordable or necessary.

The redundancies mean extra weight making the division difficult to deploy. Born of a time when much more of the force was forward deployed, lift is always a constraint in the deployment of this design.

The nature of the organization of the AOE heavy division makes it difficult to stand up complete, fightable packages of less than division size when deploying to a contingency theater. It is possible not to be able to fight an AOE heavy division until the entire division is in theater.

ANNEX B: STRENGTHS AND WEAKNESSES OF THE HEAVY/LIGHT -SMALL BASE DIVISION

With the HL-SB Division, we begin to see changes in the strength and weaknesses of the AOE design, but the result seems to be a compromise without significant strengths or weaknesses. It mitigates some weaknesses of the other designs without offering important strengths.

STRENGTHS

Some redundancy of combat capability remains, and this continues to facilitate tailoring — though not as much as with the AOE division.

The possibilities for economies in support functions have only been touched on in this design; it is slightly better than the AOE division. The division base, as its name infers, is smaller. The seminar strongly endorsed the pursuit of economies in support functions.

Some firepower has been retained at division — notably MLRS and attack aviation. There is a MLRS battalion vice a battery in the AOE division. The aviation brigade has an attack battalion in both designs. These capabilities give the division commander an important ability to respond quickly to unforeseen enemy activities.

WEAKNESSES

Reductions in the division base eliminated too much air defense and intelligence in the judgment of the seminar. The air defense is reduced from a battalion to a battery. Augmentation from corps can change the air defense situation. The issue is where should the basic capability be retained. This design reduced the MI battalion of the AOE design to a company. Augmentation from corps will not fix this deficiency, but changing the design will.

As often happens, the retention of the firepower capabilities mentioned above as a strength may also be a weakness should these capabilities not be needed. This is the other side of the redundancy versus economy argument.

The seminar saw mobility differential between the heavy brigades and the light brigade to be a significant problem for this design. The seminar was concerned that the mix of two heavy brigades and one light brigade would be inappropriate for some situations. If setting conditions requires the engagement of one of the heavy brigades as has been the case in some wargames, then the remaining maneuver force of one heavy brigade and one light brigade is severely limited in its close combat capability.

Implementing this design removes heavy brigades from the force. If each of the current heavy divisions is replaced with one of these divisions, a light brigade replaces one heavy brigade in each of the current heavy divisions. When looking at the two-MRC responsibilities of the entire force, the seminar thought that the Army cannot afford to swap six heavy brigades for six light brigades. Two-MRC wargaming will reveal the risk imposed by such a swap.

This design has no aerial reconnaissance capability.

This design reduced organic lift to one battalion. The seminar judged this to be insufficient, particularly with the one light brigade.

ANNEX C: STRENGTHS AND WEAKNESSES OF THE BRIGADE-BASED DIVISION

Rather significant strengths and weaknesses characterize the Brigade-Based Division.

STRENGTHS

This design provides a force organized and trained for the brigade-level fight.

The Brigade-Based Division has improved agility in the sense that it moves quickly and the brigades can respond quickly to changing situations. Further, the division can operate non-contiguously through its autonomous brigade-sized elements. With support functions organic to maneuver brigades, the brigades can operate dispersed from each other without sacrificing the ability to respond quickly to a division-wide situation.

The idea of economy of support functions is explored most fully in this design. The division base is reduced to its smallest, and redundancies between echelons are virtually eliminated. While the seminar was skeptical of some of what was removed in reaching this design, it fully endorsed the idea of looking for such economies in the design process.

This design deploys well for two reasons. First, it naturally quickly stands up the combined arms element appropriate for most early entry operations, the brigade. The brigade is about the smallest unit appropriate for early entry operations. Second, in any situation requiring brigade-sized deployments, this design delivers the deploying organization with less effort. This brigade trains together in peacetime and requires little tailoring before deployment.

Combined arms training was thought to be a strength for this design. Elements of the combined arms brigades are stationed together and will train together regularly in peacetime. Brigade-level combined arms training is critical. Division-level training of this type is just not done no matter what the division design; too many resources are required. The focus at brigade level parallels National Training Center training.

WEAKNESSES

The weaknesses of this design are significant.

First, in reducing the division base, this design eliminated commanders of CS and CSS functions at the division level. The DIVARTY, DISCOM, and engineer brigade have been removed without retaining any of the command and control capability the staffs of those organizations brought to the division level. This makes it difficult to mass combat power at the division level. Brigade-level fights are easier, but the design eliminated much of the mechanism for controlling a multi-brigade fight. If an artillery brigade is habitually assigned to the division, some difficulty is eliminated, but that brigade would not "own" the artillery in the maneuver brigades.

Removal of these functional focal points from the division moves the responsibility for the associated specialized functional training down to the brigade. The seminar judged that such training would suffer as a result.

Reinforcing it with combat multipliers in changing battlefield conditions with this design will also be difficult. Augmentation from the corps can be given directly to brigade, but would be difficult to control at the division level.

Further, this design seems to assume that automation will allow the G-4 to take over execution of logistics functions without augmentation. The seminar questioned this assumption while recognizing that part of the potential for "just-in-time" logistics is the removal of many of the division's materiel management functions.

Next, this design would not necessarily be easy to tailor below the brigade level. Modularity is just as important with this design as in the others. Moving battalions and their support between brigades must be easy. With complete modularity of design, this weakness goes away.

Next, the seminar judged that the lack of reconnaissance capability at the division level was a serious deficiency for this design. While assigning an aviation brigade can provide a cavalry squadron, there is no reconnaissance capability organic to the division base.

This design puts MI assets in the brigades in "piecemeal" fashion. Assigned this way, it may not be possible to coordinate the efforts of these units at the division level.

Finally, this design was developed in part by moving functions from division down to brigade. Until all force design details are completed, it is impossible to know, but the sum of all the parts at the brigade level may end up being greater than what the whole was at the division level. It is most likely that this division is heavy and expensive.

ANNEX D: SUMMARIZED RESULTS FOR THE SOUTHWEST ASIA SCENARIO

KEY ASSUMPTIONS

Divisions operate at the tactical echelon of command.

Divisions operate within the bounds of an operational plan.

Many external factors affect the size and type of force for a given mission.

In this scenario, the division is not an ARFOR.

The TOE structures of the alternative division designs contain (or may contain) EAD unit capabilities not normally available to a division.

The scenarios will be accepted as presented.

All Alternative designs can perform the mission outlined in the scenario.

The unit prepositioned on the ground in this scenario is organized the same as the alternative design being evaluated.

GENERAL DIVISION DESIGN IMPERATIVES

One primary function of the division echelon of command is to task the maneuver brigades and reconnoiter the missions for those brigades.

The division commander is heavily dependent on his ability to communicate, conduct reconnaissance, and gather intelligence.

The ability to integrate information for the task at hand, the mission, is key.

SCENARIO-SPECIFIC DESIGN IMPERATIVES

Every early entry battle is different.

The mission will dictate early entry force requirements, but lift constraints often determine what capability arrives and in what order.

We always need to send multiple echelons of command with the early entry force to facilitate quick and efficient command and control at all levels.

The early entry force has a highly mobile portion of the force. It must have long range attack assets to minimize attrition.

Design for the early entry force must provide a combined arms capability that stands up quickly in the contingency. How to do this is the question. Battalion-size units do not provide combined arms capability and the standard division takes awhile to build up before it can be committed. Brigade based force appears to provide the needed capability.

1. PROJECT THE FORCE

The alternatives are considered roughly equal with the Brigade-Based Division having a slight edge. The focus of the panels' consideration was on the commander's ability to stand up combat power under each alternative design after deployment. Each alternative has the capability of deploying and standing up if the commander manages carefully what is sent and when. The alternatives have about equal capability in this regard, but the Brigade-Based Division makes the commander's job a little easier. Managed badly, it is possible to not be able to fight an AOE division until the full division is in theater.

Built-in modularity of both the HL-SB Division and Brigade-Based Division make them better from the point of view of projecting the force. Modularity is a key design characteristic for this or any early entry scenario.

It is possible that the Brigade-Based Division will be expensive to move. This design has reduced support structure at the division level but has increased it at the brigade level. Until the detailed design work on all the units of the division is complete, it is impossible to know how big, in terms of lift requirements, the result will be.

2. PROTECT THE FORCE

Differences between the alternatives are small; seminar panels gave a slight advantage to the Brigade-Based Division. The Brigade-Based Division has a better cavalry structure. The HL-SB Division has less attack aviation assets and no air cavalry. The Brigade-Based Division has more NBC capability and a better intelligence structure but less capability to synchronize intelligence across the division. The HL-SB Division has more cavalry than the AOE division, but no aerial scouts. The AOE division is best for rear operations. All alternatives are missing TMD, but TMD should not be considered a division issue. For this scenario, the engineer capability was sufficient in each alternative.

3. GAIN INFORMATION DOMINANCE

Reconnaissance and surveillance are needed at every echelon because of non-contiguous operations. This includes the capability to process and confirm information from sensors and conduct enemy jamming operations. There needs to be UAV capability at division and brigade for this fight.

The seminar thought that in the HL-SB Division, the RISTA battalion commander will focus on his cavalry assets rather than his MI company. Intelligence could suffer as a function. In

the Brigade-Based Division, the division commander will lose touch as his brigades tend to coordinate with EAD. This division also has less jamming capability.

The Army can use real time situational awareness to double historical employment of combat power (usually 35%) by reducing "just in case" employments.

The AOE design is preferred due to the larger number of staff personnel available to process or fuse information coming in from multiple sources. The large number of sensors with advanced technology will allow the commander to gather an enormous amount of information. The problem will be how to process that information. The Army needs an ASAS-type capability that will allow it to fuse and analyze such information in sufficient detail.

4. SET THE BATTLESPACE CONDITIONS

Fixing the enemy force has always been fundamental in combat. This involves control of the enemy's options. With improvements in technology over time, fixing the enemy force may be accomplished by fires, dynamic obstacles, aviation, or other means. The panels were unsure what the impact of improved technology will be in this area. The seminar assumed that the level of technology was the same for all design alternatives. However, the way each alternative would be able to use this technology could be different. Because the impact of future is unknown, the short term alternative should include more reconnaissance and security capability and more heavy forces.

Both the HL-SB and Brigade-Based Divisions have more MLRS than the AOE division. The HL-SB Division has fewer attack helicopters than AOE. If the division has the responsibility to shape the battle, it must have the means to do so. The HL-SB Division is described as having been designed with a limited deep strike capability. This limited capability and the implications for changes in responsibility for deep strike at the division and corps levels have not been defined.

Deep strike assets in the Brigade-Based Division might be less responsive without a DIVARTY to focus the effort. Further, the Brigade-Based Division is the least desirable arrangement for a covering force battle--a battle coordinated at the division level. The AOE design was thought to be best for the covering force battle.

The HL-SB Division alternative was preferred.

5. CONDUCT DECISIVE OPERATIONS

Overall, the preferred alternative for this scenario would look very much like an exploitation force. Overall, the independent brigade would be preferred. This consideration tends to favor the Brigade-Based Division.

The panels felt that artillery would play an important role in both setting the conditions and decisive operations. Therefore, a key is which alternative is best equipped to make the artillery effective. Lack of a DIVARTY's capability of massing and focusing artillery at the division level is a weakness for the Brigade-Based Division, but that consideration is less important in this scenario.

6. SUSTAIN AND TRANSITION THE FORCE

The incomplete nature of the logistics concept hampered deliberations in this area.

The Brigade-Based Division is slightly better than the HL-SB Division in this case. The key factor is that support functions are organic to the maneuver unit in the Brigade-Based Division. In this design, however, the division has no apparent link to the flow of logistics information between brigade and corps. Therefore, it may play only a restricted role in logistics management. The seminar saw this as a shortcoming for the Brigade-Based Division.

OVERALL EVALUATION

The Brigade-Based Division appears to provide the best overall capability for this scenario due to its ability to quickly provide a combined arms combat team to the early entry mission. However, it lacks some critical capabilities at the division level.

GENERAL ISSUES AND COMMENTS

Mobility differences among the units in the division are an issue.

There needs to be high level discussion of reconnaissance and security. The key capability for the division commander is the ability to focus on specific tasks for the brigades. Ground reconnaissance should feed a force into a fight whereas larger and faster reconnaissance finds large forces. A key aspect of reconnaissance is who runs the sensor. The commander focuses in on what he thinks is important. How much reconnaissance is required at the brigade level? What kind — fast moving (air cavalry) or slower (ground cavalry)?

The commander needs surveillance as well as reconnaissance. The key is what do we want the division to do.

Better digital information and situational awareness should reduce risk and employment of forces to reduce that risk.

Who is responsible for information dominance? Division? Corps? JTF? All?

ANNEX E: SUMMARIZED RESULTS FOR THE PRAIRIE WARRIOR 1996 EUROPEAN SCENARIO

KEY ASSUMPTIONS

Divisions operate at the tactical echelon of command.

Divisions operate within the bounds of an operational plan.

Many external factors affect the size and type of force for a given mission.

In this scenario, the division is not an ARFOR.

The TOE structures of the alternative division designs contain (or may contain) EAD unit capabilities not normally available to a division.

The scenarios will be accepted as presented.

All alternatives can perform the mission outlined in the scenario.

GENERAL DIVISION DESIGN IMPERATIVES

One of the primary functions of division echelon of command is to task the maneuver brigades and reconnaissance the missions for those brigades.

The division commander is heavily dependent upon the ability to communicate, conduct reconnaissance, and gather intelligence.

Ability to integrate information for the task at hand (mission) is key.

SCENARIO-SPECIFIC DESIGN IMPERATIVES

Corps is operating at the tactical level.

This force must be highly mobile.

Long range fire assets (the deep fight) and positioning of units have been given over to the lead division by the corps commander.

Corps commander seems to have very little influence over the battle.

The ability to command and control the organization is the critical decision criteria. The units that tend to do this better are the ones that have a bigger base.

1. PROJECT THE FORCE

None of the alternatives contain enough lift to support the movement and resupply of the light brigade in this scenario. The AOE Division is not organized the way the fight is carried out in this scenario. As a result, habitual relationships suffer, however this design probably produces better functional training. The Brigade-Based Division is harder to train because there are no functional area commanders. The AOE and HL-SB Divisions get packaged based on a detailed mission analysis; the Brigade-Based Division may be more difficult to fine tune. This depends in part on how modular this alternative is designed to be.

The HL-SB Division is preferred slightly over the Brigade-Based Division with the AOE Division being least desirable by a small margin.

2. PROTECT THE FORCE

The evaluation of the designs varied over several specific areas:

ADA	The Brigade-Based Division is better than AOE, and both are better than the HL-SB Division.
Reconnaissance	The Brigade-Based Division is best, but a cavalry squadron should be added at the division level. The HL-SB Division has a reconnaissance capability at both the division and brigade levels, but has no air cavalry. There was discussion of the need to balance air cavalry and UAV capabilities.
TMD	None of the designs have a capability.
MI	AOE is best because functional training in peacetime would be better. The Brigade-Based Division is a close second, and the HL-SB Division is a distant third.
NBC	There is little preference among the three alternatives. The HL-SB Division was evaluated to be slightly better than the Brigade-Based Division, and both are a little better than AOE.
Engineer	Again there is little difference between the alternatives. The HL-SB Division was preferred with AOE second and Brigade-Based Division third.

Overall, the seminar preferred the Brigade-Based Division.

3. GAIN INFORMATION DOMINANCE

This is a division fight requiring information for command and control at the division level. AOE is better because it has more resources for information dominance in the division fight. AOE was built for this type of scenario.

The more the scenario is a division mission, the more the Brigade-Based Division suffers. This design has the least command and control capability at the division level.

The HL-SB Division was judged to have an intelligence deficiency.

Overall, the AOE Division was preferred with the other two judged about equal.

4. SET THE BATTLESPACE CONDITIONS

The large division base in the AOE design has slightly more ability to integrate corps plugs while simultaneously conducting movement and maneuver and focusing long-range fires. The Brigade-Based Division lacks this capability.

5. CONDUCT DECISIVE OPERATIONS

The HL-SB and AOE Divisions were judged to be better than the Brigade-Based Division because of their fire support integration capability. The seminar thought the Brigade-Based Division had a maneuver advantage, but it would be harder to synchronize when multiple brigades are required for a fight. Further, the Brigade-Based Division is more difficult to task organize during the phases of the operation of this scenario.

Overall, the seminar preferred the AOE Division in this category of comparison.

6. SUSTAIN AND TRANSITION THE FORCE

The AOE Division has greater capability to integrate support from the corps. This design contains CSS command and control at each echelon from brigade through corps.

The fights in which the Army can expect to be engaged in the future will be of short duration. The seminar expected that sustainment will most likely occur after as opposed to during the operation. There are some positive aspects to having a fixed DISCOM to accomplish sustainment.

OVERALL EVALUATION

The AOE Division appeared to have advantages over the other alternatives. This evaluation was thought to be very situational dependent. This design needs more lift. It has air but less ground cavalry.

The HL-SB Division is better than AOE on lift, but has insufficient ADA, and does not have enough attack aviation to sustain operations. It has the best ground cavalry structure but no air cavalry. Its MLRS provide a firepower capability to allow the division to buy time while waiting for support from corps.

The Brigade-Based Division has the same lift as the HL-SB Division and more lift than AOE. It has the same attack aviation as the AOE. It is probably better organized for the first two missions in this scenario.

GENERAL ISSUES AND COMMENTS

There must be an integrating commander at the division level for logistics, fire support, aviation and intelligence. The level of assets that the division receives is dependent upon the amount of the battle apportioned to the division commander.

Mobility differences among the units in the division are an issue. Mixing of mobilities is mission and terrain specific. In this scenario, the mobility afforded by the light, quicker force may be outweighed by the fire power capability of the enemy.

ANNEX F: SUMMARIZED RESULTS FOR THE PRAIRIE WARRIOR 1995 NEA MOBILE STRIKE FORCE SCENARIO

KEY ASSUMPTIONS

Divisions operate at the tactical echelon of command.

Divisions operate within the bounds of an operational plan.

Many external factors affect the size and type of force for a given mission.

The TOE structures of the alternative division designs contain (or may contain) EAD unit capabilities not normally available to a division.

The scenarios will be accepted as presented.

All alternatives can perform the mission outlined in the NEA scenario.

GENERAL DIVISION DESIGN IMPERATIVES

One of the primary functions of division echelon of command is to task the maneuver brigades and reconnaissance the missions for those brigades.

The division commander is heavily dependent upon the ability to communicate, conduct reconnaissance, and gather intelligence.

Ability to integrate information for the task at hand (mission) is key.

SCENARIO-SPECIFIC DESIGN IMPERATIVES

The division positioned itself and conducted nighttime limited visibility operations.

The division commander has chopped combined arms capabilities to the DIVARTY and brigade commanders to conduct operations in a zone. The division commander's requirement to synchronize the BOSs has been reduced by assigning sectors and assets (reconnaissance, maneuver, and deep strike) to the brigade commanders. He is only required to synchronize the actions in time, not space.

The division commander's missions include detailed planning, task organizing, determining the time for execution, and applying additional fire power when and where needed.

The division is executing an operational maneuver called for by the JTF commander.

1. PROJECT THE FORCE

Forces are already deployed at the start of this scenario. Projecting the force is not an issue for this scenario.

2. PROTECT THE FORCE

ADA is not an issue because the blue force possessed air superiority. AOE would be slightly better than the HL-SB Division.

3. GAIN INFORMATION DOMINANCE

This division did not fight an information battle at the division echelon. There is little difference between the alternatives on their abilities to perform this function. The Brigade-Based Division has the best intelligence and reconnaissance capability at the brigade level, but the division-level staff capability is weak.

4. SET THE BATTLESPACE CONDITIONS

Division commander has delegated the setting of battlespace conditions to the brigade commanders. The division commander's only task in this battle was to allocate fires and time. The reallocation of combat power during the battle to respond to unforeseen difficulties would be more difficult with the brigade-based design.

5. CONDUCT DECISIVE OPERATIONS

The Brigade-Based Division is slightly better than the other alternatives at conducting the close fight, because it already possesses the CS and CSS to operate independently on the battlefield.

6. SUSTAIN AND TRANSITION THE FORCE

On the move to and during the engagement, the Brigade-Based Division is the best alternative. The AOE Division is the best for the return and recovery. The Brigade-Based Division is unbalanced after sustaining losses because CS and CSS command and control goes back to the corps. There is no way to shift assets at the division echelon.

OVERALL EVALUATION

Conclusions drawn from this scenario are highly dependent on the specifics of the scenario. There is a very slight advantage to the Brigade-Based force in this scenario. All of the alternatives could execute the mission given in the scenario after receipt of non-divisional assets. The AOE Division would probably leave behind a great deal of the excess capability. The Brigade-Based Division would require attachment of the necessary brigades in sufficient time to facilitate the planning and positioning.

GENERAL ISSUES AND COMMENTS

Relooking the command relationships within the division can solve some force design problems encountered in this scenario. For example, for some situations it may be advantageous to attach artillery to its maneuver brigade rather than having it in a direct support or assigned relationship. This issue does have an emotional side.

The division alternatives must be evaluated within the context of a corps. There are a variety of assets that the corps commander can add to the division. The key is to pool resources (Aviation, combat, CSS) and make organic to the division only what is needed at all times.

There must be a clear understanding of the responsibilities at each echelon.

Early entry operations require the corps commander to task organize the force to the mission at hand. This force, including prepositioned elements, will be lift constrained.

Standing up combat power on the other end should be done in brigade packages. The brigade is the smallest, most mobile combined arms team. Its organization can be achieved by a mixture of command relationships. Feeding other support into the early entry scenario can be done in battalion- or even company-size packages.

The early entry force commander must have ability to command and control. He requires a functioning staff, fire support coordination capability, a CSS headquarters, and a reconnaissance and surveillance capability. This would allow the focusing of tasks to the brigades.

There must be a discussion of permanently mixing the differing types of brigades. It becomes situational and determined by the corps commander.

A division can be an ARFOR but will need a great deal of help. If a division commander is to function as both a division commander and an ARFOR, he must be supplemented with staff support from corps. A separate staff is needed to carry out the ARFOR responsibilities. The seminar felt that this was especially critical in early entry operations. Under these circumstances, the division staff would be unable to deal with the details of its subordinate units while at the same time having to coordinate support from back in the CONUS.

The 105mm artillery is not very useful unless the division is supporting light forces in difficult terrain. It was not useful in the scenarios presented. Replacing these with 120mm mortar does not make sense because of range limitations.

In non-contiguous operations, BOS integration will be done by the brigade commander. However, the division must be able to fight a coherent division fight. The division must be able to generate and process intelligence and reconnaissance.

The division will almost always operate at the tactical level. Therefore, part of the force protection and setting the conditions of the battle will be a corps responsibility. The division will conduct the maneuver portion of the decisive operation. The division must be prepared to perform unusual tasks. The division must be able to fix an enemy force with maneuver when necessary.

There is an attractiveness to the Brigade-Based Division structure for team work and for CSS. It provides inherent team work that allows the pooling of some capabilities and the reduction of redundancy. Offense-oriented, agile maneuver battalions are more attractive.

The role of the fire support and CSS commands is to bring support forward and perform integration of the support. The organization supporting that commander can be smaller because of the digitization and situational awareness.

Aviation available to the corps requires a command element at the division. Consideration should be given to placing the reconnaissance and surveillance functions under that command at the division level and assigning to it whatever aviation assets are required all the time. This division-level aviation command should be the integrator of aviation assets received from the corps.

Shape the battle is a corps mission. The corps does most of the fire support maneuver. For the long duration close fight, the corps commander must provide the robustness to the division.

Digitizing the force may someday mean smaller more agile staffs. What the enemy is doing and where friendly forces are located is the bulk of the current information flow in the staff. This information will be available on a real-time basis with digitization. The staff currently associated with gathering this information can be eliminated. This should also reduce the time required to accomplish the problem solving process. The echelons of command must prevent the problem of an information overload.

There must be a combined arms capability in a forced entry scenario. AGS is a critical system to support this mission as well as artillery and aviation. It could be used as a means to increase the mobile firepower in the light infantry divisions.

ANNEX G: GLOSSARY

DEFINITIONS

Agility	The capability of an organization to respond quickly to changing circumstances. This quality involves not only the ability to physically react in a short time, but also includes the ability to make and implement the decision to react.
Battlespace	The area in all appropriate dimensions encompassing the future battle. Dimensions include but are not limited to physical space and time.
Combined arms brigades	Brigades comprising organic maneuver, combat support, and combat service support elements.
Cyberspace	The theoretical "space" in which computers communicate with each other.
Division base	Those units in the division which provide support to the maneuver brigades.
Flexibility	The capability of an organization makes it suited to a range of missions. An organization is inherently flexible if it has a wide range of capabilities and is appropriate for a number of different taskings without having to be task organized or otherwise changed.
Modularity	The characteristic given to units in the force design process which allows them to function properly when subdivided. This characteristic can manifest itself in two ways. First, in the situation of a supporting unit supporting three maneuver units, if the supporting unit is modular, it can subdivide and support the maneuver units in three different locations without loss of efficiency or capability. Further, what remains of the support unit, if anything, will also be able to function effectively. Second, if a unit provides more than one function and it becomes useful to separate those functions, modularity will allow the unit to divide along functional lines and still operate effectively. This situation can arise when one function is needed early in a deployment and the other is not needed until later. If the unit is designed to be modular, the function needed early can deploy early without being burdened with the second function.

Pentomic	The Army division design of the 1950s comprising five self-sufficient combat groups.
Redundancy	The quality of exceeding what is necessary. Referred to in organizations when a function on one organization overlaps or duplicates one in another. Commonly occurs in the Army division when more total capability than is required is built into the organization to ensure that enough capability will be available at a particular time and place on the battlefield.
Tailorability	The characteristic of an organization which allows it to be changed or "tailored" for a specific mission.

ACRONYMS AND ABBREVIATIONS

2ID.....	U.S. Army Second Infantry Division
4ID.....	U.S. Army Fourth Infantry Division
AGS.....	armored gun system
AH.....	attack helicopter
ALB.....	Airland Battle
ALB-F.....	Airland Battle-Future
AOE.....	Army of Excellence
ARFOR.....	Army force
ASAS.....	All Source Analysis Center
atk.....	attack
AWC.....	U.S. Army War College
AWE.....	Army warfighting experiment
BCTP.....	Battle Command Training Program
bde.....	brigade
BOS.....	battlefield operating system
bn.....	battalion
BSFV-E.....	Bradley Stinger Fighting Vehicle - Enhanced
CAA.....	U.S. Army Concepts Analysis Agency
CGSC.....	U.S. Command and General Staff College
cmd.....	command
co.....	company

CONUS.....	continental United States
DISCOM.....	division support command
div.....	division
DIVARTY.....	division artillery
DS.....	direct support
EAC.....	echelons above corps
EAD.....	echelons above division
EXFOR.....	Experimental Force
FDD.....	TRADOC Force Design Directorate
FSB.....	forward support battalion
Gen.....	General
HHB.....	headquarters and headquarters battery
HHC.....	headquarters and headquarters company
HHD.....	headquarters and headquarters detachment
HIMAD.....	high and medium altitude air defense
HIMARS.....	high mobility artillery and rocket system
HQ TPS.....	headquarters troops
IFV.....	infantry fighting vehicle
JSEAD.....	joint suppression of enemy air defense
JTF.....	joint task force
LAM TF.....	Louisiana Maneuvers Task Force
LM VIII.....	Legal Mix VIII
LTG.....	lieutenant general
maint.....	maintenance
med.....	medical
METT-T.....	mission, enemy, terrain, troops, time - available
MLRS.....	Multiple-Launch Rocket System
MP.....	military police
MRC.....	major regional contingency
MSB.....	main support battalion
NBC.....	nuclear, biological, and chemical
NGID.....	National Guard Infantry Division
OEF.....	operational exploitation force
OOTW.....	operations other than war

plt.....	platoon
POD.....	port of debarkation
PREPO.....	prepositioned
QM.....	quartermaster
RAH.....	reconnaissance-attack helicopter
recon.....	reconnaissance
RISTA.....	reconnaissance, intelligence, surveillance, and target acquisition
SMR.....	senior military review
spt.....	support
TMD.....	theater missile defense
TOE.....	table of organization and equipment
TRAC.....	TRADOC Analysis Center
TRADOC.....	U.S. Army Training and Doctrine Command
trp.....	troop
TTP.....	tactics, techniques, and procedures
UAV.....	unmanned aerial vehicle
VRI.....	Vector Research, Incorporated

APPENDIX D.
DIVISION DESIGN ANALYSIS
COMPUTER ASSISTED MAP EXERCISE
(CAMEX)

This page intentionally left blank.

Table of Contents

	<i>Page</i>
EXECUTIVE SUMMARY	D-7
Conclusions	D-7
D-1 Purpose	D-9
D-2 Issues	D-9
D-3 Methodology	D-9
D-4 Goals	D-10
D-5 CAMEX Overview	D-10
D-6 Workshop Participants	D-11
D-7 Blue force employment	D-11
D-8 Battle flow summary	D-11
D-8-A Modernized Army of Excellence (AOE) Division	D-12
D-8-B Heavy/Light-Small Base (HL-SB) Division	D-13
D-8-C Modular (MOD) Division	D-14
D-9 Results for issue "Do the alternative division designs have the lethality capabilities required for the Force XXI Division?"	D-15
D-10. Results for issue "Do the alternative division designs have the survivability characteristics required for the Force XXI Division?"	D-29
D-11. Results for issue "What differences exist in the operational employment of the alternative division designs?"	D-40
D-12. Major Findings	D-41
ANNEX D-1: Participants	
ANNEX D-2: Blue Force Structure for Corps level assets	
ANNEX D-3: OPFOR Order of Battle	
ANNEX D-4: Blue Major Combat Systems List for Force Year 2001 and Force Year 2010	
ANNEX D-5: Killer-Victim Tables	

List of Exhibits

Exhibit Title

Figure D-1. AOE Battle Flow.	D-12
Figure D-2. HL-SB Battle Flow.	D-13
Figure D-3. MOD Battle Flow.	D-14
Figure D-4. Comparative lethality of division design alternatives in FY 2001 scenario.	D-15
Figure D-5. Lethality results for the AOE alternative in FY 2001.	D-16
Figure D-6. Lethality results for the HL-SB alternative in FY 2001.	D-17
Figure D-7. Lethality results for the MOD alternative in FY 2001.	D-18
Figure D-8. Comparative deep fires lethality of division design alternatives in FY 2001 scenario.	D-19
Figure D-9. Comparative lethality of division design alternatives in FY 2010.	D-21
Figure D-10. Lethality results for the AOE alternative in FY 2010.	D-22
Figure D-11. Lethality results for the HL-SB alternative in FY 2010.	D-24
Figure D-12. Lethality results for the MOD alternative in FY 2010.	D-25
Figure D-13. Comparative deep fires lethality of division design alternatives	D-26
Figure D-14. Comparison of Blue System Losses in FY 2001 scenario.	D-29
Figure D-15. AOE Losses in FY 2001 scenario.	D-30
Figure D-16. Blue Losses in the HL-SB Case, in the FY 2001 scenario.	D-31
Figure D-17. Blue Losses in the MOD Case, in the FY 2001 scenario.	D-32
Figure D-18. Comparison of Blue Systems Lost in FY 2010 scenario.	D-33
Figure D-19. AOE Blue Losses in FY 2010 scenario.	D-34

Figure D-20. HL-SB Blue Losses in FY 2010 scenario.	D-35
Figure D-21. MOD Blue Losses in FY 2010 scenario.	D-36
Figure D-22. Blue armor and IFV strength at the end of battle.	D-37
Table D-1. Blue armor and IFV initial strength and survival rates for the FY 2001 scenario.	D-38
Table D-2. Blue armor and IFV initial strength and survival rates for the FY 2010 scenario.	D-38

This page intentionally left blank.

EXECUTIVE SUMMARY

This analysis was conducted by the US Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) for the Force Design Directorate (FDD) in support of the Force XXI Division Design Analysis (DDA). The purpose of this analysis was to compare three alternative division designs and provide CG, TRADOC, with comparisons in terms of lethality, survivability, and operational employment. TRAC accomplished this by using a Computer Assisted Map Exercise (CAMEX).

The objective of the DDA is to determine areas for further investigation and robustness of the designs (Heavy/Light - Small Base (HL-SB) Division and Modular (MOD) Division). The intent of the CAMEX is to compare alternative designs through wargaming results. However, this Force XXI DDA not only considers alternative division designs (as described in Chapter 1 paragraph 4), but also the new employment concepts described in TRADOC Pamphlet 525-71, Force XXI Division Operations Concept. This was critical, and generated the need for development of a new operational scenario, because the scenario had to be sensitive to the new ideas in the operations concept.

CONCLUSIONS

1. There were four major areas on which the study had findings. The first was ground maneuver, the second was aviation, the third was cavalry, and the fourth was artillery. When discussing ground maneuver, the study reflected on armor, infantry and ground cavalry. For the mid-to-high intensity spectrum of combat operations, as represented by the CAMEX scenario, the armor strength under HL-SB and MOD appears insufficient. Infantry battalion organizations (mechanized and non-mechanized) appear to need four companies (with three platoons per company), for task organization requirements and for strength in the close fight. The brigade cavalry / reconnaissance unit should be, at most, a troop-sized element.

2. There appears to be a need for a division-level cavalry squadron, with air and ground elements. The air cavalry needed for mission flexibility (particularly for situations of distributed, non-contiguous operations), and ground cavalry elements are needed for continuous screening capability in non-contiguous operations.

3. The divisional aviation brigade appears to need a minimum of one attack helicopter battalion, to support the division's close fight requirements, and one assault helicopter battalion (for infantry lift and/or logistics lift).

4. A DIVARTY headquarters is needed for planning and integration of fires, and one direct support artillery battalion is needed for each brigade. The division appears to need one MLRS battalion to support the close fight and JSEAD requirements. A TAB is needed for the counterfire battle. In the presence of a rotary or fixed wing threat, the division needs at least a complete battalion of direct support ADA (and more under stressful conditions). A headquarters element is needed for integration, coordination, and dissemination of early warning information.

This page intentionally left blank.

Appendix D

Division Design Analysis CAMEX

D-1. **Purpose.** This analysis was conducted by the US Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) for the Force Design Directorate (FDD) in support of the Force XXI Division Design Analysis (DDA). The purpose of this analysis was to compare three alternative division designs and provide CG, TRADOC, with comparisons in terms of lethality, survivability, and operational employment. TRAC accomplished this by using a Computer Assisted Map Exercise (CAMEX).

D-2. **Issues.** The following issues provided the focus for analysis during the DDA CAMEX.

a. Do the alternative division designs have the lethality capabilities required for the Force XXI Division?

(1) What level of deep strike operations are to be conducted by organic division assets?

(2) What is the appropriate mix of deep fires systems (MLRS/ATACMS HIMARS/aviation)?

(3) Do the division alternatives have sufficient organic assets (numbers and types of systems) to generate overwhelming combat power in the close fight?

b. Do the alternative division designs have the survivability characteristics required for the Force XXI Division?

(1) How survivable are the alternative division designs in sequential, mid-to-high intensity combat operations?

(2) How much organic capability (types and numbers of systems) does the division need to protect itself from TBMs? from rotary wing threat? from high performance aviation threat?

c. What differences exist in the operational employment of the alternative division designs?

D-3. **Methodology.** The intent of the CAMEX is to compare alternative designs through wargaming results. However, this Force XXI DDA not only considers alternative division designs (as described in Chapter 1 paragraph 4), but also the new employment concepts described in TRADOC Pamphlet 525-71, Force XXI Division Operations Concept. This was critical, and generated the need for development of a new operational scenario, because the scenario had to be sensitive to the new ideas in the operations concept. The TRAC Scenario and Wargaming Center used the Prairie Warrior 96 (PW96) scenario that was being developed by the US Army

Command and General Staff College, and refined it to meet these new operational concepts. The scenario had to include considerations for: restrictive and open terrain, affecting the nature of the friendly force employed; low-to-high technologically capable enemies, using force year 2001 (FY 2001) and 2010 (FY 2010) systems; current (FY 2001) and objective (FY 2010) Blue technology systems; distributed, non-contiguous operations; sensitivities to the effects of information dominance; and absences of fixed deliberate defenses. The resultant operational scenario is visionary, daring, and embraces the precepts of the Force XXI Division Design concepts. Next, the operational scenario was implemented as an OPORD in the CAMEX man-in-the-loop constructive simulation. The resulting dynamic scenario provided the general battle flow for all investigations. All alternative designs were then wargamed through iterative application of CAMEX and Bluefor/OPFOR staffs. The iterative cycle of operations started with the staff conducting planning and providing that plan to the simulation personnel. During simulation, the staff worked on future plans. After a situational update, the staff conducted after action reviews (AARS). The results of all the runs were then analyzed.

D-4. Goals. The Force XXI Division Design Analysis CAMEX had three goals. The primary goal of this analysis was to assess the design and operational employment of the three experimental divisions in the context of the new division operations concept. The second goal was to provide insights from subject matter experts on the operational planning and execution of the three division designs in this scenario. Lastly, participants were tasked to produce a realistic and credible scenario, that documented all plans, to include as many branches and sequels as time permitted, to support future analysis in a more rigorous Vector in Commander (VIC) Model.

D-5. CAMEX Overview:

a. CAMEX is a man-in-the-loop model, and is most useful as a discussion driver. To replicate information dominance, game turns were stopped at IPB predetermined decision points; or when keyed by information from sensors. This differed from other CAMEX analysis, where game turns occurred on a more regular basis (3 hour game turns). Controllers tried to replicate information dominance in this CAMEX by shortening game turns so that the blue forces would have the required intelligence provided by their reconnaissance and surveillance plan. Superior sensors (JSTARS, UAV, Comanche etc.) and an assumed rapid processing capability allowed the Blue Force to react more quickly than the threat. The data produced by this model enabled gamers to compare the results of various courses of action. CAMEX is a low resolution model which aggregates combat results, and this model lacked the resolution to provide a definitive measure of system on system performance. Analysts, gamers, and tacticians used this tool to conduct a rapid study of a course of action (COA) without an intricate programming of action/reaction commands.

b. The CAMEX model is capable of representing units to battery and company level. In maneuver operations, CAMEX can maneuver task forces in various combat formations. As in real life, the mobility of a system is dictated by the terrain, obstacles, and maneuver formation chosen. Indirect fires are represented in direct support, general support, and counterfire roles. The intelligence picture supplied to the surrogate staff included a perceived battlefield based upon the division and echelons above division (EAD) reconnaissance and surveillance (R&S) plans.

Fixed wing representations included both CAS & AI. Ground combat was replicated through VIC modules using Lanchester based attrition algorithms.

c. There were several capabilities which, because of model limitations, had to be played off-line. These capabilities included: chemical use, ROM/FARP (unconstrained logistics), WAM minefields and bridge destruction. Some capabilities, such as air defense against UAVs, could not be played at all. Because gamers had to manually input each alternative, exact replication from case-to-case was not possible.

D-6. Workshop Participants. Subject matter expert (SME) participation and guidance from TRADOC battle labs, US Army schools and centers, and the US Air Force, ensured proper application of Force XXI concepts and the employment of future technologies. The SMEs provided their primary inputs as a surrogate division staff which fought opposite an OPFOR staff using the CAMEX (man-in-the-loop) model. Each game turn consisted of one to four hours of battle. After AARs, the simulation would continue until the commander's intent was met or the blue forces became combat ineffective. A listing of the participants and their proponent offices is provided at annex D-1.

D-7. Blue force employment. All designs were given the same mission requirement. Adjustments in employment accompanied each respective design.

a. Mission Statement. 57 ID (M) attacks 130500JUL05 in zone to defeat the Army Artillery Group (AAG), Army Group Rocket Artillery (AGRA), 11th Motorized Rifle Division (MRD), and 15th Tank Division (TD) of the 1st Biscaynian Corps. On order, reconstitute and attack elements of the 2nd Biscaynian Corps.

b. The commander's intent. To defeat the AAG and AGRA considered to be the OPFOR's center of gravity, and to continue the attack against regiments of the 11th MRD and the 15th TD, destroying their offensive capability.

D-8. Battle Flow Summary. All three versions incorporated a similar division design. In each version the first brigade was a mechanized brigade (two Bradley fighting vehicle (BFV) battalions and one armor battalion), the second brigade was an armor brigade (two armor battalions and one BFV battalion), and the third brigade was an infantry brigade, which included an AGS battalion in the Heavy/Light-Small Base and Modular division alternatives. A detailed listing of Blue corps level assets is at annex D-2, and the OPFOR order of battle is at annex D-3. The two force years of interest, 2001 (FY 2001) and 2010 (FY 2010), have implications to both sides. For Blue, the force years affect the technological capabilities of the systems wargamed, and the systems used in each force year are listed in annex D-4. For the OPFOR, the FY 2001 enemy has large numbers of low-to-medium technology systems, creating a "most likely" technologically capable enemy. The FY 2010 OPFOR has limited quantities of high technology systems, creating a "worst case" technologically capable enemy. The FY 2010 OPFOR has fewer total systems than the FY 2001 case.

a. **Modernized Army of Excellence (AOE) Division (Figure D-1).** Phase 1: (Movement) At H-Hour 57 ID (M) was in its assembly areas (vicinity Zielona-Gura) preparing to move. The OPFOR began to uncoil vicinity Plauen and moved north along two avenues of approach. The 57 ID began this phase by forward positioning 2 divisional and 3 corps attack helicopter battalions approximately eighty kilometers ahead of the main body (into assembly areas Pegasus and Mercury). The division's UH-60s, augmented by Corps CH-47s, air mobilized the 3rd Brigade (an infantry brigade) to crossing sites along the Elbe River, together with their direct support artillery, a 155mm ATCAS battalion. The division requested air interdiction against bridges along the OPFOR's main avenues of approach to slow their advance. ATACMS Block I was used to suppress enemy air defense (SEAD) along the ingress and egress routes of the air interdiction sorties, and to destroy suspected OPFOR forward arming and refueling points (FARPS). The division's air cavalry completed a route reconnaissance to the Elbe river and established a screen line forward of third brigade. The third brigade completed its movement to defensive positions in and around Torgau. Also, during this phase, all corps aviation attachments and organic division aviation completed their moves to Pegasus and Mercury.

(1) Phase 2: (Deep Attack) Preceded by ATACMS fires, two corps attack helicopter battalions engaged the lead motorized rifle regiments (MRRs) of the 11th Motorized Rifle Division (MRD) in engagement areas Crimson and Red. A corps attack helicopter battalion exploited success in EA Crimson, reattacking remnants of the lead MRR. Second echelon regiments of the 11th MRD moved into EA Crimson, triggering the employment of an attack helicopter battalion from the division. Shortly thereafter, the corps' two attack battalions repositioned to FARPs Gold and Silver in preparation for an attack against the 15th Tank Division.

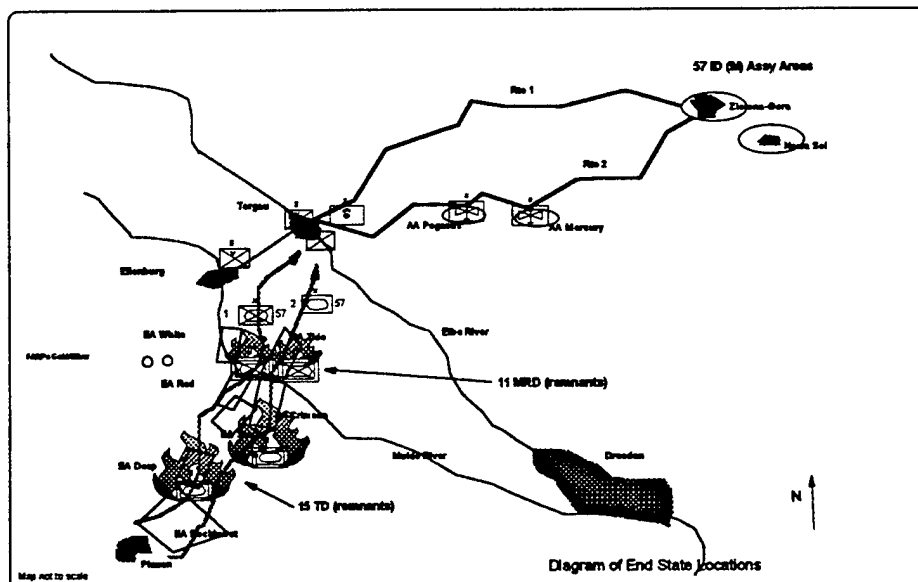


Figure D-1. AOE Battle Flow.

(2) Phase 3: (Elbe Crossing) Lead elements of the 1st Brigade reached the bridge crossing sites near Torgau. ATACMS keyed by UAV sensor, began firing into EA Deep attriting the 15th Tank Division (TD). Immediately following this strike, the first of the two corps' attack helicopter battalions engaged the 15th TD in EA Deep. Simultaneously, remnants of the 11th MRD were engaged in EA Red by a division attack helicopter battalion. First and second Brigades crossed the Elbe River vicinity Torgau and Belgern. Remnants of the 11th MRD reached Eilenburg.

(3) Phase 4: (Decisive Battle) First Brigade was in contact with battalion sized remnants of 11th MRD between Eilenburg and Torgau. Lead elements of 2nd Brigade were still 10 km north of EA Tide and moving south. One of 3rd Brigade's battalions conducted an air assault to seize the bridgehead at Eilenburg. During this time, corps attack aviation continued to attrit the 15th TD in EA Deep. First Brigade engaged remnants of an MRR at the northern edge of EA White. At end of mission lead elements of 2nd Brigade were halted at the northern edge of EA Tide, 3rd Brigade retained bridge sites along Elbe and Mulde, and the OPFOR was combat ineffective.

b. **Heavy/Light-Small Base (HL-SB) Division** (Figure D-2). The battle flow for this alternative did not markedly deviate from that of the AOE excursion. The Battle space was shaped by ATACMS, attack helicopters and fixed wing assets. In the FY2010 exercise: this design employed a HIMARS battery that was repositioned to assembly area Pegasus by intra-theater USAF assets, then moved forward to provide an early deep strike, deep SEAD, and general support capability, as well as augment the fires of the infantry's direct support artillery. A subtle change from the AOE excursion occurred in the employment of attack helicopter assets, because of the reduction in attack helicopter battalions in the division. The division committed an

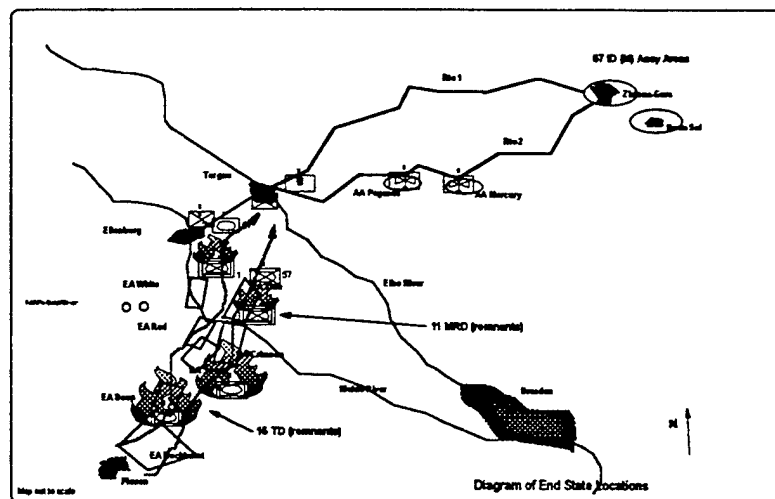


Figure D-2. HL-SB Battle Flow.

—



D-9. Results for issue "Do the alternative division designs have the lethality capabilities required for the Force XXI Division?"

a. Results for Force Year 2001 (FY 2001). The overall comparisons of lethality results for the alternative division designs in the CAMEX FY 2001 scenario are shown in figure D-4. It is readily apparent that there are some variations in the Blue systems that do the killing, but the total kills for the different designs (1645, 1896, and 1794, for AOE, HL-SB, and MOD, respectively) are about the same. In each simulated battle, the respective alternative designs were able to accomplish the required mission. However, the division designs alternatives used different tactics

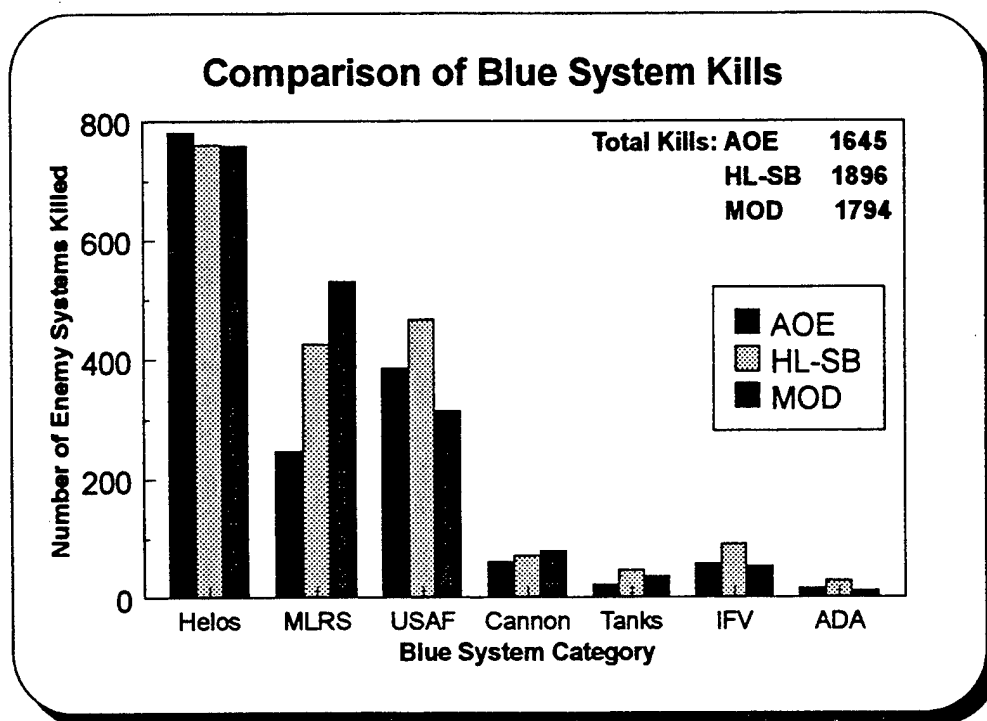


Figure D-4. Comparative lethality of division design alternatives in FY 2001 scenario.

to accomplish their tasks. In the FY 2001 timeframe, all the division designs were dependent on some form of a close fight to perform the final decisive operation. For the AOE division, with the largest number of M1A1 and IFV systems, the fight was shorter and more intense than the other designs. In the HL-SB and MOD cases, because they have fewer armored weapons systems, the final decisive close fight took more time. However, in effecting a longer battle, the artillery and MLRS systems supporting that fight were more lethal (they had more time to engage the enemy). For all three designs, the predominant killers are attack helicopters, MLRS, and/or USAF fixed wing systems. The alternative designs, with variations in the quantities of major combat systems, made their attacks in slightly different manners (with the most pronounced differences being in how they employed their attack helicopters, MLRS, and USAF assets). The resulting differences, as they appear in the figures, in MLRS and USAF kills are more a reflection of changes in tactical employment, then in fluctuations in system quantities. Specifically, the number of air sorties was

the same for HL-SB and MOD, but the timing of their employment resulted in changes in effectiveness. The paragraphs that follow provide more detailed summaries for each specific design. Overall Killer-Victim scoreboards are at annex D-5.

(1) AOE FY 2001 lethality results. The results of OPFOR systems killed by Blue are shown in figure D-5(a). The types and quantities of systems killed are a direct reflection of the assigned mission, to destroy the offensive capability of two maneuver divisions and the army artillery and rocket artillery groups that were the OPFOR centers-of-gravity. The attack helicopter battalions (AHBs), two divisional and three corps AHBs, and USAF ground attack systems were the predominant killers in the AOE FY 2001 scenario, as shown previously in figure D-4. The AOE MLRS systems did not make as large a contribution as the other designs in because there were fewer systems (nine in the division versus 18 in HL-SB and MOD). In assessing the killing contributions of all Blue systems, MLRS and cannon field artillery (at 18.7%) did not make as great a contribution as AHBs (47.4%) and USAF (23.4%), as shown in figure D-5(b), because the FY 2001 systems do not have the precision guided munitions of ATACMS block II. Consequently, the precision engagement capability necessary to offset the OPFOR's advantage in quantities of tanks, artillery and rocket systems had to come from the AHBs, with AH-64 Longbow, and USAF munitions. A short, intense fight involving the armor and mechanized infantry battalions provided the final decisive operations.

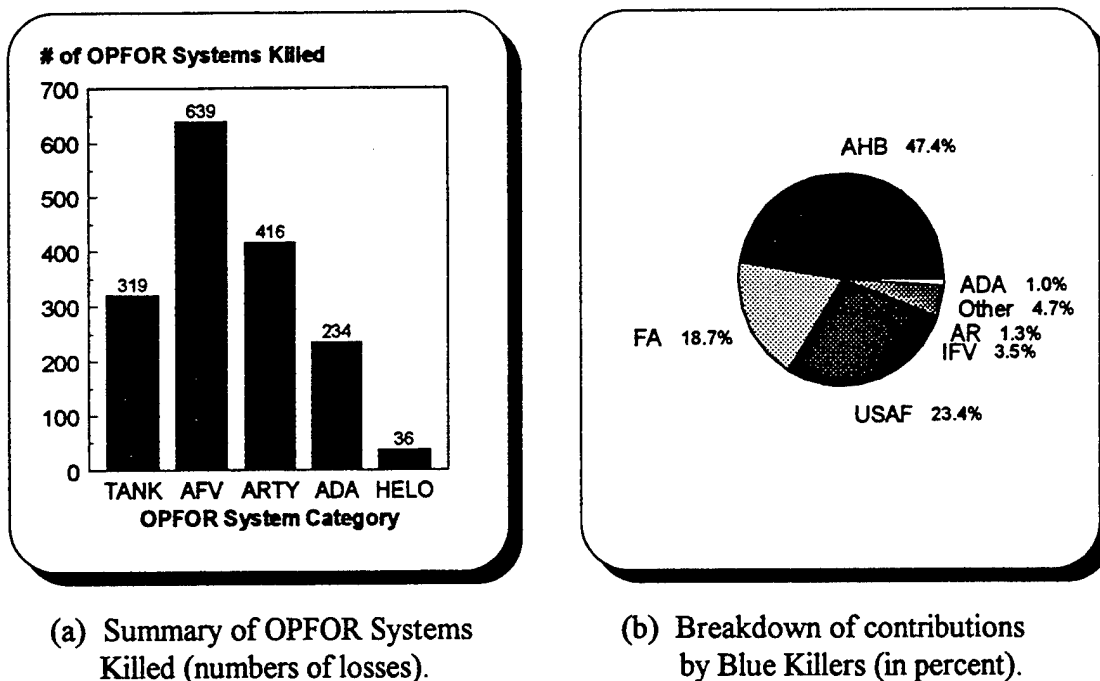
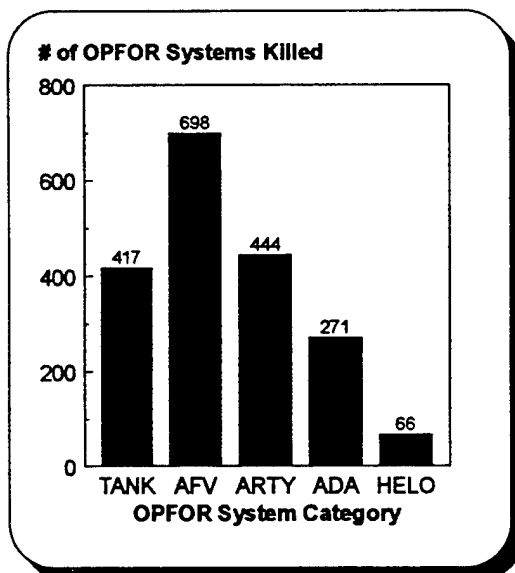


Figure D-5. Lethality results for the AOE alternative in FY 2001.

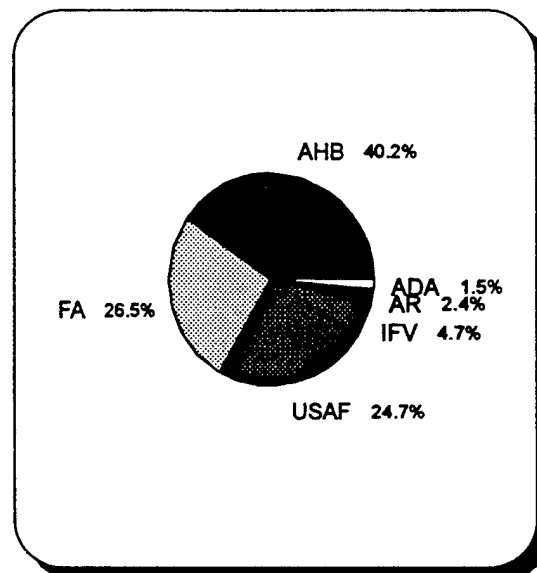
(2) HL-SB FY 2001 lethality results.

(a) In the FY 2001 scenario, the HL-SB had some differences from the AOE division results, both in tactical employment and lethality results. In this alternative, the division had only one attack helicopter battalion (AHB). However, there were still three AHBs in the corps attack helicopter regiment, and with the corps augmentation, the aviation force structure was sufficient. This is seen in the results in figure D-4, which show minimal reduction in AHB kills, even though this alternative's wargame total AHB assets are reduced from five to four. Figure D-4 also shows increased (over AOE) kills by MLRS and USAF assets. These increases were due to changes in the duration of the close fight, and a change in tactics. The HL-SB has a smaller armor capability than the AOE division, and the HL-SB required a longer period of time to inflict the same number of casualties as the AOE. The longer battle provided opportunity for more direct support artillery effects, as well as effects from MLRS and USAF. The decrease in armor capability also created a desire for more thorough battlefield shaping. The longer battle duration permitted more USAF engagements, and enabled the battlefield shaping.

(b) Examination of the OPFOR systems killed, shown in figure D-6(a), reflects the nature of the battle outcome. Kills went up (as compared to AOE) against OPFOR AFVs, because the USAF and Blue artillery was more effective in the longer battle. In the longer battle, the overall contributions to kills changed among the Blue systems, as shown in figure D-6(b). Blue artillery killed more OPFOR artillery and AFVs. Simultaneously, the number of OPFOR tanks killed increased, because the longer battle permitted changes in employment of the division and corps AHBs. Instead of attacking only once, the AHBs attacked several times against different targets. By beginning its strikes earlier, the AHBs were more effective against the



(a) Summary of OPFOR Systems Killed (numbers of losses).



(b) Breakdown of contributions by Blue Killers (in percent).

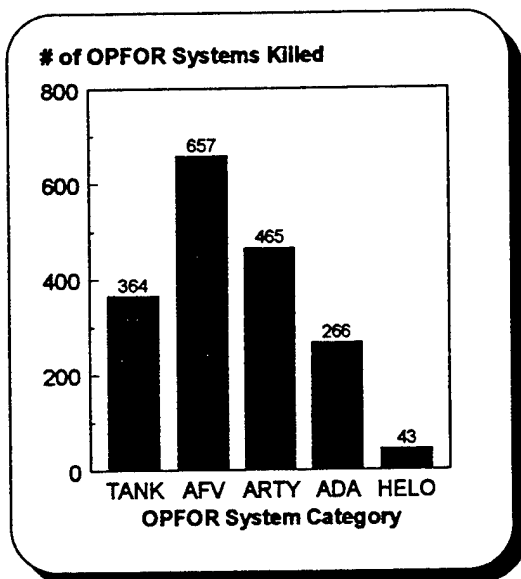
Figure D-6. Lethality results for the HL-SB alternative in FY 2001.

OPFOR tank units. During the course of the exercise, the battle staff noted the need for the division to be able to react to unanticipated OPFOR actions, and in the case of armored attacks, this capability was needed in the form of AHBs. In this scenario, it appeared that the division's AHB provided the minimum reaction capability necessary, until support from the corps attack regiment arrived.

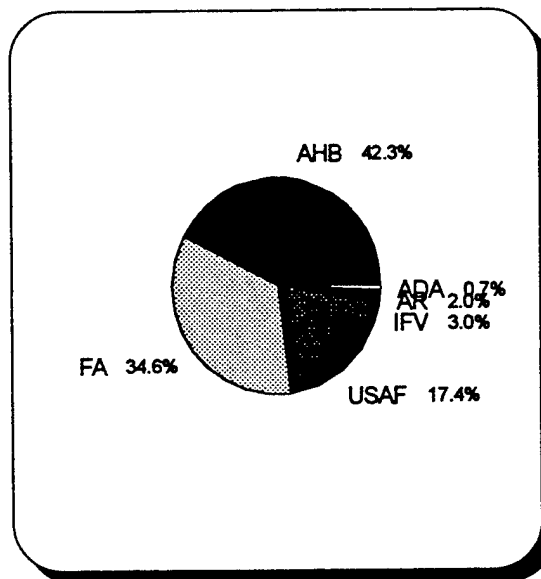
(3) MOD FY 2001 lethality results.

(a) The results for the MOD alternative design reflect trends seen in both the AOE and HL-SB cases. Figure D-4 shows that the contribution by the division and corps AHBs is comparable to the AOE and HL-SB cases. The figure also shows that the contribution by MLRS is the greatest of the three alternatives, while the USAF contribution is the smallest. The shift of kills by MLRS and USAF assets is a reflection of changes in timing of events across the alternatives. For the MOD design, the division's armor and IFV strengths are less than in the AOE design. Consequently, this design is most heavily dependent upon the proper conditions being set prior to the final close decisive maneuver. (If the battlefield shaping is done by US Army or USAF assets is not the critical question to this division, but whether or not sufficient shaping can be done at all.) Even with the extensive battlefield shaping operations, this alternative had the longest battle duration of any of the alternatives.

(b) In the MOD alternative, examination of the OPFOR systems killed, as seen in figure D-7, finds the total number of OPFOR kills is between those of the AOE and HL-SB alternatives.



(a) Summary of OPFOR Systems Killed (numbers of losses).



(b) Breakdown of contributions by Blue Killers (in percent).

Figure D-7. Lethality results for the MOD alternative in FY 2001.

The battle was fought with extensive use of the division and corps AHBs. In fact, the results show that the largest killers of tanks and AFVs were helicopters. The Blue artillery was involved in planned fires, but also a heavy, prolonged counterfire battle with the OPFOR artillery. As a result, most of the Blue artillery kills are OPFOR artillery systems. The precision armor killing was done by attack aviation, with artillery prosecuting the counter battery fight, and the USAF assets were used to fill the voids, as necessary. This design, the MOD division, with the smallest ground combat forces, was the most sensitive to proper battlefield shaping, and it needs to have at least one AHB and a MLRS battalion to ensure that those operations can be accomplished.

(4) Long range fires. The lethality results have shown that the designs have varying dependencies on both how and how well the battlefield conditions are set. Looking at the lethality results for the shaping systems (attack aviation, MLRS/ATACMS Block I, and USAF), as shown in figure D-8, the results are more reflective of how the battle is fought, as opposed to changes in quantities of systems. For example, there are minimal differences in total numbers of kills by AHBs. This indicates that the total requirement for Blue AHBs is about four, for this particular scenario, especially since the timing of their employment changed from alternative to alternative. The increases in MLRS/ATACMS Block I kills (from AOE to HL-SB to MOD), can be partially attributed to more divisional systems available in HL-SB and MOD. However, because the number of MLRS systems is same for HL-SB and MOD (HIMARS was not available in this timeframe), the kills are more reflections of the battles durations. The fluctuation in USAF contributions is due to differences in the timing of their engagements in conjunction with other Blue combat systems.

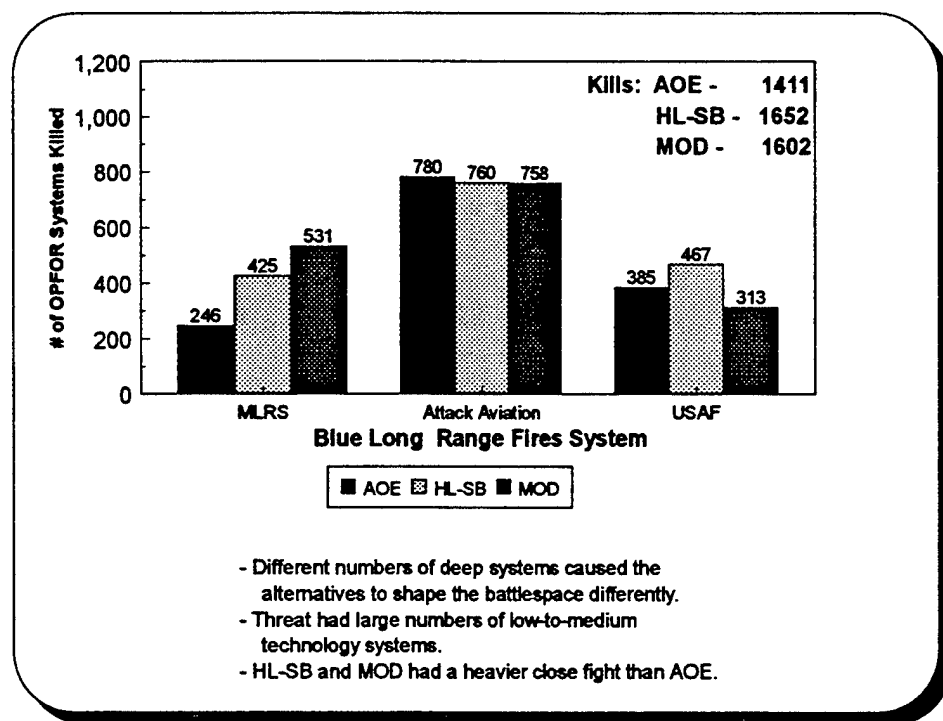


Figure D-8. Comparative deep fires lethality of division design alternatives in FY 2001 scenario.

b. Results for FY 2010 scenario.

(1) General observations.

(a) In the objective Force XXI division (whether AOE, HL-SB, or MOD design), the addition of future technological fire support capabilities should clearly provide increased lethality. For the objective force year division, the precision, long-range deep strike capability provided by ATACMS Block II/IIA was crucial to shaping the battle space. It enabled the attack of enemy forces and high payoff targets early in the battle, while both the blue and red forces were still deploying from their respective assembly areas. ATACMS Block I/IA also provided SEAD for Army aviation and Air Force attack of deep targets, enhancing the lethality and survivability of these assets. It must be noted that the limited number of ATACMS missiles, of all variants, were kept at Corps level. The mobility, range, suite of munitions, and volume of fire provided by MLRS rocket units, Crusader and ATCAS enhanced the lethality and survivability of the division force overall. An important aspect of the advanced fire support systems' capabilities in supporting the force was captured in the representations of their self-locating, self-laying, on board fire direction "shoot and scoot" capabilities. This allowed the field artillery units to provide timely support from the march, or while maneuvering on the battlefield, while reducing the counterfire, air, and ground threat to the systems. The effectiveness of all fire support was directly tied to the capabilities of advanced target acquisition systems and information sharing. Shared situational awareness was key to achieving the precise synchronization of fires necessary to effectively shape the battle space. The synchronization of available sensor assets (i.e., cross cueing between JSTARS, UAV, SOF, aviation and other sensors) and the near-real-time linking of sensors to attack assets was critical to efficient target detection, assessment, and attack. Synchronization was represented through a single fire support wargaming cell which played both corps and divisional FSEs.

(b) The mix of scout and attack helicopters was sufficient to conduct successful Force XXI divisional operations, although corps augmentation made it difficult to measure the effects created by changes to the organic division aviation assets. The corps staff synchronizes the AHBs, MLRS, ATACMS and USAF assets to shape the division's battlefield. Attack aviation missions flown into engagement area "Deep" (initially over 100 kilometers from the locations of the forward-most maneuver brigades) was a "true" corps deep fight.

(2) Lethality results. The overall lethality results for the FY 2010 scenario are presented in figure D-9. In this scenario, contrary to the FY 2001 scenario, the differences in results are predominantly driven by changes in the quantities of Blue systems, and to a much lesser degree by changes in tactical employments. In this timeframe, the Blue addition of the ATACMS Block II capability caused all three battles to be fought nearly identically. Here, the precision guided killing capability provided by ATACMS Block II made fires, not maneuver, the decisive operation. Consequently, the lethality results reflect how well the various alternatives could prosecute the simultaneous deep attacks, with larger quantities of systems being more effective than lesser quantities. The FY 2001 results showed that four AHBs were probably sufficient for this wargame, even though five were available. In this scenario, aviation was surged to shape the battlefield and buy time. Had the division conducted extended operations, it would

have been extremely difficult to maintain the pressure or amount of fire, as crews would require rest and helicopters would require maintenance. In the FY 2010 battles (as with FY 2001), the AOE design had a total of five AHBs, so the reduction to four in HL-SB and MOD divisions does create a proportionate decrease in kills. It is interesting to note that there is a difference in HL-SB and MOD division kills by AHBs, even though they have the same numbers of systems. Here, there is a difference in HL-SB and MOD AHB kills because the HL-SB did not have any air cavalry elements, and AHB assets had to be diverted to perform those missions. This created the slight reduction in kills by AHBs, seen in figure D-9. On the other hand, the MLRS/ ATACMS Block II kills are more directly reflective of the number of platforms available to support the battles. The AOE division has the fewest systems; HL-SB has more, especially with HIMARS included; and the MOD design has more than AOE, but fewer than HL-SB. However, the magnitude of the sensitivity to quantities is mitigated by the presence of four MLRS battalions as corps assets. The HL-SB division had the fewest number of USAF contributed kills, but some of this is due to "target stealing" by the MLRS/ATACMS Block II systems in the division design. A portion of the huge increase in kills by MLRS in HL-SB alternative, are OPFOR systems that were killed by USAF assets in the AOE and MOD division designs. All division design alternatives successfully accomplished the mission. Detailed discussions for each division design alternative follow.

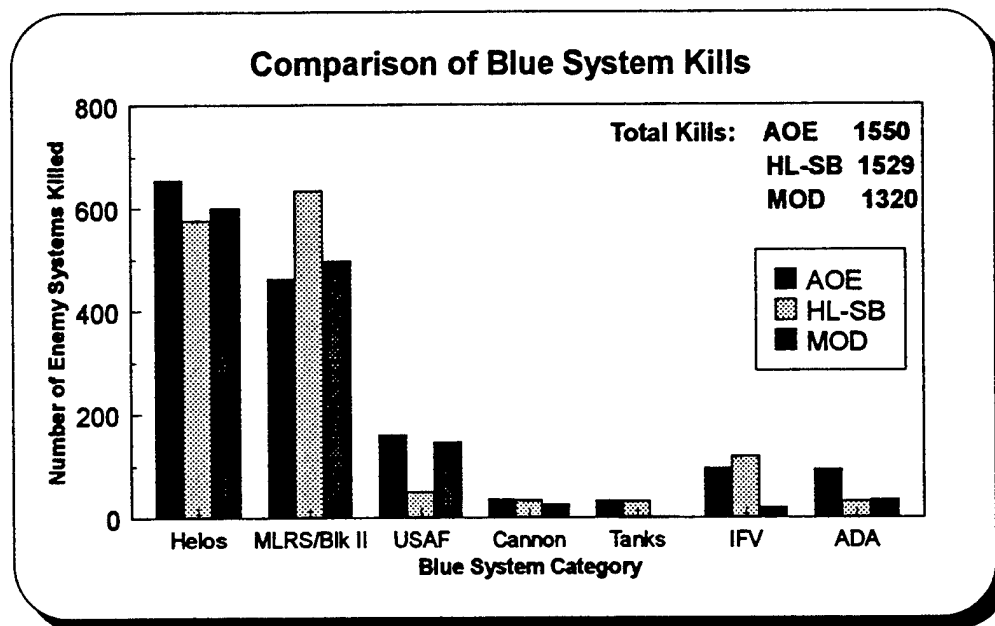


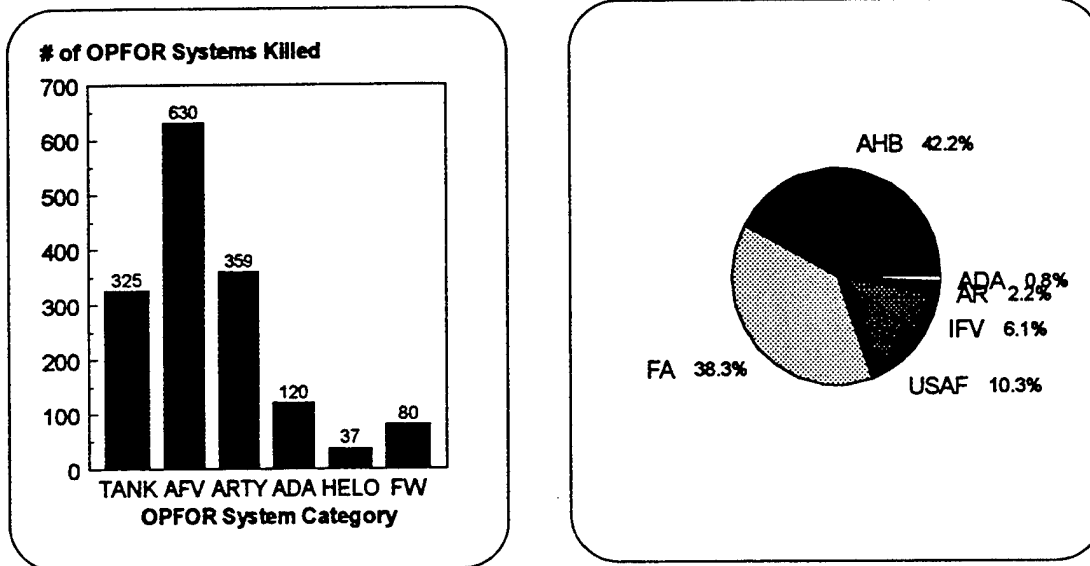
Figure D-9. Comparative lethality of division design alternatives in FY 2010.

(3) AOE FY 2010 lethality results.

(a) For the AOE FY 2010 scenario, the OPFOR maneuver divisions and artillery forces were simultaneously engaged at long range, and destroyed by precision fires before they could close with the Blue forces. The simultaneous aspect, as compared to sequential operations, was crucial to mission success. By attacking simultaneously, the OPFOR units did not methodically go to defensive postures upon initial engagement, saving the offensive combat power of follow-on OPFOR corps forces. The quantities of OPFOR losses shown in figure D-10(a) are reflective of each major unit sustaining more than 40-percent casualties.

(b) For the AOE configured Blue forces, figure D-10(b) shows that AHBs and MLRS/ATACMS were the two biggest killers in this alternative; they began engagements as the maneuver force moved the 180 kilometers toward the key terrain. The mission of the maneuver forces was to be in position to halt OPFOR forces, and to engage in close combat operations, as necessary. In this wargame, fires and attack aviation performed the decisive operations, which is consistent with the new Force XXI Division Operations Concept.

(c) The participants observed that in this FY 2010 scenario, if the OPFOR had been in a defensive posture (consistent with a sequential attack), ground maneuver would have most likely been necessary for decisive operations. The quantity of Blue ground maneuver units, when compared to the OPFOR, would have made such an operation extremely difficult, if possible at all. For example, had the OPFOR made it to the Elbe River first, he would have been stationary,



(a) Summary of OPFOR Systems Killed (numbers of losses).

(b) Breakdown of contributions by Blue Killers (in percent).

Figure D-10. Lethality results for the AOE alternative in FY 2010.

in a hasty defensive posture, with prepared ADA, and artillery, prior to the Blue force arrival. The subsequent attack across the river would have been very difficult.

(4) HL-SB FY 2010 lethality results.

(a) The HL-SB division design had a more robust fire support structure than the AOE division alternative. An eighteen launcher MLRS battalion (three batteries of six launchers each) and a six launcher HIMARS battery replaced the AOE's nine launcher MLRS battery, giving the division a net gain of nine M270 launchers and six HIMARS launchers. The addition of the airliftable HIMARS battery allowed the division to project deep strike assets and a significant general support capability well forward, early in the battle by airlanding these systems at a forward airfield. Again, as with the AOE alternative, the effectiveness of all fire support was directly tied to the effectiveness of advanced target acquisition capabilities and information sharing.

(b) Even with the more robust fire support structure noted above, the mix of fire support systems within the HL-SB division design would have been inadequate without corps supplementation. Again, 40-percent of the cannon assets and 87-percent of the MLRS assets employed in this scenario alternative were provided from Corps Artillery. The division could not have properly shaped the battle space nor provided adequate counterfire and close support without the significant fire support assistance provided by the corps, especially since the division has only one AHB in this alternative. The addition of the HIMARS battery provided the commander a flexible means of extending the reach of his deep attack capability, allowing him to place a significant general support capability forward by air insertion, thereby enhancing his ability to control and shape the battle space. However, having a forward airfield within the ADA "umbrella", and the USAF transport requirements for HIMARS increased the complexity of the already difficult mobility issues for the heavy and light forces in the infantry brigade. Shared situational awareness remained a critical enabler for effective fire support. The reduction in the number of sensors (UAVs) and the intelligence processing capability in the RISTA Battalion (only one ASAS workstation as compared to 14 for the AOE alternative) had a negative impact on our ability to see and fire deep.

(c) The quantities and the types of OPFOR systems killed in this alternative are almost identical to the AOE FY 2010 case. A comparison of figures D-10(a) and D-11(a), especially for the primary ground targets (tanks, AFVs, and artillery) reflects this similarity. The battle end states for AOE and HL-SB are indistinguishable.

(d) The results for how Blue systems contributed to the destruction of the OPFOR forces is seen in figure D-11(b), and it shows a more pronounced difference in the alternatives' results. The figure shows the heavy reliance the HL-SB design placed on cannon/MLRS/ATACMS and attack aviation capabilities, as they contributed a combined 83 percent of the kills. MLRS and attack aviation were used to attack the lead MRRs of the 11th MRD, as well as the lead MRRs of the 15th TD. (As the division's key long range fires assets, they prevented the OPFOR from securing the Torgau Bridgehead.) However, comparing figure D-10(b) to D-11(b) shows that the proportion of kills for AHBs decreases from the AOE design (42.2 percent) when

compared to the HL-SB design (34.7 percent). Conversely, the proportion of kills contributed by cannon/MLRS/ATACMS increases when comparing the AOE results (38.3 percent) to the HL-SB results (48.3%). Because both of these alternative designs used decisive fires to destroy the OPFOR, employing the same tactical concepts, the change in kill contributions is a direct reflection of the changes in the quantities of available killing systems.

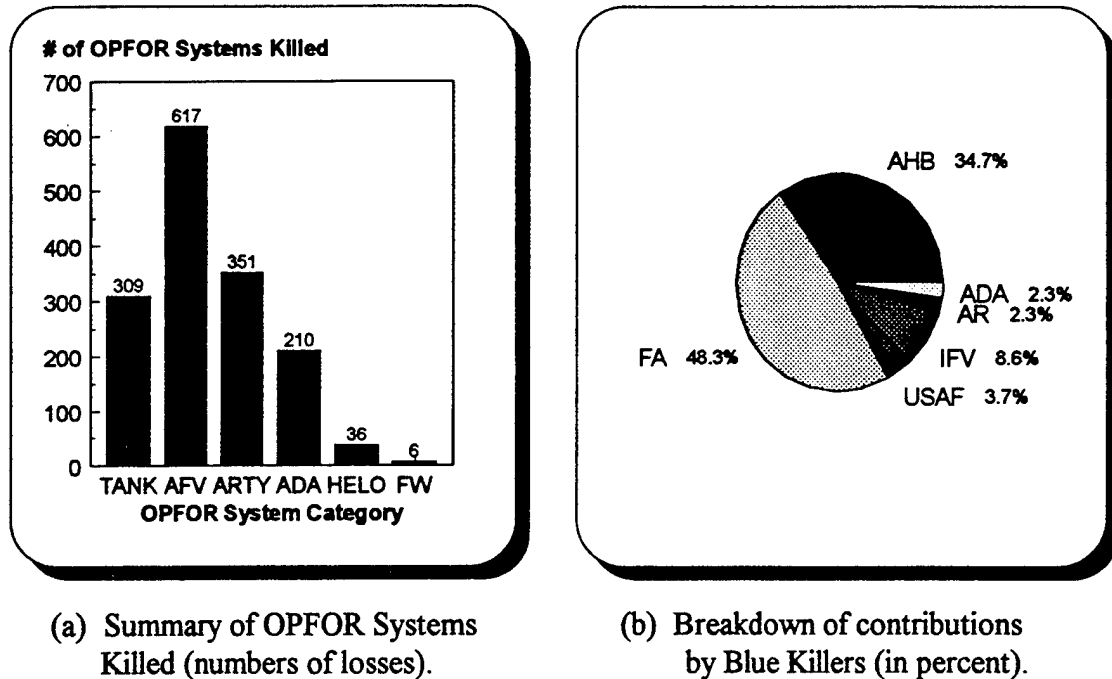
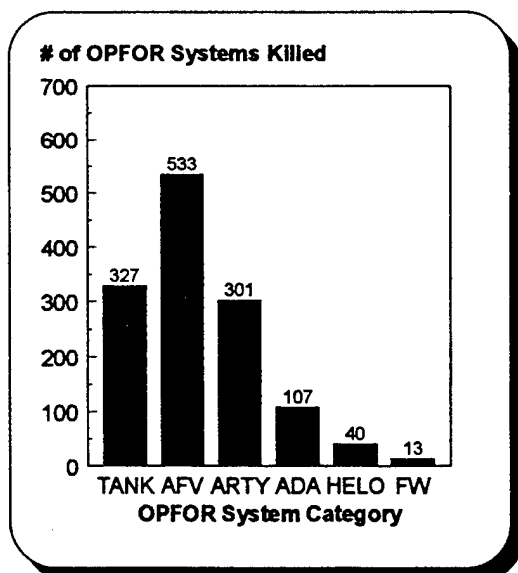


Figure D-11. Lethality results for the HL-SB alternative in FY 2010.

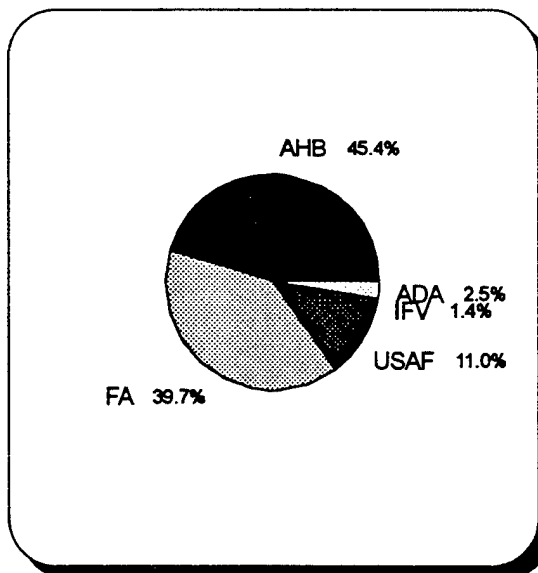
(5) MOD FY 2010 lethality results.

(a) The MOD division had the lowest lethality results for the FY 2010 scenario, as seen in figure D-9. The alternative successfully accomplished the mission, but it had to modify its tactics to ensure success. The MOD division has the fewest tank and IFV assets, and, consequently, is the most heavily dependent on long range fires for either setting the conditions or decisive operations. In the FY 2010 scenario, the OPFOR also has smart precision munitions capabilities, and any Blue losses to its tanks and IFVs will affect its ability to conduct close combat operations. Thereby, this design is the most heavily oriented on long range operations.

(b) The summary of OPFOR losses in figure D-12(a), shows the MOD division inflicting fewer casualties than either the AOE or HL-SB designs. The MOD division accomplished the mission, but at the end of the battle, many of the OPFOR units were just under the survivability threshold (60 percent surviving) that caused them to go into hasty defensive positions. If the OPFOR units had been slightly stronger, many of them would have continued the attack. The MOD division has fewer attack helicopters than the AOE division (one AHB versus two for AOE), and fewer MLRS-type systems than HL-SB (it does not have HIMARS). As a result, the MOD division could not bring the same degree of simultaneous fires on the moving OPFOR forces, and the OPFOR maintained more momentum in their movement. This also reduced the number of casualties they suffered. Figure D-12(b) shows that nearly all OPFOR losses were caused by Blue AHBs, artillery, and USAF assets. These results indicate that one divisional AHB and one MLRS battalion are absolute minimums for long range fires capabilities for this level of combat intensity.



(a) Summary of OPFOR Systems Killed (numbers of losses).



(b) Breakdown of contributions by Blue Killers (in percent).

Figure D-12. Lethality results for the MOD alternative in FY 2010.

(6) Long range fires. The FY 2010 division alternatives differ markedly from the FY 2001 designs in their application of, and success attained by the long range fires. The FY 2001 designs used long range fires to set the battlefield conditions, while the FY 2010 designs used them to conduct decisive operations. Because there were fewer OPFOR system in the FY 2010 scenario, Blue needed slightly fewer kills to "push" the OPFOR below the threshold for continued offensive operations.

(a) The results for lethality contribution of the long range fires systems (attack aviation, MLRS/ATACMS, and USAF), shown in figure D-13, comprise the bulk of all kills Blue inflicted on the OPFOR. These systems account for 82-to-94 percent of the total kills. The comparative results for MLRS (including HIMARS) and ATACMS are show lethality trends that mirror the quantities of available launcher systems. The HL-SB division has the most systems and attains the most kills. The MOD and AOE divisions follow with fewer systems and kills. The attack aviation results also show lethality trends that follow the availability of systems, to include reductions in effectiveness for the HL-SB, where attack helicopter companies had to perform air cavalry types of missions (the HL-SB does not have an air cavalry element). Most importantly, the total long range kills are nearly identical for all three designs. The Blue system contributions change, but the overall effects are the same.

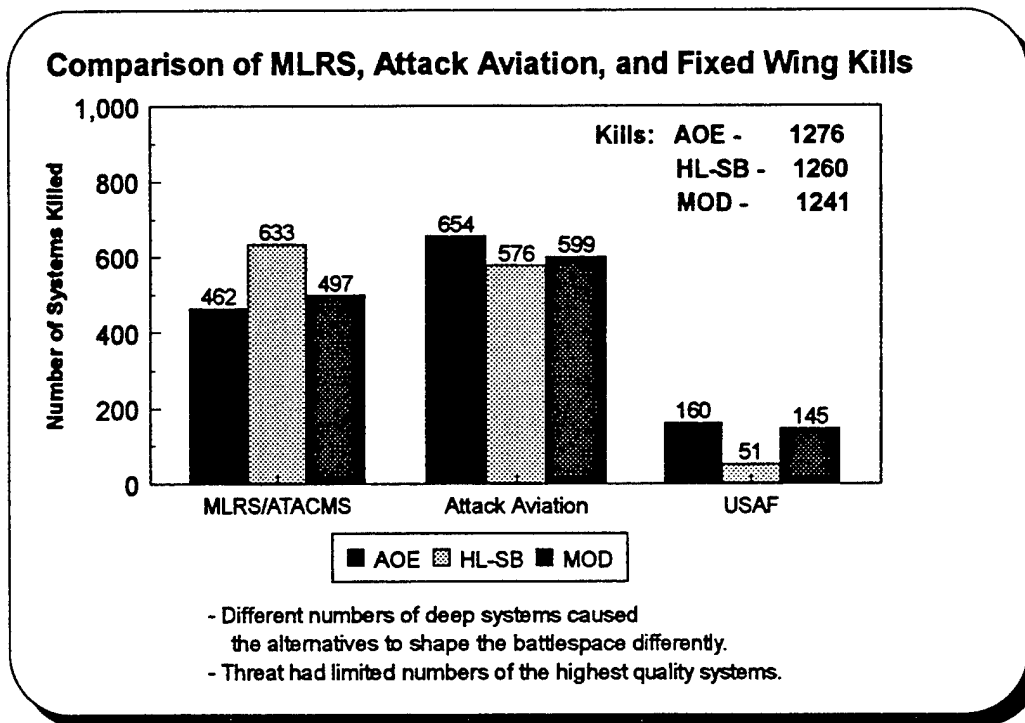


Figure D-13. Comparative deep fires lethality of division design alternatives

(b) Each of the alternative designs received significant fire support augmentation from corps to accomplish its mission. Corps provided three field artillery brigades in reinforcing, or

general support roles for a total of six MLRS battalions and two Crusader battalions. In each alternative, approximately 40-percent of the cannon assets and 90-percent of the MLRS assets (to include all ATACMS assets) were provided by Corps. The division could not have shaped its battle space nor provided adequate counterfire and close support without this significant fire support assistance provided by the corps. The wargame level of resolution provided by the CAMEX limits the discernability of whether the killing systems were performing in support of the corps plan, or if they were firing in support of the division. The resolution also limited the ability to capture the timing of when OPFOR units were killed (whether in support of setting the conditions, or in the execution of decisive operations). In any case, the lethality results appears to indicate that the division's reliance on corps fire support assets supports the current force allocation guidelines of two field artillery brigades in support of each committed division.

c. Summary for lethality sub-issues.

(1) What level of deep strike operations are to be conducted by organic division assets?

All division alternatives accomplished the mission in these scenarios (FY 2001, FY 2010). The degree that Blue's divisional long range fires systems contributes to the battle is dependent on the quantities available and the capabilities resident in the weapons systems. In the near term (FY 2001 timeframe), the precision armor killing capability is in the AHBs, but in the objective force, ATACMS Block II/IIA appear to be a preferred system. As the quantities of ground maneuver forces decrease, the reliance of those elements on properly set battlefield conditions increases.

(2) What is the appropriate mix of deep fires systems (MLRS/ATACMS/HIMARS/aviation)?

In both scenarios evaluated (FY 2001 and FY 2010), there were a number of corps units available to provide augmentation/support to the Force XXI division. Given that this division was the corps main effort, it is a reasonable assumption that corps support could be made available to the division in some unforeseen circumstances. The corps augmentation makes it appear that one AHB and one MLRS battalion are the minimum number of assets to be organic to the division. These units exist in the HL-SB and MOD division alternatives. The MOD division design retained the MLRS Battalion (3X6), but does not have the HIMARS battery that the HL-SB division has. This makes the MOD division organic fire support more robust than AOE, but less than HL-SB. In these scenarios, corps retained the ATACMS fires capabilities, and they were critical for shaping the battle space. ATACMS provided SEAD for Army aviation and Air Force strikes, area fire, and precision attack of threat artillery and armor systems. Corps provided SEAD operations were essential to the success of the AHBs. The absence of the HIMARS battery prevented the AOE and MOD divisions from having the ability to project a deep strike asset well forward and as early as the HL-SB alternative.

(3) Do the division alternatives have sufficient organic assets (numbers and types of systems) to generate overwhelming combat power in the close fight?

(a) The three alternatives (AOE, HL-SB, and MOD) have varying quantities of ground maneuver systems. The AOE division has the most tanks and IFVs, and it had the most effective decisive close fight in the FY 2001 scenario. Its armor fighting capabilities permitted it to engage in a short, intense fight, with overwhelming results. The HL-SB division, with fewer tanks, but more ground cavalry assets, was also successful, but required more time to accomplish the same tasks the AOE division accomplished. The MOD division, with the fewest tank and IFV systems, had the longest battle, and had the most difficulty in accomplishing the mission. All the designs had sufficient organic assets for the close fight, but at the high end of the spectrum of combat operations, the armor strength in the HL-SB and MOD divisions appears marginal.

(b) In considering the objective force and the division operations concept for the future (FY 2010), long range fires are increasingly important to the commander's ability to dominate the battlespace (making attack aviation and ATACMS Block II more important). Still, the division will need sufficient ground forces to gain or hold key terrain, and the ground maneuver elements should not be reduced to the MOD division levels.

(c) Fire support systems. The mix of fire support systems within the AOE division design would have been inadequate without corps augmentation. In these scenarios, 40 percent of the cannon assets and 95 percent of the MLRS assets employed were from corps artillery, including all deep strike (i.e., ATACMS) capabilities. The division could not have shaped its battle space, provided adequate counterfire, nor close fire support without the assistance provided by corps. The lack of an air transportable deep attack system (HIMARS) in the AOE alternative structure prevented the force from putting forward a deep strike capability, or a significant general support capability early in the battle, as BLUE deployed from its assembly areas and sought to rapidly seize and hold bridging sites over the Elbe River. Addition of this capability would have provided the corps an opportunity to strike deep earlier in the battle, perhaps defeating enemy aviation in assembly areas to the rear of the 15th TD. The air transportability of ATCAS provided an air assaultable cannon fire support capability for the infantry brigade. However, divisional air transport capability was inadequate to conduct the operation without significant medium lift (CH-47) augmentation from corps. The addition of support vehicles and ammunition for the artillery air assault force required a great amount of aviation resources. While the scenario demonstrated the tremendous benefit of a CH-47 air transportable 155 mm cannon system, such as ATCAS, it also raised the issue that ATCAS may be more appropriate as a divisional general support asset. A lighter, more mobile fire support system may provide a more compatible capability for the infantry brigade. However, the armored threat would have been less affected by the 105 mm munitions than it was by the 155 mm family of munitions.

(d) This scenario created a requirement to conduct several long range air assaults, and movement of an infantry brigade requires more than one assault aviation battalion. The division requested and received a corps assault battalion, it, and any other corps aviation battalions, need the division's aviation brigade headquarters to facilitate coordination of operations. These corps aviation assets would be difficult independently command and control by the division staff.

D-10. Results for issue "Do the alternative division designs have the survivability characteristics required for the Force XXI Division?"

a. Results for FY 2001. The overall comparisons of Blue losses, for the alternative division designs in the FY 2001 scenario, are shown in figure D-14. The figure shows the HL-SB and MOD divisions with fairly comparable numbers of losses (370 and 392 systems, respectively), which were both markedly larger than the AOE losses (298). In assessing the causality, it must be recalled that the HL-SB and MOD divisions had longer battles than the AOE division. Consequently, the OPFOR direct support artillery and large caliber multiple rocket launch systems had more opportunities to inflict casualties on Blue in the HL-SB and MOD cases. The MOD design had the longest fight and suffered the largest number of losses. When considering the remaining combat power after this initial battle, the fact the HL-SB and MOD divisions sustain more losses than the AOE division becomes even more important, because those designs also start with fewer tanks and/or IFVs. In this force year scenario, there were no losses to OPFOR fixed wing aircraft, due to the assumption of Blue air superiority. Detailed discussions for each alternative design, and the concern for maintaining combat capability will follow.

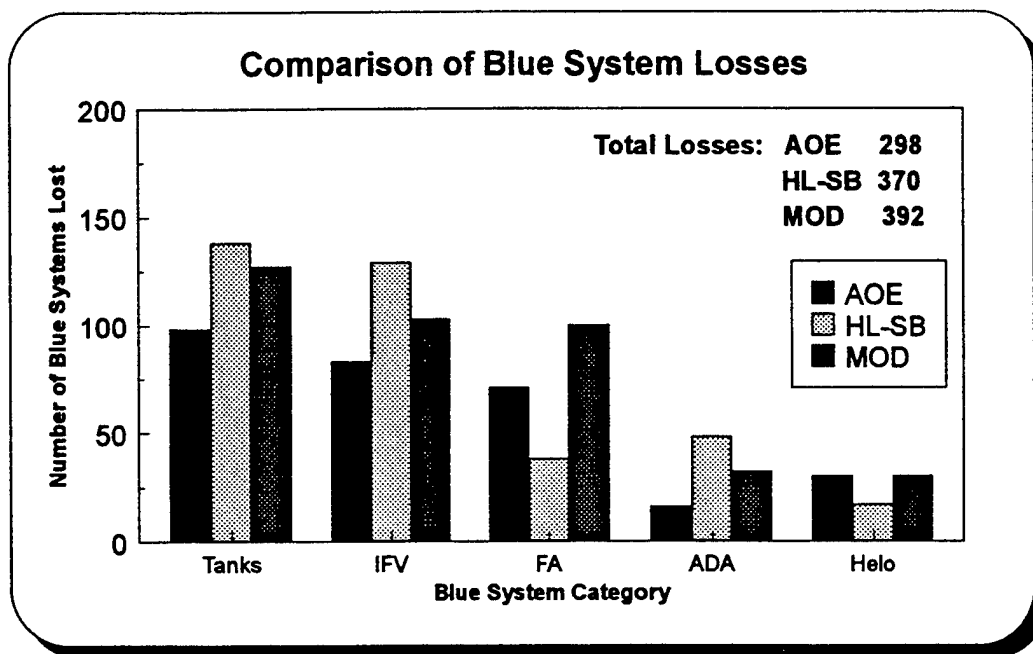


Figure D-14. Comparison of Blue System Losses in FY 2001 scenario.

(1) AOE FY 2001 survivability results. The AOE division suffered significant attrition from OPFOR artillery, as shown in Figure D-15. The OPFOR artillery accounted for nearly all of the AOE division's losses in tanks (89 of 98), IFVs (77 of 83), and artillery (59 of 71). OPFOR attack helicopters also contributed to the battle, and inflicted losses to the AOE designs tanks, IFVs, artillery, and ADA systems. The OPFOR artillery contributions were provided from both direct support fires (engaging the tanks and IFVs in maneuver generated attacks) and counter-battery fires (resulting in Blue artillery losses).

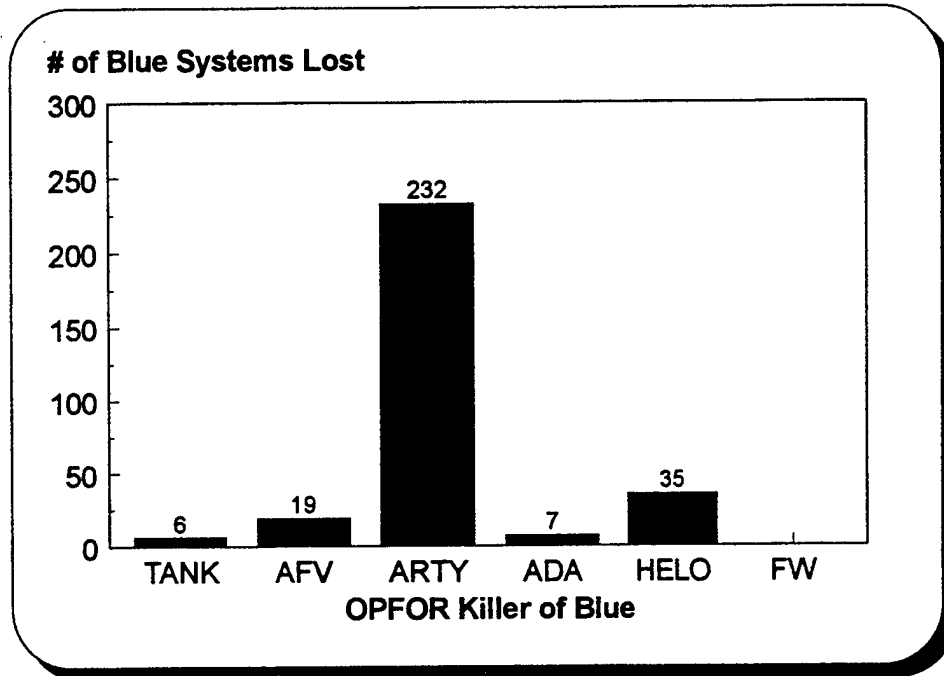


Figure D-15. AOE Losses in FY 2001 scenario.

(a) In the FY 2001 scenario, the AOE division's organic direct support and general support air defense assets -- two BSFV batteries and two Avenger batteries -- provided adequate coverage to the division. (The coverage was considered adequate because the OPFOR lost 36 attack helicopters in the process of killing 35 Blue ground systems.) However, those structures did not provide the division commander with flexibility to weight the brigade with the division's main effort with additional assets. The FA brigades and the corps attack helicopter regiment also had corps ADA assets for protection. These units provided additional coverage zones in the division area. Corps assets (SAMs & Avengers) were also needed to augment division air defense to support counter-RISTA operations. These corps assets provided coverage for the division rear, and assumed protection of river crossing sites once the division was 70% across. The presence of the division and corps ADA assets did not provide total protection, as the OPFOR was still able to inflict 35 losses to Blue systems with their attack helicopters. All ballistic missile defense was provided by echelons above division (EAD) assets.

(b) The organic direct support engineering assets focused on supporting close operations, and required corps augmentation to perform bridging operations, and other rear area tasks. The AOE alternative is marginally capable of accomplishing all the general engineering tasks in the division area. However, it would become more dependent upon corps assets (to maintain lines of communication and main supply routes) as the division area extended. As a marginal package, any additional requirements, such as the infantry brigade fighting a defensive battle, would have required additional assets from corps.

(c) The organic direct support chemical assets were able to provide some concealment with smoke and were prepared to perform limited decontamination missions. Corps support was necessary to provide the required smoke for current operations, as well as any large area decontamination. The organic military police company is dependent on corps military police to provide area security, battlefield circulation control and ammunition supply point security in the division rear area and river crossing operations.

(2) HL-SB FY 2001 survivability results. The trends seen in the AOE division were very similar to those of the HL-SB division. As shown in figure D-16, the OPFOR artillery was again the predominant killer of Blue systems. The longer (than AOE) battle permitted the OPFOR artillery to kill more tanks and IFVs in the direct support battle, and more Blue artillery systems in the counterfire battle. OPFOR attack helicopters continued to provide contributions to the total kills.

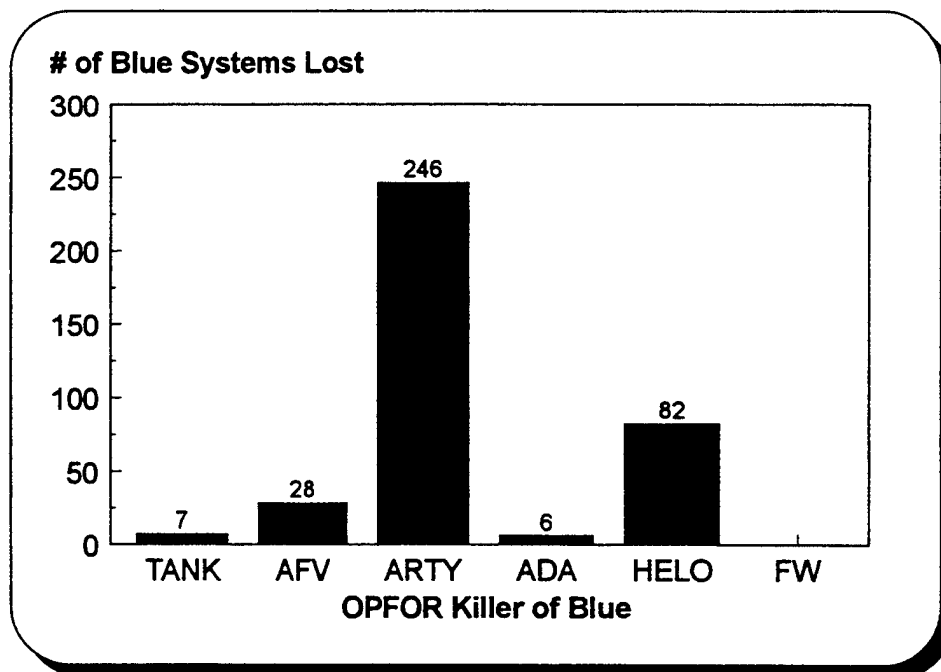


Figure D-16. Blue Losses in the HL-SB Case, in the FY 2001 scenario.

(3) MOD FY 2001 survivability results. The MOD division alternative's Blue losses continued the trends seen in the AOE and HL-SB designs. Figure D-17 shows that OPFOR artillery, again, had the greatest success in this battle (inflicting 295 Blue losses, as compared to 232 OPFOR kills of AOE systems and 246 OPFOR kills of HL-SB systems). The losses are reflective of the longer battle and how the OPFOR artillery has an increase in opportunities to engage the Blue forces. The OPFOR attack aviation was still able to inflict casualties, even though this alternative had the greatest number of ADA systems.

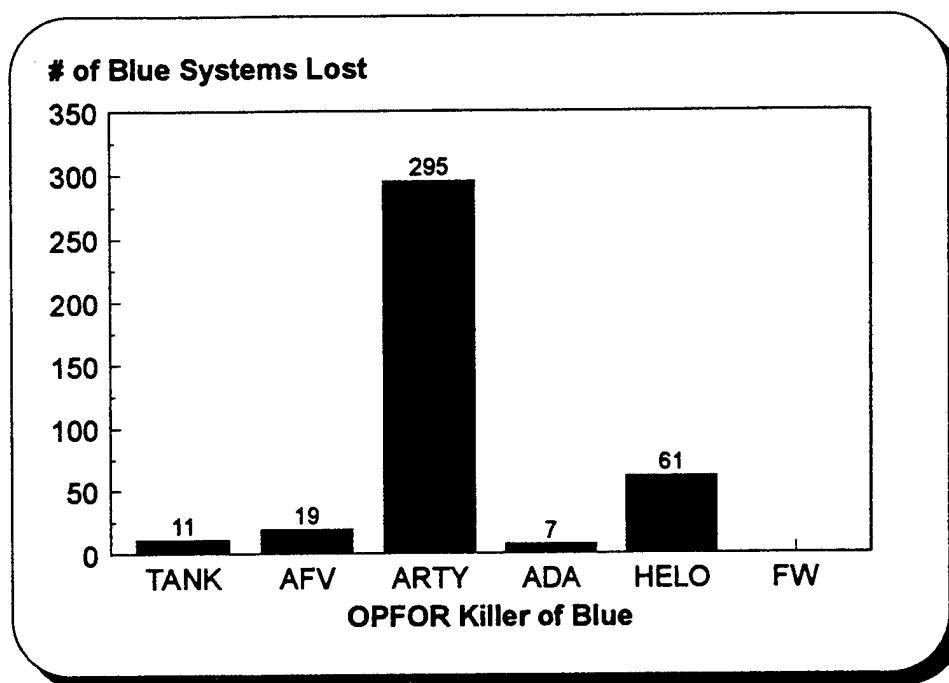


Figure D-17. Blue Losses in the MOD Case, in the FY 2001 scenario.

(4) Comparisons of FY 2001 survivability results. The AOE division design suffered fewer losses than either the HL-SB or MOD division designs. Because most of the losses (for all alternatives) were due to OPFOR artillery, the length of battle duration becomes the critical factor in the Blue force survivability. The AOE division's ability to generate a short, intense decisive operation abbreviated the time available for the enemy artillery to kill Blue systems. The additional MLRS assets in the HL-SB and MOD divisions, as shown in the lethality results, allow those divisions to eventually attain more Blue kills of OPFOR artillery, by increasing the effectiveness of the counterfire battle. However, by creating a situation where a longer close fight is required, the remaining OPFOR artillery systems continue to inflict losses on the Blue force (unlike the maneuver forces, which halt their attack when they sustain the 40 percent loss threshold, the artillery units continue to engage the enemy).

b. FY 2010 Survivability results. All division alternatives successfully accomplished the mission in this force year, and the overall comparison of Blue force losses finds that all three alternative designs suffered about the same number of total losses. Figure D-18 shows the overall Blue losses, and the quantities of the major combat systems lost by the Blue forces. While the total losses are about the same, there are shifts where the losses occurred. Some of these changes are due to OPFOR adjustments, as they attacked different units in the respective designs. The OPFOR intended to destroy those elements they perceived to be critical to the specific designs. Some of the other parts of the changes are due to Blue changing the timing of its operations, in accordance with the capabilities of the particular design. In the AOE alternative, most of the losses were incurred by the IFVs and artillery systems. In the HL-SB and MOD designs, the majority of the losses were sustained by the tanks and IFVs. This is an important point because in these two division designs, the number of tanks in the armor battalions are reduced. Losses of this magnitude could make the division incapable of sustained heavy combat operations. These alternatives will not be able to continue to the second, third, or subsequent battles. The paragraphs that follow will provide more detailed discussions of each of the respective alternative designs. A summary, addressing the ability, or inability to continue with several combat operations is also included.

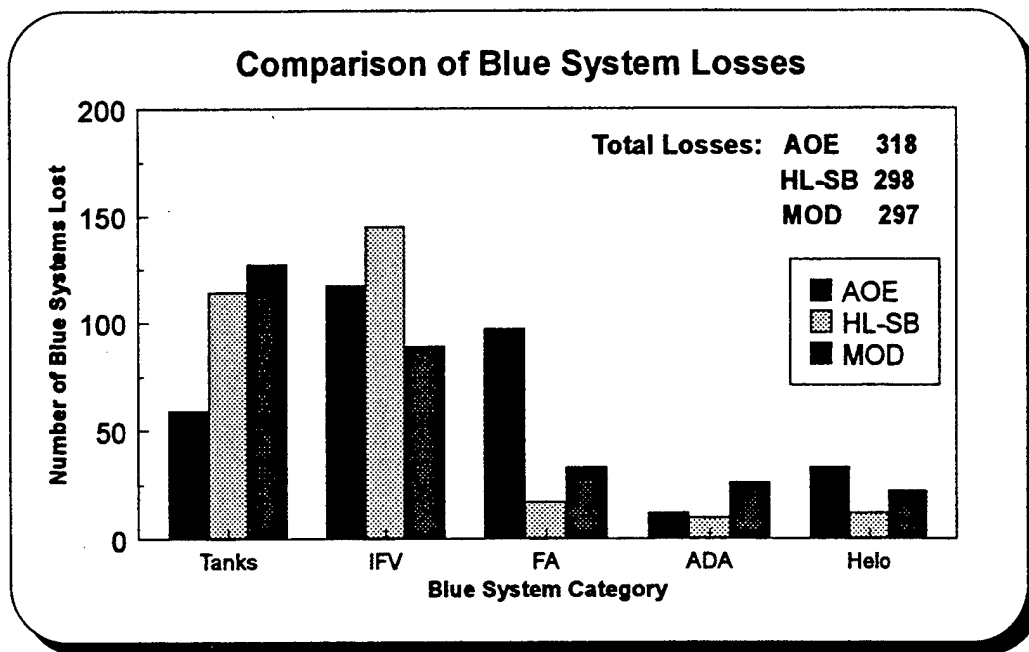


Figure D-18. Comparison of Blue Systems Lost in FY 2010 scenario.

(1) AOE FY 2010 survivability results. Figure D-19 shows that OPFOR fixed wing assets were their most effective killing systems. This force year scenario assumed the condition of air parity. Consequently, the OPFOR was able to surge his assets and fly across the FLOT to strike the moving blue brigades. These operations supported his lead divisions, which were moving to the Elbe River. These aircraft were successful in spite of the division's air defense. The magnitude of the losses is unacceptable, but it indicates that in a condition of air parity, where an enemy can mass air assets and attack in a coordinated fashion, one direct support ADA battalion may be inadequate for division protection. In addition to the air strikes, the OPFOR direct support artillery also had some degree of success against the AOE division. The direct support artillery engagements occurred OPFOR maneuver units (either scouts, UAVs, or lead elements of the MRRs) gained contact with the division and when their artillery units were within 45 kilometers of the Blue forces. The OPFOR artillery inflicted some casualties to the armor and mechanized infantry units (killing 10 tanks and 27 IFVs). However, the greatest OPFOR artillery contributions came against Blue artillery, predominantly in the form of success in the counterfire battle.

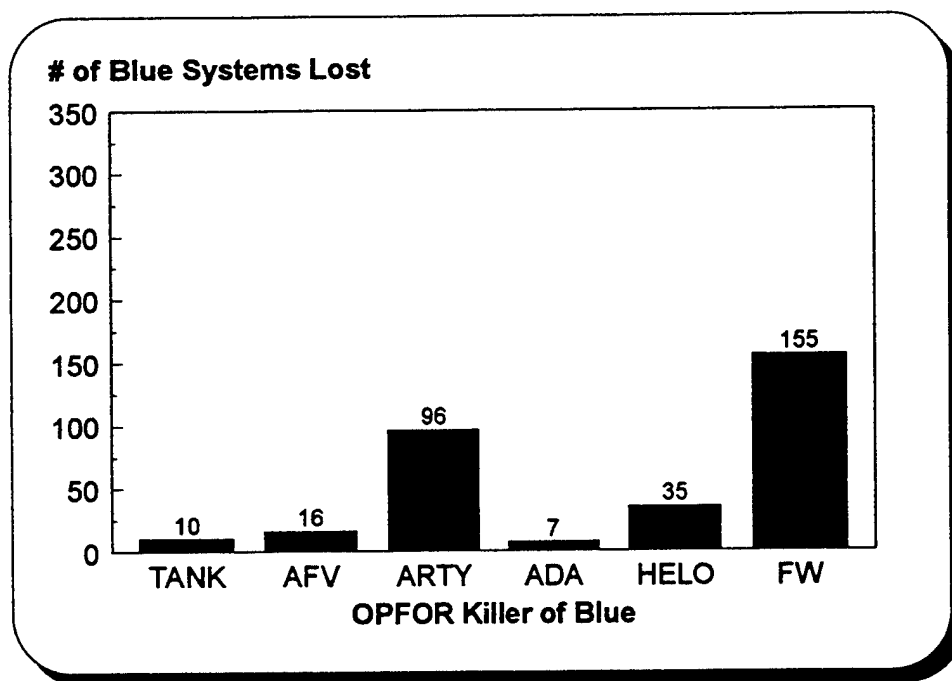


Figure D-19. AOE Blue Losses in FY 2010 scenario.

(2) HL-SB FY 2010 survivability results. The results for the HL-SB division, depicted in figure D-20, show that OPFOR fixed wing aircraft again made contributions to Blue losses (losses which, as stated previously for the AOE design, are unacceptable) . However, here it can be seen that the number of Blue systems lost to OPFOR aviation decreases from 155 in the AOE case, to 66 for the HL-SB design. For the HL-SB alternative, this result is a reflection of changes in the Blue force timing of maneuvers, which caused the OPFOR aviation to miss engaging the Blue. Some of the "slack", created by the missed timing, however, was taken up by the OPFOR direct support artillery. The results show that the quantites of Blue systems killed increased from 96 in the AOE design, to 133 for the HL-SB design. For this case, the OPFOR artillery accounted for nearly half of the HL-SB design's losses. In a divergence from the AOE results, the principle systems killed by the OPFOR artillery is not Blue artillery in the counterfire battle, but, instead, the losses are primarily Blue tanks and IFVs. This shift occurred as the OPFOR deliberately tried to destroy the Blue heavy ground maneuver capability. By making the Blue tanks and IFVs the priority targets, the focus of the attack and, subsequently, where the losses occurred changed.

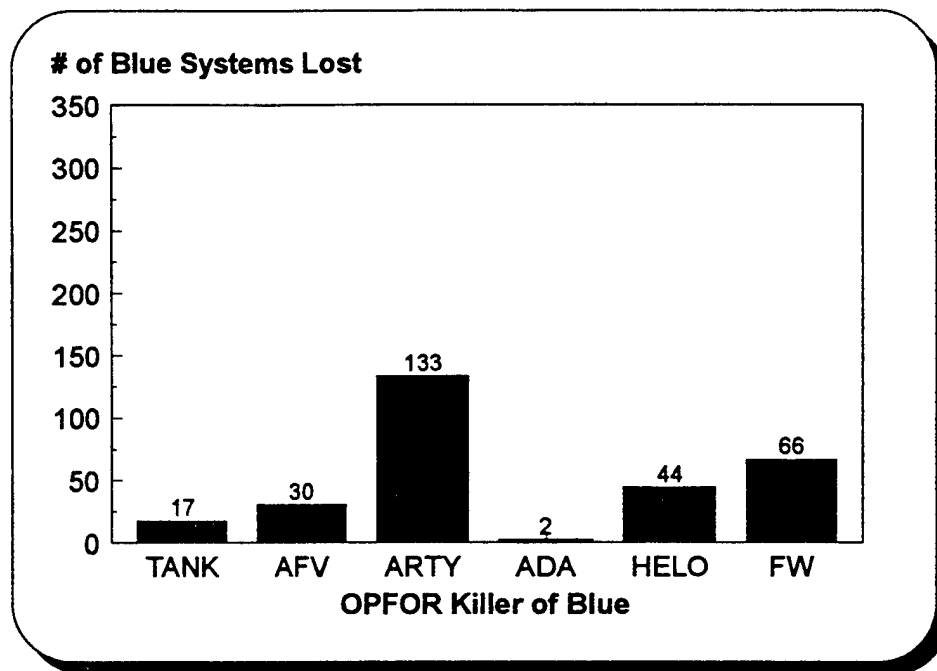


Figure D-20. HL-SB Blue Losses in FY 2010 scenario.

(3) MOD FY 2010 Survivability results. The MOD division results are almost exactly the same as the HL-SB design. As seen in figure D-21, the OPFOR artillery is, again, the predominant killer of Blue systems. However, with the MOD division, the Blue ground maneuver timing scheme is different from the HL-SB design (and AOE, as well), and its maneuver scheme allows the OPFOR fixed and rotary wing aviation to make more contributions than they did in the HL-SB case. The combined success of the fixed and rotary wing aircraft does not equal the OPFOR successes against the AOE division, but it is better than what occurred against the HL-SB division.

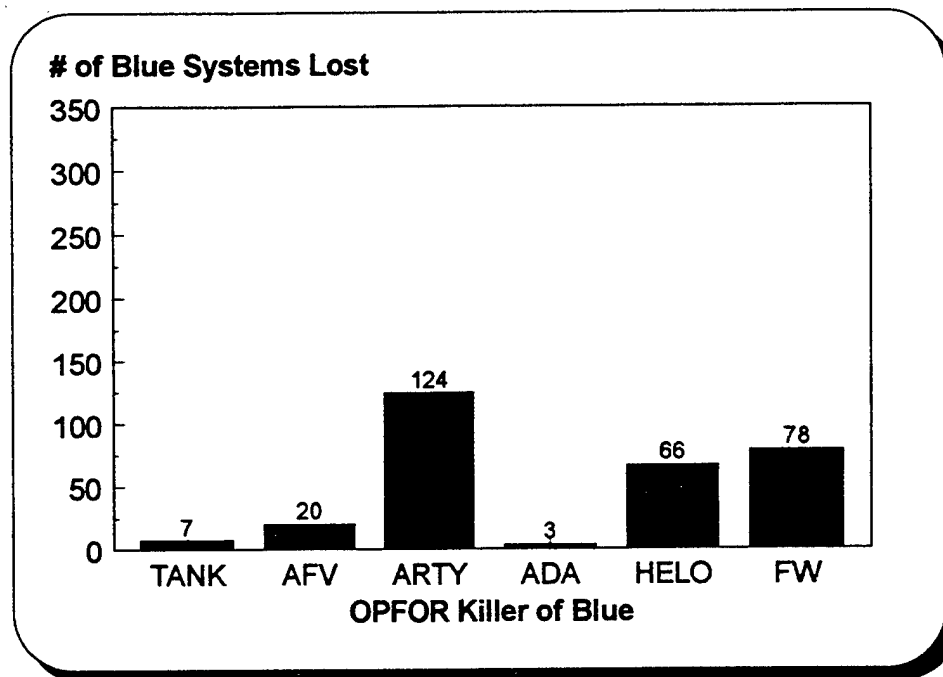


Figure D-21. MOD Blue Losses in FY 2010 scenario.

(4) Comparisons of FY 2010 survivability results. From the perspective of incurred losses, the results for the FY 2010 scenario have no meaningful differences among the three alternative designs. In this force year, all three alternatives used the same method, long range fires, to perform the decisive operations. The magnitude of the adjustments to the ground maneuver tactics that were seen in the earlier, FY 2001 scenario, did not occur in FY 2010. There were adjustments, corresponding to the changes in Blue force structure, but they were all oriented to positioning the Blue force in anticipation of a final close fight that did not occur on the scale of the FY 2001 battles. The observed changes where Blue sustained its losses were attributable to how the OPFOR adjusted its timing and strategies in trying to attack different aspects of the alternative division designs. As shown, in the AOE case, the OPFOR fixed wing systems were the largest killers of Blue systems. In the other two cases, the OPFOR artillery was the predominant killer. Because the three designs incurred about the same numbers of losses, one could be misled into believing that survivability is not a discerning criteria for division design comparisons. However, since there are major differences in the quantities of tanks and/or IFVs in

these designs, the quantities available after these battles is a discerning factor. The next section will address this topic of continuing combat operations.

c. Ability to survive and conduct sequential combat operations ("resiliency"). The three division design alternatives have different sizes of armor and mechanized infantry battalions. The AOE division has the largest units, followed by those from the HL-SB division, with the MOD division having the smallest. Because the alternative incur about the same number of losses, especially in the FY 2010 scenario, the combat capability remaining after these battles is a concern. Figure D-22 shows the tank and IFV strength remaining at the end of each battle for the FY 2001 and 2010 scenarios. Tables D-1 and D-2 list the initial quantities of tanks and IFVs in each design, and their respective survival rates at the end of the battle. The comparison of quantities remaining, versus percent surviving, illustrate the key points to be discerned. The tables list only those systems for the armor battalions and mechanized infantry battalions (the brigade and division cavalry systems were excluded, to allow direct comparison of maneuver battalion capabilities) in this divisional task organization. There are only three armor battalions and three mechanized infantry battalions in these battles.

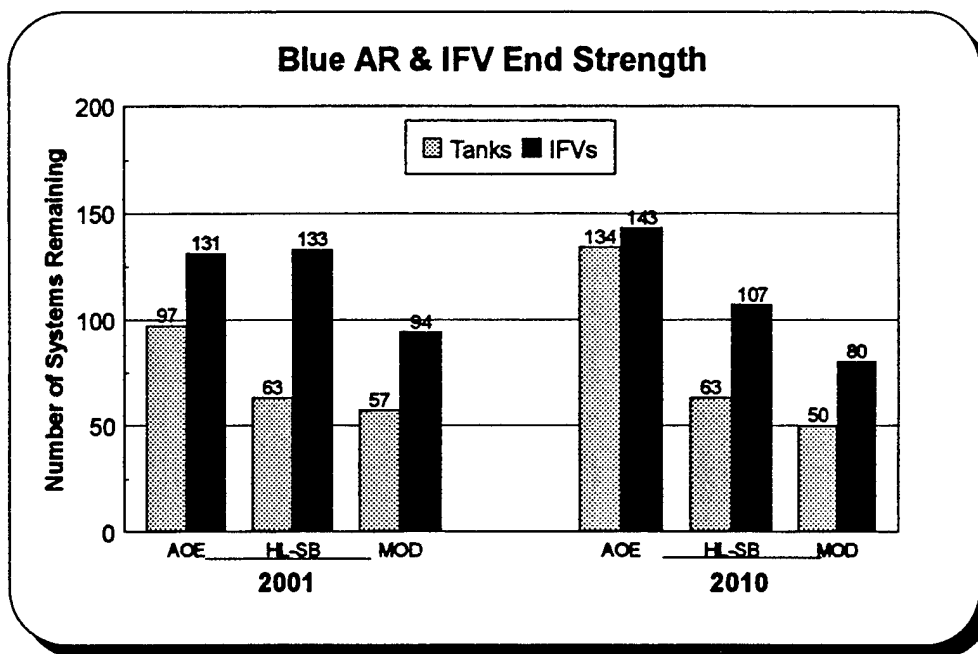


Figure D-22. Blue armor and IFV strength at the end of battle.

(1) Resiliency for the FY 2001 scenario. Table D-1 shows the IFV survival rates are nearly identical for all three designs. The table also shows a steady decline in tank survivability rates, corresponding to the initial quantities of armored systems in each type of brigade. This indicates that the heavier forces have shorter, more intense battles, and have a better overall survival rate. However, the armor forces survival rates creates concern for follow-on missions. The AOE division has slightly less than two armor battalions remaining. The survival rates for the HL-SB and MOD divisions are less than 50 percent, but more importantly, because of the smaller

2001	Tanks			IFVs		
	AOE	HL-SB	MOD	AOE	HL-SB	MOD
Initial #	174	135	135	162	168	126
% Surviving	56%	47%	42%	81%	79%	75%

Table D-1. Blue armor and IFV initial strength and survival rates for the FY 2001 scenario.

initial quantities, the remaining tank strength is about the equivalent of one AOE armor battalion. The mechanized infantry battalions survive better, with nearly identical survival rates. The initial IFV strength in the AOE and HL-SB designs are approximately the same, and they appear to have adequate capabilities for further operations. The MOD design, with its smaller mechanized infantry battalions, is not as capable. The HL-SB and MOD designs created less overwhelming combat power in the close fight (a more prolonged fight than the AOE design), and it is questionable if their remaining assets could continue to be effective in immediately following operations.

2010	Tanks			IFVs		
	AOE	HL-SB	MOD	AOE	HL-SB	MOD
Initial #	174	135	135	174	168	126
% Surviving	78%	47%	37%	82%	64%	63%

Table D-2. Blue armor and IFV initial strength and survival rates for the FY 2010 scenario.

(2) Resiliency for the FY 2010 scenario. Table D-2 lists the tank and IFV initial strengths and end of battle survival rates. Unlike the FY 2001 results, the IFV survival rates were about the same for the HL-SB and MOD designs, but they were both less than the AOE IFV survival rate. The tank survivability rates differed for all designs. In this FY 2010 scenario, the OPFOR smart munition capability creates this seemingly disparity in results. The total quantities of Blue losses are nearly identical. Since these losses are predominantly due to fixed quantities of precision munitions (whether attack helicopters, or artillery and air delivered smart munitions), and the engagements are nearly uniformly distributed across the targeted Blue units, the results show the larger units (combined tank and IFV strengths) have more survivors than the smaller units. Consequently, the AOE design has a definite advantage over the other designs for this high intensity type of operation. Further, it is very questionable if the survival rates for the HL-SB and MOD designs will support immediate follow-on missions.

(3) Comparing results across all alternatives, and in both force years, it appears that the division armor strength needs to be larger than it is in the HL-SB and MOD division designs, if the divisions are to fight a high intensity combat operations with immediate follow-on missions.

d. General observations for Blue force survivability.

(1) The air defense assets in the HL-SB alternative were identical to the AOE design, except that they now come from corps. The battalion staff of this corps asset, is capable of air defense planning, and liaison in support of the division. Although it did not occur in this scenario, a corps commander may choose to weight the battle and provide no coverage to one division. Integration of air defense assets from corps was the responsibility of the division staff. The MOD alternative had the largest number of organic air defense systems and sensors. The BSFV battery was well suited to protect the heavy maneuver brigades, and the Avenger battery protection to the infantry brigade. The MOD division does not have a special staff to conduct planning, or execute air defense operations, such as A2C2, and no capability to integrate corps air defense systems (FAAD C3I). While the division designs had different numbers of Blue kills of OPFOR attack helicopters, the resolution of the CAMEX air defense modules is not sufficient to clearly state that one is better than another. Similarly, the designs all suffered losses to OPFOR attack aviation, and the level of resolution can only allow the discernment that all alternatives require more protection to reduce the OPFOR aviation inflicted casualties. The contribution of FAADs against threat UAVs effecting threat artillery targeting was not demonstrated due to CAMEX limitations.

(2) The HL-SB organic smoke capabilities were increased by 300% and organic decontamination assets were reduced by 75% (as compared to the AOE division), providing for increased survivability, but being more reliant on corps for decontamination. The MOD design was totally dependent on corps for these capabilities, because in this design, division smoke and decontamination assets were reduced, and the reconnaissance assets were totally eliminated. In situations other than the wargamed scenario, the decrease in decontamination assets may result in OPTEMPO degradation, due to extended wear of MOPP.

(3) Engineer structures could not be evaluated directly. In the HL-SB design, engineer assets were increased over the AOE design. Participants felt that these structures provided adequate support to their respective divisions, and the additional command and control links to accommodate integration of additional corps engineer assets. In the MOD design, divisional engineers were reduced by two-thirds, and their functions were not moved to corps. Therefore, organic engineers could not support both mobility and survivability requirements without corps support. Engineer command and control was complicated by the loss of the division engineer brigade headquarters.

D-11. Results for issue "What differences exist in the operational employment of the alternative division designs?"

a. Cavalry and reconnaissance observations.

(1) In the HL-SB design, sufficient ground reconnaissance assets were available within the division. The ground cavalry troops performed advance guard, screen, and enroute and zone reconnaissance missions. This was a significant strength of the HL-SB division. However, there were no air cavalry troops in the HL-SB division. In these scenarios, there are several priority missions requiring air cavalry units: reconnaissance, escort for air assaults, and flexible responses to screening missions. As a result, AHB assets had to be diverted to do these air cavalry missions, reducing their availability to perform their primary mission. Further, the attack helicopter is not an optimum airframe for reconnaissance missions. The division must retain an ability to conduct air cavalry missions.

(2) There were sufficient reconnaissance assets to ensure the effectiveness of the force. The scenarios assumed effective cross-cueing between JSTARS and UAVs. If we have objective sensor equipment and if we can provide timely situational awareness in the objective force structure, the need for ground cavalry must be evaluated.

b. The dismounted capabilities of the infantry brigade gave the division a critical mobility advantage. The division could not have execute this mission, under these scenario conditions, without the infantry brigade. A mechanized brigade could not be moved rapidly enough to reach the key terrain in the narrow window of opportunity, and it also lacked sufficient dismounted infantry strength to accomplish key missions independently. The infantry brigade provided the pivotal positional advantage in this type of terrain. However, it appeared that the infantry brigade would have been just as effective if it were a corps assets that was attached to the division for specific missions.

c. Mobility differential observations.

(1) A serious mobility differential exists between the infantry brigade and the two heavy brigades in the division. This task/division organization effectively separated combined arms teams, and degraded mutual support. The third brigade was air assaulted from tactical assembly areas to the crossing sites along the Elbe river. This mission resulted in the infantry brigade being at the bridgehead 130 kilometers forward of the heavy brigades. Because the infantry brigade had limited tank killing capability, there were tremendous risks while the heavy brigades moved to link-up, and again when the heavy brigades continued into more forward positions.

(2) Mobility issues had an impact on close fire support systems in all alternatives. The helicopter transportability of ATCAS provided a means of delivering potent cannon fire support forward to the infantry brigade. However, divisional air transport capability was inadequate to conduct the operation without significant medium lift (CH-47) augmentation from corps. The addition of support vehicles and required ammunition for the air assault artillery force required a greater amount of aviation resources. While the scenario demonstrated the tremendous benefit of

a CH-47 air transportable 155 mm cannon system, such as ATCAS, it also raised the issue that ATCAS may be more appropriate as a division general support asset while a lighter, more mobile fire support system provides direct support to the infantry brigade. The tremendous potential for ATCAS was apparent during the second air assault mission, when it provided a forward emplaced counterfire/counterreconnaissance fire support system for the division force, as well as direct support for the infantry battalion. The HL-SB division's HIMARS battery provides the capability of projecting a significant deep strike and GS asset forward (provided joint lift assets are available). This permits earlier engagement of high payoff targets.

d. Information operations contributed to increased effectiveness of the maneuver force. Information flowed to the division staff in a concise picture, and it allowed the maneuver commander to judiciously apply combat power. Improvements to situational awareness and the common relevant picture should improve the effectiveness of the division. The brigades need direct support military intelligence companies with UAV and some processing capability (common ground sensor, ASAS). Also, the division's sensors need a range which will support targeting for their deep strike assets. If the division is expected to affect operations beyond 50 kilometers, it needs UAVs and processing capabilities available to the aviation brigade and/or DIVARTY.

e. Corps augmentation. Each division alternative structure required significant support from Corps. Corps augmentation provided air defense support in the HL-SB alternative; as all air defense came from Corps. Division engineer assets required augmentation for bridging in all alternatives. Corps smoke assets were necessary to support the division's deception plan and provide concealment at bridging sites. Mobility, countermobility and survivability become critical issues as divisional assets were moved to corps. Air defense and concealment resources were required to support bridging operations. Maintaining the lines of communication in the division rear was critical to maintain momentum. Responsive decontamination assets would reduce the need to "fight dirty". Military police provided rear area security of a larger area with fewer assets. Coordination of these critical issues was further complicated when command and control came from outside the division.

f. Lack of a third heavy brigade presented a problem in the resilience of the force. The division's total density of combat vehicles was reduced by this scenario's task organization, with the division having only two heavy maneuver brigades. Accordingly, the division staff weighted the deep fight more heavily. However, in the designs with only one AHB, if the infantry brigade was unable to maintain pace with the two heavy brigades, and if one of the heavy brigades was defeated, then the division could become combat ineffective.

D-12. Major Findings.

a. For the mid-to-high intensity spectrum of combat operations, as represented by the CAMEX scenario, the armor strength under HL-SB and MOD appears insufficient. In DDA Phase II, the total tank strength of the division should be evaluated, whether to increase by making the tank battalions bigger, or by creating more tank battalions.

b. Infantry battalion organizations (mechanized and non-mechanized) appear to need four companies (with three platoons per company), for task organization requirements and for strength in the close fight. In DDA Phase II, the assessment will be continued to determine if the fourth company is a line (to address the insufficient dismount strength problem) or an anti-armor company (for both infantry and/or mechanized infantry battalions).

c. AGS in the infantry brigade does not appear to be a good idea for full time assignment. The mobility differential and sustainment problems will be difficult to overcome. A better approach appears to be placing the AGS battalions at corps, where they can be task organized to the brigades when there are appropriate METT-T conditions.

d. The divisional aviation brigade appears to need a minimum of one attack helicopter battalion, to support the division's close fight requirements, and one assault helicopter battalion (for infantry lift and/or logistics lift).

e. A DIVARTY headquarters is needed for planning and integration of fires, and one direct support artillery battalion is needed for each brigade. The division appears to need one MLRS battalion to support the close fight and JSEAD requirements. A TAB is needed for the counterfire battle. In all iterations, the division's heavy reliance on corps reinforcing and general support fires seems to validate the requirement for at least two Field Artillery Brigades to be placed in support of each committed division.

f. There appears to be a need for a division-level cavalry squadron, with air and ground elements. The air cavalry needed for mission flexibility (particularly for situations of distributed, non-contiguous operations), and ground cavalry elements are needed for continuous screening capability in non-contiguous operations.

g. The brigade cavalry / reconnaissance unit should be, at most, a troop-sized element. This area needs continued assessment, in Phase II, for reconnaissance versus cavalry missions, and/or possible deletion, based on availability and quality of common relevant picture (e.g., from UAV and digitization).

h. In the presence of a rotary or fixed wing threat, the division needs at least a complete battalion of direct support ADA (and more under stressful conditions). A headquarters element is needed for integration, coordination, and dissemination of early warning information. In DDA Phase II, the assessment for an upper bound on the size of ADA elements will be continued.

i. Division military intelligence assets should be at least a battalion-sized unit. The RISTA battalion organization is inadequate for divisional support of information operations, and should be discarded.

j. CSS, including support concept and DISCOM structure (currently with headquarters, three forward support battalions, and one division support battalion) needs continued investigation in Phase II.

Annex D-1.

CAMEX Participants

The following personnel participated as the Division and OPFOR staffs in the Division Design Analysis CAMEX at Fort Leavenworth Kansas from 16 to 27 October 1995.

CPT Kenneth Leon, Directorate of Combat Developments, Fort Leavenworth, KS

CPT Bryan M. Lynch, Directorate of Combat Developments, U.S. Army Chemical School, Fort McClellan, AL

CPT Daniel Twomey, Air Combat Command Joint Programs Office, Fort Leavenworth, KS

MAJ Walter Barge, U.S. Army Engineer School, Fort Leonard Wood, MO

MAJ Glynn Beckman, Battle Command Battle Laboratory, Fort Leavenworth, KS

MAJ Rui O. Cunha, Directorate of Combat developments, U.S. Army ADA School, Fort Bliss, TX

MAJ Anthony F. Daskevich, U.S. Army Field Artillery School, Fort Sill, OK

MAJ Charles Hardy II, U.S. Army Aviation Center and School, FT Rucker, AL

MAJ Mark Hopson, Early Entry Lethality and Survivability Battle Lab, Fort Monroe, VA

MAJ Christopher Mayer, Directorate of Combat Developments, U.S. Army Armor Center, Fort Knox, KY

MAJ Kyle Rogers, Directorate of Combat Developmetns, U.S. Army Intelligence Center and School, Fort Huachuca, AZ

MAJ Bob Rossi, Directorate of Combat Developments, U.S. Army Armor Center, Fort Knox, KY

MAJ Steve Townsend, Force XXI Office, U.S. Army Infantry Center, Fort Benning, GA

LTC Kevin Henson, Directorate of Combat Developments, U.S. Army Field Artillery School, Fort Sill, OK

LTC Billy Wells, Force XXI Office, U.S. Army Infantry Center , Fort Benning, GA

MR. Charles F. Ennis, Threats Support Directorate, Fort Leavenworth, KS

MR. Steve Steger, Threats Support Directorate, Fort Leavenworth, KS

Annex D-2. Blue Force Structure for Corps level assets

57ID(M)

66 FA Bde (R 57 DIVARTY)

1-661 (MLRS) FA

2-661 (MLRS) FA

1-611 (155, SP) FA

67 FA Bde (R 57 DIVARTY)

1-662 (MLRS) FA

2-667 (MLRS) FA

2-611 (155, SP) FA

201 EN Bn

202 EN Bn

203 EN Bn (WHL)

2001 EN Co (MGB)

2002 EN Co (AFB)

2003 EN Co (AFB)

2004 EN Co (AFB)

1001 EN Bn (CBT HVY)

5001 CSE Co

5002 CSE Co

105 Avn Bde (OPCON)

200 Atk Bn

300 Atk Bn

400 Atk Bn

CML Co (SMK)

CML Co (SMK/Decon)

Air Amb Co

1006 MI Bn (TAC X)

501 PA Tm

506 EN Bn (M) (C) DS

507 EN Bn (M) (C) DS

5082 EN Cbt Spt equip Co

Annex D-2. Blue Force Structure for Corps level assets

(contd)

Corps Troops

54th EN Gp (-) GS

5086 EN Cbt Spt Equip Co

5087 EN Cbt Spt Equip Co

508 EN Bn (M) (C)

102d Avn Gp

114 Aslt Hel Bn

118 Mdm Lift Hel Bn

119 Light Utility Bn

X Corps Arty

79 FA Bde

3-661 (MLRS) FA

2-662 (MLRS) FA

3-662 (MLRS) FA

10 ADA Bde

1-323 (Avenger) ADA

1-324 (Avenger) ADA

1-325 (Avenger) ADA

1-328 (Hawk) ADA

1-326 (Patriot) ADA

40 Cml Bde (-)

404 Cml Bn

418 CML (Smk/Decon) Co

419 CML (Smk/Decon) Co

420 CML (Smk/Decon) Co

405 Cml Bn

421 CML (Smk/Decon) Co

422 CML (Smk/Decon) Co

423 CML (Smk/Decon) Co

451 Cml Recon Co

471 CML Co (BIO Detection)

472 CML Co (BIO Detection)

53 EN Bde (Corps) (-)

53 EN Bde (Corps) (-)

520 EN Bn (whl)

5083 EN Co (Dump Truck)

5099 EN Topo Co

Annex D-2. Blue Force Structure for Corps level assets
(contd)

30 MI Bde (CEWI) (-)
 301 MI Bn (CEWI) (Aer Xpln)
 310 MI Bn (CEWI) (Op)

30 MP Bde
 320 MP Bn
 321 MP Bn
 322 MP Bn
 323 MP Bn

40 Sig Bde (Corps)
 400 Sig Bn (Corps)
 401 Area Sig Bn
 402 Area Sig Bn
 403 Area Sig Bn

251 PSYOP BN

X COSCOM

This page intentionally left blank.

Annex D-3. OPFOR Order of Battle

1 CAA

11 MRD

111 MRR

- 1111 MRB (+)
- 1112 MRB (+)
- 1113 MRB (+)
- 1114 ARTY BN
- 1115 RECON BN
- 1116 ATGM BTRY
- 1151 ARTY BN
- 1161 SAM BTRY

112 MRR

- 1121 MRB (+)
- 1122 MRB (+)
- 1124 ARTY BN (+)
- 1125 RECON CO
- 1126 ATGM BTRY
- 1152 ARTY BTRY
- 1162 SAM BTRY

113 MRR

- 1121 MRB (+)
- 1122 MRB (+)
- 1123 MRB (+)
- 1124 ARTY BN
- 1125 RECON CO
- 1125 ATGM BTRY
- 1163 SAM BTRY

114 TR

- 1141 TB (+)
- 1142 TB (+)
- 1143 TB (+)
- 1144 ARTY BN
- 1145 RECON CO
- 1164 SAM BTRY

115 ARTY RGT

- 1153 ARTY BN
- 1154 MRL BN
- 1155 ARTY RECON BTRY
- 1611 ARTY BN
- 1711 MRL BN

117 AT BN

- 1171 AT BTRY

1172 AT BTRY
 1173 AT BTYR
 1173 AT BTRY
 118 RECON BN
 1181 RECON CO
 1182 RECON CO
 MRB (+) 44 BMP
 10 TANK
 2 SP ADA
 2SA-13
 6 120 MM SP MTR
 6 ATGM
 36 RPG
 9 SA-18
 6 30 MM AGS TB (+)
 31 TANK
 14 BMP
 12 RPG
 2 SP ADA
 2 SA-13
 2 120 MM SP MTR
 2 ATGM
 3 SA-18
 2 AGS
 SAM BTRY 4 SA-15
 201 AT RGT
 2011 AT BN
 2012 AT BN
 2013 AT BN
 211 IND HELO RGT
 2211 ATK SQDN
 2212 ATK SQDN
 2213 MED LIFT SQDN
 231 SOF BN
 2311 SOF CO
 2312 SOF CO
 2313 SOF CO
 543 ARTY BDE AAG
 5431 ARTY BN
 5432 ARTY BN
 5433 ARTY BN
 5434 ARTY BN
 5435 ARTY RECON BTRY
 544 SAM BDE (-) (AAG)
 5451 MRL BN
 1514 ARTY BN

1515 RECON CO
 1551 ARTY BN
 1561 SAM BTRY
 152 TR
 1521 TB (+)
 1522 TB (+)
 1523 TB (+)
 1524 ARTY BN
 1525 RECON CO
 1552 ARTY BN
 1562 SAM BTRY
 153 TR
 1531 TB (+)
 1532 TB (+)
 1533 TB (+)
 1534 TB (+)
 1535 RECON CO
 1563 SAM BTRY
 154 MRR
 1541 MRB (+)
 1542 MRB (+)
 1543 MRB (+)
 1544 ARTY BN
 1545 RECON CO
 1546 ATGM BTRY
 1564 SAM BTRY
 155 ARTY RGT
 1553 MRL BN
 1554 ARTY RECON CO
 1614 ARTY BN
 158 RECON BN
 1581 RECON CO
 1582 RECON CO
 1583 RECON ASLT CO
 161 ARTY BDE (-) (AAG)
 1613 ARTY BN
 1615 ARTY RECON BTRY
 171 MRL RGT (AAG)
 1713 MRL BN
 1714 ARTY RECON BTRY
 181 SSM BDE
 1811 SSM BN
 1812 SSM BN
 1813 SSM BN
 191 SAM BDE
 1911 SAM BN

14 TD

141 TR

1411 TB (+)
1412 TB (+)
1413 TB (+)
1414 ARTY BN
1415 RECON CO
1451 ARTY BN
1461 SAM BTRY

142 TR

1421 TB (+)
1422 TB (+)
1423 TB (+)
1424 ARTY BN
1425 RECON CO
1452 ARTY BN
1462 SAM BTRY

143 TR

1431 TB (+)
1432 TB (+)
1433 TB (+)
1434 ARTY BN
1435 RECON CO
1463 SAM BTRY

144 MRR

1441 MRB (+)
1442 MRB (+)
1443 MRB (+)
1444 ARTY BN
1445 RECON CO
1446 ATGM BTRY
1464 SAM BTRY

145 ARTY RGT

1453 MRL BN
1454 ARTY RECON CO

1612 ARTY BN

1712 MRL BN

148 RECON BN

1481 RECON CO
1482 RECON CO
1483 RECON ASLT CO

15 TD

1511 TB (+)
1512 TB (+)
1513 TB (+)

Annex D-4. Blue Major Combat Systems List for Force Year 2001 and Force Year 2010

The following columns list the types of systems available to the three division design alternatives for the FY 2001 and FY 2010 scenarios. The FY 2001 systems are equipment items for the near term force. Nearly all of these systems are available in today's US Army. The FY 2010 systems are the objective technology systems for the Force XXI Division. In most cases, the FY 2010 systems are one-for-one replacements for the FY 2001 systems. The noted exceptions are the FY 2010 HIMARS, which has no current equivalent; the Crusader will be fielded in battalions of consisting of three firing batteries with 6 Crusaders per battery. This differs from the present M109 fielding, which has three batteries of eight M109s in each battalion. The M109A6 Paladin is being studied for fielding plans, whether to be 3x8 or 3x6 battalions.

<u>FY 2001</u>	<u>FY 2010</u>
M1A1	M1A2
AGS	AGS
M2A2 IFV	M2A3 IFV
M3A2 CFV	FSV (heavy)
HMMWV	FSV (light)
M109A6	Crusader
M119	ATCAS
MLRS	MLRS
	HIMARS
ITV	LOSAT
AH-64	AH-64
OH-58D	RAH-66
Avenger	Avenger
BSFV	
BSFV-E	
120 mm Mortars	120 mm Mortars
81 mm Mortars	81 mm Mortars
ATACMS Blk I	ATACMS Blk I and Blk II
	MSTAR

This page intentionally left blank.

Annex D-5. Killer-Victim Tables
AOE FY 2001

BLUE TO RED			VICTIM				
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	TOTAL
TANK	0	3	12	0	7	0	22
IFV	0	28	6	11	12	0	57
FA	3	63	108	131	3	0	308
ADA	0	0	0	0	15	0	15
HELO	206	317	201	56	0	0	780
USAF	110	207	38	30	0	0	385
OTHER*	0	21	51	6	0	0	78
TOTAL	319	639	416	234	36	0	1,644

RED TO BLUE			VICTIM				
KILLER	TANK	IFV	FA	ADA	HELO	USAF	TOTAL
TANK	0	0	0	0	6	0	6
AFV	2	1	0	0	16	0	19
ARTY	89	77	59	7	0	0	232
ADA	0	0	0	0	7	132	139
HELO	8	6	12	9	0	0	35
FW	0	0	0	0	0	0	0
OTHER*	0	0	0	0	0	0	0
TOTAL	98	83	71	16	30	132	430

*Dismounted anti-armor weapon systems.

Annex D-5. Killer-Victim Tables

(contd)

AOE FY 2010

BLUE TO RED		VICTIM					
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	TOTAL
TANK	0	11	6	1	15	0	33
IFV	0	50	24	11	9	0	94
FA	132	205	131	45	0	80	593
ADA	0	0	0	0	13	0	13
HELO	146	275	183	49	0	0	653
USAF	47	89	14	10	0	0	160
OTHER*	0	1	0	4	1	0	6
TOTAL	325	630	359	120	37	80	1,551

RED TO BLUE		VICTIM					
KILLER	TANK	IFV	FA	ADA	HELO	USAF	TOTAL
TANK	0	0	0	0	10	0	10
AFV	1	0	0	0	15	0	16
ARTY	10	27	51	6	2	0	96
ADA	0	0	0	0	7	22	29
HELO	2	7	20	6	0	0	35
FW	45	83	26	1	0	0	155
OTHER*	0	1	0	0	0	1	2
TOTAL	59	117	97	12	33	22	340

*Dismounted anti-armor weapon systems.

Annex D-5. Killer-Victim Tables

(contd)

HL-SB FY 2001

BLUE TO RED		VICTIM					TOTAL
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	
TANK	12	24	3	1	6	0	46
IFV	28	19	12	7	24	0	90
FA	12	104	182	199	3	0	500
ADA	0	0	0	0	28	0	28
HELO	241	303	181	36	0	0	761
USAF	125	249	65	27	0	0	466
OTHER*	0	0	0	1	5	0	6
TOTAL	417	698	444	271	66	0	1,896

RED TO BLUE		VICTIM					TABLE
KILLER	TANK	IFV	FA	ADA	HELO	USAF	
TANK	1	0	0	0	6	0	7
AFV	23	0	0	0	5	0	28
ARTY	98	107	22	18	1	0	246
ADA	0	0	0	0	6	150	156
HELO	15	21	16	30	0	0	82
FW	0	0	0	0	0	0	0
OTHER*	0	0	0	0	0	0	0
TOTAL	138	129	38	48	17	150	520

*Dismounted anti-armor weapon systems.

Annex D-5. Killer-Victim Tables

(contd)

HL-SB FY 2010

BLUE TO RED		VICTIM					TOTAL
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	
TANK	1	14	10	3	4	0	32
IFV	0	40	40	33	5	0	118
FA	167	243	173	77	0	0	660
ADA	0	0	0	0	26	6	32
HELO	131	198	111	36	0	0	476
USAF	10	21	17	3	0	0	51
OTHER*	0	0	0	59	1	0	60
TOTAL	309	617	351	210	36	6	1,529

RED TO BLUE		VICTIM					TOTAL
KILLER	TANK	IFV	FA	ADA	HEL	USAF	
TANK	4	8	0	0	5	0	17
AFV	8	18	0	0	4	0	30
ARTY	61	55	10	7	0	0	133
ADA	0	0	0	0	2	42	44
HELO	8	31	2	3	0	0	44
FW	32	29	5	0	0	0	66
OTHER*	0	4	0	0	0	0	4
TOTAL	114	145	17	10	12	42	340

*Dismounted anti-armor weapon systems.

Annex D-5. Killer-Victim Tables

(contd)

MOD FY 2001

BLUE TO RED		VICTIM					TOTAL
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	
TANK	0	22	1	0	13	0	36
IFV	0	0	31	7	15	0	53
FA	3	161	255	198	4	0	391
ADA	0	0	0	0	12	0	12
HELO	242	346	135	37	0	0	760
USAF	119	128	43	23	0	0	313
OTHER*	0	0	0	1	0	0	1
TOTAL	364	657	465	266	43	0	1,795

RED TO BLUE		VICTIM					TOTAL
KILLER	TANK	IFV	FA	ADA	HELO	USAF	
TANK	0	0	0	0	11	0	11
AFV	2	0	0	6	11	0	19
ARTY	110	77	97	10	1	0	295
ADA	0	0	0	0	7	88	95
HELO	15	26	3	17	0	0	61
FW	0	0	0	0	0	0	0
OTHER*	0	0	0	0	0	0	0
TOTAL	127	103	100	32	30	88	480

*Dismounted anti-armor weapon systems.

Annex D-5. Killer-Victim Tables

(contd)

MOD FY 2010

BLUE TO RED		VICTIM					TOTAL
KILLER	TANK	AFV	ARTY	ADA	HELO	FW	
TANK	0	1	0	0	0	0	1
IFV	0	0	0	0	19	0	19
FA	151	203	129	40	0	0	523
ADA	0	0	0	0	20	13	33
HELO	128	260	159	52	0	0	599
USAF	48	69	13	15	0	0	145
OTHER*	0	0	0	0	0	0	0
TOTAL	327	533	301	107	40	13	1,321

RED TO BLUE		VICTIM					TOTAL
KILLER	TANK	IFV	FA	ADA	HELO	USAF	
TANK	0	0	0	0	7	0	7
AFV	3	5	0	0	12	0	20
ARTY	75	36	8	4	1	0	124
ADA	0	0	0	0	3	45	48
HELO	4	21	20	21	0	0	66
FW	45	27	5	1	0	0	78
OTHER*	0	0	0	0	0	0	0
TOTAL	127	89	33	26	22	45	342

*Dismounted anti-armor weapon systems.

This page intentionally left blank.

APPENDIX E

BRIGADE DESIGN ANALYSIS

TABLE OF CONTENTS

PARAGRAPH	Page
1.0 Purpose.....	E-1
1.1 Scope.....	E-1
1.2 Background.....	E-1
2.0 BDA Concept.....	E-2
2.1 Overview.....	E-2
2.2 DDA/BDA Issues.....	E-2
2.3 BDA Phase I Methodology.....	E-5
2.4 Scope of BDA Phase I Analysis.....	E-9
3.0 BDA Phase I Analytical Results.....	E-9
3.1 Base Case Evaluation.....	E-10
3.2 Reduced ARTY Capability Excursion Evaluation.....	E-13
3.3 Improved Scout Vehicle Excursion Evaluation.....	E-14
3.4 Improved 155mm(SP) Howitzer Excursion Evaluation.....	E-15
3.5 More Responsive ARTY Excursion Evaluation.....	E-16
3.6 Summary of the Results of the Base and Excursion Cases.....	E-20
4.0 Crosswalk of the BDA Phase I Results.....	E-23
4.1 Issue 15.....	E-23
4.2 Issue 16.....	E-24
4.3 Issue 17.....	E-24
ANNEXES	
E-1 Force XXI Division Design Principles/ Capabilities.....	E-1-1
E-2 Model Results.....	E-2-1

LIST OF FIGURES

<u>No.</u>	<u>Page</u>
E-1 Division/Brigade Design Evaluation Strategy.....	E-2
E-2 BDA Phase I Methodology Review.....	E-5
E-3 HRS 37 Storyline.....	E-7
E-4 Loss Exchange Ratio for the Division Design Alternatives.....	E-10
E-5 Kills by BLUE ARTY.....	E-10
E-6 Kills Achieved by BLUE and RED Aviation.....	E-11
E-7 Percent of Aviation Losses.....	E-11
E-8 Percent of Threat Armored Vehicles Killed.....	E-12
E-9 Percent of Blue Armored Vehicles Surviving.....	E-12
E-10 Cumulative BLUE Kills Over Time.....	E-13
E-11 Cumulative BLUE Losses Over Time.....	E-13
E-12 LER Comparison for the Base Analysis and Decreased ARTY...	E-14
E-13 Differences in ARTY Kills.....	E-14
E-14 LER Comparison for Improved Scout Vehicle Excursion.....	E-15
E-15 LER Comparison for Improved ARTY Excursion.....	E-15
E-16 Comparison of Kills by BLUE ARTY in Artillery Excursion.....	E-16
E-17 LER Comparison in the Artillery Forward Excursion.....	E-16
E-18 BLUE Kills for the HL-SB/ARTY Excursion.....	E-17
E-19 BLUE Kills for the BDE Based/ARTY Excursion.....	E-17
E-20 LER Comparison for the Enhanced BLUE Systems Excursion...	E-18
E-21 Percent Improvement in Kills and Losses.....	E-18
E-22 Cumulative BLUE Kills Over Time Comparison.....	E-19
E-23 Cumulative BLUE Losses Over Time Comparison.....	E-19

LIST OF TABLES

E-1 DDA/BDA Issues Matrix.....	E-3
E-2 HRS 37 Force Equipment Composition Derivation.....	E-8
E-3 BDA Phase I Excursion Matrix.....	E-9
E-4 Statistical Significance Test Results.....	E-20
E-5 Equipment Assignments for the BDE Alternatives.....	E-21

APPENDIX E

Results of The Brigade Design Analysis (BDA): Phase I

1.0 Purpose. To report on Phase I of the Brigade Design Analysis (BDA) performed by the US Army TRADOC Analysis Center-White Sands Missile Range for the December 1995 interim division design decision. A description of the projected analytical support for the Division Design Analysis (DDA) post interim design decision requirements at the brigade level (Phase II of BDA) is also provided.

1.1 Scope. The interim division design decision scheduled for June 1996, which will set the brigade and below organizational designs, was pushed up from June 1996 to December 1995 by CG, TRADOC. Due to the resulting abbreviated timeline, it became obvious that only limited BDA modeling and analysis would be possible in the available time. The intent of BDA Phase I was to investigate the impact of the weapon equipment changes on force effectiveness between the current AOE structure and the alternative design structures at the brigade level. However, in Phase II, the modeling and analysis will focus on the specific force structure differences at the brigade level and the impact of those differences on force effectiveness.

1.2 Background. The Brigade Design Analysis (BDA) is intended to be an effort of constructive, brigade and below, modeling and analysis in support of the Division Design Analysis (DDA). Both efforts support Joint Venture.

1.2.1 Issue Evaluation. The DDA and BDA are required address a set of critical Joint Venture issues at their respective echelon levels. The current version of these issues, as well as corresponding essential elements of analysis (EEAs), will be discussed in detail in later sections.

1.2.2 Interim Decision Division Alternatives. The Army of Excellence (AOE) division force structure, as it exists today, will be the baseline division force design. The Heavy/Light-Small Base (HL-SB) Division structure and the Brigade Based (BDE Based) structure are the alternative force designs. For the most part, the major difference between the two alternative division designs is whether specific elements are organic to the brigades, division, or echelons above division (EAD).

The HL-SB Division design alternative is a more flexible and modular construct than the current AOE division. The primary characteristics of this division design are: the mix of mounted/heavy and dismounted/light units within the same force structure; increased capability for decisive operations but with limited deep operations capability; the brigades are the principle maneuver organizations; and each brigade has an HHC, cavalry squadron with reconnaissance and security mission capabilities, and a mix of armor and infantry battalions.

The Brigade Based design alternative is designed to provide the division with the flexibility to perform missions across the spectrum of conflict in any type of terrain and attain its required capability through the assignment of mission specific brigade force packages. Under the BDE Based concept, the division echelon is focused on battle command and is capable of commanding a variety of subordinate brigade-sized units. The brigades are constructed as 'self-contained' packages that have some of the AOE CS and CSS elements (typically found in the division) embedded in the brigades. The remaining CS and CSS elements are moved to separable task organized brigades, or moved to corps and EAC levels. These elements, when needed, are drawn from the force pool in specific task organized packages.¹

2.0 BDA Concept.

2.1 Overview. Figure E-1 presents an overview of the DDA/BDA design evaluation strategy that will be used for both phases of the BDA. In general, the intent of the evaluation is to assess the relative effectiveness of the AOE and two design alternatives in terms of lethality, survivability and tempo control. The evaluation of the DDA/BDA issues will be based on that effectiveness assessment and must be achieved within the context of the desired Force XXI division design principles over the various BOSs and patterns of operations. Finally, the results of the evaluation of the DDA/ BDA issues will be used to substantiate the DDA/BDA hypothesis.

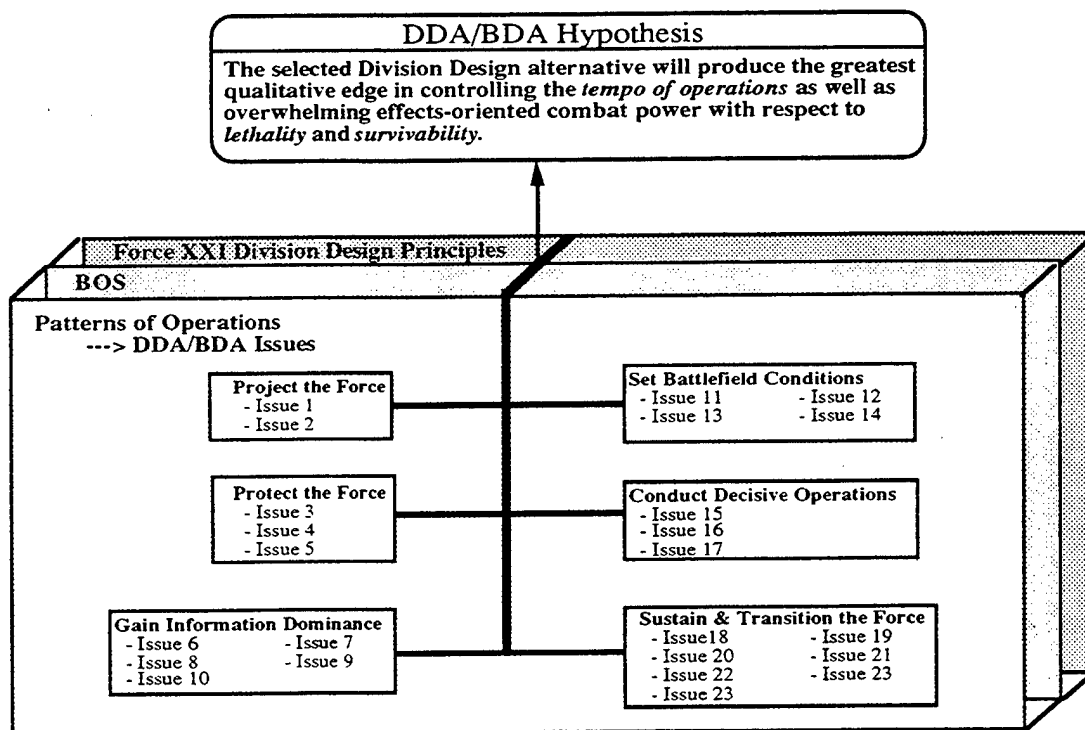


Figure E-1. Division/Brigade Design Evaluation Strategy

2.2 DDA/BDA Issues. Table E-1 presents each of the issues addressed as part of the DDA and BDA. Each issue is grouped according to the six patterns of operations. Essential elements of analyses (EEAs) are defined that are applicable to each issue. The last column of Table E-1 designates the possibility of whether a particular issue can be addressed in Phase I and/or Phase II of the BDA.

The *Project the Force* issues address the initial phase (i.e., deployment and buildup) of a military mission. Forces are generated and deployed, based on METT-T, through the tailoring and force projection process. An increase in modularity in the design of Force XXI unit structures should facilitate the force projection process. Normally, scenarios using BDE level constructive simulations do not represent the force projection phase as each begins with a force already projected into position and ready to initiate battle. There are, however, some high-resolution scenarios that portray an early entry mission and could possibly be used in Phase II to examine partial aspects of the issues for this pattern of operation. These issues will not be addressed in Phase I.

The *Protect the Force* issues address various active and passive measures the division can employ to ensure the survivability of the force. Digitized battle command, coupled with near real-time situational awareness, will permit more dispersed operations to be conducted resulting in degraded enemy IPB. The improved situational awareness will also allow the commander to optimize employment of his security elements.

Table E-1. DDA/BDA Issues Matrix

Patterns of Operations	DDA Issues	EEAs	Addressable in BDA?
<i>Project the Force</i>	(1) What are the force projection strategy (deployability) implications associated with the alternative division designs?	• Air & sea lift assets • Closure time at the PODs	Phase I - No. Phase II - Possibly if an early entry type scenario is used. Otherwise, issue will have to be addressed at DIV and/or EAD.
	(2) Does the division design provide sufficient inherent modularity to address anticipated missions?	• Deployment from one theater to another • Effectiveness of entry operations	Phase I - No. Phase II - Possibly if an early entry type scenario is used. Otherwise, issue will have to be addressed at DIV and/or EAD.
<i>Protect the Force</i>	(3) How much organic capability (types and number of systems) does the division need to protect itself from TBMs? from rotary-wing threat? from high performance aviation threat?	• ADA req'ts as a function of METT-T	Phase I - No. Phase II - Yes if scenario METT-T conditions include stressful AD threat.
	(4) What mix of NBC detection and decontamination assets are needed at division level?	• NBC recon/decon req'ts as a function of METT-T	Phase I - No. Phase II - Yes if scenario METT-T conditions include stressful NBC threat.
	(5) For the division design alternatives, what are the relative capabilities of organic engineer assets to perform the survivability function?	• Engineer req'ts as a function of METT-T	Phase I - No. Phase II - Yes if scenario METT-T conditions include req'ts for robust BLUE engineer capability.
<i>Gain Information Dominance</i>	(6) Given digitization and automated decision aids and tools, what is the EAD, division, and brigade C2 concept (G/S staff, digitized battle staff, multifunction staff)?	• Responsiveness of data collection, processing, and utilization for operational decision making	Phase I - No. Phase II - Yes if BDE level constructive model can explicitly represent IO.
	(7) If the division headquarters is required to act as an ARFOR headquarters, what are the additional roles and missions, and what augmentation is required?	• ARFOR/division HQ functions	Phase I - No. Phase II - Yes if BDE level constructive model can explicitly represent IO.
	(8) For the division design alternatives, what are the impacts on effectiveness from loss of habitual relationships?	• Impact on effectiveness of loss of habitual relationships	Phase I - No. Phase II - Yes if the degradations in performance due to the loss of habitual relationships can be quantified..
	(9) For the division alternatives, are there different factor priorities in attaining information dominance (acquire/manage/exploit information, C2 protection, C2 attack)?	• Factor priorities in attaining information dominance	Phase I - No. Phase II - Possibly. It could be determined at the BDE level if the factor priorities are different for the division design alternatives.
	(10) What is the mission for the division IO organization and what assets does that organization need?	• IO organizational mission and asset req'ts	Phase I - No. Phase II - Yes. IO Mission and asset requirements can be determined at the BDE level.
<i>Set Battlefield Conditions</i>	(11) What level of deep strike operations are to be conducted by organic division assets?	• Echelon to do deep OPs • Amount of organic assets to do deep OPs	Phase I - No. Phase II - Yes if scenario METT-T conditions include requirement for deep strike capability.
	(12) What is the appropriate mix of deep fires systems (MLRS/ATACMS/HIMARS/aviation)?	• Effectiveness of deep fires • Impact of deep fires on threat battle tempo	Phase I - No. Phase II - Yes if scenario METT-T conditions include requirement for deep strike capability.
	(13) What joint and combined intelligence and attack assets will be consistently available to the division?	• Deep fire assets from EAD • Level of targeting/early warning information from EAD	Phase I - No. Phase II - Partially. BDE level intel & attack asset requirements by each of the division design alternatives could be determined.
	(14) Is there a requirement for a divisional Air CAV element?	• Aerial recon capability req't	Phase I - No. Phase II - Yes if scenario METT-T conditions include requirement for aerial recon capability.
<i>Conduct Decisive Operations</i>	(15) Do the division alternatives have sufficient organic assets (numbers and types of systems) to generate overwhelming combat power in the close fight?	• # of major combat systems • Effectiveness achieved • Losses suffered	Phase I - Yes. Phase II - Yes.
	(16) For the division design alternatives, what assets best satisfy the functions of reconnaissance and security (Cavalry and scouts), by echelon, and for the spectrum of operations (from linear to non-contiguous)?	• Recon and security req'ts	Phase I - Partially. Phase II - Yes.
	(17) What is the appropriate mix (numbers and types of systems) of close fight (direct fire), deep fight (indirect fire), and attack aviation systems?	• Effectiveness achieved by systems mix	Phase I - Partially. Phase II - Yes.

Table E-1. DDA/BDA Issues Matrix (Cont'd)

Patterns of Operations	DDA Issues	EEAs	Addressable in BDA?
<i>Sustain and Transition the Force</i>	(18) Can the DDA CSS concept meet the required replenishment of supplies and services for the combat mission?	• Preferred CSS concept • Associated supporting units habitual requirements	Phase I - No. Phase II - Partially. BDE modeling can generate levels of fuel/ammo usage for a particular BLUE force and set of METT-T conditions.
	(19) Does the CSS operational concept maintain the operational tempo of the maneuver elements? Does the CSS concept support high intensity battle where peak replenishment is required?	• Maneuver BN organic support function req'ts • Optimum resource resupply technique • Logistics information requirements & disruption vulnerabilities	Phase I - No. Phase II - Partially. BDE modeling can generate levels of fuel/ammo usage for a particular BLUE force and set of METT-T conditions.
	(20) What personnel and finance support does the force require, when it is needed, and where will it be provided?	• Finance support req'ts	Phase I - No. Phase II - No.
	(21) What CSS host nation support is required to support the combat mission?	• Host nation CSS req'ts	Phase I - No. Phase II - No.
	(22) Does the Force XXI medical evacuation concept adequately support the combat mission?	• Medical evaluation req'ts	Phase I - No. Phase II - Yes. If the medical evacuation can be represented in the BDS level models.
	(23) What are the joint logistics impacts?	• Joint logistics impacts	Phase I - No. Phase II - No.
	(24) Does the CSS concept have the capability to enable reconstitution and redeployment of the division to and from multiple theaters?	• Redeployment & reconstitution req'ts	Phase I - No. Phase II - No.

Enhanced speed and agility will allow Force XXI elements to choose when and where to strike, resulting in fighting on friendly terms. Enhanced night (and obscurity) vision capability, improve NBC operations, and multi-dimensional AD operations will also improve force protection. Protect the Force issues will not be addressed in Phase I but will be in Phase II if the appropriate scenario METT-T conditions are included in the high resolution scenarios selected for the analysis.

The *Gain Information Dominance* issues are concerned with the dominance and control of the electromagnetic spectrum through information operations (IO) across the theater battle space. This will be achieved by the Force XXI division having information connectivity allowing each echelon to see a particular portion of the battlefield with the same relevant situational awareness. Also, the combined arms command and control warfare (C2W) operations are continuous and are a combination of engagements using lethal (e.g., maneuver, ARTY, attack helicopters, etc.) and non-lethal (e.g., jamming, deception, etc.) resources with the purpose of reducing enemy information operations to the point the enemy commander no longer exercises effective battle command. None of the issues designated for this pattern of operation (Table E-1) will be evaluated in Phase I of BDA. Evaluation of these issues in Phase II will depend on the fidelity of the IO representation in the constructive modeling.

The *Set Battle Space Conditions* issues address the ability of the division to achieve simultaneous, precision attacks throughout the depth of the battle space that will set the conditions for decisive operations. While none of the designated issues for this pattern of operation will be addressed in Phase I, each will be addressed in Phase II of the BDA.

The *Conduct Decisive Operations* issues address the division achieving decisive effects through the synchronized application of fires and committing ground forces to the direct fire fight. Increased situational awareness will enhance the effectiveness of the tactical fight by: 1) allowing precision placement of dynamic obstacles; 2) fixing forces positioned just in time; 3) executing precision deep strikes; 4) resulting in more precise and responsive close air support targeting; 5) permitting quick strike-break contact-reattack at another point operations; and 6) providing the friendly, enemy, terrain, and detailed knowledge enabling an attack to be deliberate instead of hasty. The issues for this pattern of operation will be at least partially addressed in Phases I and II.

The *Sustain and Transition Force* issues address the division's ability to sustain itself and to reconstitute and redeploy when necessary. While these issues cannot be explicitly addressed at the brigade level for the AOE and HL-SB alternatives, some insights may be gained for the BDE Based alternative where there are some inherent organic CSS resources. Note, constructive modeling at the brigade level could be used to establish materiel and supply usage rates for particular METT-T conditions. In turn, the brigade level usage rates could be used by division/corps level modeling to address CSS requirements.²

2.3 BDA Phase I Methodology. Phase I of the BDA provides brigade level insights for the December 1995 interim division design decision. Despite the limited time available, the analysis was at least partially based on evaluation of constructive simulation results. The following methodology was developed and executed to best utilize available tools within the allotted time.

As illustrated in Figure E-2, the primary intent of Phase I was to investigate the impact of the weapon equipment changes on force effectiveness between the current AOE structure and the alternative design structures at the brigade level. To do this assessment in a timely manner to meet the BDA milestones, an assumption had to be made that the HL-SB and BDE Based brigade force structures will be virtually the same as for the AOE.

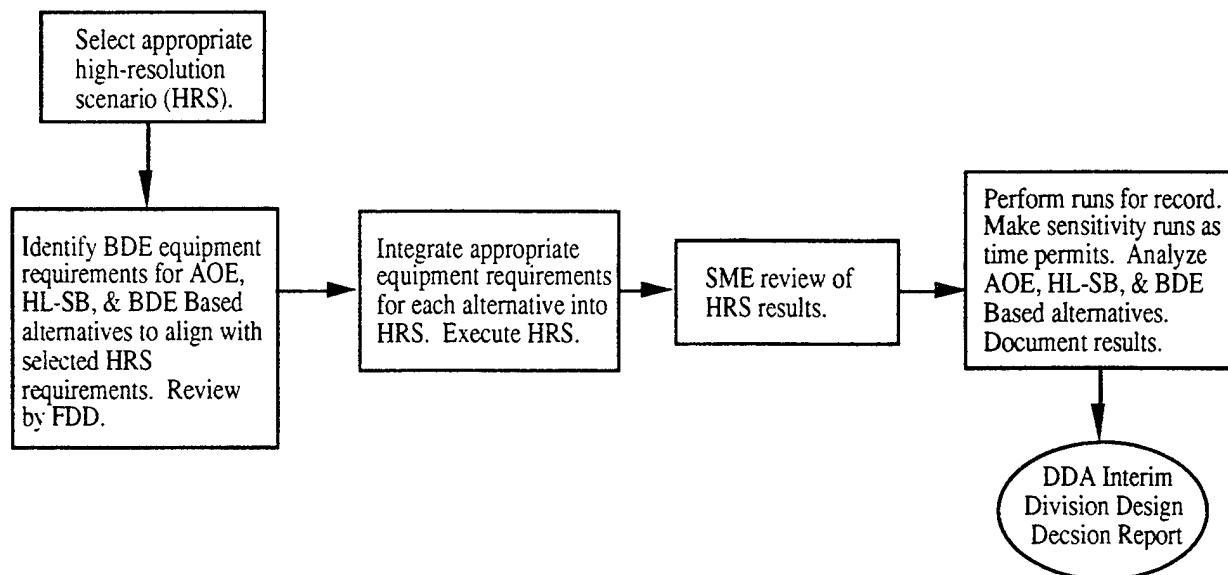


Figure E-2. BDA Phase I Methodology Overview

2.3.1 CASTFOREM High Resolution Scenario Selection. A survey was performed to identify a CASTFOREM high resolution (HRS) scenario that would provide a sufficient basis for an analysis of the impact of the equipment differences between the AOE design and the alternative designs on force effectiveness. The primary requirement was for the scenario to be stressful, i.e., the threat would be sufficiently robust to provide a potential difference in force effectiveness between the AOE and two force equipment variations. Based on that criteria, HRS 37, the selected scenario, portrays a BLUE mechanized infantry brigade attacking a threat tank regiment in Europe.

The threat force consists of two lead tank battalions of the second echelon regiment of a first echelon tank division. The threat force conducts its movement with the two battalions, traveling in parallel march columns, each reinforced by a motorized rifle company. The threat force mission is to conduct a movement to contact to pass through the first echelon of the division and to continue the attack of the division. The composition of the threat force is provided below. Note, generic RED system names are used instead of specific names to keep this report unclassified. The threat represented is very robust and reflects a far-term, approximately 2005+ time frame.

<u>Threat Systems</u>	<u>Quantity</u>
T-80	56
BMP	22
BMP RECON	4
BMP ADA	5
BRM	1
BRDM	3
HOKUM	5
ACRV FO	21
ACRV FDC	24
AD Gun/Missile System	8
AD Missile System	4
122mm SP HOW	15
152mm SP HOW	46
120mm TWD Mortar	5
220mm MRL	5
122mm MRL	15

The BLUE force consists of a brigade-sized element of two mechanized infantry task forces and one armor task force. A brigade slice of combat support assets provides support to the brigade. Additionally, an attack helicopter battalion is under the operational control of the brigade commander. The mission of the BLUE force is to conduct an attack to destroy enemy forces. It is the intent of the BLUE brigade commander to inflict maximum damage to the threat force in the engagement area by maneuvering into the flank of the threat force as it moves south. The BLUE force compositions for the AOE, HL-SB, and BDE Based alternatives are presented in the next section.

Figure E-3 presents the graphical storyline for HRS 37. HRS 37 begins after BLUE divisional attack helicopters have destroyed the threat regiment's second echelon battalions in their assembly areas. Additionally, the BLUE force will fight through the threat divisional recon assets enroute to their objectives. Initially, BLUE CAV units deploy laterally heading in a northwest direction and begin zone reconnaissance (in the two division design alternatives only). The scout units engage any threat units of platoon size or smaller, as well as call in fire support on other larger threat units detected. The scouts continue their mission until they reach the objectives and withdraw to flank screening positions when the mechanized infantry battalions arrive.

One BLUE attack helicopter company maneuvers to BP COBRA to attack the threat tank battalions as they move south in column formation toward EA BLACK. A platoon of the second BLUE attack helicopter company establishes a screen line oriented to the north of BP COBRA. The threat commander responds to the presence of the BLUE aviation by deploying his attack helicopter company to the hill mass northeast of BP COBRA. Their mission is to counter the BLUE attack helicopter threat and to protect the flank of the main RED maneuver force from attack by BLUE ground forces (i.e., armor battalion). The BLUE screening force detects the threat attack helicopters, exchanges fire, and eventually drives them north to less favorable firing positions.

The first BLUE mechanized infantry battalion task force occupies a blocking position in the vicinity of OBJ JOHN to prevent the threat forces from maneuvering south to escape the attack in EA BLACK. The third attack helicopter company maneuvers with this blocking force to attack the threat tank battalions from the south to help divert attention away from the upcoming main attack from the northeast. The second mechanized infantry battalion task force attacks to seize OBJ PAUL causing the threat tank battalions to be fixed, thus forcing them to occupy hasty defensive positions in EA BLACK.

The first BLUE attack helicopter company moves to firing positions on the southern end of BP COBRA and continues attacking the threat tank battalions in EA BLACK. The initial screening force is relieved on station by another platoon of attack helicopters. The BLUE armor battalion task force sweeps to the north of BP COBRA in preparation for a flanking attack of the threat tank battalions in EA BLACK. Threat attack helicopters detect and engage the exposed right flank of the armor task force as it turns westward to make its attack into EA BLACK. The scenario concludes as the BLUE armor battalion task force completes its attack of the left flank of the threat tank battalions in EA BLACK.

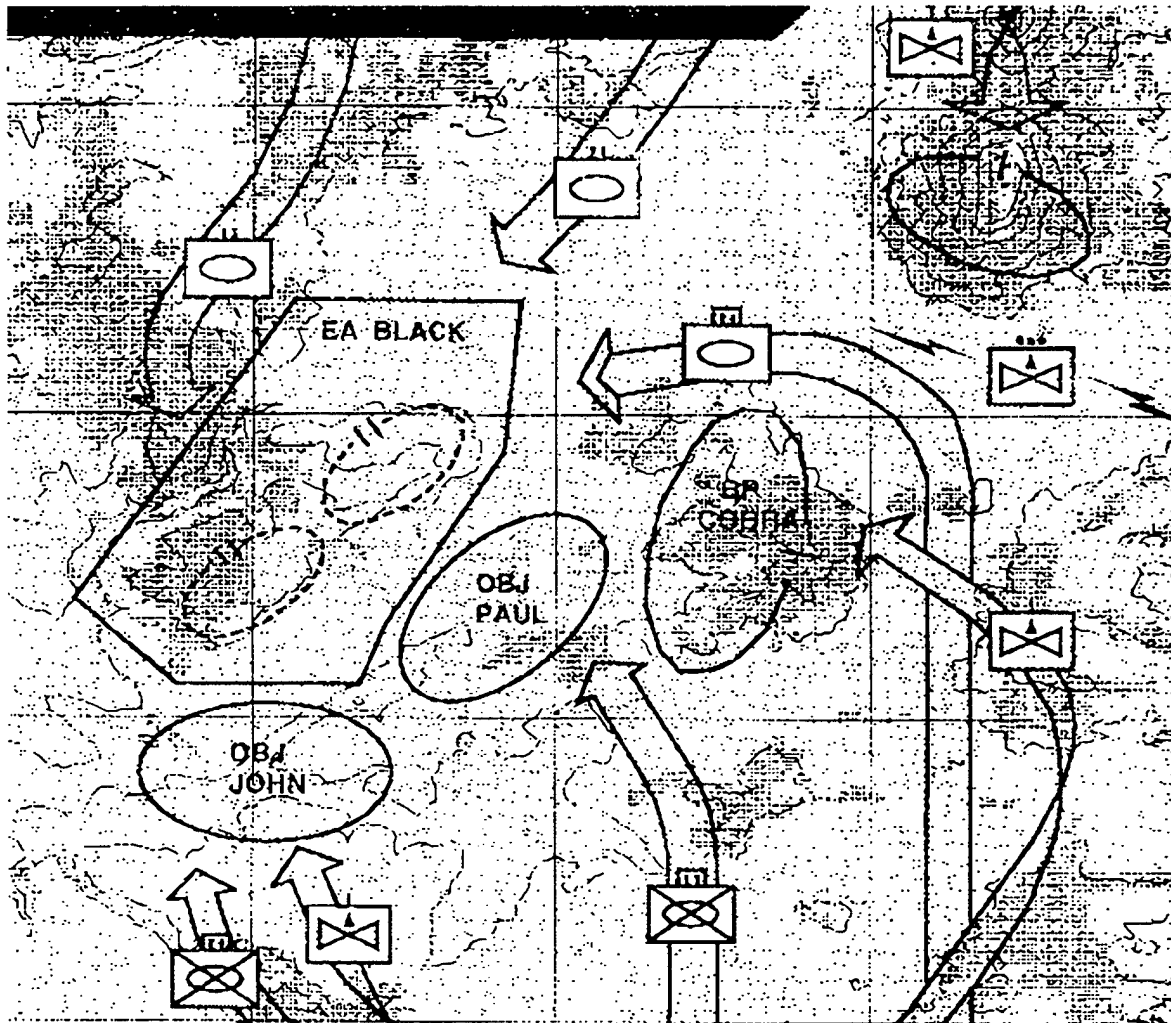


Figure E-3. HRS 37 Storyline

2.3.2 HRS 37 BLUE Force Equipment Assessment. Table E-2 provides a matrix of the HRS 37 BLUE force equipment compositions for the three brigade force structure alternatives. It is assumed that the BLUE mechanized infantry brigade force equipment composition initially portrayed in HRS 37 is representative of an equivalent AOE brigade force equipment composition. Given the HRS 37 BLUE force equipment composition and the suggested division design force specifications for the HL-SB and BDE Based alternatives, corresponding force equipment compositions for those two alternatives, applicable to HRS 37, were derived. This effort required input and review from the Force Development Directorate (FDD) and TRAC's Scenario and Wargame Center (SWC) to ensure the appropriate equipment had been represented in HRS 37 for each of the alternative designs. An inspection of Table E-2 reveals the major equipment differences between the AOE design and the two alternatives are with the tanks, armored fighting vehicles, scout vehicles, and MLRS. Also, the primary differences in equipment between the two alternative designs are the HL-SB design has somewhat more tanks and MLRS but fewer armored fighting vehicles than does the BDE Based design.

Table E-2. HRS 37 Force Equipment Composition Derivation

	AOE BDE Design			HL-SB BDE Design			BDE Based BDE Design		
									
M1A1	1x14 BN CDR: 1 S-3: 1 → Total: 72 [*] Includes 1 CO from notional 2nd armor battalion in the BDE	1x14	3x14 [*]	1x14 BDE CAV SQRN: 18 BN CDR: 1 S-3 & XO: 2 → Total: 77 [*] Includes 1 CO external to the BDE	1x14	2x14 [*]	BDE CAV SQRN: 18 BN CDR: 1 S-3: 1 XO: 1 → Total: 63	1x14	2x14
M2A2	3x13 HQ: 4 → Total: 95	3x13	1x13	2x18 [*] HQ: 4 → Total: 94 [*] 1 CO task organized out of the BDE	2x18	1x18	3x18 HQ: 4 → Total: 112	2x18	1x18
FSV/ HMMWV	1x10 → Total: 30	1x10	1x10	1x10 BDE CAV SQDN: 45 → Total: 75	1x10	1x10	1x10 BDE CAV SQDN: 45 → Total: 75	1x10	1x10
M109A6	2 BN @ 3x8 DIVARTY 3x8 BN DS 3x8 BN GSR → Total: 48			3x8 BN DS [BDE] 3x8 BN GSR [Corps] → Total: 48			3x8 BN DS [BDE] 3x8 BN GSR [Corps] → Total: 48		
MLRS	1x9 Bty [DIVARTY] 3x9 BN [Corps] → Total: 36			3x6 BN [DIV] 3x9 BN [Corps] → Total: 45			3x9 BN [Corps] → Total: 27		
AH-64/ OH-58	15 AH-64 → Total: 15			15 AH-64 → Total: 15			15 AH-64 → Total: 15		
ADA	Avenger: 0 Manpads: 8 BSFV: 8			Avenger: 8 Manpads: 0 BSFV: 8			Avenger: 8 Manpads: 0 BSFV: 8		

2.3.3 HRS 37 Modifications for Alternative Division Designs. There were numerous changes required to integrate the appropriate equipment of the alternative division designs into HRS 37. The most difficult part was 'wiring in' the additional cavalry scouts into the alternative force structures. The other equipment changes were rather straight forward and made by either uniformly decreasing or increasing the numbers of particular systems accordingly. Following are descriptions of other HRS 37 modifications required to adapt it to this application.

- As mentioned previously, extensive modifications were required to integrate the additional scout capability into the HL-SB and BDE Based alternatives in HRS 37. BLUE scouts are represented as performing their recon activities until they detect enemy units. Upon detection, if the approaching enemy units are platoon size or smaller, the scout units, supported by dedicated CAV squadron tanks, will attempt to engage and destroy them. If larger enemy units (company sized or greater) are detected, the scouts will go to hull defilade and not engage. If the main threat force is detected, the scout units fall back and hook-up with corresponding maneuver force units.

- By the time the scouts reach positions to start detecting enemy units in the AOE alternative, the ARTY units have moved to their tactical positions and are prepared to provide fire support for the scouts. In the HL-SB and BDE Based alternatives where there are significantly more scouts (from the BDE CAV squadron), fire support may be called in much sooner. However, some of the ARTY units do not respond because they are still moving to their tactical positions. To ensure there are at least some fire support assets available and prepared to support the scouts in the HL-SB and BDE Based alternatives, a 155mm (SP) battery is placed in direct support to the BDE CAV to provide immediate fire support.

- The CAV and BN scouts have only eyeballs/binoculars as sensors. Subsequently, their target acquisition capability is limited with respect to range and battlefield obscuration when it occurs. To enhance the target acquisition capability to a level commensurate with the threat's, BLUE scouts are equipped with sensors comparable to those found on the M1A1.

Several issues in HRS 37 have surfaced during this initial effort. Instead of making additional changes to the scenario to address each of these issues (which would be included in the runs for record), the decision was made to examine their impacts in a set of excursion (or sensitivity) runs. The results of addressing these issues will be presented in the analysis results section.

2.4 Scope of BDA Phase I Analysis . The BDA Phase I HRS 37 CASTFOREM results for the AOE and alternative division designs were analyzed to determine the extent force effectiveness, in terms of lethality, survivability, and tempo of operations, was impacted by the variations in equipment composition for the alternatives. Numerous measures of performance and effectiveness (MOP/MOE), similar to those listed below, were used to assess the lethality, survivability, and tempo of operations for each alternative.

- Loss Exchange and System Exchange Ratios
- Killer Victim Scoreboards (i.e., Systems killed by what systems)
- Kills and Losses Over Time and Range
- Residual Combat Power
- Time To Accomplish Mission (OPTEMPO)

Insights corresponding to the Force XXI division design principles (defined in Annex E-1) are formulated based on the force effectiveness differential analysis performed. The insights derived from what can be expected to occur for a mechanized brigade performing an attack mission in a European environment will be used to address the applicable DDA/BDA issues. Those insights may provide a basis for estimating results for other brigade type, mission type, and environment type variations.

3.0 BDA Phase I Analytical Results. The BDA Phase I results are presented in two parts. The first part is an evaluation of the comparative AOE, HL-SB, and BDE Based design alternative results. The second part provides evaluation results of several excursions addressing the impacts of modifications such as upgrading equipment to the near and far term and enhancing BLUE tactics. Table E-3 presents a matrix of the specific alternative/excursion combinations evaluated. Annex E-2 provides the detailed model results for the base case and excursions.

Table E-3. BDA Phase I Excursion Matrix

Exc. Code	Excursion	Division Design Alternative		
		AOE	HL-SB	BDE Based
a	Base Case	X	X	X
b	Reduced ARTY Resources	X	X	X
c	HMMWV Scout ---> CFV Scout	X	X	X
d	M109A6 ---> Crusader	X	X	X
e-h	ARTY Forward Variations	NA	X	X
i	Enhanced AD	X	X	X
j	Enhanced BLUE (Far-Term)	X	X	X

3.1 Base Case Evaluation. The following section presents the base case results for each of the three alternatives. The focus of the analysis was: force effectiveness in terms of LERs; scout/ARTY synergistic effects; aviation and air defense impacts; maneuver force effects; and BLUE effectiveness versus battle time.

Figure E-4 presents the BLUE loss exchange ratio (LER) results for each of the division design alternatives. While the LER results are comparable, it can be seen there is an increase in BLUE kills in the HL-SB and BDE Based alternatives as compared to the AOE. The increase in kills was caused primarily by the BLUE ARTY (i.e., M109A6) firing more missions due to the additional 45 scouts calling for fire support. The difference in kills between the HL-SB and BDE Based alternative was due to more RED ARTY being killed by the additional MLRS in the HL-SB alternative. Similarly, the differences in losses resulted because more MLRS were being killed in the HL-SB alternative as there were considerably more launchers engaging and being engaged by RED counter-battery fires.

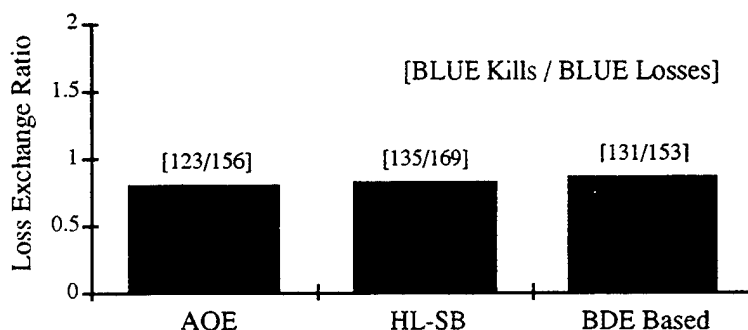


Figure E-4. Loss Exchange Ratio for the Division Design Alternatives

As noted in the previous figure, the increase in BLUE effectiveness in the HL-SB and BDE Based alternatives was due primarily to the increase in the direct support ARTY (i.e., M109A6) effects. In Figure E-5, the level of counter-battery effects achieved by the MLRS were similar when considered in the context of the relative proportion to the total MLRS resources in each alternative (i.e., 36 in AOE, 45 in HL-SB, and 27 in the BDE Based).

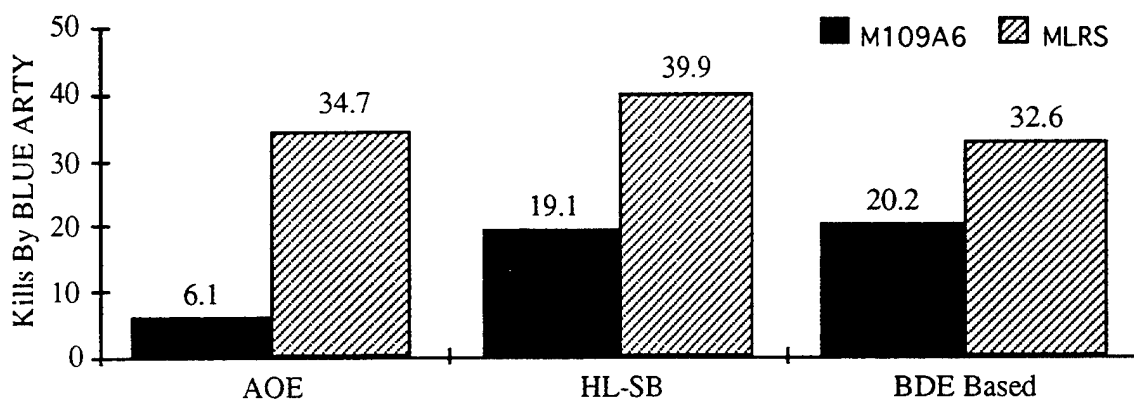


Figure E-5. Kills By BLUE ARTY

As seen in Figure E-6, the level of BLUE attack aviation kills remains somewhat constant over the alternatives. Since BLUE had almost three times as many attack helicopters as RED (i.e., 15 vs. 5), BLUE aviation should and does achieve more kills than RED aviation. Since BLUE had the same number of aircraft in each alternative, it appears other BLUE equipment differences between the alternatives did not necessarily impact attack helicopter performance. Threat aviation performance, however, decreased somewhat in the HL-SB and BDE Based alternatives because the increased intelligence provided by the scouts and the resulting ARTY fire missions force the RED attack helicopters to be less aggressive.

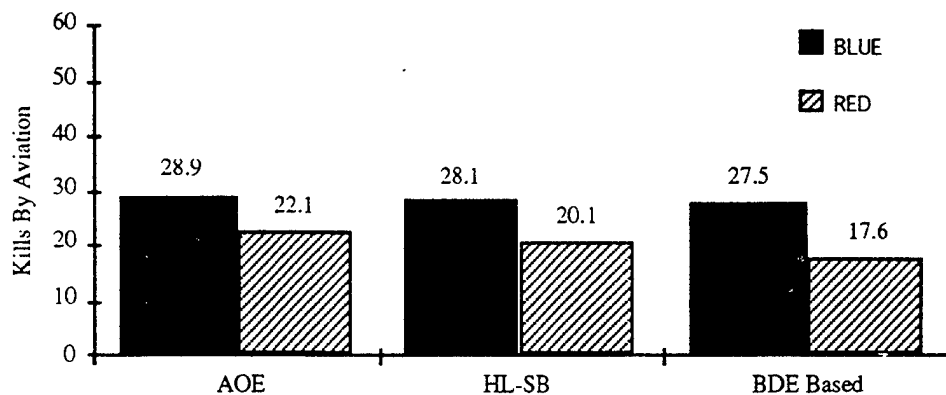


Figure E-6. Kills Achieved By BLUE and RED Aviation

Figure E-7 presents the percent of the BLUE and RED aviation resources that are killed by the opposing sides. As seen in this graph, BLUE aviation tended to survive better in the HL-SB and BDE Based alternatives as compared to the AOE case. Just the opposite occurred for the threat attack helicopters as the increase in losses adversely impacted their effectiveness as shown in the previous figure. Further investigation into the results revealed two interesting observations.

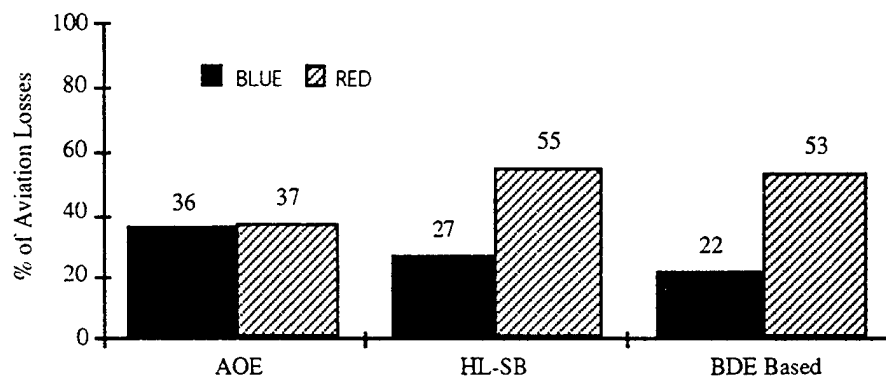


Figure E-7. Percent of Aviation Losses

First, BLUE air defense was relatively ineffective against threat attack helicopters in HRS 37. This occurred because the BLUE Stinger systems in the area of the BLUE armor task force (which was being engaged by the five Hokums) were not engaging the RED aviation. Model results showed the Bradley Stinger Fighting Vehicles (BSFVs) detecting RED attack helicopters. However, when the soldiers dismount and attempt to reacquire, no detections occur because the RED attack helicopters are positioned at distances exceeding the maximum range of the soldier's DVO sensors. Although time constraints did not allow the BLUE AD representation to be optimized, an excursion will be performed to examine the impact of moving the BSFVs within range of the RED attack helicopters. In the AOE alternative, all of the RED aviation losses were achieved by BLUE attack helicopters. In the other two alternatives, the additional RED attack helicopter losses were caused by the M1A1s with the BDE CAV units.

Second, the additional scouts in the HL-SB and BDE Based alternatives were able to call in ARTY on the RED air defense to suppress and kill them, thus forcing their retreat to less favorable positions. The less effective RED air defense, combined with fewer RED attack helicopters surviving or available, resulted in BLUE attack helicopters being considerably more survivable than in the AOE alternative.

Figure E-8 provides the percent of the total threat armored vehicles (i.e., T-80s and BMPs) killed by BLUE. While there appears to be virtually no difference in tanks killed across the alternatives, a noticeable increase in BMPs killed occurred in the HL-SB and BDE Based alternatives as compared to the AOE. The additional BMP kills were due to the increase in ARTY missions

against the RED maneuver units. Since the BMPs are considerably softer than the tanks, more BMP kills occurred.

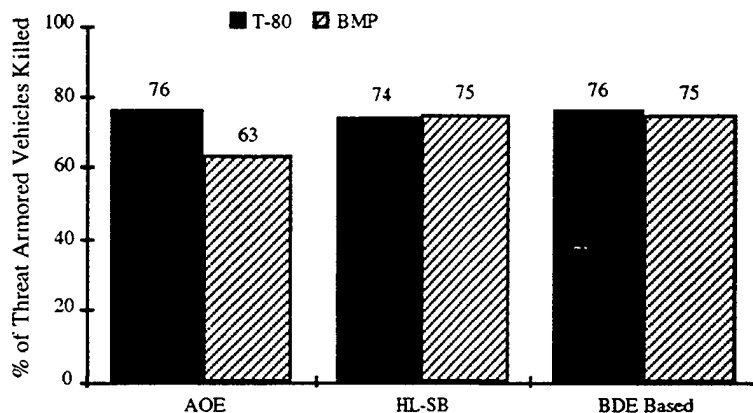


Figure E-8. Percent of Threat Armored Vehicles Killed

Figure E-9 presents the percent of the BLUE armored force surviving. There is a noticeable increase in survivability of the BLUE tanks and Bradleys in the HL-SB and BDE Based alternatives over the AOE alternative, a synergistic effect of the increase in BLUE scout capability and subsequent additional fire support.

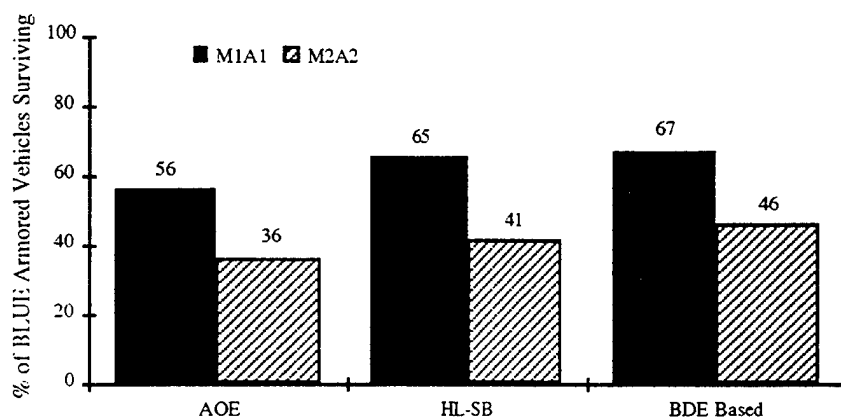


Figure E-9. Percent of BLUE Armored Vehicles Surviving

The previous analysis examined force effectiveness in terms of end-of-game results. Often, end-of-game results may reveal minimal and confusing differences between two alternatives when one or more static measures are compared. However, dynamic measures, such as kills over time or shots over range, often provide insights that might not be realized when only considering the comparison of static measures.

Figure E-10 provides the cumulative BLUE kills over time for the three force design alternatives. As these effectiveness results depict, if the end of game results are compared, the differences between the alternatives are minimal. However, the kills over time reveal a considerably different picture as the HL-SB and BDE Based alternatives performed considerably better than the AOE case. Several observations should be cited. First, the main battle begins at approximately 105 minutes into the fight. Up to that time, the resulting kills were due primarily to BLUE ARTY being called for by the scouts as well as any effects achieved by the scout units when engaging RED units. In the AOE alternative, the mean time that the first kill occurred is 66 minutes whereas in the other two alternatives, the first kill occurred at approximately 32 minutes. Second, at the time the main battle began, BLUE had achieved 16 kills (14 percent of the total kills) in the AOE alternative. However, in the HL-SB and BDE Based alternatives, 58 and 55 kills (43 and 46 percent of the total kills), respectively, had occurred. These additional effects over what was

achieved in the AOE alternative were due primarily to the BDE CAV squadron's ability to call in more ARTY fire missions sooner. Third, after the main battle commences, BLUE killed the RED force at a higher rate in the AOE alternative. Since BLUE ARTY conducted many more fire missions in the HL-SB and BDE Based alternatives, more BLUE ARTY losses occurred which means at the start of the main battle, there were more ARTY resources in the AOE alternative. BLUE then achieved less ARTY effectiveness after the main battle commenced in the HL-SB and BDE Based alternatives thus reducing the kill rate.

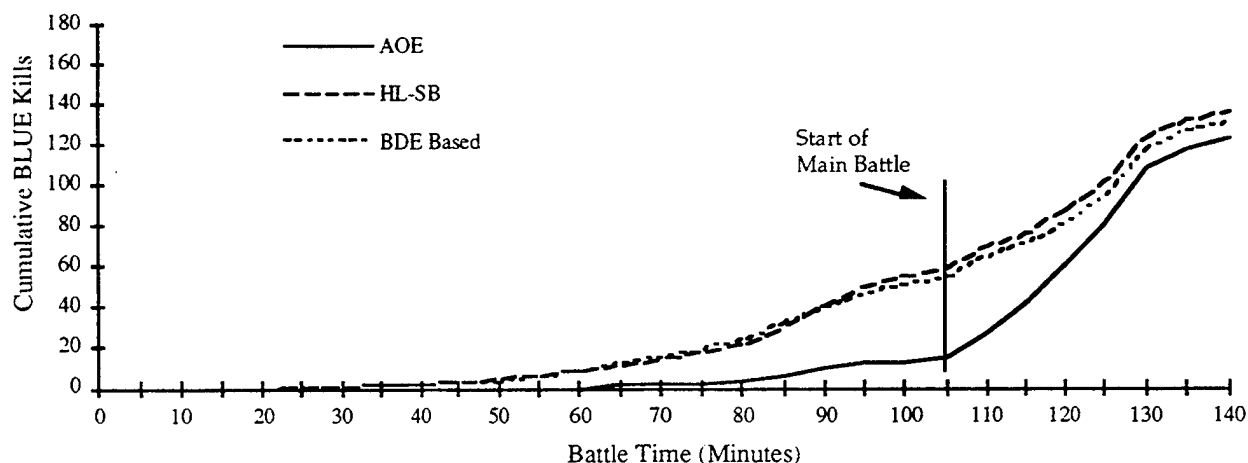


Figure E-10. Cumulative BLUE Kills Over Time

Figure E-11 presents the BLUE losses over time that correspond to the BLUE kills in Figure 10. The BLUE losses prior to the start of the main battle were comprised mostly of scout vehicles. These losses were minimal in the AOE alternative because of the small number of scout resources. However, since the HL-SB and BDE Based alternatives had considerably more scout unit resources (i.e., BDE CAV squadron) than the AOE alternative, it seems reasonable that more losses occurred. After the start of the battle, BLUE losses in the HL-SB and BDE Based alternatives occurred at a rate equal to or less than what occurred in the AOE alternative.

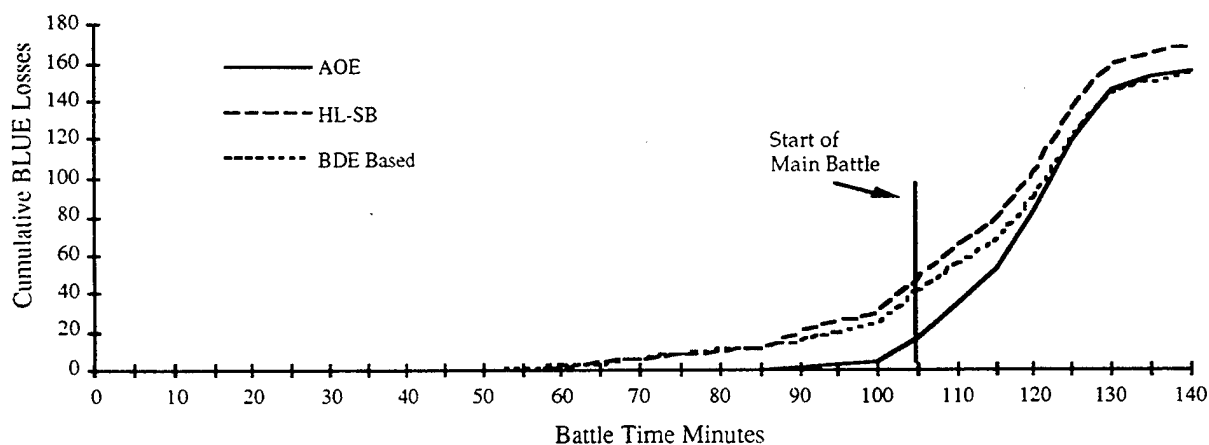


Figure E-11. Cumulative BLUE Losses Over Time

3.2 Reduced ARTY Capability Excursion Evaluation. The following section presents the results for each of the alternatives when the ARTY assets for the BLUE brigade are reduced in HRS 37. The play of ARTY resources in HRS 37 assumed that almost all of the non-organic ARTY resources were available to the BLUE brigade. This excursion examined the impact if only organic M109A6 assets and one battery of MLRS were available to the brigade in each of the alternatives.

Figure E-12 provides an LER comparison between the base case and the reduced ARTY case for each of the alternatives. As might be expected in the decreased ARTY case, BLUE effectiveness,

in terms of LER, dropped somewhat when compared to the base case, especially in the BDE Based alternative. Note the BDE Based alternative LER is lower than the AOE alternative LER. This implies that the level to which BLUE ARTY resources were reduced in this excursion decreased the impact that ARTY might have had on the battle. This means the battle will now be decided on the outcome of the direct fire fight. The LER results show this is what may have occurred - the force effectiveness resulting in the BDE Based alternative was lower than the AOE and HL-SB results because it had considerably fewer tanks (i.e., 72 in AOE, 77 in HL-SB, and 63 in BDE Based).

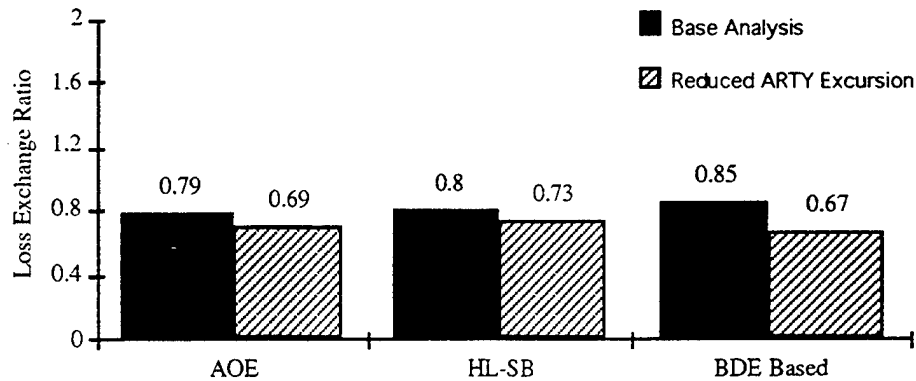


Figure E-12. LER Comparison For The Base Analysis and Decreased ARTY Excursion

Further investigation of the separate effects achieved by the M109A6 and MLRS systems revealed some interesting observations. The kills achieved by the BLUE ARTY (Figure E-13) showed similar trends in the base case and in the reduced ARTY case for each of the three alternatives. The decrease in LERs in the reduced ARTY case was due primarily to the reduction in kills achieved by the BLUE ARTY. When kills by the specific BLUE ARTY systems were examined (Figure E-13), the M109A6 results showed relatively small differences between the two cases for each of the design alternatives when compared to the large differences for the MLRS. Since similar effects were achieved by the M109A6s in the base case (48 howitzers) as in the reduced ARTY case (24 howitzers), it implies the M109A6 may have been under-utilized in the base case. The excursion where the BLUE ARTY systems are moved forward will address this issue.

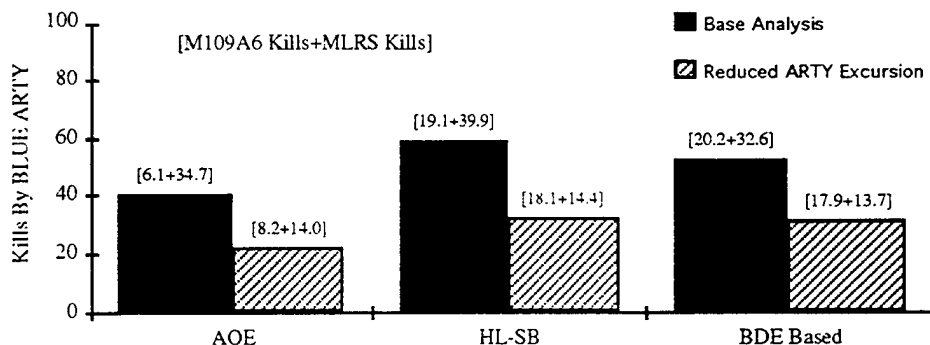


Figure E-13. Differences in ARTY Kills Between The Base Analysis and The Decreased ARTY Excursion

3.3 Improved Scout Vehicle Excursion Evaluation. In this excursion, the scout vehicles are upgraded from HMMWV to CFV, a more survivable scout vehicle. Since the HL-SB and BDE Based alternatives had significantly more scout vehicles than did the AOE alternative, a greater increase in effectiveness for these alternatives was expected when the scout vehicle is upgraded.

Figure E-14 presents an LER comparison between the improved scout vehicle and base cases for the AOE, HL-SB, and BDE Based alternatives. The LERs for the HL-SB and BDE Based alternatives showed a noticeable increase in effectiveness for the improved scout vehicle case over

the base case. This occurred because the improved scouts were more effective with respect to target acquisition, lethality, and survivability. In fact, the LER increases in the improved scout vehicle case were due to the additional kills achieved by the CFVs as the HMMWVs achieved no kills. The negligible difference between the cases for the AOE alternative occurred because of the significantly fewer number and reduced utility of the scout vehicles.

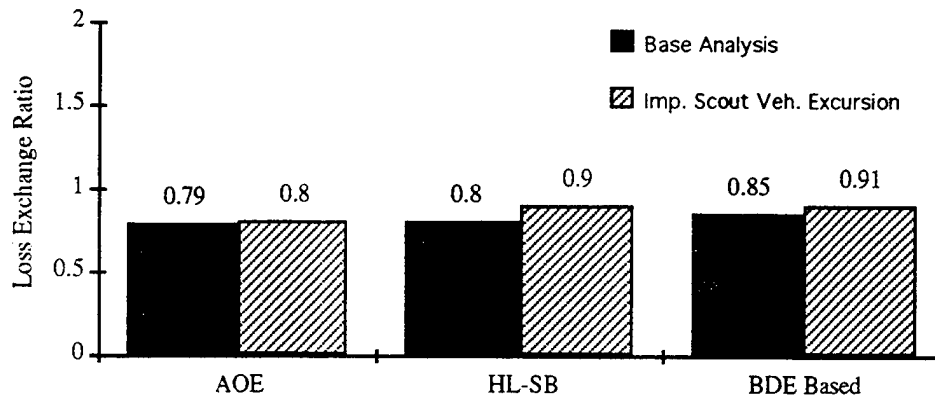


Figure E-14. LER Comparison for Improved Scout Vehicle Excursion

3.4 Improved 155mm(SP) Howitzer Excursion Evaluation. In this excursion, the 155mm (SP) howitzers were upgraded from M109A6s to Crusaders. The Crusader has greater lethality and survivability (i.e., improved SADARM munition and extended range) over the M109A6. To adapt this system to the three alternatives, the 3x8 battalions of M109A6s were changed to a 3x6 battalions of Crusaders. The 120mm mortars were also upgraded in this excursion to have a precision guided munition (PGM).

Figure E-15 presents a comparison of the BLUE LER results for the AOE, HL-SB, and BDE Based alternatives when the M109A6 is upgraded. The improved ARTY case showed a considerable increase in LER over the base case, especially for the HL-SB and BDE Based alternatives. In fact, the LER components (i.e., kills achieved by BLUE and BLUE losses) revealed a considerable improvement over the base case in both BLUE force lethality and survivability with the 155mm (SP) howitzer and mortar enhancements.

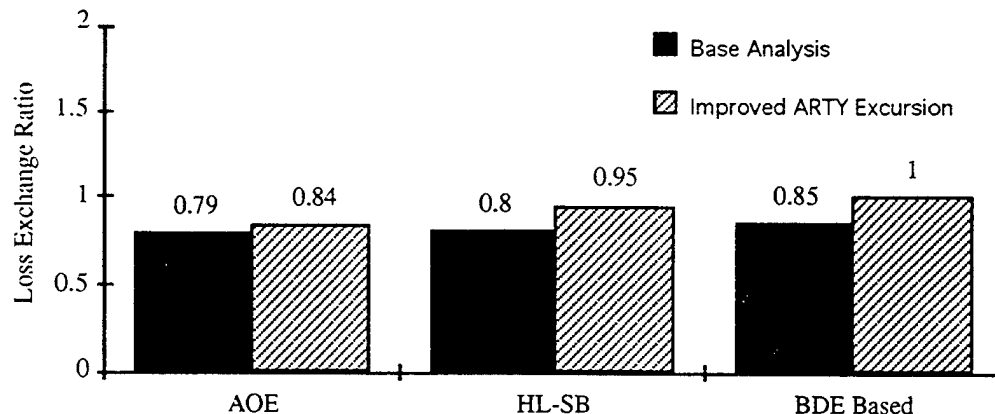


Figure E-15. LER Comparison For Improved ARTY Excursion

Figure 16 presents the total kills achieved by the BLUE ARTY for the base and improved ARTY cases for each of the alternatives. As seen in this figure (and supported by Figure E-15), the improved ARTY capability resulted in a noticeable increase in kills achieved by BLUE ARTY, especially for the BDE Based alternative. More specifically, the increase in kills in the improved ARTY case was due almost solely to the Crusader and improved 120 mm mortar as there was virtually no change in MLRS effectiveness. This meant the increase in kills by the improved BLUE ARTY was primarily against RED maneuver (i.e., T-80s and APCs). As cited previously,

the base and improved ARTY case kill differentials between the AOE alternative and the other two alternatives occurred because there was a sizable increase in the number of scouts in the HL-SB and BDE Based alternatives.

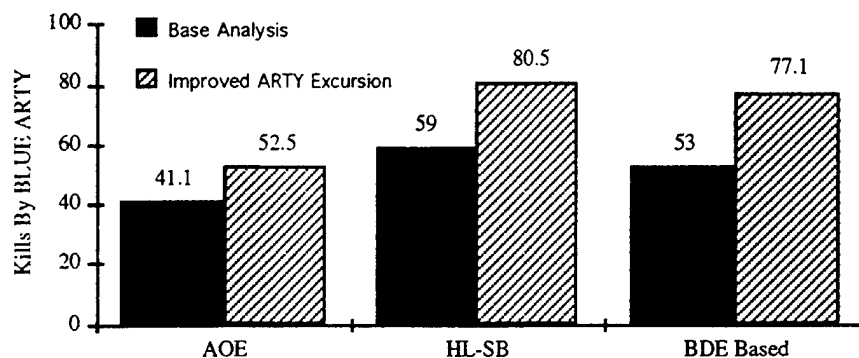


Figure E-16. Comparison of Kills By BLUE ARTY in Improved Artillery Excursion

3.5 More Responsive ARTY Excursion Evaluation. This set of excursions examined the impact of moving the BLUE ARTY units forward in a synchronized manner to assure all ARTY resources were available and within range to respond to the scouts requests for fire support. As described earlier, in the base case for the HL-SB and BDE Based alternatives, portions of the BLUE ARTY units were moving up to their tactical positions when the BDE CAV squadron scouts first began to request fire support. Thus, those ARTY units that were moving up were not available to respond to fire support requests from the BDE CAV scouts.

Figure E-17 provides a comparison of LERs between the HL-SB and BDE Based alternatives, for the Paladin and Crusader ARTY systems in the base case and ARTY forward excursions. The results showed that in the HL-SB alternative, moving the ARTY forward resulted in an improvement in LER for both the Paladin and Crusader. However, in the BDE Based alternative, an improvement in LER was not noticed for either ARTY system. This resulted because of a subtle synergism that occurred. Moving the ARTY forward will make it more vulnerable to RED counter-battery fires. If BLUE had sufficient MLRS to suppress the RED counterfire, BLUE ARTY losses would be minimized. The HL-SB alternative appeared to have sufficient MLRS resources to engage the RED ARTY while the BDE Based alternative apparently did not.

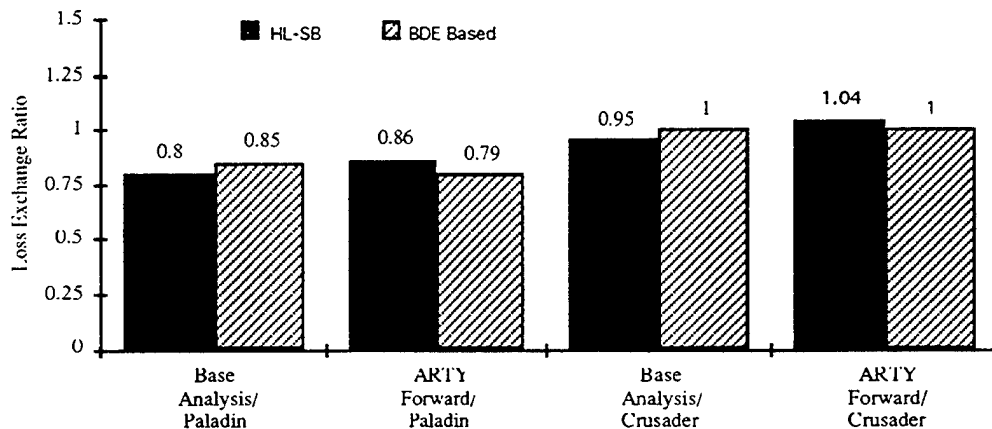


Figure E-17. LER Comparison in The Artillery Forward Excursion

Figures E-18 and E-19 provide cumulative kills versus time for the HL-SB and BDE Based alternatives, respectively, for the base and ARTY forward cases for both Paladin and Crusader. The results support past findings showing the Crusader equipped force did somewhat better than the Paladin equipped force. However, when the ARTY was moved forward, the kills over time results revealed more interesting phenomena. First, in both the HL-SB and BDE Based

alternatives, the Paladin did somewhat better than the Crusader before the main battle commenced. This may have resulted because the call for fire support was relatively high and the ARTY system that could service the most missions may have been more effective (i.e., the Paladin battalion is 3x8 while the Crusader battalion is 3x6). Once the battle started however, the Crusader equipped force produced significantly better results than the Paladin equipped force. This was due to the Crusader's accuracy, lethality, and survivability advantage over the Paladin which in turn enhanced the impact of the direct fire systems. Second, moving either system forward had the greatest impact before the battle starts. After the battle starts, however, moving the ARTY forward resulted in only a slight increase in effectiveness.

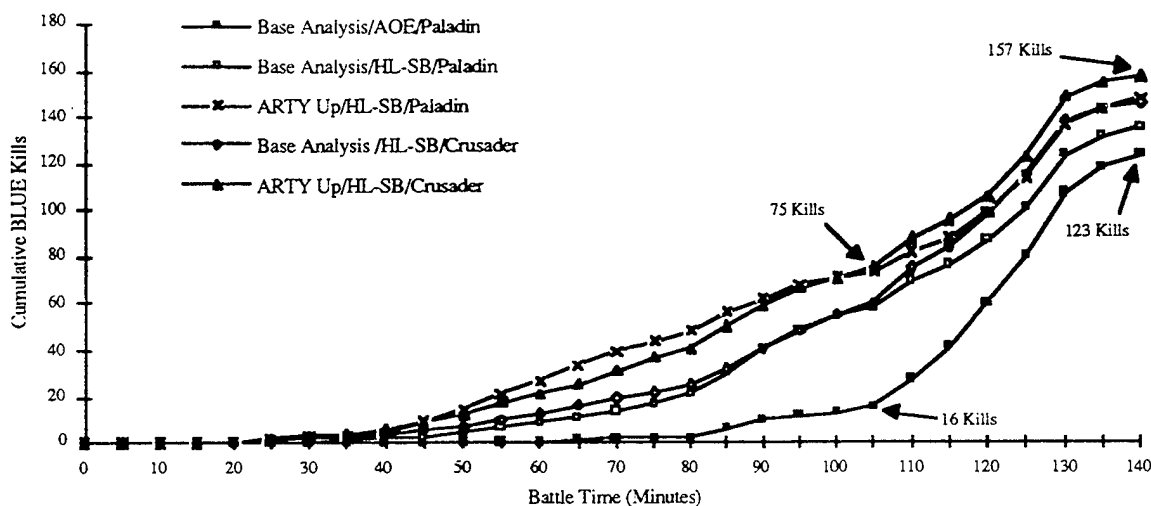


Figure E-18. BLUE Kills For The HL-SB/ARTY Forward Excursion Comparison

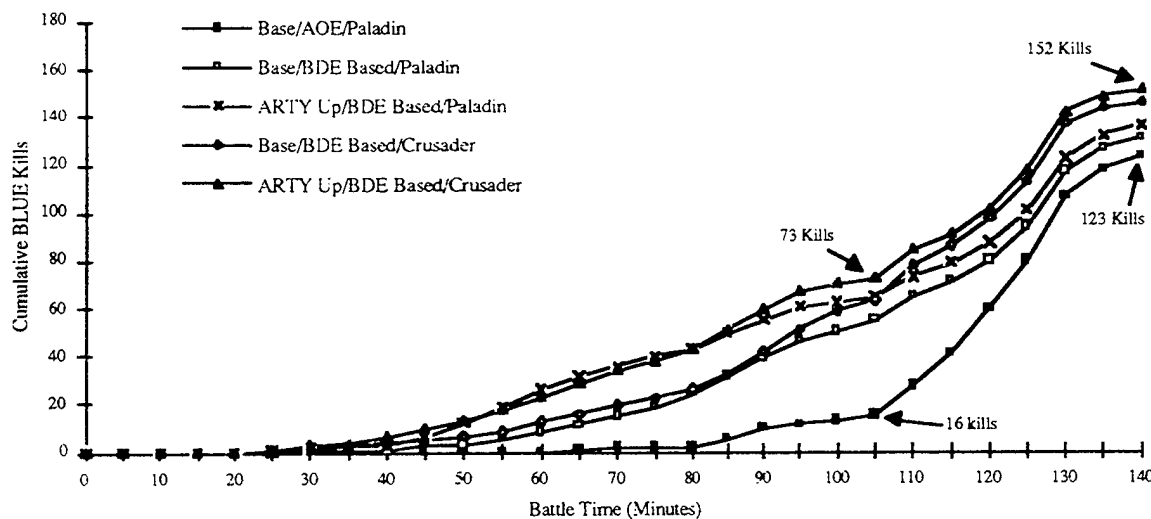


Figure E-19. BLUE Kills For The BDE Based/ARTY Forward Excursion Comparison

3.6 Enhanced BLUE Systems Excursion Evaluation. An excursion was conducted where the M1A1s, M2A2s, HMMWV scouts, and M109A6s were upgraded to M1A2s, M2A3s, CFV scouts, and Crusaders, respectively. These systems are representative of the objective technologies for the Force XXI Division. Due to time constraints, the aviation (i.e., AH-64s) and ADA (i.e., Manpads, BSFVs, and Avengers) systems could not be upgraded. Figure E-20 presents the LER results for this excursion as compared to those from the base case. As illustrated in Figure E-20, the differences in LER between the AOE alternative and the HL-SB and BDE Based alternatives are

relatively small in the base case. However, the differences were quite noticeable when the BLUE systems were upgraded. This implies the enhanced BLUE force was considerably more capable to deal with the very stressful 2005+ threat in HRS 37. It also implies the impact of the advantages inherent in the HL-SB and BDE Based forces over the AOE force may be more distinct when the BLUE systems are comparable to or better than the RED systems.

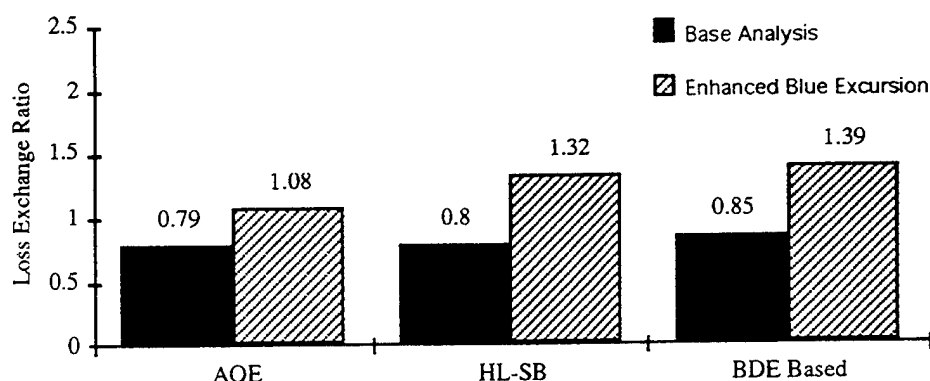


Figure E-20. LER Comparison For The Enhanced BLUE Systems Excursion

Figure E-21 provides the percent improvement in BLUE kills and losses of the BLUE objective systems (enhanced) excursion over the base case for the three alternatives. Note 'improvement' means more kills and fewer losses (e.g., 18% more kills and 14% fewer losses occurred in the enhanced BLUE systems excursion than in the base case for the AOE alternative). A more detailed review of the results shows the improvement due primarily to the increased lethality and survivability of the M2A3s, CFV scout vehicles, and the Crusaders.

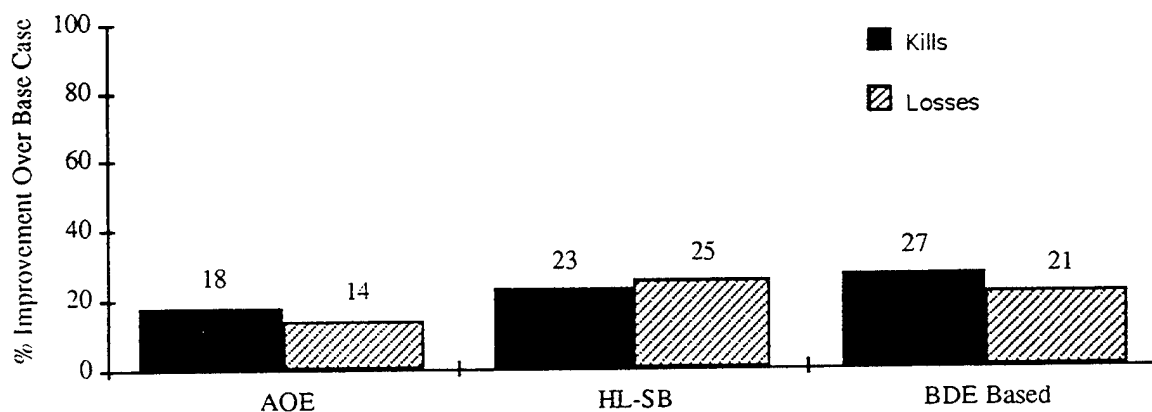


Figure E-21. Percent Improvement in Kills and Losses

Some very interesting observations can be made from the cumulative BLUE kills over time presented in Figure E-22. First, in the AOE alternative for the base case and enhanced BLUE excursion, the level of kills by BLUE is comparable before the main battle commences. Once the main battle starts, however, the increase in kills in the enhanced BLUE excursion is noticeable (18% by the end of the battle). Since the scouts are minimally used in the AOE alternative, the level of ARTY fire missions prior to the main battle is relatively low, thus precluding the demonstration of the Crusader's advantage over the M109A6. In the main battle, the improved performance of the M2A3s and Crusaders results in the 18% increase in kills in the enhanced BLUE excursion. Second, the differences in attrition of the RED force were very comparable between the HL-SB and BDE Based alternatives in both the base alternative and enhanced BLUE excursion. Third, as noted in the discussion of the previous figures, the introduction of the improved BLUE systems results in a remarkable increase in the attrition of the RED force in both the HL-SB and BDE Based alternatives (approximately 25% at the end of the battle). If the aviation and ADA had also been enhanced, the difference may have been even larger.

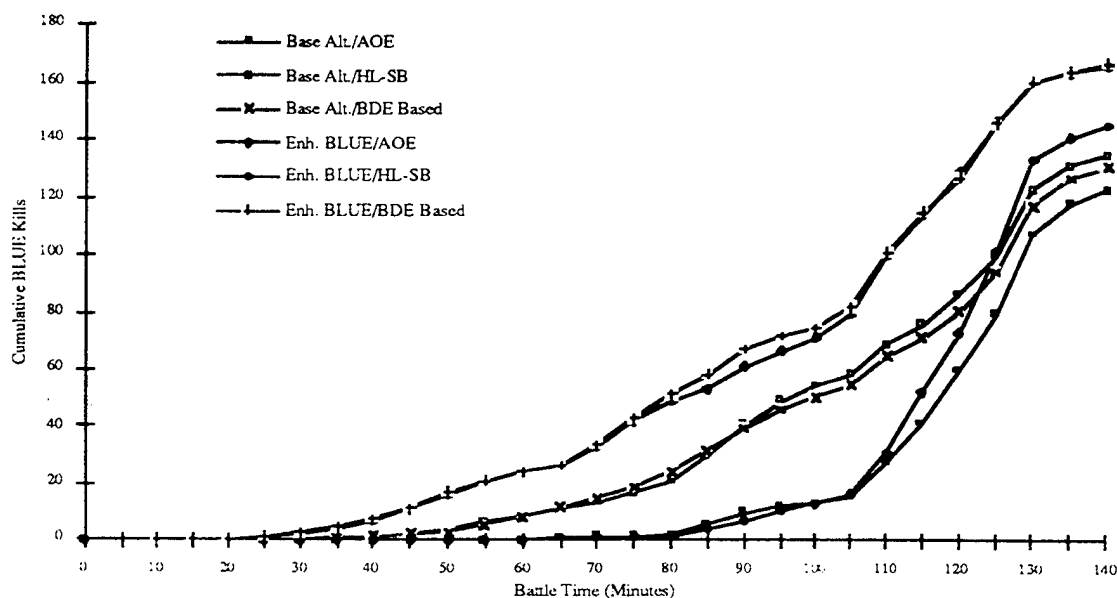


Figure E-22. Cumulative BLUE Kills Over Time Comparison

Figure E-23 presents the cumulative BLUE losses over time. The AOE alternative results for the base case and enhanced BLUE excursion show comparable trends as the kills achieved by BLUE in the previous figure (i.e., a 14% reduction in BLUE losses when the enhanced BLUE systems are fielded). In the HL-SB and BDE Based alternatives, the results are somewhat different.

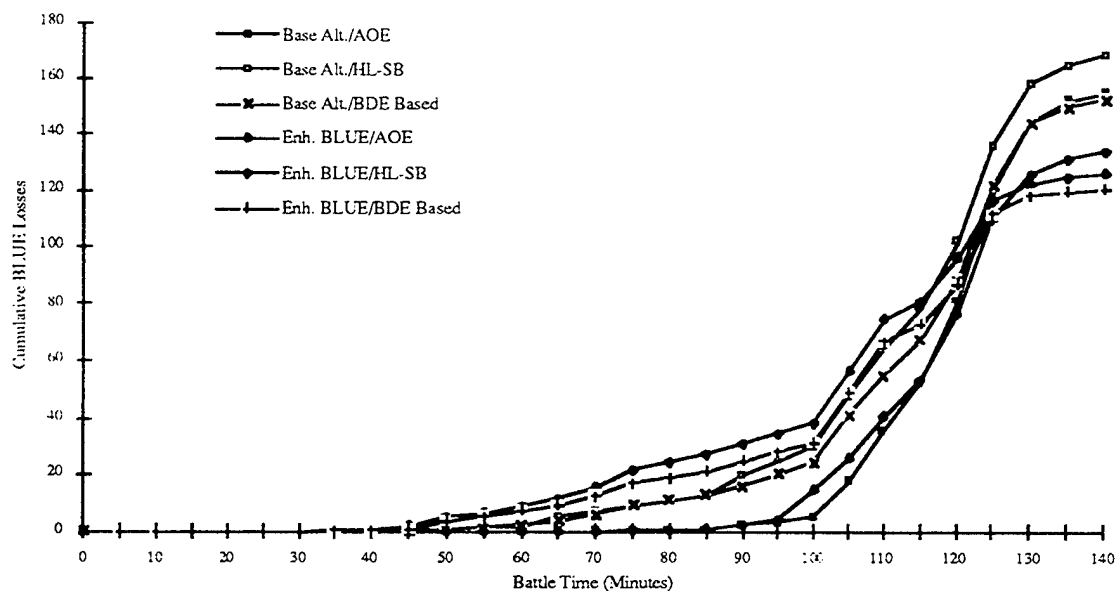


Figure E-23. Cumulative BLUE Losses Over Time Comparison

Prior to the start of the main battle, more BLUE losses occurred in the enhanced BLUE excursion than in the base case. This occurs because the improved scout vehicles were able to call in more ARTY fire missions which in turn increased the RED counterbattery missions resulting in an increase in BLUE ARTY losses. The increase in the kills of the RED force by the time the main battle commenced, combined with the improved survivability of the enhanced BLUE systems, resulted in considerably fewer losses in the enhanced BLUE excursion for the HL-SB and BDE Based alternatives.

3.7 Summary of The Results of The Base and Excursion Cases. This section summarizes the results of the base case and excursions with the intent of establishing a basis by which the DDA/BDA issues can be addressed. The results of the analysis must be evaluated in the context of the conditions and limitations of HRS 37.

3.7.1 Statistical Test Results. The differences between the AOE alternative and the HL-SB and BDE Based alternatives were each statistically tested to determine if the differences were significant. The measures selected for testing were the BLUE kills and BLUE losses from the base case and first three excursions. An analysis of variance procedure to statistically test the differences between means (95% confidence level) was used and the results are provided in Table E-4. A 'Yes' means the difference between the AOE alternative and the designated alternative for that measure was significant. A 'No' means the test specified no significant difference. The information in brackets designates whether the value of the measure for the specified alternative was greater or less than that for the AOE alternative. The statistical test was not performed for differences between excursions.

The results show the HL-SB and BDE Based alternatives produced significantly more BLUE kills than the AOE alternative in all four excursions except for the BDE Based alternative in the reduced ARTY excursion. While the scout/ARTY advantage still occurred in this excursion for the HL-SB and BDE Based alternatives, the reduced amount of ARTY lessened the differences in BLUE kills between these two alternatives and the AOE alternative. Since the HL-SB alternative had more M1A1s than the AOE (or the BDE Based), the corresponding differences in kills was significant. This was not the case for the BDE Based alternative. The differences between the HL-SB and BDE Based alternatives for each excursion were not significant for this measure.

The results of the BLUE losses were somewhat more difficult to interpret. As seen in the trend analysis, the tendency was for the HL-SB and BDE Based alternatives to kill more than the AOE but suffer more losses, especially the ARTY losses due to RED counter-battery fire. This was the case in each of the BLUE losses excursion/alternative comparisons except for the BDE Based alternative in the M109A6 --> Crusader excursion where there were significantly more BLUE losses in the AOE. This occurred because the Crusader is more survivable than the M109A6 and there were fewer MLRS missions than in the HL-SB alternative.

Table E-4. Statistical Significance Test Results

Excursion	BLUE KILLS		BLUE Losses	
	HL-SB	BDE Based	HL-SB	BDE Based
Base	Yes [> AOE]	Yes [> AOE]	Yes [> AOE]	No [< AOE]
Reduced ARTY	Yes [> AOE]	No [> AOE]	No [> AOE]	Yes [> AOE]
Improved Scout Vehicle	Yes [> AOE]	Yes [> AOE]	No [> AOE]	No [> AOE]
M109A6 --> Crusader	Yes [> AOE]	Yes [> AOE]	No [< AOE]	Yes [< AOE]

3.7.2 HRS 37 Assumptions and Limitations. Due to the relatively short time to perform the Phase I analysis for the BDA, many of the mission profiles (i.e., maneuver by BLUE and RED forces) inherent in HRS 37 had to be accepted as found. Also, numerous assumptions had to be imposed resulting in subsequent limitations for the analysis. The bulk of the time then was spent on the integration, representation, and refinement of the BDE CAV squadron scouts in the HL-SB and BDE Based alternatives. This meant there simply was not enough time to refine every aspect of this scenario (this will however, be performed in Phase II as HRS 37 will be one the scenarios used in that analysis). Several excursions were conducted to gain insights into some of these limitations. Following are assumptions and limitations, identified in HRS 37, possibly impacting force effectiveness results.

- The BLUE and RED tactics, techniques, and procedures (TTPs) inherent in HRS 37 were not modified or refined to adapt to the new equipment numbers in the HL-SB and BDE-Based alternatives.
- The artillery resources available to the brigade may be viewed as excessive. In other words, all of the ARTY resources of the division were available to the brigade. This assumption could be justified based on the commander's intent.
- A good portion of the BLUE ARTY units were moving up to their positions when the scouts began calling for fire support in the HL-SB and BDE Based alternatives. This resulted in the ARTY not being totally responsive to the BDE CAV squadron's call for fire until the ARTY units reached their planned tactical positions.
- MLRS vehicle positioning within a battery, as played in HRS 37, may have caused the the MLRS to be killed at a higher rate than normally expected. Although the MLRS launchers did conduct survivability moves, collateral effects (i.e., effects achieved against a launcher that is close to another launcher receiving fire) did occur to some degree.
- No attack helicopter scouts were played.
- Corps attack aviation assets were not dedicated to the close fight. However, one battalion of attack helicopter assets was given to the brigade in all three force design alternatives.
- Stingers were relatively ineffective because the RED attack helicopters were located beyond the maximum range of the DVO sensors used with the Stingers.
- Scout vehicles were HMMWVs. Since BDE CAV doctrine does not exist, a compilation of DIV CAV squadron TTPs and SME inputs were used to develop the scheme of maneuver. *FM 17-95, Cavalry*, 19 Sept 91, was used as the reference for cavalry operations.
- HRS 37 represented a very stressful threat (time frame 2005+).
- The HL-SB brigade operational concept assumes there is an ability to task organize within the division, thus facilitating the tailoring of the force. This is not included in the BDE Based alternative's operational concept.
- Due to time limitations to complete Phase I, digitization and situational awareness issues were not addressed. The model is currently being enhanced to allow digitization and situational awareness to be represented with more fidelity for utilization in Phase II of the BDA.

3.7.3 Interpretation of the Analysis Results. As mentioned previously, the intent of Phase I was to examine the impact of the equipment differentials between the AOE, HL-SB, and BDE Based alternatives on force effectiveness. Insights were then to be developed based on the examination. Before the results of the examination are presented, it might be beneficial to review the HRS 37 equipment assignments for each alternative where there were differences (Table E-5).

Table E-5. Equipment Assignments For The BDE Alternatives

	AOE	Hvy/Lgt-Small Base	Brigade Based
M1A1	72	77	63
M2A2	95	94	112
MLRS	1x9 DIVARTY	3x6 DIV	
	3x9 Corps	3x9 Corps	3x9 Corps
HMMWV/Scouts	30	75	75

Table E-5 shows the HL-SB alternative to have more M1A1s, MLRS, and scouts, but fewer M2A2s than the AOE. The BDE Based alternative has fewer M1A1s and MLRS but more M2A2s and scouts than the AOE alternative. In contrast, the HL-SB has more tanks and MLRS but fewer Bradleys than the BDE Based. This implies the HL-SB alternative may be expected to achieve somewhat better force effectiveness than the BDE Based alternative against an armor threat as presented in HRS 37. Following are observations derived from the analysis results.

- LERs between the alternatives appear to be comparable. However, there does appear to be noticeable differences in BLUE kills and losses between the AOE alternative and the HL-SB and BDE Based alternatives.
- The increase in RED losses (especially BMP-3s and other APCs) in the HL-SB and BDE Based alternatives over the AOE alternative occurred because the number of M109A6 fire missions requested (by the additional scouts) increased significantly. This, in turn, caused the BLUE maneuver force to survive considerably better than in the AOE alternative.
- The additional BLUE ARTY fire missions resulting in the HL-SB and BDE Base alternatives adversely impacted RED air defense effectiveness by forcing the threat AD units to retreat to less favorable positions.
- The effectiveness of the RED attack helicopters decreased in the HL-SB and BDE Based alternatives from the AOE alternative. This was due to the presence of the M1A1s with the BDE CAV units restricting the latitude experienced by the RED attack helicopters in the AOE alternative.
- The rate at which kills were achieved by BLUE was significantly greater up to the time the main battle commenced in the HL-SB and BDE Based alternatives. The increase in effects was due to the increase in BLUE ARTY fire missions called by the additional scouts. Once the main battle begins, however, the kill rate is greater in the AOE alternative.
- Overall, the increase in effectiveness that can be achieved by the BLUE force in the HL-SB and BDE Based alternatives over the AOE alternative is sensitive to:
 - The level of available ARTY resources, both with respect to types and numbers of systems (and munitions) as well as the positioning of those systems, for fire support and counter-battery missions.
 - The number of scout resources.
 - The relative lethality and survivability of the scout vehicle.
 - The lethality and survivability of the direct support howitzer system.

3.7.4 Summary of the Analysis Results and Insights . The analysis results clearly show that a force modification to increase the scout assets of the brigade will definitely improve force effectiveness by permitting the enemy to be located, engaged, and killed sooner, thus enhancing the force's chances of achieving overwhelming combat power in the close fight. The results also showed that proper positioning of the ARTY in support of the scouts is critical if the required fire missions are to maximize enemy suppression and friendly survivability.

The analysis also revealed that the HL-SB and BDE Based alternatives were both significantly better than the AOE alternative with respect to lethality, especially at the point where the main battle commences. That significance would probably also have resulted for survivability, if the scenario had been modified for the BLUE commander to change the force deployment and tempo of operations to take advantage of the RED force losses occurring before the main battle started.

The level of BLUE force effectiveness in the HL-SB and BDE Based alternative were also shown to be sensitive to the relative lethality and survivability capability of the systems in the force compared to that of the opposing RED force.

Several insights were gained from the analysis that will be extremely useful in Phase II. Evaluation and subsequent modification of the techniques, tactics and procedures (TTPs) may be necessary to ensure the force is being properly utilized in the interim division design. Also, the significant increase in the number of scout assets into the brigade resulted in a sizable increase in the brigade's battle space. This may warrant a review of doctrine to determine if the current force deployment and support requirements are sufficient in the interim division design. The concerns stated here can be addressed at the brigade level in Phase II.

4.0 Crosswalk of the BDA Phase I Results and The DDA/BDA Issues. This section will attempt to use the observations derived in the previous section to map the analysis results to the three applicable DDA/BDA issues identified earlier. Please keep in mind that the following comments must be considered in the context of the characteristics, assumptions, and limitations of HRS 37, a brigade level scenario.

4.1. Issue 15: *Do the division alternatives have sufficient organic assets (numbers and types of systems) to generate overwhelming combat power in the close fight?*

- General. In the context of the equipment system differences, the analytic trends indicate the additional scouting capability found by including a BDE CAV squadron in the brigade, (the HL-SB and BDE Based alternatives) has the potential to considerably increase force effectiveness over the AOE alternative in a scenario similar to HRS 37. As stated previously, the impact of the additional scouts was most noticeable before the start of the main battle. If the BLUE force had changed its tactics during the main battle to take advantage of the effects achieved before the main battle commenced, the resulting combat power may have been more overwhelming in the close fight, and allowed the BLUE force to achieve its objective with far fewer losses.

- Scout Assets. The additional scout resources in the HL-SB and BDE Based alternatives, when combined with a sufficient level of fire support assets and appropriate tactics and doctrine, have the potential to provide the commander with a significant advantage going into the close fight. To further maximize the scout potential, the scout vehicles must be survivable and capable of engaging and destroying enemy scout and expeditionary units.

- ARTY Assets. Sufficient ARTY resources are critical if the full potential of the enhanced scout capability in the HL-SB and BDE Based alternatives is to be realized. The ARTY sufficiency not only pertains to number of systems but also to the types of systems (and munitions) and their relative availability (tactical position and status). The HL-SB has possibly up to 18 more MLRS than does the BDE Based alternative (the AOE has up to nine more MLRS) whereas the number of 155mm howitzers is identical.

- Aviation/AD Assets. Aviation and air defense assets and doctrine were similar in the AOE, HL-SB, and BDE Based alternatives. BLUE attack helicopters were deployed primarily in support of the maneuver force. BLUE air defense, deployed with the maneuver units, was relatively ineffective. If some of the BSFVs had been deployed with the BDE CAV units or the Avengers moved up with the maneuver units, air defense activity potential would have increased thus possibly decreasing RED attack helicopter effectiveness.

- Mech/Armor. The HL-SB alternative has one more company of tanks than the BDE Based alternative because of cross-attachment, and five more tanks than the AOE alternative. The additional armor capability in the HL-SB alternative did not result in the BLUE tanks achieving a noticeable increase in kills over the BDE Based alternative. However, considerably more tank losses occurred in the HL-SB alternative because there were 14 more tanks deployed.

4.2 Issue 16: For the division design alternatives, what assets best satisfy the functions of reconnaissance and security (Cavalry and scouts), by echelon, and for the spectrum of operations (from linear to non-contiguous)?

- The increase in scout assets in the HL-SB and BDE Based alternatives results in a considerable increase in effects achieved by the BLUE force prior to the start of the main battle. The magnitude of this advantage is directly related to the reconnaissance and security capability inherent in the scout force. While the impact of the additional scout assets noticeably improved force effectiveness, their capability was restricted because of their vulnerability to enemy fire, their inability to perform the security mission, and the inadequacy of their target acquisition capability. Upgrading the scout vehicle to the equivalent of a CFV, or better, would greatly enhance the BDE CAV units' reconnaissance and security capability.

4.3 Issue 17: What is the appropriate mix (numbers and types of systems) of close fight (direct fire), deep fight (indirect fire), and attack aviation systems?

- The appropriate mix of close fight, deep fight, and attack aviation assets in a force is highly dependent on the mission/objectives of that force. In a stressful mission similar to that in HRS 37, a greater level of deep fight and attack aviation assets, complimented by sufficient scout resources, may be warranted to achieve overwhelming combat power in the close fight.

REFERENCES:

1. *Force XXI Division Design Analysis Study Plan*, Sept. 1995, LTC George Prueitt, TRAC.
2. *Force XXI Division Operations Concept*, Aug 1995, MAJ Stephen Heard, DCSCD.

ACKNOWLEDGMENTS

This report was prepared by Mr. Bryson McCool, CPT Kevin Wainer, MAJ Geoff Coleman, and CPT Mike Wallace, Brigade Combat Support Directorate, TRAC-WSMR. Also, LTC George Prueitt, DDA Director, provided significant support in the planning, execution, and review of this effort. The following individuals also made valuable contributions to this study.

COL Marshall Eubanks	TRAC-WSMR
Ms. Lounell Southard	TRAC-WSMR
Mr. Angelo Chieffo	TRAC-WSMR
Ms. Edna Gibbs	TRAC-WSMR
Mr. Tom Loncarich	TRAC-WSMR

Annex E-1: Force XXI Division Design Principles/Capabilities

- 1. Optimized Information-Based Operations**
 - Conduct information operations throughout the division battlespace
 - Maintain a relevant, common picture of the battlefield while executing Force XXI full dimensional operations.
- 2. Dominate Battle Space: Speed, Space, and Time**
 - Dominate division's transition to and its operations during battles and engagements throughout the battlespace that is defined by 3-dimensional space and time.
- 3. Control battlefield tempo with overwhelming lethality and superior survivability.**
 - Overwhelm the enemy in terms of tempo (agility, relative pace of operations, and sustainment of tempo).
 - Within division battle space, overmatch the enemy in terms of lethality
 - Employ nonlethal systems to assist in the domination of its battlespace.
 - Have increased survivability against lethal and nonlethal fires.
- 4. Be able to mount, sustain, and recover from operations simultaneously.**
 - Be capable of continuous operations so that the basic process to plan, prepare, execute, and recover is seamless.
 - Be capable of conducting prolonged operations.
- 5. Be capable of a quick, decisive victory with minimum casualties.**
- 6. Be rapidly deployable, easily tailorable, sustainable, and operationally agile.**
 - Allow force optimization, balance and versatility to conduct operations in the joint and multinational environment.
 - Be deployable with fewer resources by facilitating modularity based on mission, enemy, troops, terrain and weather, and time available (METT-T), and have the operational agility to execute diverse missions during the course of a campaign.
 - Be capable of rapid strategic mobilization and deployment to execute missions throughout the world and anywhere along the spectrum of conflict.
 - Within divisional battle space, operate across all battlefield operating systems (BOS), be capable of participating in joint and multinational operations, and with appropriate augmentation, serve as an ARFOR headquarters.
- 7. Enhance tailorability through modularity across the force.**
 - Modularity will enable the detachment and acceptance of modules/units to adapt to changing METT-T conditions.
- 8. Divert tasks and functions that inhibit division primary mission.**
 - Division's primary function is to fight and win battles and engagements while being prepared to conduct OOTW operations.
 - Be designed primarily to fight (organization, doctrine, and materiel) but also be able to conduct OOTW.
 - Successful OOTW will result from training, leadership, battle command, and agile force tailoring resulting from modularity. Where possible, those tasks that detract from the core combat function will be diverted to another echelon.
- 9. Be effective in war and OOTW as part of a joint and multinational team in all operational environments.**

Annex E-2: Model Results

Note: The 'Start #'s' include a 5% reduction for BLUE force and a 15% reduction for RED (uniformly across each force) due to engagements prior to the start of this scenario.

BASE
ANALYSIS

BLUE Effects

Alternative Measure	M1A1	M2A2	M3A2	AH-64	HMMWV / Scout	Manpads or Avenger	BSFV	120 MTR	MLRS M109A6	FW	Other Tactical Vehicles	Totals		
AOE	Kills	23.62	22.67	2.48	28.9	0	0.24	0.71	0.33	34.71	6.1	3.59	0	123.35
	Losses	29.9	57.9	21.76	5.05	0.1	0.33	7.43	2.76	13.19	1.48	0	15.82	155.72
	SER	0.79	0.39	0.11	5.72	0.00	0.73	0.10	0.12	2.63	4.12	ND	0.00	0.79
	Start #	68.00	90.00	25.00	14.00	29.00	8.00	8.00	17.00	34.00	46.00			
	% Losses	44	64	87	36	0	4	93	16	39	3			
HL-SB	Kills	22.62	18.67	3.15	28.05	0	0	0.76	0.05	39.86	19.05	3.24	0	135.45
	Losses	25.67	52.76	18.61	3.81	18.67	0	5.34	2.14	18.33	4.28	0	19.42	169.03
	SER	0.88	0.35	0.17	7.36	0.00	ND	0.14	0.02	2.17	4.45	ND	0.00	0.80
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	46.00			
	% Losses	35	59	74	27	26	0	67	13	43	9			
BDE BASED	Kills	21.66	21.95	3.09	27.48	0	0	0.81	0.24	32.57	20.23	3	0	131.03
	Losses	19.86	57.14	17.95	3.05	17.09	0	5.58	2	8.33	5.61	0	16.77	153.38
	SER	1.09	0.38	0.17	9.01	0.00	ND	0.15	0.12	3.91	3.61	ND	0.00	0.85
	Start #	60	106	25	14	71	8	8	17	26	46			
	% Losses	33	54	72	22	24	0	70	12	32	12			

BASE ANALYSIS	RED	Effects													
			Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other
AOE	Kills	59.1	11.52	0.72	22.05	2.71	1.43	3.48	29.48	1.05	3.95	0.19	20	155.72	
	Losses	42.8	19.57	23.3	1.86	1.9	1.67	7.81	18.57	2.95	0.62	1.29	1	123.33	
	SER	1.38	0.59	0.03	11.85	1.43	0.86	0.45	1.59	0.36	6.37	0.15	20.00	1.26	
	Start #	56	31	49	5	8	4	15	46	15	5	5			
	% Losses	76	63	48	37	24	42	52	40	20	12	26			
HL-SB	Kills	63.1	16	0.77	20.14	2.86	1.1	3.86	30.14	3.33	9.95	0.14	17.71	169.05	
	Losses	41.6	23.14	24.1	2.76	2.24	2.57	5.9	24.33	4.19	2.14	1.62	0.81	135.41	
	SER	1.52	0.69	0.03	7.30	1.28	0.43	0.65	1.24	0.79	4.65	0.09	21.86	1.25	
	Start #	56	31	49	5	8	4	15	46	15	5	5			
	% Losses	74	75	49	55	28	64	39	53	28	43	32			
BDE BASED	Kills	61.9	15	1.19	17.62	2.76	0	4.43	24.14	2.43	5.38	0.29	17.57	152.67	
	Losses	42.7	23.14	22.6	2.67	2.38	0	4.14	21.38	5.24	2.33	0.95	3.35	130.88	
	SER	1.45	0.65	0.05	6.60	1.16	ND	1.07	1.13	0.46	2.31	0.31	5.24	1.17	
	Start #	56	31	49	5	8	4	15	46	15	5	5			
	% Losses	76	75	46	53	30	0	28	46	35	47	19			

Reduced BLUE Effects
ARTY

Alternative Measure	M1A1	M2A2	M3A2	AH-64	HMMWV / Scout	Manpads or Avenger	BSFV	120 MTR	MLRS M109A6	FW	Other Tactical Vehicles	Totals
AOE	Kills	24.33	23.14	1.71	28.95	0	0.33	0.57	13.95	8.19	3.38	0 105.07
	Losses	31.19	58.86	21.67	5.14	0	0.33	7.05	3.38	2.86	0	20.67 151.77
	SER	0.78	0.39	0.08	5.63	ND	1.00	0.08	0.15	2.86	ND	0.00 0.69
	Start #	68.00	90.00	25.00	14.00	29.00	8.00	8.00	17.00	9.00	23.00	
	% Losses	46	65	87	37		4	88	20	7	12	
HL-SB	Kills	23.81	19.38	2.53	28.95	0	0	0.81	0.19	14.38	18.14	3.05 0 111.24
	Losses	27.57	53.67	17.76	3.29	17.81	0	5.91	2.57	1.24	3.71	0 19.86 153.39
	SER	0.86	0.36	0.14	8.80	0.00	ND	0.14	0.07	11.60	4.89	ND 0.00 0.73
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	9.00	23.00	
	% Losses	38	60	71	24	25	0	74	15	14	16	
BDE BASED	Kills	22.86	18.86	2.67	30.29	0	0	0.76	0.24	13.71	17.9	2.62 0 109.91
	Losses	24.76	61.71	19.42	3.62	18.76	0	6.1	2.33	1.48	4.34	0 20.48 163
	SER	0.92	0.31	0.14	8.37	0.00	ND	0.12	0.10	9.26	4.12	ND 0.00 0.67
	Start #	60	106	25	14	71	8	8	17	9.00	23.00	
	% Losses	41	58	78	26	26	0	76	14	16	19	

Reduced ARTY	RED	Effects												
Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals	
AOE	Kills	60.33	12.57	0.43	23.76	3.1	1.05	5	23.86	0.71	3.9	0.1	17.05	151.86
	Losses	43.62	19.1	19.6	1.62	1.48	1.76	5	10.38	1	0.57	0.62	1	105.77
	SER	1.38	0.66	0.02	14.67	2.09	0.60	1.00	2.30	0.71	6.84	0.16	17.05	1.44
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	78	62	40	32	19	44	33	23	7	11	12		
HL-SB	Kills	59.24	15.81	0.24	18.9	2.67	1	3.48	25.57	2.19	6.57	0.24	17.46	153.37
	Losses	42.38	22.19	19.1	2.81	1.76	2.95	2.71	12.24	2.62	1.14	0.52	0.81	111.23
	SER	1.40	0.71	0.01	6.73	1.52	0.34	1.28	2.09	0.84	5.76	0.46	21.56	1.38
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	76	72	39	56	22	74	18	27	17	23	10		
BDE BASED	Kills	63.05	17.81	0.67	18.86	2.57	0.86	3.81	27.05	2.29	6.62	0.48	18.95	163.02
	Losses	41.67	21.48	19.7	2.43	2.48	2.52	3.19	12.38	1.67	0.95	0.71	0.76	109.9
	SER	1.51	0.83	0.03	7.76	1.04	0.34	1.19	2.18	1.37	6.97	0.68	24.93	1.48
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	74	69	40	49	31	63	21	27	11	19	14		

Improved BLUE Effects
Scout Vehicle

Alternative Measure	M1A1	M2A2	M3A2	AH-64	CFV/ Scout	Manpads or Avenger	BSFV	I20 MTR	MLRS M109A6	FW	Other Tactical Vehicles	Totals		
AOE	Kills	23	24.62	1.28	29.62	0	0	0.71	0.62	32.48	6.71	3.52	0	122.56
	Losses	28.05	59.19	20.85	4.43	0	0	7.66	3.19	13.43	2.1	0	14.57	153.47
	SER	0.82	0.42	0.06	6.69	ND	ND	0.09	0.19	2.42	3.20	ND	0.00	0.80
	Start #	68.00	90.00	25.00	14.00	29.00	8.00	8.00	17.00	34.00	46.00			
	% Losses	41	66	83	32		0	96	19	40	5			
HL-SB	Kills	19.86	18.95	3.47	23.71	20.1	0	0.76	0.24	38.05	15.81	3.09	0	144.04
	Losses	23.48	50.38	16.91	3.48	18.24	0	5.81	2.48	18.1	3.81	0	16.8	159.49
	SER	0.85	0.38	0.21	6.81	1.10	ND	0.13	0.10	2.10	4.15	ND	0.00	0.90
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	46.00			
	% Losses	32	57	68	25	26	0	73	15	42	8			
BDE BASED	Kills	16.1	21.9	3.43	26.48	19.43	0	0.76	0.24	33.48	17.67	2.85	0	142.34
	Losses	19.77	57	16.81	3.43	18.62	0	5.86	1.76	8.81	4.57	0	19.62	156.25
	SER	0.81	0.38	0.20	7.72	1.04	ND	0.13	0.14	3.80	3.87	ND	0.00	0.91
	Start #	60	106	25	14	71	8	8	17	26	46			
	% Losses	33	54	67	25	26	0	73	10	34	10			

Improved Scout Vehicle	RED	Effects												
Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals	
AOE	Kills	57.62	11.52	0.67	22.95	2.67	1.14	3.62	32.9	0.86	2.67	0.24	17.29	154.15
	Losses	43.14	18.76	22.6	2.05	1.29	1.81	7.95	18.76	1.95	0.38	1.38	1	121.04
	SER	1.34	0.61	0.03	11.20	2.07	0.63	0.46	1.75	0.44	7.03	0.17	17.29	1.27
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	77	61	46	41	16	45	53	41	13	8	28		
HL-SB	Kills	55.05	12.52	0.48	20.76	2.81	1.1	3.57	32.62	3.19	9.95	0.14	18.29	160.48
	Losses	45.1	25.24	28.6	2.62	2	3	5.57	23.62	4.43	1.71	1.38	0.76	144.05
	SER	1.22	0.50	0.02	7.92	1.41	0.37	0.64	1.38	0.72	5.82	0.10	24.07	1.11
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	81	81	58	52	25	75	37	51	30	34	28		
BDE BASED	Kills	55.81	13.29	0.24	20.19	2.71	0.81	3.29	29.57	3.52	8.33	0.1	18.29	156.15
	Losses	45.14	25.33	27.6	2.52	2.62	2.95	4.38	22.86	4.86	2.05	1.52	0.76	142.56
	SER	1.24	0.52	0.01	8.01	1.03	0.27	0.75	1.29	0.72	4.06	0.07	24.07	1.10
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	81	82	56	50	33	74	29	50	32	41	30		

M109A6 --> BLUE Effects
Crusader

Alternative Measure	M1A1	M2A2	M3A2	AH-64	HMMWV / Scout	Manpads or Avenger	BSFV	120 MTR	MLRS	Crusade r	FW	Other Tactical Vehicles	Totals
AOE	Kills	20.81	21.52	1.1	31	0	0.19	0.76	5.52	34.62	12.38	2.91	0 130.81
	Losses	27.81	57.62	20.91	4.81	0.14	0.19	7.33	7.33	12.38	0.76	0	15.81 155.09
	SER	0.75	0.37	0.05	6.44	ND	1.00	0.10	0.75	2.80	16.29	ND	ND 0.84
	Start #	68.00	90.00	25.00	14.00	29.00	8.00	8.00	17.00	34.00	34.00		
	% Losses	41	64	84	34		2	92	43	36	2		
HL-SB	Kills	17.61	16.95	2.52	24.76	0	0	0.67	3.67	38.29	38.57	3.24	0 146.28
	Losses	22.38	48.48	17.24	3.24	17.19	0	4.9	2	21.19	2	0	15.76 154.38
	SER	0.79	0.35	0.15	7.64	ND	ND	0.14	1.84	1.81	19.29	ND	0.95
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	34.00		
	% Losses	31	54	69	23	24	0	61	12	49	6		
BDE BASED	Kills	16.67	19.14	2.04	28.1	0	0	0.86	3.24	29.76	44.14	2.62	0 146.57
	Losses	15.66	54.05	18.85	3.1	17.24	0	5.52	1.52	12.05	2.9	0	15.57 146.46
	SER	1.06	0.35	0.11	9.06	ND	ND	0.16	2.13	2.47	15.22	ND	1.00
	Start #	60	106	25	14	71	8	8	17	26	34		
	% Losses	26	51	75	22	24	0	69	9	46	9		

Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals	
AOE	Kills	54.43	10.67	0.28	21.19	2.9	1.05	3.76	35.29	0.81	8.19	0.33	16.19	155.09
	Losses	44.67	20.43	23.4	1.76	1.81	1.86	8.62	21.95	2.81	0.95	1.9	1	131.14
	SER	1.22	0.52	0.01	12.04	1.60	0.56	0.44	1.61	0.29	ND	0.17	ND	1.18
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	80	66	48	35	23	47	57	48	19	19	38		
HL-SB	Kills	57.33	11.9	0.81	18.33	2.9	0.86	2.81	31.38	2.24	7.48	0.19	18.14	154.37
	Losses	46.1	25.95	24.3	2.81	2.05	2.9	7.24	25.19	4.52	2.57	1.95	0.71	146.28
	SER	1.24	0.46	0.03	6.52	1.41	0.30	0.39	1.25	0.50	ND	0.10		1.06
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	82	84	50	56	26	73	48	55	30	51	39		
BDE BASED	Kills	58.52	13.19	0.15	17.95	2.67	0.81	2.57	22.05	3.14	7.14	0.71	17.57	146.47
	Losses	45.05	26.9	25.2	2.86	1.71	3.1	6.76	26.14	4.48	2	1.48	0.9	146.58
	SER	1.30	0.49	0.01	6.28	1.56	0.26	0.38	0.84	0.70	ND	0.48		1.00
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	80	87	51	57	21	78	45	57	30	40	30		

ARTY Forward/ Crusader	BLUE	Effects											
Alternative Measure	M1A1	M2A2	M3A2	AH-64	HMMWV / Scout	Manpads or Avenger	BSFV	120 MTR	MLRS	Crusader	FW	Other Tactical Vehicles	Totals
HL-SB	Kills	17.67	17.05	2.14	29.67	0	0	0.71	3.76	47.9	35.57	2.9	0 157.37
	Losses	20.52	47.9	17.24	3.1	17.1	0	5.95	0.9	19.76	2.62	0	16.44 151.53
	SER	0.86	0.36	0.12	9.57	ND	ND	0.12	4.18	2.42	13.58	ND	1.04
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	34.00		
	% Losses	28	54	69	22	24	0	74	5	46	8		
BDE BASED	Kills	15.29	17.86	2.81	27.43	0	0	0.81	4.57	36.71	42.71	3.52	0 151.71
	Losses	16.86	54.43	18.39	2.81	16.96	0	6.28	1.86	12.81	4.14	0	17 151.54
	SER	0.91	0.33	0.15	9.76	ND	ND	0.13	2.46	2.87	10.32	ND	1.00
	Start #	60	106	25	14	71	8	8	17	26	34		
	% Losses	28	51	74	20	24	0	79	11	49	12		

ARTY Forward/ Crusader	RED	Effects	Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals
HL-SB	Kills	56.33	12.9	0.57	19.95	2.86	0.62	2.95	31.14	3.14	4.67	0.43	15.86	151.42		
	Losses	45.29	26.1	27.9	3.1	2.33	3.19	6.43	33.19	5.52	2.19	2.19	0	157.38		
	SER	1.24	0.49	0.02	6.44	1.23	0.19	0.46	0.94	0.57	ND	0.20	0.96			
	Start #	56	31	49	5	8	4	15	46	15	5	5				
	% Losses	81	84	57	62	29	80	43	72	37	44	44				
BDE BASED	Kills	56.81	13.19	0.67	20.05	2.57	0.76	3.52	27.9	2.81	5.48	0.19	18.38	152.33		
	Losses	44.76	25.38	25.9	2.86	2.29	3	5.71	30.81	5.9	2.19	2.05	0	150.83		
	SER	1.27	0.52	0.03	7.01	1.12	0.25	0.62	0.91	0.48	ND	0.09	1.01			
	Start #	56	31	49	5	8	4	15	46	15	5	5				
	% Losses	80	82	53	57	29	75	38	67	39	44	41				

ARTY BLUE Effects
Forward/
Paladin

Alternative Measure	M1A1	M2A2	M3A2	AH-64	HMMWV / Scout	Manpads or Avenger	BSFV	120 MTR	MLRS	M109A6	FW	Other Tactical Vehicles	Totals
HL-SB													
Kills	22.33	19.33	2.86	28.24	0	0	0.67	0.19	50.95	20	3.2	0	147.77
Losses	25.38	53	17.76	3.19	18.43	0	6.05	2	20.24	11.33	0	14.45	171.83
SER	0.88	0.36	0.16	8.85	ND	ND	0.11	0.10	2.52	1.77	ND		0.86
Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	46.00			
% Losses	35	60	71	23	26	0	76	12	47	25			
BDE BASED													
Kills	19.81	21.24	3.1	27.19	0	0	0.76	0.29	38.76	22.33	3.39	0	136.87
Losses	22.29	62.52	18.86	3.52	18.19	0	6.67	2.48	11	14.86	0	13.86	174.25
SER	0.89	0.34	0.16	7.72	ND	ND	0.11	0.12	3.52	1.50	ND		0.79
Start #	60	106	25	14	71	8	8	17	26	46			
% Losses	37	59	75	25	26	0	83	15	42	32			

ARTY Forward/ Paladin	RED	Effects												
Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals	
HL-SB	Kills	60.76	16.38	1.1	19.48	2.38	1.1	4	38.81	3.71	5.48	0.33	18.67	172.2
	Losses	42.67	21.1	26.8	2.67	2.38	2.24	5.81	33.71	5.62	2.67	2.24	0	147.88
	SER	1.42	0.78	0.04	7.30	1.00	0.49	0.69	1.15	0.66	ND	0.15		1.16
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	76	68	55	53	30	56	39	73	37	53	45		
BDE BASED	Kills	64.19	15.14	1.34	19.14	2.71	1.14	4.1	33.38	4.57	7.29	0.33	20.95	174.28
	Losses	41.05	21.43	24.8	2.76	2.24	2.33	5.1	28.05	5.62	2.29	1.1		136.77
	SER	1.56	0.71	0.05	6.93	1.21	0.49	0.80	1.19	0.81	ND	0.30		1.27
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	73	69	51	55	28	58	34	61	37	46	22		

Far-Term BLUE Systems	BLUE	Effects												
Alternative Measure	M1A2	M2A3	M3A2	AH-64	CFV/ Scout	Manpads or Avenger	BSFV	120 MTR	MLRS Crusader	FW	Other Tactical Vehicles	Totals		
AOE	Kills	21.86	42.19	0	22.33	0	0.29	0.71	5.43	36.76	13.05	3	0	145.62
	Losses	25.71	49.29	16.71	4.29	0	0.14	5.72	8.57	13.38	1.33	0	9.09	134.23
	SER	0.85	0.86	0.00	5.21	ND	2.07	0.12	0.63	2.75	9.81	ND	ND	1.08
	Start #	68.00	90.00	25.00	14.00	29.00	8.00	8.00	17.00	34.00	34.00			
	% Losses	38	55	67	31		2	72	50	39	4			
HL-SB	Kills	14.05	25.67	0.05	17	24.48	0	0.76	3.14	39.62	39.76	1.95	0	166.48
	Losses	19.95	27.76	11.04	4.67	18.52	0	4.72	1.38	24.76	2.09	0	11.48	126.37
	SER	0.70	0.92	0.00	3.64	ND	ND	0.16	2.28	1.60	19.02	ND		1.32
	Start #	73.00	89.00	25.00	14.00	71	8.00	8.00	17.00	43.00	34.00			
	% Losses	27	31	44	33	26	0	59	8	58	6			
BDE BASED	Kills	12.34	28.57	0	16	25.14	0	0.76	2.76	34.19	45.61	2	0	167.37
	Losses	15.57	36.1	12.33	4.71	17.95	0	5.38	1.95	10.62	3.57	0	12.66	120.84
	SER	0.79	0.79	0.00	3.40	ND	ND	0.14	1.42	3.22	12.78	ND		1.39
	Start #	60	106	25	14	71	8	8	17	26	34			
	% Losses	26	34	49	34		0	67	11	41	11			

Far-Term BLUE Systems	RED	Effects												
Alternative Measure	T80	BMP3	APCs	HOKU M	2S6	SA-15	122 HOW	152 HOW	122 MRL	220 MRL	120 MTR	Other	Totals	
AOE	Kills	42.38	5.43	0.57	16.86	3.1	1.05	3.57	32.67	1.67	10.38	0.19	16.38	134.25
	Losses	48.62	25.1	29.8	2.52	1.71	2.38	6.62	21.24	4.67	1.33	1.76	0	145.71
	SER	0.87	0.22	0.02	6.69	1.81	0.44	0.54	1.54	0.36	ND	0.11	ND	0.92
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	87	81	61	50	21	60	44	46	31	27	35		
HL-SB	Kills	31.48	8.24	0.39	18.95	3.19	0.62	1.86	31.57	4.19	9.43	0.19	16.29	126.4
	Losses	50.14	29.29	34.4	2.29	1.57	3.05	5.81	30.43	6.29	1.67	1.57	0	166.48
	SER	0.63	0.28	0.01	8.28	2.03	0.20	0.32	1.04	0.67	ND	0.12		0.76
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	90	94	70	46	20	76	39	66	42	33	31		
BDE BASED	Kills	33.95	8.33	0.56	20.05	3.24	0.62	1.9	24.1	3.14	6.19	0.19	18.48	120.75
	Losses	50.48	29	33.5	2.14	2.19	3.1	5.52	32.62	5.24	1.76	1.86	0	167.39
	SER	0.67	0.29	0.02	9.37	1.48	0.20	0.34	0.74	0.60	ND	0.10		0.72
	Start #	56	31	49	5	8	4	15	46	15	5	5		
	% Losses	90	94	68	43	27	78	37	71	35	35	37		

APPENDIX F

FORCE XXI
DIVISION DESIGN
DEPLOYABILITY ANALYSIS

This page intentionally left blank

Table of Contents

	<i>Page</i>
EXECUTIVE SUMMARY	F-4
Conclusions	F-4
1. INTRODUCTION	F-5
A. Background	F-5
B. Purpose	F-5
C. Scope	F-5
2. METHODOLOGY	F-6
A. General	F-6
B. Automated Analytical Tool	F-6
C. Assumptions	F-6
D. Model Output	F-7
3. ANALYSIS	F-8
A. Force Design and Deployment Data	F-8
B. Scenario	F-8
C. Deployment Analysis	F-11
1. General	F-11
2. Transport Requirements	F-11
3. Force Closure	F-18
4. Summary of Analysis	F-20
4. CONCLUSIONS	F-21
ANNEXes - Not attached, provided upon request	
A. Force Data Summary	
B. Force Equipment List	
C. Force Summary	
D. Missing/No Data Items	

List of Tables

	<i>Page</i>
Table 1. Army of Excellence Unit Deployment Data Summary	F-10
Table 2. Heavy/Light - Small Base Division Unit Deployment Data Summary ..	F-11
Table 3. Modular Division Unit Deployment Data Summary	F-11
Table 4. ACR, ACR "Corps Slice", EAC, and Theater Army Unit Deployment Data Summary	F-12
Table 5. Army of Excellence Cargo Vessel and Passenger Sortie Requirement	F-13
Table 6. Heavy/Light - Small Base Division Cargo Vessel and Passenger Sortie Requirement	F-13
Table 7. Modular Division Unit Cargo Vessel and Passenger Sortie Requirement	F-14
Table 8. ACR, ACR "Corps Slice", EAC, and Theater Army Cargo Vessel and Passenger Sortie Requirement	F-14
Table 9. Unit Footprint Comparison	F-15
Table 10. Summary of Personnel in the Units	F-16
Table 11. Cargo Vessel Requirement	F-17
Table 12. Passenger Sortie Requirement	F-18
Table 13. Change in Cargo Vessel Requirement from the Base Case Force	F-19
Table 14. Change in Passenger Aircraft Sortie Requirement from the Base Case Force	F-20

EXECUTIVE SUMMARY

The Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) was requested by the Training and Doctrine Command (TRADOC) Analysis Center, Studies and Analysis Center (TRAC-SAC) to analyze the deployability of division design alternatives as part of the Division Design Analysis (DDA), which is part of the 5-Year Joint Venture Analysis Plan.

The objective of the DDA is to determine areas for further investigation and robustness of the designs (Heavy/Light - Small Base (HL-SB) Division and Modular (MOD) Division). The analysis examines the time required to deploy cargo vessels and passenger aircraft required to move the current Army of Excellence (AOE), and alternative (HL-SB and MOD) division force designs to two different locations. MTMCTEA's Transportability Analysis Report Generator (TARGET) model was used to determine deployment data for the current AOE and alternative modular divisions and their support forces (Corps and Theater Army). We also estimated the change in deployment times for the alternative force designs from the current force.

Further deployability analyses will be performed during phase II of the Division Design Analysis from December 1995 through September 1997. This is an initial analysis and will be updated with more detailed deployability analysis during phase II.

CONCLUSIONS

1. Analysis of the divisions and supporting forces shows very little change in footprint (square feet) and overall deployability between the AOE and Heavy/Light - Small Base Division.
2. The increased number of soldiers in the Heavy/Light - Small Base (HL-SB) Division will require additional passenger aircraft sorties to deploy the division. An 11 percent increase in sorties is required to deploy to South West Asia (SWA) and a 14 percent increase is required to deploy to North East Asia (NEA) over the number required to deploy the AOE division. The aircraft sortie change will not affect closure time. The passenger aircraft will be timed to arrive before the ships arrive with the soldiers unit equipment.
3. The Modular (MOD) Division requires fewer cargo vessels and passenger aircraft sorties to move the force than the current AOE and the Heavy/Light - Small Base Division, which results in a decrease in the time to deploy the force. The AOE force requires 5 additional days to deploy to SWA and 2-1/2 additional days to deploy to NEA than the Modular Division force.

1. INTRODUCTION

A. BACKGROUND

TRADOC has been charged with redesigning the Warfighting Army for the 21st century, using an iterative cycle of concept definition, requirements review, force design, equipping, training, and experimenting, as described in the Joint Venture Campaign Plan. The DDA will serve as the thread of continuity for the Joint Venture Campaign/Analysis. The Force XXI division designs will be applied to the six active components that are not infantry (light), airborne, or air assault divisions. Further, the Force XXI divisions are expected to perform missions in the mid-to-high intensity range of conflict. Conflicts of lesser intensity are mainly delegated to the infantry (light) divisions. The objective of the DDA is to determine areas for further investigation and to determine the robustness of the designs.

TRAC-SAC requested us to analyze the deployability of two alternative division designs and compare the results to the deployability of today's AOE divisions.

B. PURPOSE

This analysis examines the lift assets required to deploy the force designs. The results provide TRADOC quantified deployment data for the division design alternatives, specifically, cargo vessels, passenger aircraft sorties, and closure times for the Heavy/Light - Small Base (HL-SB) and Modular (MOD) divisions compared to the AOE division.

C. SCOPE

The deployment includes movement of the forces from CONUS origins to North East Asia (NEA) and South West Asia (SWA). The analysis is based on lift assets and equipment in the forces available in calendar year 2003. No attempt will be made to determine the combat effectiveness of the units in this deployability analysis.

2. METHODOLOGY

A. GENERAL

This deployment analysis was conducted for the AOE and the alternative division design (HL-SB and MOD) forces. TRAC-SAC will use the deployability analysis and other analyses being performed to refine the division design for phase II of the DDA to be conducted from December 1995 through September 1997.

B. AUTOMATED ANALYTICAL TOOL

MTMCTEA's Transportability Analysis Reports Generator (TARGET), a unit deployability model developed in ORACLE and C languages, determines force deployment data. TARGET provides an automated method to merge unit equipment authorization data from TRADOC's Table of Organization and Equipment (TOE) Master File with the Equipment item data from FORSCOM's Computerized Movement Planning and Status System (COMPASS) Equipment Characteristics File (ECF). MTMCTEA used TARGET to generate deployment data (vehicle quantity, square feet, and short tons (STON) for the AOE and alternative division force designs. The TOE Master File and ECF data bases used were current as of May 1995.

C. ASSUMPTIONS

1. The 2d ID (Mech) and the 2d ID Corps Slice and its replacement modular division and Corps Slice are in NEA and do not have to be deployed for the NEA scenario.
2. Defense transportation system infrastructure (ports, highways, and rail networks, and so forth) will be the same for the AOE, HL-SB, and MOD divisions.
3. Airlift and sealift capabilities recommended by the Mobility Requirements Study Bottom Up Review Update (MRS/BURU) should be available in 2003. A fully supported Army Corps (with AOE divisions) may be deployed anywhere in the world in 75 days in 2003.
4. The average size Roll-on/Roll-off (RORO) vessel will have 200,000 square feet of deck space in 2003. The ship is considered fully loaded when loaded to 75 percent of the available deck space.
5. The personnel will be transported on B-747 aircraft with an average load of 401 passengers per aircraft sortie.
6. The aircraft transporting passengers will be scheduled to arrive before the ships transporting equipment; therefore, passenger arrival will not affect force closure time.
7. Other modeling and analyses will determine if the deploying force can perform the required mission.

8. The TOE master file does not include some future systems (such as Comanche, future scout vehicle, and armored security vehicle). For this analysis, the dimensional and weight characteristics of current systems, which are in the TOE file, were used for these future systems.

9. Dimensional and weight characteristics are not available for some future systems, which are in the TOE master file. Equipment with no available dimensional and weight characteristics (Appendix D) will have similar impacts on all units in the AOE, HL-SB, and MOD divisions.

10. Included for each person was 219.35 pounds of accompanying supplies and equipment and 12.7 pounds of ammunition. This equates to a 1 day supply (DOS) for class V; 5 days for classes I, IV, and VI; and 15 days for classes II, III, VIII, and IX.

11. One less ship would equal half a day of savings. Two less ships would be a savings of 1 day.

12. The Army can deploy the AOE force to SWA in 75 days. Further, it will take 70 days to deploy the AOE force to NEA.

D. MODEL OUTPUT

TARGET provides deployment data (personnel, square feet, and STON) that quantify strategic mobility requirements. We compared the deployment data of the base case and alternatives to help determine the most deployable force design. The results from the TARGET analysis output are summarized in the tables in the analysis. The divisions deployability characteristics are included in the annexes for information and reference for future DDA analyses. These annexes are described in the Analysis section but not provided in the document, but are available under separate cover upon request.

3. ANALYSIS

A. FORCE DESIGN AND DEPLOYMENT DATA

TRADOC Force Design Directorate (FDD) provided the force design and structure for AOE and the two alternative division design forces used in this deployment analysis. The AOE units analyzed are:

1st Cavalry Division	1st Cavalry Division "Corps Slice"
2d Infantry Division (Mechanized)	2d Infantry Division (Mech) "Corps Slice"
3d Armored Cavalry Regiment	3d Armored Cavalry Regiment "Corps Slice"
24th Infantry Division (Mechanized)	24th Infantry Division (Mech) "Corps Slice"
25th Infantry Division (Light)	25th Infantry Division (Light) "Corps Slice"
18th Corps	
Echelon Above Corps	
Theater Army	

"Corps Slice" are corps assets used to augment and provide direct support to the division based on the division's mission.

The alternative division design (HL-SB and MOD) units are:

Alternative Divisions*	Alternative Division "Corps Slices"*
3d Armored Cavalry Regiment	3d Armored Cavalry Regiment "Corps Slice"
18th Corps	
Echelon Above Corps	
Theater Army	

*There are four Alternative Divisions and "Corps Slices" for deployment to SWA, and three Alternative Divisions and "Corps Slices" for deployment to NEA to join with a forward based heavy division and "Corps Slice" already in theater.

Note: The following annexes are described below. They are not included as part of this appendix but are available upon request.

Annex A shows the organizations that make up the force for each of the units analyzed in this study. This information includes the standard requirement codes (SRCs), unit description, unit multiplier, personnel strength, vehicle quantity, unit square feet, unit STON, aircraft quantity, and aircraft square feet. The equipment and personnel in the units were modified to reflect information provided by TRAC-SAC for the HL-SB, and MOD divisions.

Annex B shows the force equipment list. This includes the authorized quantity, dimensions, weight, square feet, and STON for each item of equipment. Annex C is a summary of the vehicle quantities, square feet, and STON at the unit level. This includes information with equipment loaded on organic vehicles and information on items too large for C-5 transport.

Annex C is a summary of the vehicle quantities, square feet, and STON at the unit level. This includes information with equipment loaded on organic vehicles and information on items too large for C-5 transport.

Annex D provides a list of equipment in each unit that has no information available in FORSCOM's Computerized Movement Planning and Status System (COMPASS) Equipment Characteristics File (ECF). This shows that the ECF database does not contain dimensional and weight characteristics for some of the equipment in the TOE. For this analysis, we assume equipment with no available dimensional and weight characteristics will have similar impacts on all units in the AOE and modular division forces.

Tables 1 through 4 show the deployment data generated by the TARGET model for the AOE and alternative divisions forces.

TABLE 1
ARMY OF EXCELLENCE
UNIT DEPLOYMENT DATA SUMMARY

Force Design	Personnel	Square Feet	Total STON
1st Cav Div	16,748	1,484,670	102,307
1st Cav Div "Corps Slice"	11,863	1,251,038	60,769
2d Inf Div	17,093	1,416,886	93,192
2d Inf Div "Corps Slice"	12,454	1,439,058	68,062
24th Inf Div (Mech)	17,324	1,540,074	103,590
24th Inf Div (Mech) "Corps Slice"	11,826	1,251,673	60,846
25th Inf Div	11,437	533,681	17,499
25th Inf Div "Corps Slice"	10,612	888,801	38,507
18th Corps	39,740	4,153,479	166,099
Total	149,097	13,959,360	710,871

TABLE 2
HEAVY/LIGHT - SMALL BASE DIVISION
UNIT DEPLOYMENT DATA SUMMARY

Force Design	Personnel	Square Feet	Total STON
HL-SB Division	17,347	1,207,438	78,363
HL-SB Division "Corps Slice"	11,595	1,187,770	56,227
18th Corps	39,739	4,128,291	164,590
Total*	155,507	13,709,123	702,950
*The total shows four Divisions and "Corps Slices" for comparison to the AOE force.			

TABLE 3
MODULAR DIVISION
UNIT DEPLOYMENT DATA SUMMARY

Force Design	Personnel	Square Feet	Total STON
Modular Division	14,149	1,046,305	63,990
Modular Division "Corps Slice"	11,038	1,158,391	54,648
18th Corps	37,848	3,939,511	157,783
Total*	138,596	12,758,295	632,335
*The total shows four Divisions and "Corps Slices" for comparison to the AOE force.			

TABLE 4
ACR, ACR "CORPS SLICE", EAC, AND THEATER ARMY
UNIT DEPLOYMENT DATA SUMMARY

Force Design	Personnel	Square Feet	Total STON
3d ACR	4,578	415,723	31,188
3d ACR "Corps Slice"	1,455	146,424	5,437
Echelon Above Corps	10,060	1,574,791	61,618
Theater Army	85,310	6,551,209	247,459
Total	101,403	8,688,147	345,702

FDD modified the Corps in both of the alternative division forces to support the alternative divisions. FDD made no changes to the 3rd Armored Cavalry Regiment, 3rd Armored Cavalry Regiment "Corps Slice", Echelon Above Corps, and Theater Army. These forces stayed the same for all division designs.

B. SCENARIO

TRAC-SAC requested this analysis address scenarios deploying to NEA and SWA. No appropriate time-phased forced deployment list (TPFDL) is available at this time. The footprint of the units was used to determine the number of cargo vessels required to move each of the units.

C. DEPLOYMENT ANALYSIS

1. General. This analysis compares the AOE base case to the Heavy/Light - Small Base Division and to Modular Division force designs in terms of the number of cargo vessels required to transport the force and the time required to close the force to the Tactical Assembly Area (TAA). We also determined the number of passenger aircraft sorties required to deploy the troops.

2. Transport Requirements. MTMCTEA's TARGET model was used to determine the square footage of each of the force design alternatives. Analysis of TARGET output yields the number of cargo vessels and passenger aircraft sorties and is shown in tables 5 through 8. The output is not rounded off to show that the last cargo vessel and passenger aircraft sortie have partial payloads.

TABLE 5
ARMY OF EXCELLENCE
CARGO VESSEL AND PASSENGER SORTIE REQUIREMENT

Force Design	Cargo Vessels*	Passenger Sorties*
1st Cav Div	9.9	41.77
1st Cav Div "Corps Slice"	8.34	29.58
2d Inf Div	9.45	42.63
2d Inf Div "Corps Slice"	9.59	31.06
24th Inf Div (Mech)	10.27	43.2
24th Inf Div (Mech) "Corps Slice"	8.34	29.49
25th Inf Div	3.56	28.52
25th Inf Div "Corps Slice"	5.93	26.46
18th Corps	27.69	99.1
Total**	93.07	371.81

*The actual vessels would be rounded up to the next whole number. However, for planning purposes this table shows that the last vessels have a partial payload.

**This assumes all units are co-located and move through the same port of embarkation.

TABLE 6
HEAVY/LIGHT - SMALL BASE DIVISION
CARGO VESSEL AND PASSENGER SORTIE REQUIREMENT

Force Design	Cargo Vessels*	Passenger Sorties*
Alternative 1		
HL-SB Division	8.05	43.26
HL-SB Division "Corps Slice"	7.92	28.92
18th Corps	27.52	99.1
Total**	91.4	387.82

*The actual vessels would be rounded up to the next whole number. However, for planning purposes this table shows that the last vessels have a partial payload.

**The total shows four Divisions and "Corps Slices" for comparison to the AOE force. This assumes all units are co-located and move through the same port of embarkation.

TABLE 7
MODULAR DIVISION
CARGO VESSEL AND PASSENGER SORTIE REQUIREMENT

Force Design	Cargo Vessels*	Passenger Sorties*
Alternative 2		
Modular Division	6.98	35.28
Modular Division "Corps Slice"	7.72	27.53
18th Corps	26.26	94.38
Total**	85.06	345.62

*The actual vessels would be round up to the next whole number. However, for planning purposes this table shows that the last vessels have a partial payload.

**The total shows four Divisions and "Corps Slices" for comparison to the AOE force. This assumes all units are co-located and move through the same port of embarkation.

TABLE 8
ACR, ACR "CORPS SLICE", EAC, AND THEATER ARMY
CARGO VESSEL AND PASSENGER SORTIE REQUIREMENT

Force Design	Cargo Vessels*	Passenger Sorties*
3rd ACR	2.77	11.42
3rd ACR "Corps Slice"	0.98	3.63
Echelon Above Corps	10.5	25.09
Theater	43.67	212.74
Total**	57.92	252.88

*The actual vessels would be round up to the next whole number. However, for planning purposes this table shows that the last vessels have a partial payload.

**This assumes all units are co-located and move through the same port of embarkation.

Table 9 shows the footprint for the organizations that make up the divisions, Division "Corps Slices", and other units (Echelon above Division - for this analysis) for the base case and two alternatives for the two scenarios.

TABLE 9
UNIT FOOTPRINT COMPARISON
(in square feet)

	AOE	HL-SB Division	MOD Division
SWA Scenario			
Division	4,975,311	4,829,752	4,185,220
Division "Corps Slice"	4,830,570	4,751,080	4,633,564
Echelon above Division*	12,841,626	12,816,438	12,627,658
Total em	22,647,507	22,397,270	21,446,442
NEA Scenario			
Division	3,558,425	3,622,314	3,138,915
Division "Corps Slice"	3,391,512	3,563,310	3,475,173
Echelon above Division*	12,841,626	12,816,438	12,627,658
Total**	19,915,563	20,002,062	19,241,746

*Echelon above Division includes the 3rd ACR, 3rd ACR "Corps Slice", Corps, EAC, and Theater. The SWA scenario requires the movement of four divisions and "Corps Slice" into the theater. The NEA scenario requires the movement of three divisions and "Corps Slice" into theater, because the 2nd ID, its "Corps Slice", and the replacement alternative division and "Corps Slice" are located in Korea.

**The number of cargo ships cannot be determined with this total. It needs to be determined for the units moving through the same port of embarkation.

Table 10 shows the number of personnel in the organizations that make up the divisions, Division "Corps Slices", and other units for the base case for the two alternatives.

TABLE 10
SUMMARY OF PERSONNEL IN THE UNITS

	AOE	HL-SB Division	MOD Division
SWA Scenario			
Division	62,602	69,388	56,596
Division "Corps Slice"	46,755	46,380	44,152
Echelon above Division *	141,143	141,142	139,251
Total **	250,500	256,910	239,999
NEA Scenario			
Division	45,509	52,041	42,447
Division "Corps Slice"	34,301	34,785	33,114
Echelon above Division*	141,143	141,142	139,251
Total**	220,953	227,968	214,812

*Echelon above Division includes the 3rd ACR, their "Corps Slice", Corps, EAC, and Theater. The SWA scenario requires the movement of four divisions into the theater. The NEA scenario requires the movement of three divisions into theater, because the 2nd ID, its "Corps Slice", and the replacement alternative division and "Corps Slice" are located in Korea.

**The number of passenger aircraft cannot be determined with this total. It needs to be determined for the units moving through the same port of embarkation

Table 11 shows the number of cargo vessels required to move the force for both scenarios determined from tables 5 through 8. To determine the number of cargo ships required to deploy the force, it was assumed that each of the Divisions, "Corps Slices", and so forth, were deployed from a different port of embarkation and the last cargo ship with a partial load would sail without being filled by the next unit. This results in a higher number of cargo ships required to move the force than if it is located at one location and the next unit can finish filling up the partially loaded cargo ship.

TABLE 11
CARGO VESSEL REQUIREMENT

	Base Case AOE	HL-SB Division	MOD Division
SWA Scenario			
Division	35	36	28
Division "Corps Slice"	34	32	32
Echelon above Division*	87	87	86
Total	156	155	146
NEA Scenario			
Division	25	27	21
Division "Corps Slice"	24	24	24
Echelon above Division	87	87	86
Total	136	138	131
*Echelon above Division includes the 3rd ACR, 3rd ACR "Corps Slice", Corps, EAC, and Theater. The vessel requirement is higher for the force when moved from different locations through different ports. The ships with partial loads may not be moved to another port to complete the load.			

Table 12 shows the number of passenger aircraft sorties required to move the force for both scenarios determined from tables 5 through 8. To determine the number of passenger aircraft required to move the force the same assumption was made for the soldiers. They will move through a different port of embarkation and the last partially loaded passenger aircraft will not load soldiers from other units.

TABLE 12
PASSENGER SORTIE REQUIREMENT

	Base Case AOE	HL-SB Division	MOD Division
SWA Scenario			
Division	158	176	144
Division "Corps Slice"	119	116	112
Echelon above Division*	355	355	350
Total	632	647	606
NEA Scenario			
Division	115	132	108
Division "Corps Slice"	87	87	84
Echelon above Division*	355	355	350
Total	557	574	542
*Echelon above Division includes the 3rd ACR, 3rd ACR "Corps Slice", Corps, EAC, and Theater. The sortie requirement is higher for the force when moved from different locations through different airports. The planes with partial loads may not be moved to other airports to complete the load.			

The Heavy/Light - Small Base Division is only slightly smaller than the AOE heavy division (24 Inf Div (Mech)), despite the Heavy/Light - Small Base Division having two heavy and one infantry brigades (BDEs) instead of three heavy BDEs. The Heavy/Light - Small Base Division also has three brigade Cavalry Squadrons in each division. Moving air defense battalions from division to "slice" does not reduce the total ship requirement.

The Modular Division is smaller than the AOE heavy Division and Heavy/Light - Small Base Division. Modular Division has division cavalry vice brigade cavalry, armor and mechanized battalions have three companies (vice four in AOE), one Attack Helicopter battalion, one MLRS battalion, and three engineer companies (instead of three engineer battalions).

Down sizing, not migration, of units makes the force more deployable.

3. Force Closure. A detailed deployment simulation of the AOE and the interim division design will be performed during phase II of the study. Programmed improvements in the Defense Transportation System, which includes the new LMSR vessels and C-17 aircraft, may allow the Army to meet its 2003 goal of deploying anywhere in the world in 75 days. For this analysis it was assumed the Army can deploy the AOE force to SWA in 75 days. Further, it was assumed it would take 70 days to deploy the AOE force to NEA.

With these times estimated for the base case AOE force, the difference in the number of required vessels to move the alternative would be used to determine the closure time for the modular division forces. We made the assumption that one ship would equal half a day. Two less ships would be a savings of 1 day in deployment time. Table 13 shows the change in the number of cargo vessels required to transport the equipment in the modular divisions vice that of the AOE force.

Table 13 shows an increase in the number of cargo vessels required to transport the Force, even though there is a decrease in square footage in the Heavy/Light - Small Base Division (table 6) vice the AOE Base Case Division (table 5). Table 5 shows that the last cargo vessel in the AOE Division had a higher usage than the last cargo vessel in the Heavy/Light - Small Base Division (table 6).

**TABLE 13
CHANGE IN CARGO VESSEL
REQUIREMENT FROM THE BASE CASE FORCE**

	Base Case	HL-SB Division	MOD Division
SWA Scenario			
Division	35	1	-7
Division "Corps Slice"	34	-2	-2
Echelon above Division*	87	0	-1
Total	156	-1	-10
NEA Scenario			
Division	25	2	-4
Division "Corps Slice"	24	0	0
Echelon above Division*	87	0	-1
Total	136	2	-5
*Echelon above Division includes the 3rd ACR, 3rd ACR "Corps Slice", Corps, EAC, and Theater.			

Table 13 also shows that the Modular Division, which is a smaller force, could result in saving 5 days in deployment time to SWA with the Heavy/Light - Small Base Division decreasing

deployment by half a day from the AOE Base Case force. Modular Division also decreases the deployment time to NEA by 2-1/2 days and the Heavy/Light - Small Base Division increases the deployment time by 1 day over the AOE Base Case force.

Evaluating the forces with the Division and Division "Corps Slice" co-located and deploying as a single force rather than two different forces may decrease the number of cargo vessels and passenger aircraft required to move the Division and Division "Corps Slice".

Table 14 shows the change in the number of passenger aircraft required to transport the soldiers in the alternative divisions from that of the AOE force. The aircraft sortie changes will not affect the closure time. The passenger aircraft will be timed to arrive before the ships arrive with the soldiers unit equipment, per current Army Doctrine. Using less aircraft will decrease the congestion in the airport making it easier for other airport traffic.

TABLE 14
CHANGE IN PASSENGER AIRCRAFT SORTIE
REQUIREMENT FROM THE BASE CASE FORCE

	Base Case	HL-SB Division	MOD Division
SWA Scenario			
Division	158	18	-14
Division "Corps Slice"	119	-3	-7
Echelon above Division*	355	0	-5
Total	632	15	-26
NEA Scenario			
Division	115	17	-7
Division "Corps Slice"	87	0	-3
Echelon above Division*	355	0	-5
Total	557	17	-15

*Echelon above Division includes the 3rd ACR, 3rd ACR "Corps Slice", Corps, EAC, and Theater.

4. *Summary of Analysis.* TRAC-SAC provided the force designs, adjustments, and scenarios for the AOE, HL-SB, and MOD divisions. MTMCTEA's TARGET model generated deployment data, and the output was used to determine the number of cargo vessels and passenger aircraft required to deploy each of the three forces for the two scenarios. With assumptions in force closure, 75 days to deploy the AOE force to SWA and 70 days to deploy the AOE force to NEA, the HL-SB and MOD divisions could be evaluated to determine the time required for deployment. Marginal deployment differences exist between the AOE and Heavy/Light - Small Base Division forces. The changes in Modular Division force from the AOE and Heavy/Light - Small Base Division forces result in savings in cargo ships, passenger aircraft, and deployment time.

4. CONCLUSIONS

1. Analysis of the divisions and supporting forces shows very little change in footprint (square feet) and overall deployability between the AOE and Heavy/Light - Small Base Division.

2. The increased number of soldiers in the Heavy/Light - Small Base Division will require additional passenger aircraft sorties to deploy the division. An 11 percent increase is required in the number of sorties to deploy to SWA and a 14 percent increase is required in the number of sorties to deploy to NEA over the number required to deploy the AOE division. The aircraft sortie change will not affect closure time. The passenger aircraft will be timed to arrive before the ships arrive with the soldiers unit equipment.

3. The Modular Division requires fewer cargo vessels and passenger aircraft sorties to move the force than the current AOE and the Heavy/Light - Small Base Division, which results in a decrease in the time to deploy the force. The AOE force requires 5 additional days to deploy to SWA and 2-1/2 additional days to deploy to NEA than the Modular Division force.

APPENDIX G

FORCE XXI
DIVISION DESIGN
COMBAT SERVICE SUPPORT
ANALYSIS

This page intentionally left blank

TABLE OF CONTENTS

LIST OF FIGURES.....	G-4
STUDY CONTRIBUTORS.....	G-4
EXECUTIVE SUMMARY.....	G-5
G-1. PURPOSE.....	G-7
G-2. BACKGROUND.....	G-7
G-3. SCOPE.....	G-7
G-4. LIMITATIONS.....	G-8
G-5. ASSUMPTIONS.....	G-8
G-6. STUDY ISSUES AND ESSENTIAL ELEMENTS OF ANALYSIS (EEA).....	G-9
G-7. DIVISION ALTERNATIVES.....	G-12
G-8. METHODOLOGY.....	G-15
G-9. DISCUSSION.....	G-16
G-10. FINDINGS.....	G-23

LIST OF FIGURES

G-1. Current AOE Armor Division.....	G-12
G-2. HL-SB Division.....	G-13
G-3. Brigade Based Division.....	G-14
G-4. CSS Analysis Methodology.....	G-15
G-5. Rating of the Alternatives by Issue.....	G-17
G-6. High Intensity Attack Posture.....	G-21
G-7. Mid Intensity Defensive Posture.....	G-22
G-8. General Officer Observations.....	G-23

STUDY TEAM AND CONTRIBUTORS

The DDA CSS Analysis Phase I study team wishes to recognize and thank all study participants whose ideas were incorporated into this analysis.

The Director, TRAC-LEE assigned MAJ Robert E. Daniels, study director and Ms. Antoniette C. McGrady, assistant study director for the DDA CSS study efforts. Core study team members for Phase I included:

Mr. Peter Barnes
Ms. Jeannette Blumenthal
Mr. Mike Byrd
Mr. John Ortiz
Mr. John Steffey
Mr. Fairly Vanover

Additional participants included MAJ Eddie Free, TRAC-SAC; functional SMEs located at CASCOM, SSI, and AMEDD; active and reserve Division Support Command (DISCOM) Commanders; Combined Logistics Officer Advanced Course (CLOAC) students; and all TRAC-LEE analysts who were gracious enough to share their expertise.

EXECUTIVE SUMMARY

1. Introduction.

a. Purpose. The Force XXI Division Design Analysis (DDA) - Phase I Combat Service Support (CSS) Analysis assessed the new CSS concept and design structure, and supported the Commanding General (CG), TRADOC Interim Division Design decision.

b. Alternatives. The analysis examined a prototype CSS concept as it was applied to each of the three initial division design alternatives: the current AOE, Heavy/Light - Small Base (HL-SB), and Brigade Based divisions. During the course of the DDA, two additional alternatives, the Modular Division (MOD) and the Modernized Heavy Division (MOD HVY), were developed. Due to timing, these alternative designs were not available for CSS analysis.

c. Scope. The DDA is a two-phased effort. The DDA Phase I CSS analysis consisted of qualitative insights, with supporting quantitative analysis. This phase focused on the capability of the prototype CSS concept and force structure to support and sustain the Army of Excellence (AOE) Base Case and the two Force XXI Division design alternatives.

d. Limitation. This analysis was limited by the evolutionary nature of the combat force structures, and the preliminary nature of the CSS concepts and force structures.

2. Methodology. The basis of the CSS methodology was derived from previous analyses, including the Early Entry Force Analysis (EEFA), MSF 94, and MSF 95.

a. The first step was to complete a front end analysis which focused on concept definitions. It included how the CSS force design will look, what forces will require support, and how CSS units will provide that support. The concept definition work was followed by qualitative and quantitative comparisons.

b. Opinions were gathered through a survey developed and administered by TRAC-LEE, and they formed the basis for the qualitative review of the prototype CSS unit's capability to perform the critical CSS mission tasks. The quantitative analysis addressed the CSS elements' capability to perform the support and sustain mission. Analysts completed a requirements versus capabilities analysis to determine shortfalls and excesses. The analysis focused on two types of supply, Class III and V. The Operations Logistics Planner (OPLOGPLN) system, a computer program created by the Combined Arms Support Command (CASCOM), was used to calculate estimated consumption requirements for fuel and ammunition. The capabilities of the alternative designs to meet those requirements were then determined off-line. The qualitative insights, combined with preliminary quantitative results, were used to rank the alternative division designs from a Support and Sustain perspective.

3. Findings.

a. Estimates for Class III and V requirements for a high intensity attack posture exceed the capacities for all design alternatives, in all theaters examined. This indicates a potential shortfall in CSS surge capacity, unless situational conditions permit multiple daily delivery cycles by transportation assets.

b. Estimates for Class III and V requirements for a mid intensity defensive posture do not exceed the capacities for any design alternative in any theater examined.

c. The SME survey responses provided the following insights:

(1) From a functionality perspective, the AOE CSS configuration was perceived as the most capable of supporting its division. However, this may be an indication of their familiarity and confidence in AOE design, and its accompanying redundancy.

(2) The Brigade Based alternative appears to be the least effective CSS design. They highlighted weaknesses of general supportability, information operations, and medical supportability within a Brigade Based design.

(3) The ability to reconstitute and function without HNS was a concern for all alternatives, while PSS was perceived to be adequate across the alternatives.

d. The general officer (GO) observations, from the DDA Senior Military Review (SMR), preferred the HL-SB Division design, with modifications. They concluded that the AOE division base is unaffordable; therefore, it must be redesigned. The new division design should integrate the best qualities of the HL-SB and the Brigade Based alternatives.

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I COMBAT SERVICE SUPPORT ANALYSIS

G-1. Purpose. The Force XXI Division Design Analysis (DDA) - Phase I Combat Service Support (CSS) Analysis assessed the new CSS concept and design structure. This analysis addressed CSS capabilities to support and sustain a set of alternative division designs, developed by the Training and Doctrine Command (TRADOC) Force Design Directorate (FDD), with support from the various proponent schools, in the context of the new, draft TRADOC Pam 525-71, *Force XXI Division Operations Concept*. This analysis was completed in December 1995. The results were incorporated in the DDA Phase I decision brief that supported the Interim Division Design decision made by the Commanding General (CG), TRADOC in December 1995.

G-2. Background.

a. TRADOC has been charged with redesigning the Warfighting Army into the 21st century. The Director, Joint Venture is responsible for designing the objective Force XXI Division and its associated supporting elements by the end of 1998. The division redesign process is using an iterative cycle of concept definition, requirements review, force design, equipping, training, and experimenting, as described in the Five-Year Joint Venture Analysis Plan (JVAP). The DDA serves as the thread of continuity for the Joint Venture Campaign Analysis.

b. The Force XXI CSS concept and force structure must be capable of meeting the support requirements generated by the selected Force XXI Division design. The Force XXI CSS design must be able to support missions across the spectrum of combat ranging from peace-keeping to high-intensity conflict. Although the focus is now on the heavy division, this CSS concept and force structure must be capable of supporting all types of divisions: light, heavy, airborne, air assault, or any mission required combination.

G-3. Scope.

a. The DDA is being conducted as a two-phased effort. The CSS analysis for DDA Phase I, documented in this appendix, consisted of qualitative insights with supporting quantitative analysis. This analytic effort focused on the capability of the prototype CSS concept and force structure to support and sustain the Army of Excellence (AOE) Base Case and the two Force XXI Division design alternatives.

b. The CSS Battlefield Distribution (BD) Concept provided the basis for the analysis. The BD concept is a holistic system of information exchanges, management procedures, functional designs, and re-engineered operational processes that enable U. S. forces to properly request, receive, redirect, track, distribute, control, and retrograde materiel, facilities, and services within a single distribution system. The CSS concept incorporates the following functions: maintenance, supply, transportation, medical, finance, personnel, reconstitution, and deployability. Although digitization and information operations are not specifically addressed as part of BD, these areas

provide the framework for implementing all components of the concept. Therefore, the analysis considered both.

c. The DDA Phase I CSS requirements analysis was based on planning factors in three scenario environments: (1) two European scenarios, one developed by the Battle Command Training Program (BCTP) for the fall 1995 "How to Fight" seminars, and the Prairie Warrior (PW) 96 scenario; (2) the Northeast Asia scenario used in PW 95 for Mobile Strike Force (MSF) analysis; and (3) a Southwest Asia (SWA 4.2) scenario. These scenarios were also used for the combat analyses.

d. The DDA Phase I CSS analysis was focused at the division echelon, and predominantly on the Division Support Command (DISCOM). Additional areas included CSS at echelons above division (EAD), divisional CSS requirements provided by corps, and CSS capabilities removed from division and not consolidated, or relocated elsewhere in the force.

G-4. Limitations.

a. This analysis was limited by the evolutionary nature of the combat force structures, and the preliminary nature of the CSS concepts and force structures.

(1) Determination of divisional CSS requirements was limited because the Force XXI Interim Division Design decision was not made until after the completion of the DDA Phase I CSS Analysis. As a result, the support and sustainment requirements used in this analysis were more projections than definitions. These projections will be refined during DDA Phase II CSS Analysis, as the combat and CSS force designs mature.

(2) The CSS concept continues to evolve and CSS force structure development requires both a relatively mature combat design and definitive CSS concept upon which to base sustainment requirements.

(3) The alternatives developed during the course of the DDA - Phase I, the Modular Division and the Modernized Heavy Division, were not available in time for inclusion in this analysis.

b. The emerging CSS concepts and force structures were not included in the force-on-force simulations conducted to support DDA Phase I. Analysis of these concepts and force structures will play a major role in the DDA Phase II CSS analysis.

G-5. Assumptions.

a. For this DDA Phase I CSS analysis, the capabilities represented by MSF 95 provided an adequate surrogate for emerging CSS division designs. The MSF capabilities closely resemble the modular and centralized CSS concepts under development.

b. The Force XXI division will not operate autonomously, but within the context of a corps.

c. The BD, maintenance, medical, and personnel support concepts are mature enough to adequately represent the concepts that will be in place in support of Force XXI.

d. Applications and technologies that enhance communications and information flow are vital to the implementation of the CSS concepts for BD, maintenance, medical, and personnel support. Any CSS support will be dependent upon reliable communications connectivity for seamless flow of information throughout the battlefield.

e. Projected technological capabilities are valid. Appropriate subject matter experts (SMEs) can generate, or surrogate information to represent these capabilities.

G-6. Study issues and Essential Elements of Analysis (EEA). This analysis addressed eight CSS issues. The CSS DDA study team, in conjunction with the Combined Arms Support Command (CASCOM), the CSS proponent, and the DDA study director located at TRAC-SAC designed the issues to provide insights to address the "Sustain and Transition the Force" pattern of operation, described in the draft TRADOC Pam 525-71, *Force XXI Division Operations Concept*.

a. Issue 1: Is the Force XXI Division CSS concept designed to meet the requirements for supplies, transportation, and maintenance for the combat mission at division-level and EAD?

(1) EEA 1.1. What are the supply, transportation, and maintenance requirements needed to support the combat missions?

(2) EEA 1.2. What is the design capability for each CSS organizational unit (both within the division and at EAD) for the primary areas of fuel distribution, ammunition distribution, water distribution, medical evacuation, and maintenance?

(3) EEA 1.3. What division or EAD design capability adjustments, if any, are required to meet the requirements for the primary areas of fuel distribution, ammunition distribution, water distribution, medical sustainment, medical evacuation, and maintenance?

b. Issue 2: Does the Force XXI CSS concept support high intensity battle where peak replenishment is required?

(1) EEA 2.1. What are the CSS requirements needed to support high intensity battles where peak replenishment is required?

(2) EEA 2.2. Can the design capability for each divisional and EAD CSS organizational unit provide 24-hour sustainment for the primary areas of fuel distribution, ammunition distribution, water distribution, medical evacuation, and maintenance?

(3) EEA 2.3. What division or EAD design capability adjustments, if any, are needed to meet the 24-hour requirements the primary areas of fuel distribution, ammunition distribution, water distribution, medical evacuation and maintenance?

c. Issue 3: How does battlefield digitization impact command, control, communications, computers, and intelligence (C4I) for combat service support (CSS)?

(1) EEA 3.1. What are the C4I requirements for CSS?

(2) EEA 3.2. What is planned for CSS battlefield digitization?

(3) EEA 3.3. What interface is required between CSS elements and other elements employing battlefield digitization?

(4) EEA 3.4. What applications can CSS organizations make from the products of planned battlefield digitization for other functional areas?

(5) EEA 3.5. What functions of CSS elements can be digitized? What functions must be digitized to interface with other elements employing battlefield digitization?

d. Issue 4: Does the Information Operations (IO) architecture support the CSS concept?

(1) EEA 4.1. What is the IO architectures that applies to the CSS concept?

(2) EEA 4.2. What do the information technologies identified in the IO architecture contribute to the division and EAD CSS mission accomplishment?

(3) EEA 4.3. Are there additional CSS information technologies which would enhance the division and EAD CSS concept of operations and force design? If so, what are they and what are their expected contributions to mission accomplishment?

(4) EEA 4.4. How would the degradation, or loss of the designed information technologies affect division and EAD CSS functions?

(5) EEA 4.5. What adjustments to the Force XXI CSS concept are necessary in the absence of the anticipated information technology capabilities?

e. Issue 5: Can the personnel support services (PSS) concept support the division combat missions?

(1) EEA 5.1. What are the PSS requirements needed to support the combat missions?

(2) EEA 5.2. How does the PSS concept improve the responsiveness and accuracy of personnel and finance support to the division?

(3) EEA 5.3. What is the design capability for each PSS organizational unit, both within the division and at EAD, for the primary areas of personnel and finance?

(4) EEA 5.4. What adjustments, if any, are required to either divisional or EAD PSS units providing personnel and finance support to the division, for the designed capability to meet the PSS requirements?

f. Issue 6: Does the Force XXI CSS concept require host nation support (HNS) to execute the division's combat mission?

(1) EEA 6.1. What CSS tasks must rely on HNS for the division to accomplish its mission?

(2) EEA 6.2. What is the likelihood that these HNS tasks for the division can be performed in a given scenario?

g. Issue 7: Does the Force XXI medical concept adequately support the combat mission?

(1) EEA 7.1. What are the medical requirements to support the combat missions?

(2) EEA 7.2. How is evacuation and combat health support improved with the changes in the division medical concept of support?

(3) EEA 7.3. What is the design capability for each medical organizational unit, both within the division and at EAD, for the primary areas of evacuation and treatment?

(4) EEA 7.4. What adjustments, if any, are required to the designed medical capability to meet the requirements for both divisional medical unit and at EAD to support the division for the primary areas of evacuation and treatment?

h. Issue 8: Does the division structure and CSS concept have the capability to enable reconstitution?

(1) EEA 8.1. What are the CSS requirements needed to enable reconstitution?

(2) EEA 8.2. Does the CSS concept provide the division the capability to conduct follow-on missions in the same theater?

(3) EEA 8.3. Does the CSS concept provide the division the capability to re-deploy and conduct follow-on missions in a different theater?

(4) EEA 8.4. Does the CSS concept provide the division the capability to re-deploy and conduct follow-on missions in multiple theaters?

G-7. Division Alternatives. This analysis addressed the prototype CSS concept, and evaluated its ability to support each of the three initial division design alternatives: the current AOE, Heavy/Light - Small Base (HL-SB), and Brigade Based divisions. During the course of the study, two additional alternatives, the Modular Division (MOD) and the Modernized Heavy Division (MOD HVY), were developed. However, due to timing, these alternative designs were not available for CSS analysis.

a. AOE Division. The CSS DDA Base Case used the AOE Armor Division structure shown in figure G-1, below.

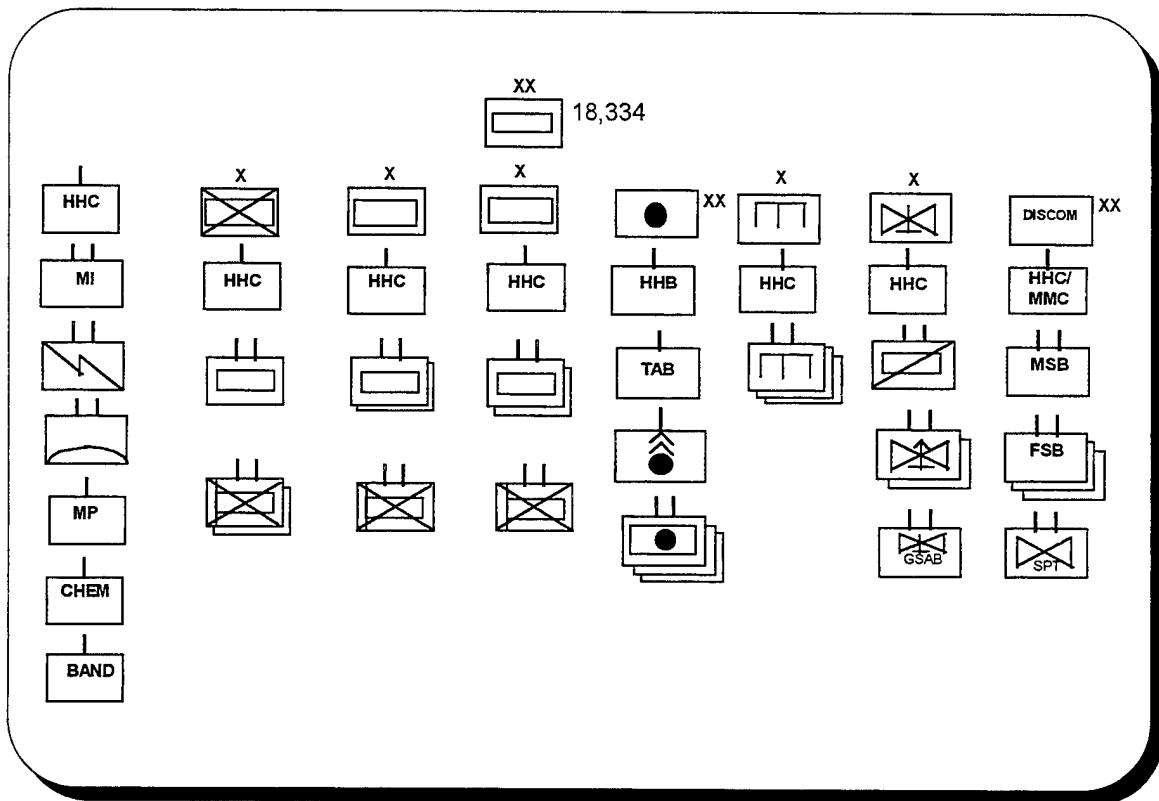


FIGURE G-1. AOE Armor Division

b. HL-SB Division. Figure G-2 depicts the HL-SB design. The principle characteristics of this division are the mix of mounted (heavy) and dismounted (light) units within the same force structure. The division design gives it the capability for decisive operations, with limited deep operations capability. The brigades are the principal maneuver organizations within this division structure. Key differences between the HL-SB and the AOE designs are as follows:

c. Brigade Based Division. Figure G-3 depicts the Brigade Based Division design. The focus of this design is the flexibility to perform missions across the spectrum of conflict. The Brigade Based Division attains this capability through the assignment of specifically required brigade force packages. Mission, Enemy, Terrain, Time, and Troops (METT-T) conditions will always drive the exact composition of the division. Under this concept, the division echelon's focus is battle command. The Brigade Based Division is capable of commanding a variety of subordinate brigade-sized units. The brigades come as "self-contained" packages that have some of the AOE combat support (CS) and CSS elements (typically found in the division) embedded in the brigade. The combat capabilities of the maneuver brigades are nearly identical to the HL-SB design since the battalion "building blocks" are the same for both designs.

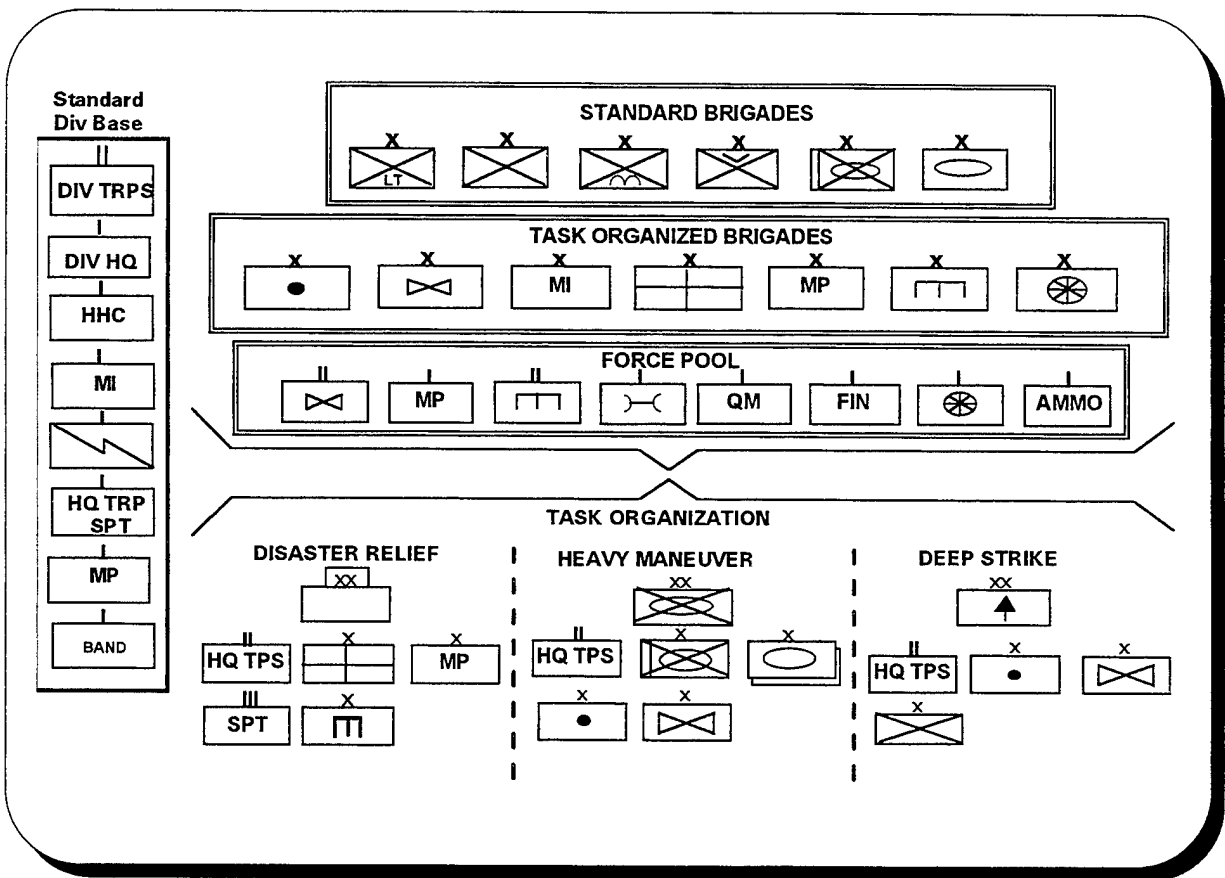


FIGURE G-3. Brigade Based Division

G-8. Methodology. The CSS methodology was derived from previous analyses, including the Early Entry Force Analysis (EEFA), MSF 94, and MSF 95. The block diagram, figure G-4, depicts how the analysis was conducted, and addresses both the methods and the analytic tools used. The discussion below addresses the individual blocks in figure G-4, showing the relationships among the blocks and describing the actions represented by each.

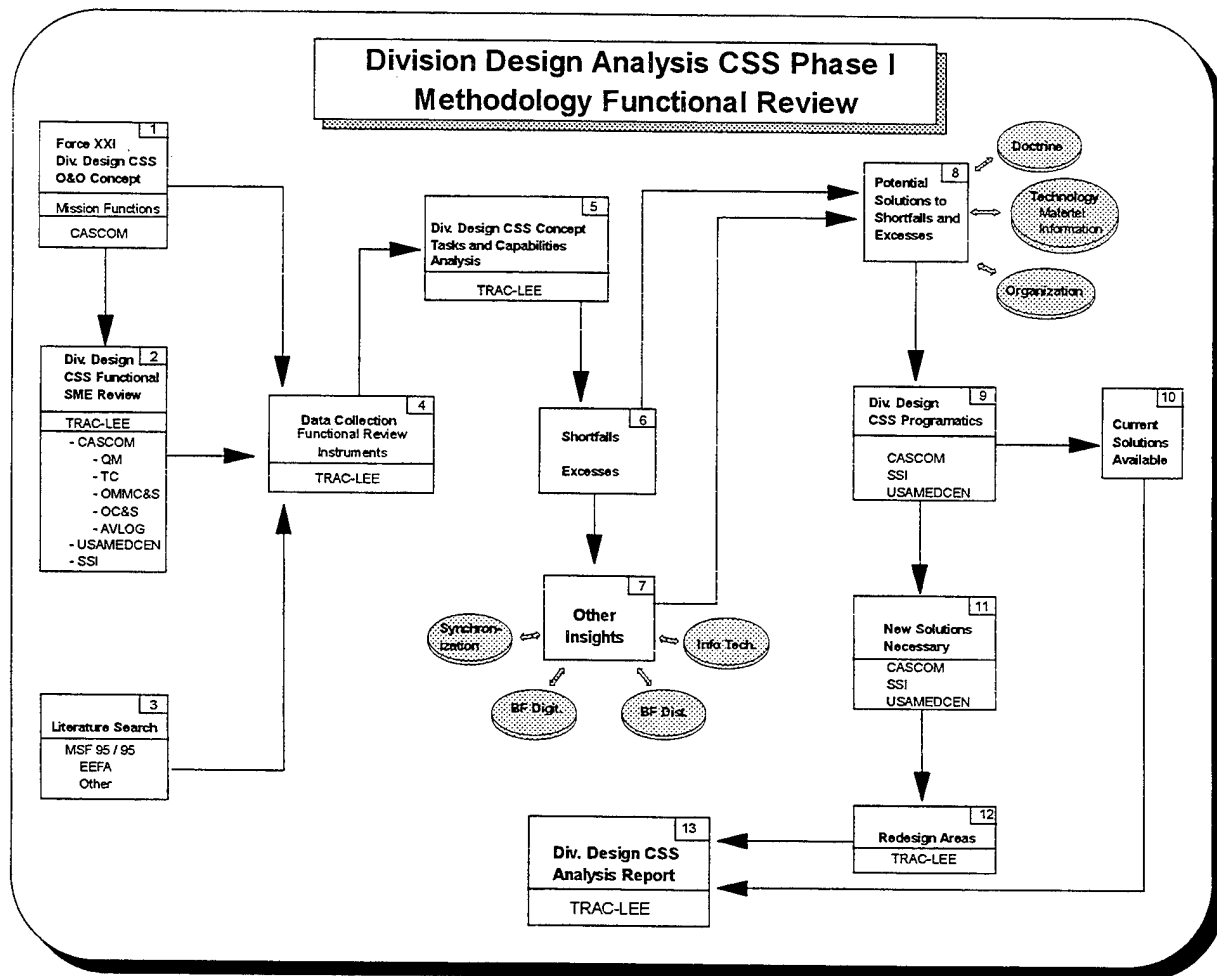


FIGURE G-4. CSS Analysis Methodology

a. Blocks 1, 2, and 3 highlight the front end analyses. The data sources represented by these blocks provided the conceptual framework for the conduct of the CSS analysis. Block 1 actions focused on concept definitions, including how the CSS force structure is designed, what forces will require support, and how CSS units will provide that support. The functional SME reviews, represented by Block 2, provided the forums for collecting SME opinions and other data. Block 3 identifies additional research completed in support of the CSS analysis.

b. Block 4 represents the DDA CSS analysis data base. It includes an accumulation of the raw qualitative data and inputs for the quantitative analysis.

c. Blocks 5, 6, and 7 represent the analytical effort. The qualitative and quantitative comparisons led to the identification of potential shortfalls and/or excesses in CSS capabilities. Block 7 indicates the qualitative analysis provided insights into synchronization, battlefield digitization, battlefield distribution, and information technology.

(1) A survey, developed and administered by TRAC-LEE analysts, was the primary tool for gathering SME perceptions and opinions. The information provided input from concept developers and personnel in the field. These opinions formed the basis for the qualitative analysis of the prototype CSS unit's capability to perform critical CSS mission tasks.

(2) The quantitative analysis addressed the CSS elements' capability to perform the support and sustain mission. Analysts completed a requirements versus capabilities analysis to determine shortfalls and excesses. The analysis focused on two types of supply, Class III and V. The Operations Logistics Planner (OPLOGPLN) system, a computer program created by the Combined Arms Support Command (CASCOM), was used to calculate estimated consumption requirements for fuel and ammunition. The capabilities of the alternative designs to meet those requirements were then determined off-line.

d. Blocks 8 through 12 represent the CSS Program Analyses. These analyses were intended to highlight potential solutions to identified capability shortfalls and/or excesses and to identify any problems associated with the Force XXI CSS concept. This included CSS initiatives required for concept implementation. However, due to the time available and the resolution of the concept and designs, the CSS Program Analyses section was deferred until DDA Phase II. The JVAP, and, consequently, this phase I analysis, includes an assumption that adequate funding has been identified, programmed, and fenced for all Force XXI initiatives.

e. The qualitative insights, combined with preliminary quantitative results, were used to provide an overall assessment of the combat division alternatives from a Support and Sustain perspective (Block 13).

G-9. Discussion.

a. Surveys.

(1) Instruments. The survey questionnaire addressed each of the issues outlined in paragraph G-6. The basic package included a survey questionnaire, a demographic form, a description of the three division designs being analyzed, an estimate of the consumption requirements for each division design, and a snapshot description of the emerging CSS support structure. The senior logistics community leaders' survey package included a decision making section, which allowed these individuals to assign relative importance rankings to each of the issues.

(2) Population. The surveys were distributed to a participant pool that included senior logistics community SMEs located at CASCOM, Soldier Support Institute (SSI), and the Army Medical Department Center and School (AMEDD); active and reserve Division Support

Command (DISCOM) Commanders; functional SMEs located at CASCOM, SSI, and AMEDD; and Combined Logistics Officer Advanced Course (CLOAC) students. Administration of the survey varied among members of the sample population. Perspective active and reserve DISCOM participants received their surveys through the mail. TRAC-LEE analysts administered the surveys to all other groups. Additional information was obtained from interviews with the 2nd Armor Division DISCOM Commander and the 1st Cavalry Division DISCOM Executive Officer.

(3) Respondents. Stratified by respondent group, we received four (4) responses from DISCOM commanders; 18 from CASCOM; three (3) from finance functional experts; 16 from medical functional experts; and 16 from CLOAC students. The sample population's demographic breakout by rank/grade was as follows:

Senior logistics community leaders (SES, Colonel, and GS 15)	20 percent.
LTC, MAJ	33 percent
CPT	39 percent
Other (CW3, GS11, SGM, SFC)	8 percent

(4) Analysis. Figure G-5 provides a consolidated look at the CSS community's survey responses to the eight issues. When looking at the three different division designs (AOE, HL-SB, and Brigade Based), there were no perceived differences among the alternatives for issues 2, 3, 5, 6, and 7. Issues 1, 4, and 7 showed perceived differences among the alternative designs. This was based on a Wilcoxon signed-rank test for comparison on medians of the three alternatives. The answers to each survey carry the same weight, regardless of the seniority of the respondent.

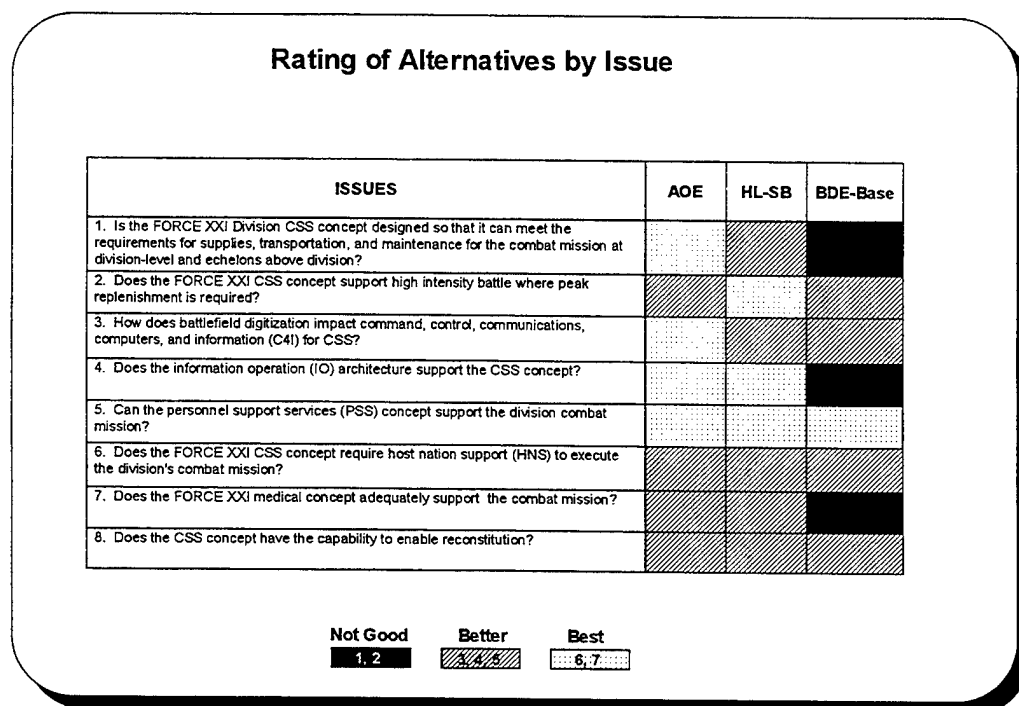


FIGURE G-5. Rating of the Alternatives by Issue

(5) Insights.

(a) Issue 1 focused on if the CSS design capability was perceived to meet or exceed anticipated Force XXI Division requirements. The requirements of the various division structures were estimated using OPLOGPLN, and previous analyses of similar divisions. The SMEs were familiar with the types and amounts of equipment represented by the various force structures and they had an idea of the types of scenarios and situations in which this type of force would be placed.

Insights: The majority of the SMEs indicated that the AOE design is adequate to support the combat missions. However, the SMEs were concerned about CSS units' ability to redirect assets to a new location. The HL-SB and the Brigade Based designs, due to their modularity and CSS concept of support, appear to provide the combat forces the greatest amount of flexibility. The SMEs also indicated that there is still a need to continue with design refinement for both alternatives. The SMEs also believe that both the DISCOM and the Division G4 section were necessary for the CSS operations to support all alternatives.

(b) Issue 2 focused on the CSS designs' capability to support high intensity battle with peak replenishment requirements. The requirements will change depending on METT-T. The SMEs were familiar with the types and amounts of equipment represented by the various force structures and were given scenario-based mission requirements.

Insights: The analysis of the AOE design indicated some shortages in transportation and POL assets. The modular and robust HL-SB and Brigade Based designs, in support of a smaller force, better supported peak requirements. The majority of SMEs responding to this issue indicated that with the enhancements in information operation, planning will be continuous and the CSS elements should be able to support peak requirements.

(c) Issue 3 examined the impact of battlefield digitization on C4I for CSS. The assessment attempted to determine if there was simply too much direct information to process at various organizations and levels within those organizations. The analysis included a determination of whether or not that information needs to be filtered by someone in the chain of command, or if it needs to be summarized for efficiency.

Insights: The majority of the respondents indicated that the Brigade Based design, which had limited command and control for CSS at the Brigade level, had a strong need for battlefield digitization. However, across all alternatives, digitization was a critical link for C4I of CSS units. Battlefield digitization allows the CSS units the flexibility to employ predictive logistics and greater situational awareness.

(d) Issue 4 was used to determine if the SMEs perceived that the IO architecture could support the CSS concept in each design.

Insights: Most respondents highlighted a concern for reducing the numbers of different IO systems in the AOE alternative. Restructuring systems compatibility, to provide greater connectivity, was felt to have a potential positive effect on the CSS concept for the HL-SB and Brigade Based designs. The SMEs also felt that the commanders would not have access to the timely and accurate information needed to provide total asset visibility and intransit visibility without the projected CSS information technology capabilities. The general indication is that the IO Architecture will support each alternative design.

(e) Issue 5 addressed the emerging PSS Concept. The analysis compared lessons learned from MSF 94 and MSF 95 to changes and emerging results from the DDA survey. The analyses is focused on whether or not the PSS concept supports the division combat mission.

Insights: Overall, the majority of respondents indicated that digitization of the personnel manning roster speeds up distribution of replacements and that the modularized PSS structure is a plus for the division. The PSS organizations were located in the right place to adequately support all the division alternatives. However, a small number of respondents indicated that the AOE design was unable to meet all the detailed requirements for providing personnel reports.

(f) Issue 6 focused on whether or not the Force XXI CSS concept requires HNS to execute the division combat mission.

Insights: The HNS often becomes a vital link for the CSS community, especially for perishable resources. The analysis found that the majority of respondents concluded that the AOE and HL-SB designs can accomplish the mission without HNS for a period of less than 10 days, but it may become difficult after 10 days. Looking at the Brigade Based design, the trend indicated that the force could survive for a period in excess of 10 days, but not more than 20 days. The HNS is an important variable used by division planners to minimize the logistic requirements for perishable and scarce resources. The respondents felt that HNS required by the division is more a function of theater of deployment, rather than dictated by any CSS design.

(g) Issue 7 focused on whether or not the Force XXI medical concept could adequately support the combat mission. The analysis determined if the medical organization, with advances in technology, is capable of evacuating, tracking, and managing casualties. Additional assessments determined if the medical ground and air transport would enhance the division medical evacuation capabilities.

Insights: The responses showed a trend that some adjustments will be needed in all alternatives, but given the system initiatives those adjustments may be marginal. Medical Support will be enhanced with the addition of a few critical system initiatives and battlefield digitization. Enhancements, such as adding the UH-60Q to the division, will reduce the time a casualty spends waiting for, and being transported to, a field medical service hospital. Adding the Enhanced Armored Ambulance will also decrease the time a casualty waits to receive medical support.

(h) Issue 8 focused on whether or not the Force XXI CSS Concept has the capability to enable reconstitution. Given a mission to reconstitute the force (to prepare for a follow-on mission or after being engaged in combat), what support could the Divisional CSS units provide?

Insights: The respondents concluded that it would be difficult for the AOE design to perform reconstitution within 48 hours. The HL-SB design, with some modifications, could be reconstituted within 48 hours using the proposed force structure. The Brigade Based design, with limited recovery assets and limited equipment levels, would have problems performing a reconstitution mission. Each division design would require support from corps. For all alternatives, the lack of replacement personnel, Class V, and Class VII will restrict reconstitution within 48 hours.

b. Division Requirements vs. Resupply Capabilities. The requirements versus capabilities comparison focused on supply classes III and V, fuel and ammunition. Logistics planning factor data in the OPLOGPLN model were used to estimate the average daily requirements for peak operations in a high intensity offensive operation (figure G-6), and the average daily requirements for a moderate intensity defensive operation (figure G-7). These requirements were estimated within the context of three scenarios: NEA, SWA, and Europe. SMEs estimated the division's fuel and ammunition resupply capability based on the quantities and capacities of assets in the Tables of Organization (TOE) for the 2nd Infantry Division (ID) and the 24th ID. A comparison between the division's estimated requirements for each of the scenarios and its estimated CSS transportation capabilities follows.

(1) Requirements. Planning factors served as the basis for fuel and ammunition requirements estimates. First, a generic AOE Division and its Corps slice were created from standard requirements codes (SRCs) and their associated line item numbers (LINs). Second, appropriate adjustments were made, reflecting the differences in equipment quantities for each proposed alternative. Finally, these modified units were grouped into Task Organizations for the scenario operations orders. Using the Task Organization, logistical planning factor data for the given theater, and intensity posture inputs, the OPLOGPLN system produced consumption estimates for fuel and ammunition.

(2) Resupply Capabilities. Projected fuel and ammunition resupply capabilities were calculated using force structure, doctrine, and asset capacity data.

(a) The number of transportation assets available for division resupply was extracted from current AOE TOEs and MSF documentation. Fuel and ammunition resupply capabilities were determined by division level force structures. The AOE Division capacities were based on one heavy division Main Support Battalion (MSB), two heavy division Forward Support Battalions (FSB) and one light division FSB. In addition to division level support, one corps PLS Medium Truck Company (48 trucks and 48 trailers) would deliver all ammunition from the corps Ammunition Supply Point (ASP) to the division Ammunition Transfer Point (ATP). Two force structure inputs provided the basis for estimating HL-SB and Brigade Based Divisions fuel and ammunition resupply capabilities. This input included current AOE force structures and capabilities represented by MSF 95.

(b) The 5-ton trucks located within CSS units were not included in the calculations, since their primary use is for miscellaneous missions (e.g., people and administrative supplies transport). However, these trucks would be available for surge requirements. The 2500-gallon fuel tanker and the Palletized Load System (PLS) served as the basis for capacity estimates. A PLS truck and trailer hauls 24 tons of ammunition per trip (specifically, 12 tons on the truck and 12 tons on the trailer). Based on the 1995 Total Vehicle Availability Study (TVARS), truck availability will be 91% for Palletized Load System (PLS) and 75% for others.

(c) Maneuver units were assumed to pick up their ammunition from the ATP and have sufficient assets for that requirement.

(d) Doctrine assumes that all trucks will make two trips per day. However, the extended and distributed nature of future operations may not permit that assumption to remain feasible. Therefore, this analysis bases capacity on a single lift, or trip, instead of two trips.

(3) Insights. Figures G-6 and G-7 provide graphic comparisons of the Division's estimated Class III and Class V requirements, and their capacities to meet those requirements. Each alternative division design requires additional EAD support to meet the estimated peak daily requirements for Class III and Class V in all three theaters examined. However, when looking at the average daily requirements in the defensive operation, all alternatives have surplus capacity in all theaters.

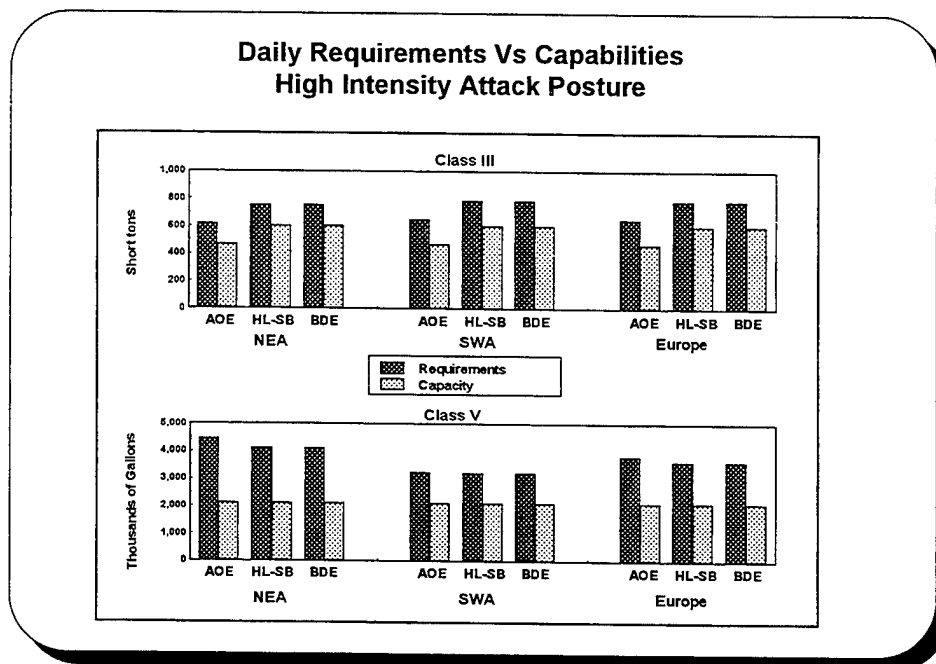


FIGURE G-6. High Intensity Attack Posture

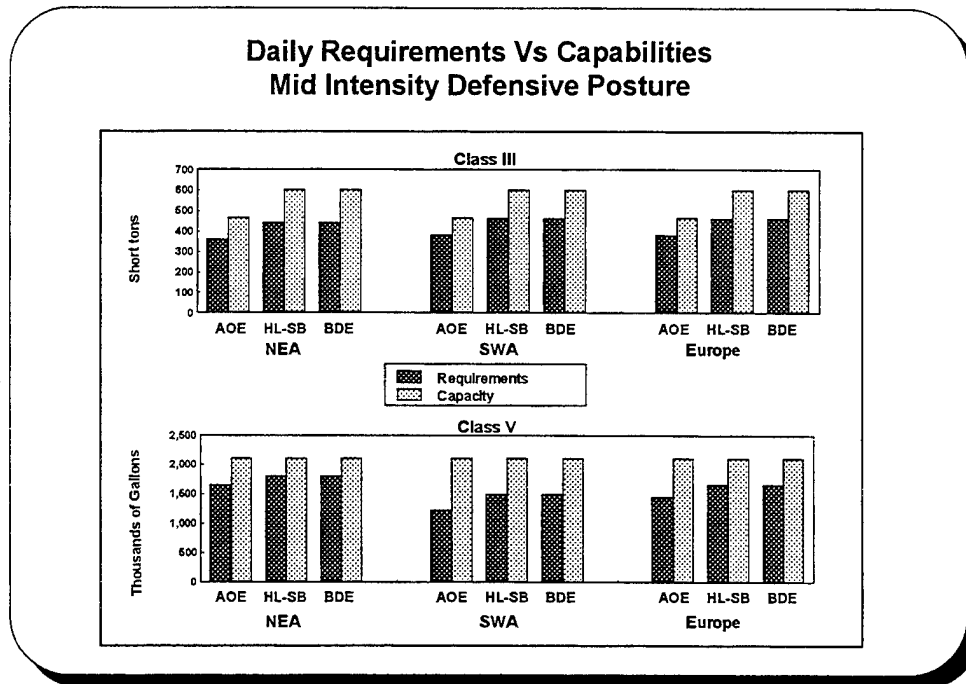


FIGURE G-7. Mid Intensity Defensive Posture

(a) High Intensity Attack Posture. Figure G-6 shows the division's estimated Class III and Class V requirements for a high intensity attack posture and its capability to move those supplies. The darker bars represent the requirements and the lighter ones indicate the CSS capacity to distribute the respective Class of Supply. This graph indicates that CSS support does not have the capacity to meet peak requirements, as represented by the high intensity attack posture. This is to be expected since both current and proposed resupply capabilities are based on expected averages, not peak requirements. The key insight is the need for CSS modularity at all echelons. Modularity provides the flexibility necessary to assign assets, **to surge capability** when and where they are most needed on the battlefield. These computations will be reevaluated in greater detail in future Force XXI analyses, as the CSS concept is finalized and the CSS design structures are further refined.

(b) Mid Intensity Defensive Posture. Figure G-7 shows the division's estimated Class III and Class V requirements for a mid intensity defensive posture and its capability to move those supplies. Again, the darker bars represent the requirements and the lighter ones indicate the CSS unit's capability to distribute the respective Class of Supply. Current and proposed CSS concepts and force structure are adequate to meet average daily requirements for Class III and Class V distribution. However, these comparisons do not take into consideration the doctrinal differences between employing an AOE division and employing a Force XXI division (i.e., differences in employment of primary weapons systems, and, subsequently, supply consumption). Again, these computations will be reevaluated in greater detail in future Force XXI analyses, as the CSS concept is finalized and the CSS design structures are refined.

c. General Officers (GO) observations. The SMR GO provided additional insights. These observations indicate that the GOs clearly see the need for change.

GENERAL OFFICERS OBSERVATIONS (FROM THE 21 OCT 95 SMR)	
POINTS	DIRECTION
✓ MOVE BEYOND AOE BASIC DESIGN	✓ RE-EXAMINE THE DIVISION BASE
✓ NONE OF THE ALTERNATIVES ARE ACCEPTABLE W/O MODIFICATIONS	✓ REDEFINE THE CONTROLS FOR COMBAT MULTIPLIERS AT BRIGADE AND DIVISION
✓ THE ARMY IS CHANGING	
CSS PERSPECTIVE	RECOMMENDATION
HL-SB DESIGN EMERGING AS PREFERRED DESIGN	RETAIN "HL-SB" AND "BRIGADE BASE," BUT CONTINUE TO ANALYZE BOTH AND THEN TAKE THE BEST OF BOTH DESIGNS.

FIGURE G-8. General Officer Observations

(1) The GO participants in the SMR indicated that it is time to move beyond the AOE Division design, because AOE redundancies make retention of this design unaffordable. The GOs stated that both the HL-SB and Brigade Based alternatives offer important characteristics, but neither alternative would be acceptable without modification. The HL-SB design offers a desirable command and control capability in the division base, while the Brigade Based design gives the best tailorability. Therefore, the panel concluded that the new division design should integrate the best qualities of the HL-SB and the Brigade Based alternatives.

(2) From the CSS perspective, the GO participants had three observations. First, it was noted that any of the designs can be supported logistically; however, a dedicated division staff member is required for both management of current logistics operations and planning for future operations support. Second, it is possible to have an austere divisional CSS structure, given a robust EAD CSS structure. Finally, the division must have the appropriate data and necessary communications systems to make and disseminate logistics plans.

G-10. Findings.

a. Estimates for Class III and V requirements for a high intensity attack posture exceed the capacities for all design alternatives, in all theaters examined. This indicates a potential shortfall in CSS surge capacity, unless situational conditions permit multiple daily delivery cycles by transportation assets.

b. Estimates for Class III and V requirements for a mid intensity defensive posture do not exceed the capacities for any design alternative in any theater examined.

c. The SME survey responses provided the following insights:

(1) From a functionality perspective, the AOE CSS configuration was perceived as the most capable of supporting its division. However, this may be an indication of their familiarity and confidence in AOE design, and its accompanying redundancy.

(2) The Brigade Based alternative appears to be the least effective CSS design. They highlighted weaknesses of general supportability, information operations, and medical supportability within a Brigade Based design.

(3) The ability to reconstitute and function without HNS was a concern for all alternatives, while PSS was perceived to be adequate across the alternatives.

d. The general officer (GO) observations, from the DDA Senior Military Review (SMR), preferred the HL-SB Division design, with modifications. They concluded that the AOE division base is unaffordable; therefore, it must be redesigned. The new division design should integrate the best qualities of the HL-SB and the Brigade Based alternatives.

APPENDIX H

FORCE XXI DIVISION DESIGN ANALYSIS: PHASE I

VALIDATION ANALYSIS

Classified -- Available Under Separate Cover

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX I
ACKNOWLEDGEMENTS

This page intentially left blank

ACKNOWLEDGEMENTS

TRAC-Study and Analysis Center could not have completed the Force XXI Division Design Analysis - Phase I without support from key analytic agencies, to include: TRAC-Operations Analysis Center and TRAC-Scenarios and Wargaming Center, Fort Leavenworth, KS; TRAC-White Sands Missile Range, NM; TRAC-Fort Lee, VA; MTMC Transportation Engineering Agency, Newport News, VA.

Key personnel that were contributing authors to this document are:

Force XXI DDA-Phase I Main Report:

LTC George C. Prueitt
MAJ Edward J. Free
MAJ Dwayne T. Hill
MAJ Sherrie George
CPT(P) Tom Cioppa
CPT Brendan Sheehan
Ms Carol Mullen
Mr Steve Schorr
Mr Warner Jackson, Vector Research Inc.

Force XXI Brigade Design Analysis:

Mr Bryson McCool
MAJ Geoff Coleman
CPT Kevin Wainer
CPT Michael Wallace

Force XXI DDA-Phase I Deployability Analysis:

Mr C. Wayne Crews

Force XXI DDA-Phase I CSS Analysis:

MAJ Robert E. Daniels
Ms Toni McGrady

The many significant contributions by these agencies and individuals is greatly appreciated.

This page intentially left blank

APPENDIX J
DISTRIBUTION LIST

This page intentionally left blank

APPENDIX J **DISTRIBUTION LIST**

	<u>No. Copies</u>
Defense Technical Information Center DTIC-TCA Cameron Station Alexandria, VA 22314	1
US Army Library Army Study Documentation and Information Retrieval System (ASDIRS) ANRAL-RS ATTN: ASDIRS Room 1A518, The Pentagon Washington, DC 20310	1
US Army Combined Arms Research Library (CARL) ATTN ATZL-SWS-L Fort Leavenworth, KS 66027-5000	1
HQDA Office of the Vice Chief of Staff ATTN: DACS-ZB 400 Army, Pentagon Washington D.C. 20310	1
HQDA Deputy Under Secretary of the Army (Operations Research) ATTN: SAUS-OR 102 Army, Pentagon Washington, D.C. 20310	1
HQDA Office of the Deputy Chief of Staff for Operations and Plans ATTN: DAMO-ZD 400 Army, Pentagon Washington D.C. 20310	1
HQDA Office of the Deputy Chief of Staff for Operations and Plans ATTN: DAMO-FD 400 Army, Pentagon Washington D.C. 20310	1

HQDA Office of the Deputy Chief of Staff for Operations and Plans ATTN: DAMO-SSW 400 Army, Pentagon Washington D.C. 20310	1
HQDA Office of the Deputy Chief of Staff for Logistics ATTN: DALO-PLZ-A 400 Army, Pentagon Washington D.C. 20310	1
U.S. Army Training and Doctrine Command Deputy Chief of Staff for Combat Developments ATTN: (MG Cravens) Fort Monroe, VA 23651-5000	1
U.S. Army Training and Doctrine Command Director, Joint Venture ATTN: (BG(P) Kellogg) Fort Monroe, VA 23651-5000	1
U.S. Army Training and Doctrine Command Office of the Deputy Chief of Staff for Simulations and Analysis ATTN: (COL Akins) Fort Monroe, VA 23651-5000	1
Director, TRADOC Force Design Directorate ATTN: ATCD-F Ft. Leavenworth, KS 66027	1
U.S. Army Training and Doctrine Command BLITCD ATTN: ATCD-B Fort Monroe, VA 23651-5000	1
Commander, USACASCOM ATTN: ATCL-C 3901 A Avenue, Suite 230 Ft. Lee, VA 23801-1809	1
Commander, USAIC&FH ATTN: Director of Combat Developments Ft. Huachuca, AZ 85613	1

Commander, USAAVNC ATTN: ATZQ-CD Bldg 515 Ft. Rucker, AL 36362	1
Commander, USAAVN Director, DOTDS ATTN: ATZQ-TDS Fort Rucker, AL 36362	1
Commander, USASC&FG ATTN: Director of Combat Developments Ft. Gordon, GA 30905	1
Commandant, USA MP School ATTN: ATZN-MP Ft. McClellan, AL 36205	1
Commandant, USAES ATTN: ATSE-CD Ft. Leonard Wood, MO 65473	1
Commandant, USACMLS ATTN: ATZN-CMC-C Ft. McClellan, AL 36205-5020	1
Commandant, USAIS ATTN: Combined Arms and Tactics Directorate, Force XXI Office Ft. Benning, GA 31905	1
Commandant, USAFAS ATTN: ATSF-CBL Ft. Sill, OK 73503-5600	1
Commandant, USAARMS ATTN: Director of Combat Developments Ft. Knox, KY 40121	1
Commandant, USAADASCH ATTN: ATSA-CDF Ft. Bliss, TX 79916-0002	1
Commandant, USATRANS School ATTN: Director of Combat Developments Ft. Eustis, VA 23604	1

Commandant, USAORD School ATTN: Director of Combat Developments Aberdeen Proving Ground, MD 21005	1
Commander, USACASCOM ATTN: Combat Service Support Battle Lab Fort Lee, VA 23801-6000	1
Director, DB BL USAIS Ft. Benning, GA 31095-5400	1
Director, MB BL USAARMC ATTN: ATZK-MW Ft. Knox, KY 40121-5000	1
Director, EELS BL HQ TRADOC ATTN: ATCD-L Ft. Monroe, VA 23651-5000	1
Chief, TRADOC Threats Support Division ATTN: ATZL-CST Ft. Leavenworth, KS 66027	1
Commander, U.S. Army Test and Evaluation Command ATTN: AMSTE-TD Aberdeen Proving Ground, MD 21005	1
MTMC-TEA ATTN: Mr. Davis 720 Thimble Shoals Blvd, Suite 130 Newport News, VA 23606	1
Commander, U.S. Army Operational Test and Evaluation Command ATTN: CSTE-ECC-ACE Park Center IV 4501 Ford Ave Alexandria, VA 22302	1
Director, U.S. Army Concepts Analysis Agency ATTN: CSCA 8120 Woodmont Ave Bethesda, MD 20814	1

Rand Corporation 1
ATTN: LTC Pat Vye
1700 Main St.
Santa Monica, CA 90407

Dir, National Simulation Center 1
ATZL-NSC
Fort Leavenworth, KS 66027

Director, USATRAC:

Director, TRAC-FLVN, ATTN: ATRC-F, Ft Leavenworth, KS 66027 1
Director, TRAC-WSMR, ATTN: ATRC-W, WSMR, NM 88002-5502 1
Director, TRAC-TOD, Ft Leavenworth, KS 66027 1
Director, TRAC-SWC, Ft Leavenworth, KS 66027 1
Director, TRAC-Lee, Fort Lee, VA 23801-6140 1
Director, TRAC-Monterey, Monterey, CA 93943 1
Director, TRAC-SAC, Ft Leavenworth, KS 66027 3

This page intentionally left blank