AD-A118 917   ARMY WAR COLL CARLISLE BARRACKS PA   F/G 15/3
A CONCEPTUAL DESIGN FOR MODELING THE AIR WAR IN CENTRAL EUROPE.(U)
JUN 82   D L COLE

UNCLASSIFIED   NL

1 of 1

END
DATE
FILMED
10 82
DTIC

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

JUNE 1982

A CONCEPTUAL DESIGN FOR MODELING THE AIR WAR IN CENTRAL EUROPE

by

LIEUTENANT COLONEL DENNIS L. COLE, USAF

[illegible]

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A118917	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Conceptual Design for Modeling the Air War in Central Europe		5. TYPE OF REPORT & PERIOD COVERED Study Project
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Dennis L. Cole Lieutenant Colonel USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army War College Carlisle Barracks, PA 17013		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Same		12. REPORT DATE 3 June 1982
		13. NUMBER OF PAGES 85
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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

The purpose of this study is to enhance the effectiveness of the McClintic Theater Model (MTM) as a teaching tool at the operational art level, based on Air Force management of air combat power in a Central European conflict. US/NATO Tactical Air Doctrine, Command and Control relationships, and air assets are examined and analyzed, followed by a similar treatment of their Soviet Union/Warsaw Pact counterparts. Factors which affect air operations are related to overall air combat MTM - compatible model of a Central European Air War is developed, emphasizing operational art level decision-making and --

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Item 20. (Continued)

interaction of opposing blue and red strategies. The resulting conceptual design is intended to serve as a baseline for further development work, providing a consistent source of relationships and factors which can be integrated into an MTM NATO War Game, thereby providing future top-level Army leaders with a clear picture of how the Air Force manages its combat power in the Air-Land Battle.

US ARMY WAR COLLEGE

MILITARY STUDIES PROGRAM PAPER

A CONCEPTUAL DESIGN FOR MODELING THE AIR WAR IN CENTRAL EUROPE

BY

LIEUTENANT COLONEL DENNIS L. COLE, USAF

COLONEL WALLACE P. FRANZ, INF
STUDY ADVISOR

3 JUNE 1982

ABSTRACT

AUTHOR: Dennis L. Cole, LTC, USAF

TITLE: A Conceptual Design for Modeling the Air War in Central Europe

FORMAT: Individual Study Project

DATE: 3 June 1982 PAGES: 85 CLASSIFICATION: Unclassified

The purpose of this study is to enhance the effectiveness of the McClintic Theater Model (MTM) as a teaching tool at the operational art level, based on Air Force management of air combat power in a Central European conflict. US/NATO Tactical Air Doctrine, Command and Control relationships, and air assets are examined and analyzed, followed by a similar treatment of their Soviet Union/Warsaw Pact counterparts. Factors which affect air operations are related to overall air combat power and strategy decisions. With the foregoing as a baseline, an MTM - compatible model of a Central European Air War is developed, emphasizing operational art level decision-making and interaction of opposing blue and red strategies. The resulting conceptual design is intended to serve as a baseline for further development work, providing a consistent source of relationships and factors which can be integrated into an MTM NATO War Game, thereby providing future top-level Army leaders with a clear picture of how the Air Force manages its combat power in the Air-Land Battle.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER I

BACKGROUND

This military study grew out of the author's experiences acting as a student controller for the US Army War College NATO War Game (Academic Year 1982) based on the McClintic Theater Model (MTM). During training and game play, it became apparent that the MTM had several shortcomings with regard to the conduct of Air Operations in a Central European NATO-Warsaw Pact conflict scenario, and fell short of its potential in terms of teaching future top-level Army leaders how the Air War in Central Europe would be conducted and controlled from both sides, based on opposing doctrines, organizations, and air assets. Such a shortcoming could leave future Division, Corps, and Army Group commanders with a distorted view of how air assets are integrated into the Air-Land battle, and thus lead to less than optimum combat effectiveness during time of conflict.

The bottom line is that modern battles are fought and won by Air and Land forces operating together and nearly every combat function requires both interaction and cooperation between air and land forces in order to succeed.[1] Toward this end, this study will develop a conceptual Air War model for integration into the MTM which will reflect current Air Doctrines, strategies, and employment modes so that future USAWC War Game players can gain deeper insight into the capabilities and limitations of Air Power in the European Central Region, and thus enhance their store of knowledge for future use as high-level decisionmakers.

ASSUMPTIONS

Since this will be a highly specialized study with a single objective target, it is assumed that the reader will have a working knowledge of basic theory and operation of the McClintic Theater Model, will be familiar with basic organizational relationships of the NATO Central Region, will have participated in the USAWC NATO War Game, and will be able to design a detailed computer air war model compatible with the MTM which incorporates the concepts developed herein. It is also assumed that for the NATO War Game, the main focus will continue to be on decisionmaking at the Operational Art level, where leaders cannot become embroiled in minutiae, but must continuously look at the "big picture" in terms of overall campaigns and their results.

ORGANIZATION OF THE STUDY

The study will begin with an overview of both NATO and Warsaw Pact (WP) Air Doctrines, organizational relationships, and air assets, to provide a conceptional basis for later game design. Next, a series of factors which affect Air Operations will be explored, to provide a feel for just how important both internal and external events and situations can be in the outcome of an air war. With these two areas firmly established, it will then be possible to proceed directly to the air war game concept itself, providing the building blocks and their interrelationships which are necessary for follow-on developmental work.

Finally, play of the game will be addressed, to provide guidelines for player assignments, man/machine interface, and the types of input/output formats required to insure effective, efficient game play which will provide a positive learning experience. As in any war game model, the rules governing play and final results are not necessarily true reflections of real-world outcomes for similar situations, and should not be thought of as predictive tools. However, war gaming experiences can provide positive learning as long as simplifications and limitati are acknowledged and results are kept in the proper context. Everyth contained in this study will be based on unclassified material, so th the resulting model will not be unnecessarily constrained in use or application. Additionally, this study will be limited in scope to insure a manageable air game can be developed. To this end, Soviet Long Range Aviation assets as well as US Strategic Projection Force assets will be excluded from the purview of the study. All Airlift assets will be considered to be a direct service for ground commanders and not require Air decisions or control. Finally, helicopter assets will be considered as part of the inherent combat power of their parent ground units, and will not be played from an Air point of view.

CHAPTER I

ENDNOTES

1. US Department of the Army. Field Manual 100-5, p. 8-1 (Herein after referred to as "FM 100-5").

CHAPTER II

US/NATO TACTICAL AIR DOCTRINE, COMMAND AND CONTROL, AND ASSETS

"The mission of the United States Air Force is to fly and fight . . . and don't you forget it."[1] Such an admonition could be applied equally well to any Air Force of any nation on earth. How it fights and how it organizes to control its assets are two key considerations which contribute to overall success in the execution of the Air-Land Battle. This chapter will outline US/NATO Tactical Air Doctrine, delineate key organizations where decisions are formulated at the Operational Art level, and provide a consolidated listing of the types and quantities of assets available to Air Commanders for utilization during periods of conflict.

DOCTRINE

NATO operates on the basic premise that "available air resources must be employed under command arrangements that preclude undue dissipation and fragmentation of effort and permit their integrated, responsive, and decisive application to tasks in the overall air effort that best achieves designated objectives."[2] Stated another way, this reflects the concept of centralized control and decentralized execution of air operations, where a single air commander provides the direction to employ the forces, and lower echelons conduct the operations.[3]

Operating within this framework, NATO has developed an organizational structure and procedures designed to provide the most effective use of air assets possible, based on the Air Commander's strategy and assets to be used. Before proceeding into command and control arrangements and their supporting organization, it is necessary to define the spectrum of Air Operations which will fall under such a network and how each type of operation supports the overall Air-Land Battle effort.

COUNTER-AIR OPERATIONS

> In spite of the fact that air power alone can never be decisive in total war, the air battle must be won if the war is to be won.[4]

In a nutshell, Counter-Air Operations are directed against an enemy's air offensive and defensive capability in order to attain and maintain a desired degree of air superiority.[5] This is a critical area because of the adverse impact enemy air assets may have on the outcome of the land battle. Since the results of Counter-Air Operations can influence all other aspects of the Air-Land Battle, anytime an enemy air threat is substantial, Counter-Air Operations will probably demand the highest priority.[6] Counter-Air Operations are broken into two basic classifications: Offensive Counter-Air (OCA) and Defensive Counter Air (DCA), where OCA is designed to destroy, disrupt, or limit enemy air power as close to the source as possible, and DCA is designed to nullify or reduce the effectiveness of enemy air attacks.[7]

For purposes of this study, and to keep the resulting air game at a manageable level, OCA can be considered to utilize two primary modes: Air to Surface Strikes (STR) and Combat Air Patrol (CAP). STR missions are targeted against assets and facilities that would most degrade enemy air capability if destroyed, e.g., airfields and supporting facilities, aircraft on the ground, and command and control facilities.[8] CAP missions are designed to provide temporary air superiority over a general area to protect friendly air or ground forces from enemy air attack with the primary purpose of destroying enemy aircraft before they can pose a threat to friendly forces.[9] Other OCA missions which would unnecessarily complicate the game include Defense Suppression, Fighter Sweeps, and Air Escort.[10] Utilization of these specialized ancillary missions is more a tactical decision than an operational art decision and can be accounted for in game design.

Air Defense measures are broken into two categories: (1) Active, which includes fighter aircraft, surface to air missiles, and air defense artillery, and (2) Passive, which includes such measures as dispersal, deception, hardening of facilities, camouflage, concealment, and the like.[11] Again, for game design purposes, this discussion will be limited. Active DCA missions will be based on fighter aircraft, with surface defenses accounted for in game design, and passive effectiveness will be based on dispersal decisions made to reduce aircraft vulnerability to massed enemy air attacks. In a graphic sense, the array of Counter Air Operations which will be modeled and are most affected by decisions at the operational art level are shown in Figure II-1.

COUNTER-AIR OPERATIONS

OFFENSIVE COUNTER AIR (OCA)		AIR DEFENSE	
STRIKE	COMBAT AIR PATROL	DEFENSIVE COUNTER AIR	DISPERSAL
(STR)	(CAP)	(DCA)	(DIS)

FIGURE II-1

OFFENSIVE AIR SUPPORT

Offensive Air Support (OAS) is broken into three primary mission activities: Tactical Air Reconnaissance (REC), Battlefield Air Interdiction (BAI), and Close Air Support (CAS), and is conducted in direct support of land operations.[12] Even though REC assets are grouped in this category, their unique mission effectively sets them slightly apart from the overall Air-Land Battle in terms of utilization and employment. REC assets are used primarily to gain information for subsequent decisions and thus, while indirectly affecting the eventual outcome, they do not in themselves add firepower directly to the overall battle equation. This is not to discount the importance of reconnaissance, but rather to point out that its contribution is felt in the types of decisions made by field commanders. Indeed, appropriate reconnaissance can determine the outcome of the battle if it is effective and properly utilized.[13]

Battlefield Air Interdiction is air action against hostile land units which are in a position to directly affect friendly forces. BAI is designed to delay, destroy, or neutralize enemy forces which are in the battlefield but not yet engaged by friendly forces.[14] Obviously, the targeting of BAI missions is a direct function of the ground commander's assessment of the battle situation and the effectiveness of intelligence/reconnaissance information. BAI is designed to produce a short-term payoff of denying enemy accumulation of combat power at critical points which may then be exploited by the friendly ground commander. Most BAI targets/missions are selected so that effects on enemy forces at the front will be seen in the one to three day time frame.

Close Air Support is air action against hostile targets which are in close proximity to friendly forces and require detailed integration of air strikes with the fire and movement of friendly forces.[15] For all practical purposes, CAS is used to increase the firepower of friendly forces engaged in battle with enemy forces, and its use has an immediate, direct effect on any specific land battle between opposing forces. The requirement for detailed integration of firepower and the close proximity of active enemy forces to friendly forces makes CAS an extremely difficult mission, requiring high precision in its execution.

Thus, Offensive Air Support encompasses th. range of operations shown below:

OFFENSIVE AIR SUPPORT
(OAS)

RECONNAISSANCE (REC)	BATTLEFIELD AIR INTERDICTION (BAI)	CLOSE AIR SUPPORT (CAS)

FIGURE II-2

INTERDICTION

The basic purpose of Air Interdiction Operations (AIO) is to destroy, neutralize, or delay the enemy's military potential (underline mine) before it can be brought to bear effectively against friendly targets or forces.[16] Of necessity, such a campaign would encompass a vast array of targets, including transportation systems, communications facilities, and supply sources.[17] AIO are designed to reduce enemy personnel and materiel to levels which limit his overall effectiveness in terms of continued full scale military action. In this context, the effects of AIO are not felt immediately on the battlefield; indeed, results of an effective AIO campaign are not likely to be noticed for weeks or months. For this reason, interdiction can be considered as a rather low priority mission when faced with critical battlefield situations. In fact, until the battlefield situation is at a point where the ground commander feels somewhat sure of himself, interdiction will probably not be a part of the overall Air-Land Battle. Resources which would be committed to a lengthy, costly interdiction operation with delayed feedback of a rather tenuous nature could be used in a much more effective manner for other missions which have more immediate impact.

CHEMICAL AND NUCLEAR OPERATIONS

From an air viewpoint, chemical and nuclear weapons are delivered on targets in much the same manner as conventional munitions. Obviously, the destructive power and political ramifications of their employment will greatly alter the course of any conflict.

US policy with regard to chemical warfare is to renounce its first use, but at the same time to maintain a program which will deter the use of chemical agents by other nations, and if deterrence fails, to have a credible retaliatory capability.[18] Thus, our stockpile in the NATO theater would be used to retaliate against a Warsaw Pact first use, according to decisions reached at the National Command Authority level, with the intent of discouraging further use of chemicals by the enemy. Air missions which could use chemical munitions in retaliations include Chemical Strike (CSTR), Chemical Battlefield Air Interdiction (CBAI), Chemical Air Interdiction Operations (CAIO), and in rare cases, Chemical Close Air Support (CCAS). Due to our limited stockpiling, great care must be used in targeting to achieve the most effective results from scarce resources. Commitment to chemical operations will of necessity divert resources being used for conventional missions.

Nuclear operations are initiated exclusively by the National Command Authority, and in NATO, must be agreed to in consultation with all NATO political authorities.[19] For air purposes, two concepts are important to planning and operations: (1) A certain percentage of NATO air resources are always on nuclear alert, and this percentage is directly controlled by the Supreme Allied Commander, Europe (SACEUR),[20] and (2) the inherent destructive power of nuclear weapons restricts their effective use to Strike (NSTR), Interdiction (NAIO), and Battlefield Air Interdiction (NBAI) missions only.

OTHER AIR OPERATIONS

There is a wide spectrum of other air operations which are beyond the scope of this paper. To introduce them into a game aimed at the operational art level would unnecessarily confuse and complicate the issue. By proper game design, their effects can be accounted for in a manner that remains invisible to the game player and requires no conscious effort on his part. Anyone interested in exploring these other missions is referred to Tactical Air Command Manual 2-1, and NATO Manual ATP-33(A) for in-depth explanations of their purposes and integration into the Air-Land Battle.

COMMAND AND CONTROL

At the highest levels, the command and control arrangements for Air Forces in NATO's Central Region are relatively simple. As shown in Figure II-3, the Commander, Allied Air Forces Central Europe (COMAAFCE) reports directly to the Commander in Chief Allied Forces Central Europe (CINCAFCENT), and controls two Allied Tactical Air Forces (ATAFs) to cover the Central Region.

To understand how NATO controls and uses its air.assets to best advantage, it is necessary to define some terms. Allotment is the temporary change of assignment of air assets between subordinate commands.[22] This provides a measure of flexibility to insure air power can be applied where necessary based on threat assessment and battlefield situation. Allotment decisions affect only the employment of air assets and do not necessarily require restationing of aircraft or support functions. Apportionment is the determination and assignment of total expected effort by percentage and/or priority that should be devoted to various air operations for a given period of time.[23] Within the scope of this study, air operations which must be covered in apportionment decisions for conventional munitions delivery are shown in Figure II-4.

NATO COMMAND STRUCTURE

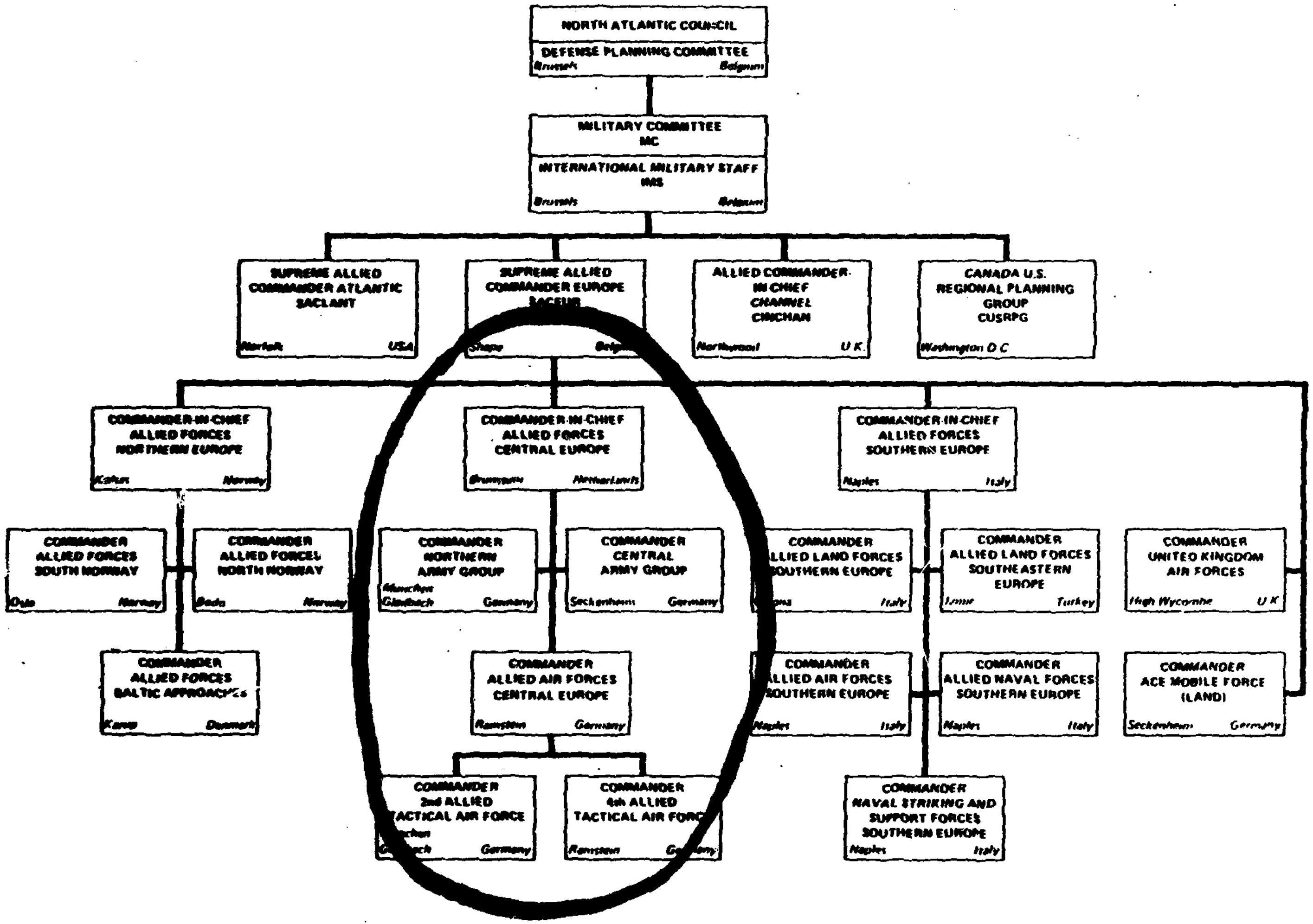

FIGURE II-3

APPORTIONMENT OF AIR OPERATIONS

COUNTER-AIR OPERATIONS . . . . ____%

STR . . . ____%
CAP . . . ____%
DCA . . . ____%

OFFENSIVE AIR SUPPORT . . . . ____%

BAI . . . ____%
CAS . . . ____%

INTERDICTION . . . . ____%

AIO . . . ____%

TOTAL 100%

FIGURE II-4

Nuclear assets on Quick Reaction Alert (QRA) are not included in the apportionment decisions of Figure II-4 due to the SACEUR control imposed on them and due to the unique circumstances which would govern their use. However, most aircraft transition easily from the task of delivering conventional munitions to delivering chemical munitions. Once a decision to retaliate with chemical weapons is made, additional categories would also compete for the apportionment decisions, namely Chemical Strike (CSTR) under Counter-Air Operations, Chemical Close Air Support (CCAS) and Chemical Battlefield Air Interdiction (CBAI) under Offensive Air Support, and Chemical Air Interdiction Operations (CAIO) under Interdiction. Again, due to limited resources, wise decisions are required to optimize results. <u>Allocation</u> is the translation of the apportionment into total numbers of sorties by aircraft type available for each operation.[24] This is where aircraft capabilities are matched to the tasks at hand in an attempt to achieve the best results. Finally, <u>tasking</u> is the process of translating the allocations into orders and passing those orders to appropriate units for execution.[25]

In practice, at the Operational Art level, the air war can be thought of as operating on a 24 cycle, where Allotment, Apportionment, and Allocation decisions are updated based on the previous day's results. Working within the overall Strategic direction provided by SACEUR, COMAAFCE, after consulting with both COM2ATAF and COM4ATAF, will first determine overall Apportionment goals for conduct of operations. If required, he then directs allotment of appropriate resources between ATAFs to achieve desired strength balances. Once this is accomplished, the two ATAF Commanders allocate their resources based on priority of targeting required to meet commitments within their own geographical area of responsibility. Individual air units are then tasked to execute appropriate missions in support of the overall air strategy. On the surface, it appears extremely simple; however, there are thousands of staff and line functions that must work in close harmony to enable leaders at the top levels to plan, execute, evaluate, and redirect air campaigns in order to achieve overall success in the Air-Land Battle.

ASSETS

It is not the intent of this study to provide a detailed "bean count" of air assets available to either side in a potential NATO-Warsaw Pact conflict. Indeed, "judgments based on bean counts about how an actual conflict would turn out can be very unreliable."[26] Rather, an overview of the types and quantities of air assets capable of performing the various air missions previously described will be presented, to provide a basis for developing relative force ratios for war gaming.

There are any number of sources which could be investigated, cross-correlated, and combined in an attempt to determine exactly how many of what air resources are available to NATO Air Commanders to perform combat operations. However, for the purposes of this study, it will be possible to use a previously integrated listing which was developed for the Air War College Theater War Exercise (TWX) Wargame. This listing is a reasonably accurate assessment of tactical air strength for the appropriate regions of Europe under perusal and will serve the purpose of this study admirably. Before proceeding to the air assets listing, some definitions are required: Ground Attack Fighter (GAF) refers to an aircraft primarily designed to deliver munitions against ground targets. Certain types of GAFs are capable of carrying nuclear munitions if required. An Air Superiority Fighter (ASF) is one optimized for Air to Air Combat, with the primary purpose of engaging and destroying enemy aircraft, either with missiles or guns. Both fighters of the types described above are very limited in their ability to switch roles and perform the other's mission, due to weapon system design, aircrew training, and munition limitations. A Dual-Role Fighter (DRF) is one which has been built to perform both roles: Ground Attack and Air Superiority, but at a less than optimum level for each task based on design compromises forced in to accommodate both missions. With some ground preparation, DRFs can be switched from one role to the other as needed - a key element in flexibility of employment of air assets.

Figure II-5 shows NATO Central European Air Assets which could reasonably be expected to be available at the start of hostilities, broken down by ATAF of assignment, type, and mission capabilities. Augmentation schedules would add to these totals in accordance with current reinforcement plans following initiation of hostilities.

It is important to note that not all aircraft can do all things, and even more important, not all aircraft perform equivalent missions equally as well. However, Figure II-5 provides a reasonable overview of resources and mission capabilities available to NATO Air Commanders. Careful perusal of quantities of aircraft available for differing types of missions will indicate that a great deal of flexibility is available in using these air assets, especially where Dual Role Fighters are concerned. Depending on which role these assets are assigned to, it is possible to project widely varying air power force capabilities, based on threat assessment and overall strategic requirements.

NATO AIR ASSETS

	Aircraft Designation	Qty	Type				Conventional Mission Capabilities							Special Mission Chemical				Capabilities Nuclear		
			GAF	ASF	DRF	Other	CAP	DCA	BAI	CAS	STR	AIO	REC	CSTR	CBAI	CAIO	CCAS	NSTR	NBAI	NAIO
2 ATAF	F-4	120			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	F-16	80			X		X	X	X	X	X	X		X	X	X	X			
	F-104	120			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	F-111	75	X						X	X	X	X		X	X	X	X	X	X	X
	Toronado	14	X						X	X	X	X		X	X	X	X			
	Alpha Jet	42	X						X	X										
	Mirage	80			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	F-5	80	X						X	X										
	AV-8	20	X						X	X										
	Jaguar	50	X						X	X	X	X		X	X	X	X			
	Buccaneer	24	X						X	X	X	X		X	X	X	X	X	X	X
	F-15	26		X			X	X												
	RF-4	20				X							X							
	RF-104	20				X							X							
	Jag-R	20				X							X							
	TOTALS	791	305	26	400	60														
4 ATAF	A-10	102	X						X	X					X		X			
	F-4	235			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	F-104	180			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	F-111	100	X						X	X	X	X		X	X	X	X	X	X	X
	Alpha Jet	62	X						X	X										
	G-91	40	X						X	X										
	F-15	75		X			X	X												
	RF-4	76				X							X							
	TOTALS	870	304	75	415	76														

FIG II-5

CHAPTER II

ENDNOTES

1. Anon. Widely used in Air Force units/agencies to emphasize the real mission when parochial interests seem to outweigh bottom-line organizational goals.

2. North Atlantic Treaty Organization. _NATO Tactical Air Doctrine_, _ATP-33(A)_, p. 3-3 (hereinafter referred to as ATP-33(A).

3. United States Air Force. _Air Force Manual 1-1_, p. 5-2 (hereinafter referred to as AFM 1-1).

4. Gen Omar Bradley (1951), quoted in AFM 1-1, p. 5-4.

5. ATP-33(A), p. 4-1.

6. _Ibid_., p. 4-1.

7. _Ibid_., p. 4-3.

8. United States Air Force. _Tactical Air Command Manual 2-1_, p. 4-19 (hereinafter referred to as TACM 2-1).

9. _Ibid_., p. 4-21.

10. _Ibid_., p. 4-17.

11. _Ibid_., p. 4-24.

12. _ATP-33(A)_, p. 4-9.

13. _TACM 2-1_, p. 4-13.

14. _ATP-33(A)_, p. 4-9.

15. _Ibid_., p. 4-9.

16. _Ibid_., p. 4-5.

17. _TACM 2-1_, p. 4-30.

18. _FM 100-5_., p. 11-2.

19. ATP-33(A) p. 8-1.

20. Interview with Colonel Dean Pappas, Director, Combined Air Warfare Center, Air War College, Maxwell AFB, Alabama, 17 Mar 1982.

21. John Collins, US - Soviet Military Balance, p. 293.

22. ATP-33(A)., p. 3-1.

23. Ibid., p. 3-1.

24. Ibid., p. 3-1.

25. Ibid., p. 3-1.

26. US Congress, Congressional Budget Office, Assessing the NATO/ Warsaw Pact Military Balance, P. xvii.

27. Compiled from USAF Air War College Theater War Exercise Guidance Books and supporting computer documentation.

CHAPTER III

SOVIET/WARSAW PACT TACTICAL AIR DOCTRINE, COMMAND AND CONTROL, AND ASSETS

"The role of the Air Force in armed combat is so important that no significant future military operation can occur without the active involvement of aviation."[1] The Soviet Union has based its operational concepts of air power on the realization that it can play a critical, even decisive, role in the outcome of any conflict. However, even though reams have been written about Soviet tactical aircraft, very little hard information concerning current concepts has appeared in public print.[2] As a result, most Western analyses of Soviet Tactical Air Doctrine are based on rather limited source material, supplanted by interpretation of and speculation about demonstrated hardware capabilities. There is no doubt that the Soviet Union and its Warsaw Pact allies are deeply committed to a strong Tactical air arm; however, precise details of their weapon systems' capabilities and how they intend to employ them are extremely difficult to obtain and are classified at the highest levels when they are discovered. In spite of these limitations, there has been enough open-source analysis work done in Western circles to gain a general idea of the basics of Soviet Union/Warsaw Pact (SU/WP) Tactical Air Doctrine. Furthermore, concentration on Soviet doctrine provides a common answer to the entire SU/WP doctrinal spectrum because Eastern Europe's "strategy, tactics, and command decisions derive directly from the Kremlin."[3] With these limitations in mind, this chapter will provide an overview of SU/WP Tactical Air Doctrine, outline the Command and Control structure where Operational Art level decisions are made, and consolidate SU/WP air assets and mission capabilities which are available for use during a European Combat Scenario.

DOCTRINE

> Soviet Frontal Aviation . . . exists essentially as part of a combined-arms air-ground strike force configured for offensive shock action on a grand scale.[4]

The Soviet Union has gone to great lengths in recent years to transform its Frontal Aviation (FA) forces from primarily defensive roles to one with a significant deep penetration and offensive strike capability.[5] Evolving Soviet doctrine is placing great emphasis on this new capability. When combined with the Soviet philosophy of "strict centralized control of forces - allowing for flexibility and variations as necessary,"[6] the SU/WP tactical air arm poses a significant threat to NATO air and land forces. Not surprisingly, Soviet Tactical Air Doctrine is somewhat similar its US/NATO counterpart — methodologies, priorities, and task names may vary somewhat, but when viewed in terms of a systems approach, the basic jobs for tactical air forces are nearly identical for both sides in any major armed conflict.

AIR SUPERIORITY

In the Soviet view, "achievement of air superiority is the necessary and obligatory condition for the attainment of success in operations and a war."[7] The preferred method of obtaining air superiority is through massive surprise strikes on enemy airfields to destroy their airpower, followed by concentration on enemy air defense capabilities.[8] This concept parallels the US/NATO Offensive Counter-Air Strike (STR) mission, and has equivalent objectives. Air Cover is an adjunct to the Air Superiority mission area, with a primary objective of providing defense against enemy air attacks for friendly ground units and operational areas.[9] The objective is to destroy enemy aircraft in the air before they can inflict damage on friendly forces or facilities. This concept requires active air cover over the battlefield area as well as dedicated air defense resources to protect important targets in the rear. Close integration with ground-based defenses is required to achieve mutually supporting coverage and insurance against inadvertent shootdown of friendly aircraft.[10] The combination of being able to "sweep airspace clean over essential areas of operation,"[11] coupled with point defense capabilities of both aircraft and ground based systems, provides a potent deterrent to enemy air capabilities. These two functions closely parallel the US/NATO Combat Air Patrol (CAP) and Defensive Counter Air (DCA) missions, with the primary difference lying in the _defensive_ nature of the SU/WP CAP-type missions. In fact, approximately forty percent of the aircraft assigned to frontal aviation have the primary mission of defending ground forces from air attack.[12] This is due primarily to relatively short flight times of SU/WP interceptor-type aircraft and their widespread reliance on Ground-Controlled Intercept (GCI) operations for air-to-air engagements rather than allowing pilots to seek and engage enemy aircraft independently.

Defensive measures designed to protect vital air assets also include hardened bunkers, revetments, dispersal, and a complete range of measures known as _maskirovka_, (camouflage, concealment, and deception).[13] The Operational Art level decisions which most directly affect the air battle are dispersal decisions; bunker and revetment construction can be considered strategic, and maskirovka efforts are more tactical in nature.

Thus, a graphic portrayal of SU/WP Air Superiority missions and relationships, expressed in terms which reflect US/NATO thinking, would appear as shown in Figure III-1.

AIR SUPERIORITY OPERATIONS

OFFENSIVE ACTION	DEFENSIVE ACTION		
STRIKE (STR)	AIR COVER (CAP)	AIR DEFENSE (DCA)	DISPERSAL (DIS)

FIGURE III-1

SUPPORT OF GROUND OPERATIONS

In the Soviet view, Air Strikes are considered an extension of artillery fire, with greatest emphasis placed on preplanned strikes against command posts, tactical nuclear delivery means, and support/reserve elements.[14] This concept is strikingly similar to the US/NATO Battlefield Air Interdiction (BAI) mission, with a slight difference in targeting emphasis to reflect the shock nature of SU/WP operations. Frontal Aviation does not normally use high performance aircraft for Close Air Support (CAS) along the immediate line of contact except in specific instances, such as mountain operations, Airmobile assaults, or hasty river crossings.[15] Widespread reliance on attack helicopters as integral parts of the combined arms armies has all but eliminated CAS from the Frontal Aviation mission. However, it still does exist, but to a very limited degree and only in special circumstances. One would expect to see very few Frontal Aviation CAS missions in any large SU/WP operation. Graphically, Support of Ground Operations can be expressed as shown in Figure III-2.

<u>SUPPORT OF GROUND OPERATIONS</u>

PREPLANNED STRIKES (BAI)	CLOSE AIR SUPPORT* (CAS)

* Minimal Effort, only for special cases.

FIGURE III-2

ISOLATING THE BATTLEFIELD

The SU/WP concept of isolating the battlefield corresponds roughly to the US/NATO Interdiction (AIO) mission. Soviet planners stress that it must be used on a wide front, under a common plan and centralized control, and must be continuous in operation, with repeat attacks to prevent repair and reuse of damaged targets.[16] This concept implies a long-term effort with long-term results to be felt at the front. Effectiveness of a battlefield isolation campaign would not be felt immediately, but would establish situations which could be exploited at later times for maximum effect. It is to be expected that this type of mission would receive less priority than others in SU/WP operations, at least until the battle for control of the skies is decided.

AIR RECONNAISSANCE

The Soviets view Tactical Air Reconnaissance (REC) as a primary and continuous requirement for successful combat operations.[17] To be effective, reconnaissance must range out "to the depth of the entire disposition of enemy combat formations."[18] Primary items of interest include battle area emplacements defensive systems, assembly, bivouac, and supply areas, and tactical nuclear delivery, supply, and command and control systems.[19] Because Soviet Doctrine is rooted in the concepts of shock and tempo, reconnaissance is viewed as vitally important in providing commanders with information required for decisions which must be made to maintain a desired pace of combat operations. "Surprises" which slow or halt operations can be disastrous to a campaign plan based on mass and speed; reconnaissance can help commanders cope with, bypass, or crush enemy "surprises," depending on objectives and time available.

CHEMICAL AND NUCLEAR OPERATIONS

Soviet tactical doctrine places the use of toxic chemicals in the setting of complementary warfare, with the intent to utilize the most effective attributes of <u>all</u> weapons in the most effective manner.[20] Even though the Soviet Union has formally renounced "first use" rather than "no use" of chemical weapons, their preparation and planning for chemical operations has been considerable. From a tactical air viewpoint, delivery of chemical munitions is akin to conventional weapons delivery — all that is required is the decision to do it. The SU/WP chemical warfare capability far outweighs that of the US/NATO countries. In fact, the US has "no offensive forces in that medium which might make the Kremlin fear starting a fray it could not finish."[21] Thus, once the political decision to use chemical weapons was made, a tremendous military capability would be unleashed, creating an environment in which the Soviets have trained for years to function effectively. It is envisioned that the entire range of tactical air operations would be used for chemical operations including Chemical Strike (CSTR) missions to enhance Air Superiority gains, Chemical Support of Ground Troops (CBAI), minor Chemical Close Air Support (CCAS) missions for special circumstances (remember, SU/WP troops are trained continuously to operate in a chemical environment), and Chemical Isolation of the Battlefield (CAIO). An initial massive chemical strike would enable the Soviets to gain surprise, achieve a major penetration, and destroy effective resistance,[22] and they have the quantitative means to do it.

In the nuclear arena, the Soviet Union places highest priority on destruction of enemy nuclear delivery means, including associated airfields and storage sites. Following these critical targets, high echelon headquarters, defensive positions, reserves, supply centers, and communication centers are considered appropriate for nuclear strikes.[23] Soviet stress on surprise for the initial attack, coupled with their first priority targeting, indicates that once a decision to escalate to the nuclear level is made, they want a minimum of retaliatory capability facing them. In order to insure that surprise can be achieved, a certain percentage of nuclear-capable resources are maintained on Quick Reaction Alert (QRA), to provide near-instantaneous execution of the decision to escalate to the nuclear level. Additionally, on the offensive, nuclear weapons will supplement rather than replace conventional weapons, with the emphasis on inflicting maximum enemy casualties and minimizing danger to friendly troops in the most efficient manner possible.[24] Tactical Air missions would thus include Nuclear Strike (NSTR), Nuclear Support of Ground Troops (NBAI) and Nuclear Interdiction (NAIO), emphasizing surprise, mass, and rapid follow-up to exploit this quantum increase in firepower and destructiveness.

OTHER AIR OPERATIONS

There are other factors which would affect the overall air war, but are beyond the scope of this study and would only detract from an Operational-Art-level war game if included. If committed to a European Scenario, Long Range Aviation assets could drastically affect the overall balance of air power. Variations of air missions and differences in tactics could contribute to imbalances, as could the heavy Soviet emphasis on Electronic Warfare. However, these effects can be accounted for in proper game design. For further investigation, the reader is referred to the bibliography as a starting point.

COMMAND AND CONTROL

"Centralized command and control is the command and control principle recognized in the armed forces."[25] Soviet Frontal Aviation is organized into Tactical Air Armies (TAA), with organizational patterns adapted to combat requirements. During peacetime, TAAs are administratively controlled by Headquarters, Soviet Air Force, in Moscow. Operational control during peacetime is exercised by Military District or Group of Forces Commanders.

Once a wartime footing is established, SU/WP forces come under control of a Theater of Military Operations (TVD), which is assigned the responsibility for attaining overall strategic objectives required for victory. Each TVD is made up of a number of subordinate Fronts, each responsible for specific geographical regions and neutralization of enemy capabilities. The TVD can be considered the strategic organization, and the Front can be considered the Operational Art organization.[26] During combat operations, the Front Commander assumes primary operational control of his assigned TAA, to include control over targeting and mission priorities. The TAA Commander executes air operations in accordance with guidance provided by the Front Commander and serves as the Front Commander's deputy for all air matters.[27] Essentially, this arrangement puts all the TAA resources assigned to a Front under the exclusive control of the Front Commander. Responsiveness to requirements from lateral Fronts or to directives from higher echelons is limited, since a large amount of time is required to effect a complete transfer of operational control of any portion of a TAA from one front to another. For all practical purposes, the assignment of resources to a TAA locks them into that organization and its parent Front for the duration of a conflict.

For a SU/WP - US/NATO Scenario the Warsaw Pact TVD is broken into three subordinate fronts: Northwestern, West Central, and Southwestern. Each Tactical Air Army within these three fronts will be operationally independent of the other two, responding to guidance from its own Front Commander only. The NATO concept of allotment between ATAFs is nonexistent in SU/WP Front relationships. Each TAA Commander will be limited by the resources assigned him and must use them in accordance with his Front Commander's guidance. Timely transfer of air assets between Fronts is not an option in SU/WP operations.

Thus, Soviet concepts of centralization of control put an upper bound on the flexibility of air assets at the Front level. Within each Front, standard tasks of Apportionment, Allocation, and tasking must still occur as a function of the Front Commander's overall guidance. It can be seen that a very real possibility exists for wide variances in apportionment prioritization between Fronts, with a possible resultant dilution of effectiveness compared to priority control at the TVD level. Each TAA commander is responsible for apportionment of his own resources in accordance with Figure III-3, acting independently of the other TAA commanders.

SU/WP TAA APPORTIONMENT

AIR SUPERIORITY . . . . ____%

STR . . . ____%
CAP . . . ____%
DCA . . . ____%

SUPPORT OF GROUND OPERATIONS . . . . ____%

BAI . . . ____%
CAS . . . ____%

ISOLATING THE BATTLEFIELD . . . . ____%

AIO . . . ____%

TOTAL 100%

FIGURE III-3

As with their NATO counterparts, SU/WP QRA Nuclear Assets are managed at higher than the Front level. If QRA commitments are increased, resources required must come out of the available resources which would otherwise figure in each Front Commander's Apportionment decisions. Chemical strikes, once authorized, compete with conventional missions for resources of the TAA. The SU/WP forces have a distinct advantage in the chemical arena due to the large stockpile they maintain. Exact figures are classified, but it is safe to assume that SU/WP Air-Delivered Chemical munitions capability exceeds that of US/NATO forces by a factor of at least eight to one. This will allow SU/WP commanders wide latitude in their selection of targets and intensity of effort once the chemical threshold is crossed.

In summary, SU/WP Command and Control of Frontal Aviation assets during Combat is integrated into the Front organization, with the Tactical Air Army Commander directly responsible to his Front Commander for successful execution of the air war. Transfer of assets between Fronts is an unlikely prospect for SU/WP forces, and can limit flexibility somewhat. Each TAA Commander is responsible for his own Apportionment decisions. Subsequent allocation and tasking then take place entirely within the TAA, providing centralized control of all air assets within the Front. No air decisions are made at the TVD level which directly affect combat operations. However, the TVD Commander can direct reinforcements to whichever Front most critically needs them, providing some long-range force enhancement to bolster combat effectiveness. Once committed to a Front, those assets will probably remain there for the duration of a conflict. It must be remembered that this overview of SU/WP Frontal Aviation Command and Control is of necessity very generalized. It is purposely compared to US/NATO concepts because, as was mentioned earlier, the basic functions of tactical forces are practically the same for both sides in any major conflict, even though terminology and relative emphasis may differ. Comparison of this Chapter with Chapter II can provide a solid baseline for understanding basic differences between US/NATO and SU/WP concepts of employment of tactical air power.

ASSETS

As with their US/NATO counterparts, the SU/WP forces have deployed air assets to support their overall objectives in case of war. As indicated previously, this section is not designed to provide a detailed "bean count" of air assets, but rather to show types and quantities of aircraft together with their capabilities for performing the various types of missions previously discussed. In the tactical arena, SU/WP aircraft can also be broken down into GAF, ASF, and DRF types as defined in Chapter II. Figure III-4 shows SU/WP Air Assets which could reasonably be expected to be available at the start of hostilities, broken down by Front of assignment, type, and mission capabilities. Augmentation schedules would increase these totals and assignment of these additional assets would be a function of the overall battle situation and relative posture of air strength vis a vis the enemy.

As in the NATO case, a great amount of flexibility is available to each Front Commander due to the large quantities of Dual Role Fighter (DRF) aircraft available. Based on overall campaign priorities and the battlefield situation, assignment of these DRF aircraft to the proper mission roles can make a real difference in relative combat power with the enemy, both in the air and on the ground. Careful perusal of Figure III-4 and comparison with Figure II-5 can provide meaningful insight into the relative strengths of the two Air Forces facing each other in Central Europe, and can suggest just how well different strategies could be supported with available assets.

[illegible] AIR ASSETS

	Aircraft Designation	Qty	Type				Conventional Mission Capabilities							Special Mission Chemical				Capabilities Nuclear		
			GAF	ASF	DRF	Other	CAP	DCA	BAI	CAS	STR	AIO	REC	CSTR	CBAI	CAIO	CCAS	NSTR	NBAI	NAIO
NORTHWEST FRONT	SU7	65	X						X	X	X	X		X	X	X	X	X	X	X
	SU17	84	X						X	X	X	X		X	X	X	X	X	X	X
	M17	480			X		X	X	X	X					X		X			
	M21	100			X		X	X	X	X					X		X			
	SU17R	18				X							X							
	M21R	20				X							X							
	M25R	18				X							X							
	TOTALS	785	149	0	580	56														
WEST-CENTRAL FRONT	SU7	80	X						X	X	X	X		X	X	X	X	X	X	X
	SU17	168	X						X	X	X	X		X	X	X	X	X	X	X
	M21	736			X		X	X	X	X					X		X			
	M23	200			X		X	X	X	X	X	X		X	X	X	X	X	X	X
	M27	250	X						X	X	X	X		X	X	X	X	X	X	X
	SU17R	36				X							X							
	M21R	60				X							X							
	M25R	20				X							X							
	TOTALS	1550	498	0	936	116														
SOUTHWEST FRONT	SU7	80	X						X	X	X	X		X	X	X	X	X	X	X
	M21	324			X		X	X	X	X					X		X			
	Y28R	20				X							X							
	M21R	16				X							X							
	TOTALS	440	80	0	324	36														
	GRAND TOTALS	2775	727	0	1840	208														

FIG III-4

CHAPTER III

ENDNOTES

1. Lomov, N.A. ed. Scientific-Technical Progress and the Revolution in Military Affairs, p. 110.

2. Collins, p. 225.

3. Ibid., p. 299.

4. Ibid., p. 225.

5. Kerry Hines, "Frontal Aviation: Committed to Air Superiority," Air Force Magazine, March 1982, p. 92.

6. Savkin, V.V. The Basic Principles of Operational Art and Tactics, p. 266.

7. Hines, quoting Marshal Kntakhov, Chief of Staff of the Soviet Air Forces, p. 92.

8. Hines, p. 92.

9. Department of the Army, United States Army Intelligence and Security Command, Soviet Army Operations, p. 5-33 (hereinafter referred to at "Soviet Army Operations").

10. Ibid., p. 5-33.

11. Collins, p. 225.

12. Soviet Army Operations, p. 5-38.

13. Department of the Air Force, Soviet Aerospace Handbook, p. 105.

14. Soviet Army Operations, p. 5-34.

15. Ibid., p. 5-34.

16. Ibid., p. 5-34.

17. Ibid., p. 5-34.

18. *Soviet Aerospace Handbook*, p. 113.

19. *Soviet Army Operations*, p. 5-34.

20. *Ibid*., p. 5-44.

21. Collins, p. 400.

22. *Soviet Army Operations*, p. 5-44.

23. *Ibid*., p. 5-42.

24. Ibid., p. 5-43.

25. *Dictionary of Basic Military Terms*, Translated and published by the US Air Force, p. 226.

26. *Soviet Army Operations*, p. 2-6.

27. *Soviet Aerospace Handbook*, p. 39.

28. Compiled from Air War College *Theater War Exercise* Documentation, Army War College *War Gaming Handbook*, and the *Soviet Aerospace Almanac*.

CHAPTER IV

FACTORS AFFECTING AIR OPERATIONS

The bottom-line common denominator for determining the amount of air power available in any conflict is the number of effective combat sorties which can be generated and flown on their assigned missions to successful completion. For purposes of this study, a sortie can be defined as a single aircraft which takes off, flies its assigned mission, and returns to land. The number of aircraft in a theater is only one of a large number of factors which affect total sortie capability of an Air Force. It does no good for an Air Commander to have 2000 aircraft in a theater if only 500 of them can fly one sortie each day and he is facing an opponent with 1000 aircraft, each capable of two sorties per day. In terms of overall air power, he is at a 1:4 disadvantage, a very uncomfortable position. This chapter will examine a series of factors which can either enhance or degrade air power in terms of effective combat sorties. Each factor has its own unique manner of contributing to the final result and many of them can be affected by enemy actions. In keeping with the thrust of this study, the factors will be treated from the point of view of their incorporation into a war game; thus, numerous simplifications will be used in order to keep overall game design and play at a manageable level.

From an operational art level, the number of sorties available for different types of combat missions required to support the overall air strategy are the true measure of the resources which determine air power. As in any situation, there will never be enough resources to insure adequacy for all requirements. Decisions on how to divide the resources between all required tasks, where to place the highest priority to insure ultimate victory, and how to react to enemy strategy and initiatives are the key to success in an air war.

AIR BASE CAPACITY AND STATUS

For any number of aircraft stationed at a given air base, there are two factors which act together to determine the number of sorties which can be flown from that location: base capacity and base status. Base capacity is a measure of the sizes and numbers of facilities equipment, supplies, and personnel which support an air combat operation at that location. It is convenient to express base capacity in terms of the number of aircraft which can be supported at maximum sortie rates. For any air base, capacity will be a fixed number. This number is not an upper limit on the number of aircraft which can be stationed at the base, but above this number, facilities will be overburdened and maximum sortie rates per aircraft will not be realized. The other half of the air base factor is base status: a measure of the condition or availability of support equipment, supplies, facilities and personnel. Status can change as a function of enemy attack, personnel shortages, logistics problems, or natural disasters. It is most convenient to express base status as a decimal figure between 0 and 1.0, where 0 is no sortie generation capability whatsoever, and 1.0 reflects 100% capability to generate maximum sorties possible.

These two factors are interrelated, especially in terms of overloading a base. Obviously, if a base has fewer aircraft than its stated capacity, sortie generation capability will be strictly a function of status. However, if a base is overloaded (i.e., more aircraft than stated capacity), it will not be able to generate maximum sortie rates for all aircraft. This relationship can be accounted for by using a simple mathematical relationship and a graphic guide to determine final sortie generation capability as a function of base loading and facility conditions. By computing a Ratio:

$$\text{Ratio} = \frac{\text{Number of aircraft on a base}}{\text{Base Capacity}}$$

And using that figure as an entering argument for Figure IV-1, the resulting scale factor can be applied to the sortie generation capability, accounting for base status as well. For example, if 60 aircraft are stationed at a base with a capacity of 40, the resulting RATIO is 1.5. If status is 1.0 (no damage or shortages) the resulting scale factor is .75, which is then applied to the formula:

Sorties = Scale X Max Sortie Rate X Number of Aircraft

to find total daily sorties available from a base (Max Sortie Rate is fixed for any type of aircraft). Total sorties available for an ATAF, front, or entire theater are determined merely by adding up all bases available.[1]

LOGISTICS

At the operational art level, logistics is a factor which is seen in the quantity of sorties able to be produced. From a gaming viewpoint, the overall effect of deteriorating logistics throughout a long conflict can be applied as a common logistics factor to every base in the theater. This factor, between 0 and 1.0, can be applied as a direct multiplier to each base's sortie generation result each day prior to summation for the theater. At conflict initiation, it is reasonable to assume that the logistics factor will be quite high, on the order

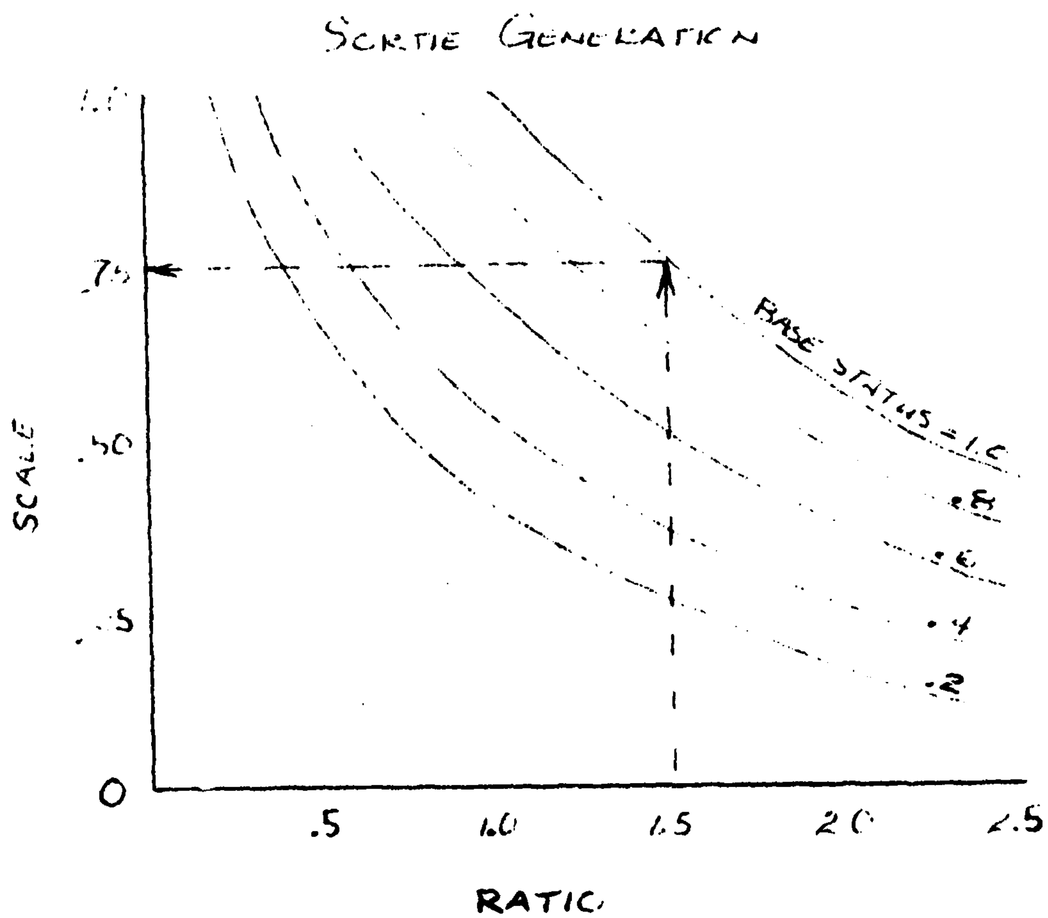

FIG. IV-1

of .96 to .99. Over a protracted conflict, this factor would deteriorate and could eventually drop quite low, possibly as far as .50 to

nels, vulnerability, industrial capacity, etc., and can be arbitrarily set in a gaming situation to reflect realistic expectations for both sides in any postulated scenario. The simplest way to account for logistics deterioration in a game is to use a straight line method as shown in Figure IV-2.

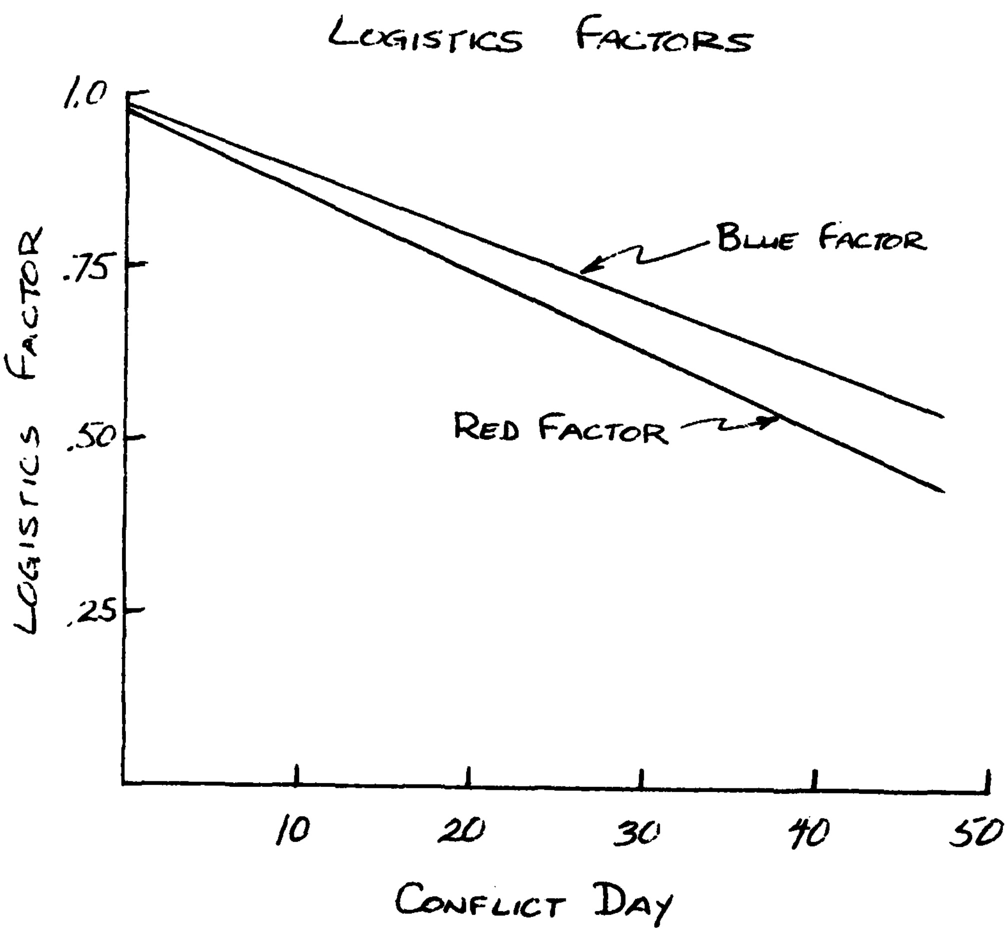

FIG. IV-2

DISPERSAL

Large quantities of aircraft on a few large air bases may increase efficiency due to economies of scale, but they are a lucrative and vulnerable target. In order to enhance survivability, air assets must be dispersed throughout a theater. This forces an enemy to attack a greater quantity of targets in an attempt to gain air superiority and dilutes his overall effort. However, a penalty is paid for dispersal - bases are usually smaller, facilities are less capable, and logistics problems are multiplied. The basic trade-off is one of sortie generation capability vs survivability of air assets.

For gaming purposes, both sides in a Central European scenario can be thought of as having three basic levels of dispersion: Peacetime, consisting of relatively few Main Operating Bases (MOBs) where air assets are concentrated and each base capacity may be at or near its peak, and two Wartime levels, the first consisting of asset dispersal to a series of Colocated Operating Bases (COBs) which have prepositioned stocks and preplanned facilities to maintain relatively high sortie generation capability, and the second consisting of maximum dispersal of assets throughout the theater to Remote Operating Bases (ROBs), where survivability is the paramount consideration and sortie generation capability must suffer. Dispersal effects on air combat power (sorties) can be accounted for by applying a dispersal factor each base's sortie generation computation. Once sorties are figured based on capacity, status, and logistics, a dispersal factor for each base, depending on its classification, would be applied to determine its final figure before summation for the whole theater, according to Figure IV-3.

DISPERSAL FACTORS

Base Classification	Factors
MOB	1.0
COB	.97
ROB	.85

FIGURE IV-3

At the operational art level, the only decisions required are when to disperse and to what level. Proper game design can spread air assets evenly among available bases for each dispersal level. Ratios of MOBs to COBs to ROBs can be established based on real-world capabilities, and it must be remembered that each succeeding dispersal level utilizes all bases, not just those at its own level (See Figure IV-4).

DISPERSAL EXAMPLE

	Dispersal Level	Bases Used	Total Aircraft in Theater	Average Aircraft Per Base
Peacetime	DIS-1	10 MOB	1000	100
Wartime	DIS-2	10 MOB 10 COB	1000	50
Wartime	DIS-3	10 MOB 10 COB 30 ROB	1000	20

FIGURE IV-4

REROLE

As stated previously, tactical air assets can be broken into three categories, Ground Attack Fighters (GAF), Air Superiority Fighters (ASF) and Dual Role Fighters (DRF), capable of performing both jobs or roles, though to a somewhat lesser degree than the pure types. This DRF capability of switching roles provides a great amount of flexibility in any air campaign and can mean the difference between victory and defeat in the air war. Rerole decisions are driven by the relative priority placed on the various types of missions required by overall air strategy.

Figure IV-5 shows combat missions and the types of aircraft required to fly them. By proper configuration changes, DRF aircraft can be designated either Dual-Role Air Superiority (DRA) or Dual-Role Ground-Attack (DRG) fighters. Aircraft assigned to typed-incompatible missions have minimal effectiveness.

AIRCRAFT TYPE REQUIREMENTS BY MISSION

Mission	Aircraft Required			
STR	GAF	DRG		
CAP			DRA	ASF
DCA			DRA	ASF
BAI	GAF	DRG		
CAS	GAF	DRG		
AIO	GAF	DRG		
C STR	GAF	DRG		
C BAI	GAF	DRG		
C CAS	GAF	DRG		
C AIO	GAF	DRG		
N STR	GAF	DRG		
N BAI	GAF	DRG		
N AIO	GAF	DRG		

FIGURE IV-5

As seen in Chapters II and III, percentages of overall effort to all missions are assigned as goals. The DRF assets are used to make actual operations come as close to these goals as possible. As priorities change during a conflict, DRF assets will need to switch roles in order to attain overall percentage of effort goals for every type at mission. However, a price must be paid for this flexibility, and the price is the ground maintenance time it takes to change configurations from one role to the other. This time is translated into loss of availability of the affected aircraft for generation of combat sorties. Most rerole changes can be made in less than three to six hours, which roughly means that DRF assets undergoing rerole will be able to fly one less sortie than their normal maximum rate for the day the rerole action is to occur. For gaming purposes, this can be accounted for internally by subtracting the quantity of sorties (in the new category) corresponding to the number of aircraft reroled into that category. Thus, if a decision is made to rerole 100 DRG aircraft into DRA aircraft, total DRA sorties for the ATAF or front would be reduced by 100 after final overall summation.

NUCLEAR CAPABLE ASSETS

Aircraft assigned to carry nuclear weapons are controlled at the highest levels. Minimum quantities are established on Quick-Reaction Alert (QRA) and are not available for conventional sorties. These assets follow the same dispersal patterns as other aircraft in the theater in order to strive for maximum survivability. If any of these assets are destroyed by enemy action, they must be replaced immediately to maintain required QRA levels. Once committed to action, these assets will have lower sortie rates than conventional missions due to the special handling and preparations required for the nuclear delivery mission.

It can be anticipated that QRA levels will be directed to be increased during a conflict based on the overall strategic situation. These additional assets must come out of those already in the theater and will lower the quantity of aircraft available for conventional missions.

RECONNAISSANCE

Selection of the most lucrative targets to destroy is a critical function. From an air power point of view, reconnaissance can provide invaluable, timely inputs to targeting decisions and thus profoundly affect the overall air war. Since its effects are felt indirectly, it is appropriate for gaming purposes to treat reconnaissance in a different manner than other air assets. As with other aircraft, a given quantity of REC aircraft can provide a number of sorties daily over areas of interest. Success rates of these sorties and drawdown of the REC assets can be applied deterministically, rather than as an interactive model. This allows air commanders to concentrate on direct combat power requirements and places REC capabilities as a service to provide inputs to decision-making. From an operational art viewpoint, reconnaissance consists of a quantity of REC sorties able to provide information about a quantity of unknowns, including enemy airfield capacity, status, aircraft basing, troop locations, and so forth. Thus, a deterministic model at this capability, based on expected losses and projected probabilities of mission success, is more than adequate to provide the type of information required throughout a conflict scenario. Figure IV-6 shows a typical profile of reconnaissance assets available during a conflict scenario, and Figure IV-7 indicates relative amount of effort required to insure adequate coverage of reconnaissance targets. These two concepts can be combined in a game to provide commanders with an intelligence source which can provide information critical to the overall Air-Land Battle.

Typical Reconnaissance Asset Drawdown

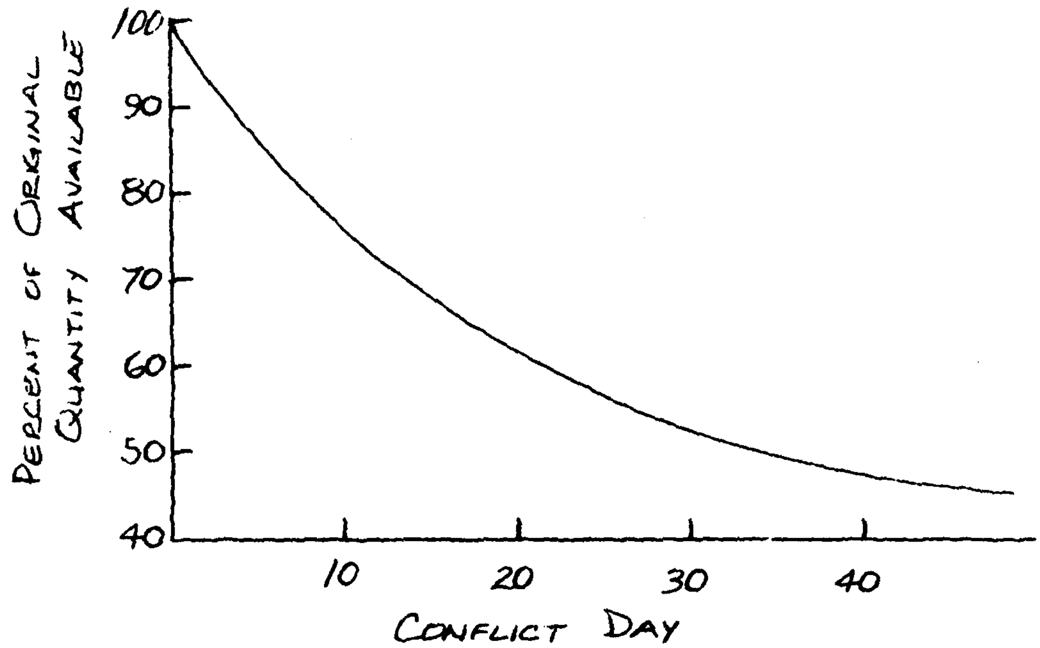

Fig. IV-6

Reconnaissance Effectiveness[2]

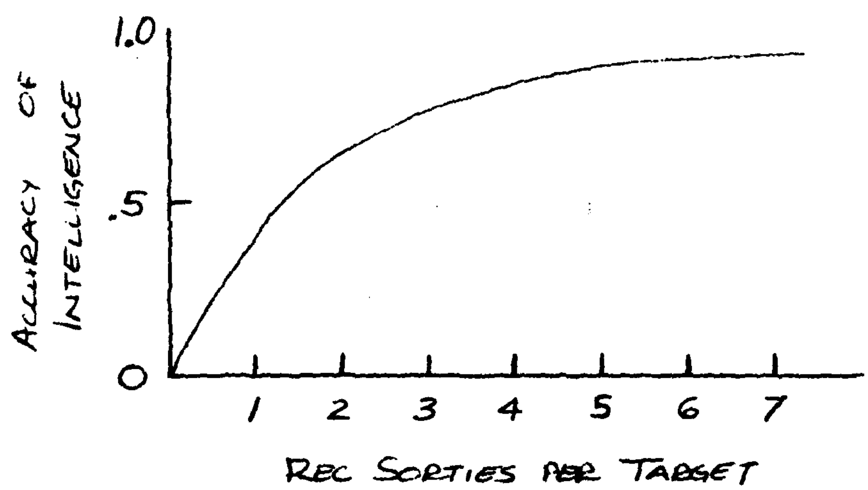

Fig. IV-7

TIME O

Differences between daylight and nighttime can have profound effects on air combat. Not all aircraft perform their missions equally well day and night. In fact, the majority of air resources are severely restricted in their ability to find and destroy ground targets at night, and only the latest generation aircraft have the sophistication necessary for effective nighttime aerial combat. Overall combat effectiveness in terms of target kill capability is drastically reduced during hours of darkness.

This difference in air power effectiveness between day and night operations tends to place most emphasis on daylight air missions and nighttime repair and reconstitution, to keep assets airborne when they will be most effective. Conversely, night operations require daytime repair and reconstitution. It is immediately apparent that air assets committed to night operations are on the ground and vulnerable during daylight to more effective enemy combat missions than those same assets would be if flown during daylight and repaired at night.

This difference does not mean that night operations are impractical or totally unwise; there is a great surprise factor in nighttime air strikes and if mounted with enough force, positive results are possible. The question to be answered is whether the surprise factor is worth the risk taken by exposing valuable air assets to daylight enemy attacks. From a war gaming perspective, each 24 hour day can be considered to contain two operational periods: day and night. The decision to use combat sorties in one period will mean that those sorties will not be available for the other. The decision then becomes one of determining how much of the overall effort will be devoted to each period, within the overall strategy and based on both threat assessment and relative vulnerabilities of uncommitted assets during each period.

WEATHER

The degree of success of individual combat missions depends on actual target weather which is not known during planning stages. Additionally, weather also affects reconnaissance, air-to-air combat, and losses from surface-to-surface defenses.[3] Depending on degree of sophistication, some aircraft are less affected by weather factors than others. In fact, the latest generation aircraft retain a high degree of mission effectiveness under all but hurricane or thunderstorm conditions. Weather is probably the single most important factor in determining individual mission combat effectiveness over the target,[4] and must be accounted for in any air war game design.

From a gaming viewpoint, weather can be divided into three categories: good, marginal, and poor. Combat effectiveness of different types of aircraft flying different types of missions must be adjusted based on actual weather to provide an accurate portrayal of weather effects. Weather can vary greatly throughout a theater. The ideal method of accounting for this phenomenon from a gaming perspective is to divide the theater into a number of weather zones (six to eight would suffice for a Central European scenario), with weather patterns moving through the zones in a realistic pattern. Additionally, weather forecasts (with typical forecasting reliability) must be available to planners so that strategies, targeting, and sortie counts can be adjusted to achieve maximum effectiveness of available resources within weather constraints. The importance of weather in both the planning and execution of an air war cannot be overstated. It is vital to properly account for weather effects in a realistic manner in any war game where air power will be exercised.

SPECIAL SUPPORT MISSIONS

In order to provide increased effectiveness in combat, aircraft assigned to high priority targets are provided with Special Support Missions (SSM) which enhance their probability of success. These SSMs include: Defense suppression aircraft, designed to counter enemy surface defenses; Electronic countermeasures aircraft, designed to jam or confuse enemy radar systems, thereby allowing the strike force to escape detection, and escort aircraft, air superiority fighters which accompany the strike force to keep enemy interceptors away from the strike aircraft. These SSM aircraft are usually limited in number and must be "packaged" to provide maximum effectiveness.

From a gaming perspective, the SSM factor can be easily incorporated. SSMs act together to provide a "force multiplier" effect for missions in the STR, CSTR, BAI, CBAI, AIO, and CAIO categories. (CAS missions do not warrant SSM packages and nuclear missions utilize unique tactics and low sortie count per target which preclude SSM participation.) This force multiplier effect can be applied against a small percentage of all targets listed under STR, CSTR, BAI, CBAI, AIO, and CAIO categories, divided according to relative numbers of targets in each of the categories. Targets must be listed in order of priority in each category for this scheme to operate properly.

Figure IV-8 shows how the SSM force multiplier would be applied assuming SSM assets were available for 10% target coverage. Basic computation rules would require a minimum of one target in each category, and a maximum SSM enhancement corresponding to relative percentage of targets, starting with least effort and working toward greatest effort. From the example, with 100 targets to be hit, ten targets would receive SSM enhancement during the mission divided as shown.

SAMPLE SSM APPLICATION

Mission	STR	BAI	AIO	CSTR	CBAI	CAIO
Number of Targets to be Hit	50	30	10	7	2	1
Quantity of Targets Attacked	3	3	1	1	1	1

FIGURE IV-8

SUMMARY

This chapter has investigated a number of factors which, acting singly or in concert, can have profound effects on the outcome of an air war and, in turn, the overall Air-Land Battle. From an operational art viewpoint, their manifestation is seen in the number of effective combat sorties which can be used daily to achieve results required by the overall strategic goal. From a gaming viewpoint, the majority of them can be mechanized in a manner that makes them transparent to the player - only the results are required to provide inputs for decision-making and interaction between opposing sides in the conflict.

CHAPTER IV

ENDNOTES

1. U.S. Air Force, Air War College, _TWX Book II, Weapons Systems Characteristics Guide_, pp. 2-C-2 through 2-C-4.

2. _Ibid._, p. 2-C-22.

3. _Ibid._, p. 2-7.

4. Pappas, Interview, 16 March 1982.

CHAPTER V

CONCEPTUAL GAME DESIGN FOR MTM AIR PLAY[1]

INTRODUCTION

From previous chapters, it is evident that air commanders on both sides of a conflict have essentially the same goal: To win the air war, and in so doing, contribute in a positive way to success in the overall Air-Land Battle. This chapter will outline a series of concepts based on material already discussed, with the primary orientation of providing a baseline for their incorporation into the McClintic Theater Model. This move from real-world to model-world is not intended to encompass all details and considerations required for modeling and programming, but rather to provide a consistent source upon which sound development work can be based.

"THE BIG PICTURE"

Air commanders have different assets which can fly different categories of sorties to support overall strategic goals for the air war. Figure V-1 provides a graphic representation of the different types of missions used and where they are flown with respect to friendly and enemy forces. STR, BAI, and AIO missions must cross into enemy territory to be effective. CAS missions are fought at the meeting line between friendly and enemy forces. CAP missions overfly the battle area to engage enemy CAS missions programmed against friendly troops, establish battlefield air superiority by defeating enemy CAP, and to intercept enemy BAI and STR missions attempting deep penetrations. DCA missions, combined with surface-to-air defenses (SADs), provide the final shield in the rear area against enemy air attacks. Both sides in a conflict mount similar, opposing groups of missions each day in a conflict. A mirror image of Figure V-1 superimposed over it would show the interactions between both sides. Relative strengths in each category and relative effectiveness of opposing assets within the categories will determine who emerges as both the short and long term victor in the air side of the Air-Land Battle. This is the crux of the modeling problem - to account for air assets, how they are affected by enemy actions and all other important factors, and how they in turn contribute to overall air and land combat power in a conflict.

AIR ASSETS

For war game play at the operational art level, it is not necessary to model all the various models and types of aircraft available on both sides of a conflict. High-level air commanders are only interested in the number of sorties available to perform the various categories of missions to achieve strategic goals. Thus, it is possible to combine the assets for a given side into three generic aircraft, a Ground Attack Fighter (GAF), an Air Superiority Fighter (ASF), and a Dual Role Fighter (DRF), capable of switching between Ground Attack (DRG) and Air Superiority (DRA) roles as required. Each of these generic aircraft can be assigned various effectiveness factors for each type of mission as shown in Figure V-2. The "Signature" of each aircraft then becomes the

"THE BIG PICTURE"
(FROM A "FRIENDLY" POINT OF VIEW)

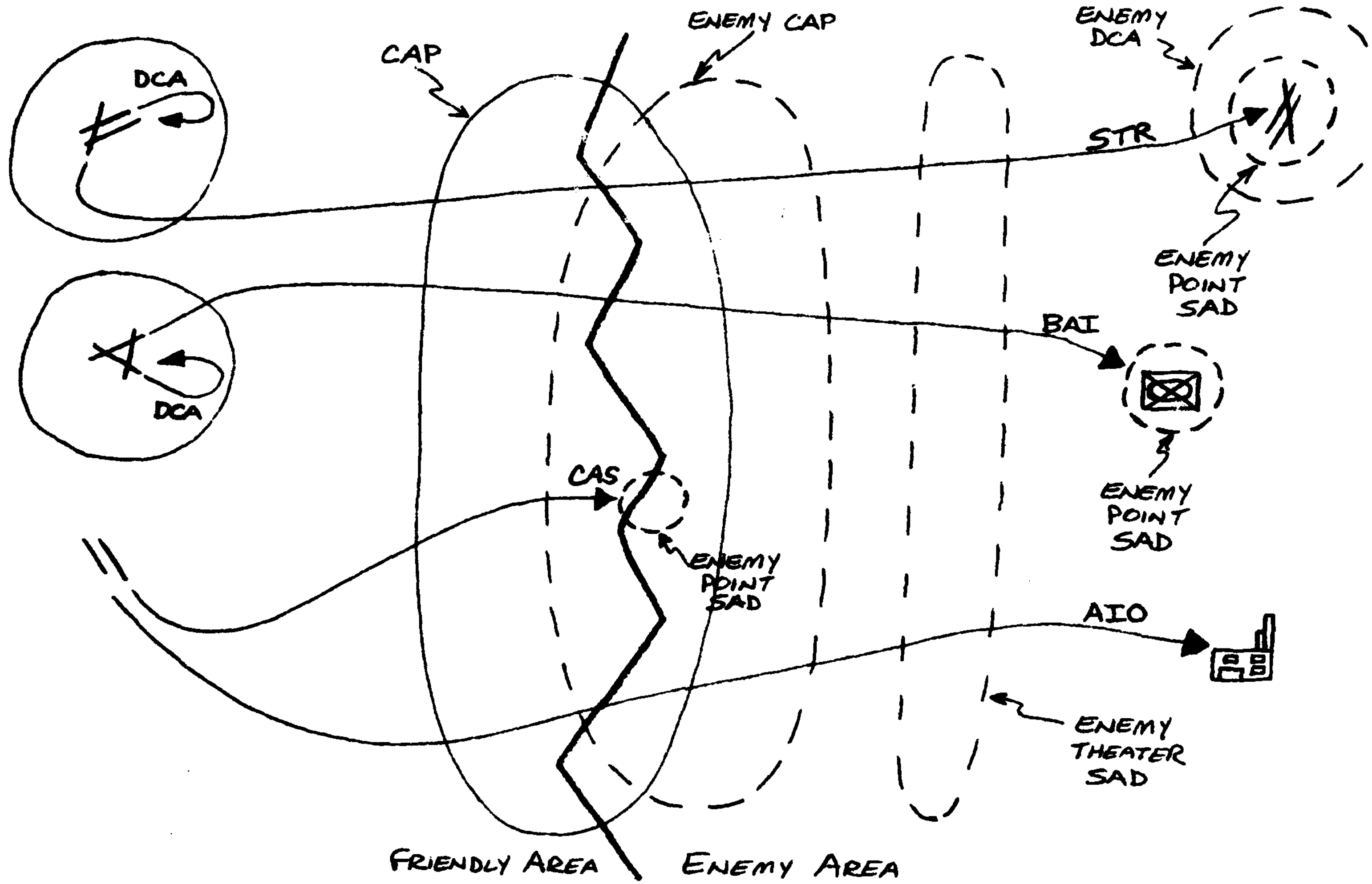

FIG. V-1

basis for its later incorporation in a conflict model. The data shown in Figure V-2 are intended to emphasize the relative strengths of the different types of aircraft and would have to be "fine-tuned" in a working model to achieve realistic results over the combat spectrum. The figures do not represent probabilities <u>per se</u>, but are relative measures of merit which can be used when computing conflict results with engagement algorithms. Each factor will find a use in the conflict model and definitions (see p. 56) must be fully understood to insure appropriate, accurate results. These factors must be defined for aircraft on <u>both</u> sides of a conflict based on aggregation of real capabilities.

GENERIC AIRCRAFT EFFECTIVENESS FACTORS
(TYPICAL EXAMPLE FOR BLUE)

		DRF		
Aircraft Type	GAF	DRG	DRA	ASF
Max Sorties	2.4	2.2	2.8	3.1
MDE-STR	.85/.50	.70/.40	0/0	0/0
MDE-BAI	.75/.45	.65/.35	0/0	0/0
MDE-CAS	.70/30	.60/.20	0/0	0/0
MDE-AIO	.85/.50	.75/.45	0/0	0/0
SASI	.80/.60	.70/.55	.75/.60	.85/.70
AEI	.40/.45	.35/.40	.75/.75	.85/.85

FIGURE V-2

DEFINITIONS FOR FIGURE V-2

MAX SORTIES - Maximum sorties the aircraft can fly in a 24 hour day. The sorties will all be flown in either the day or night period as assigned.

MDE - Munitions Delivery Effectiveness. A relative measure of an aircraft's ability to locate and deliver munitions on the correct target once in the target area. This factor must be used with a series of destructiveness functions and actual number of sorties over the target to determine damage inflicted on the target. Since the destructiveness of conventional, chemical, and nuclear munitions varies so widely, three separate functions must be used, as shown below:

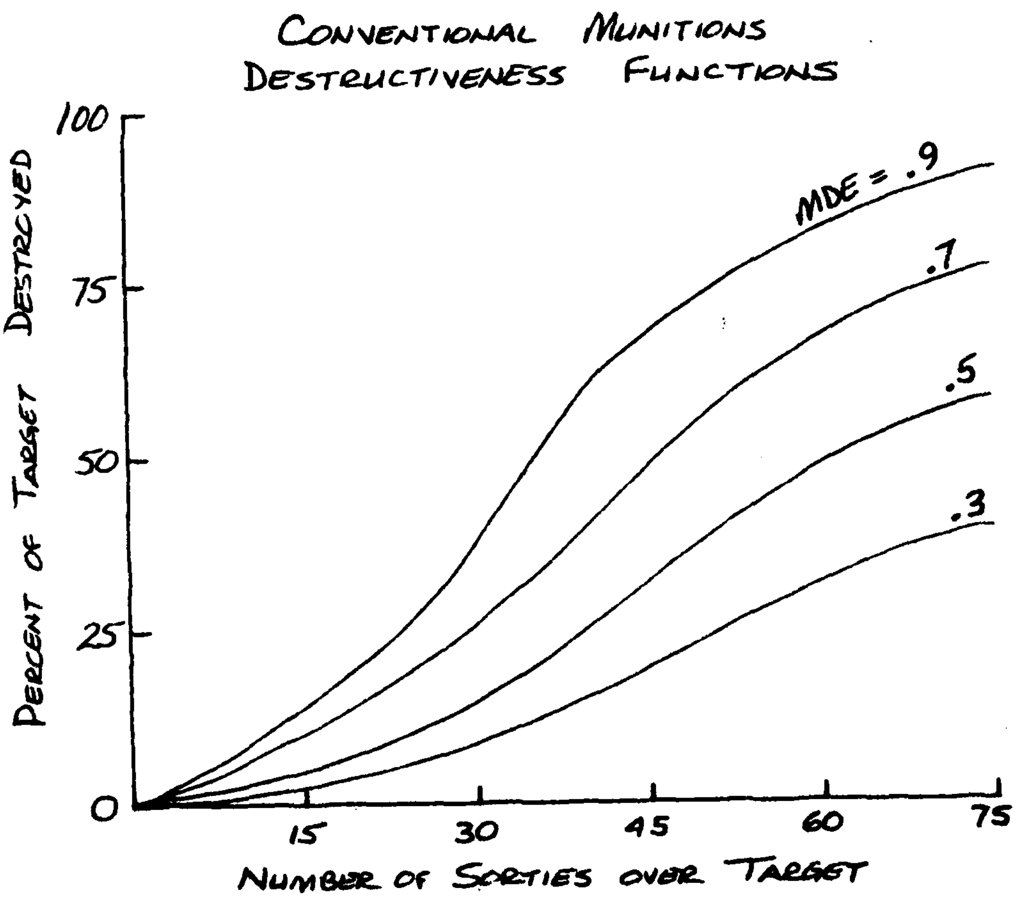

FIG V-2-A

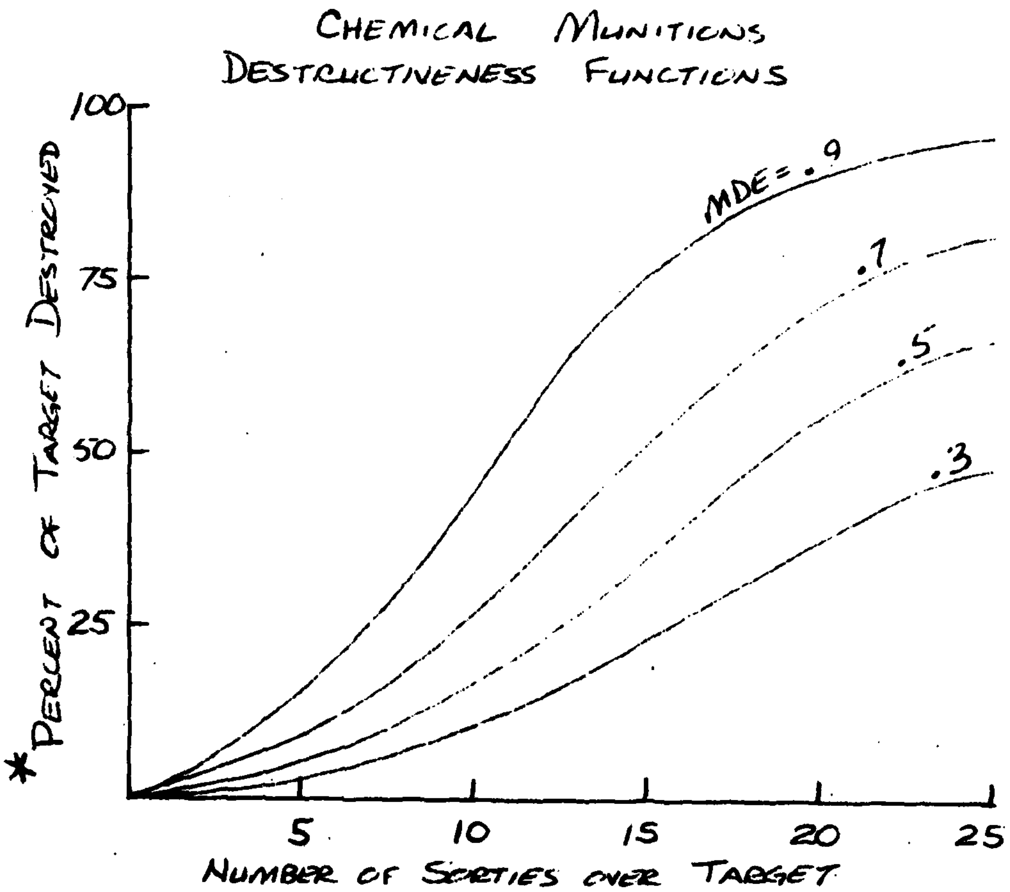

FIG V-2-B

* **Even though chemical munitions are antipersonnel in nature, their effects greatly reduce overall combat effectiveness of any unit or target, and this can be translated into the concept of "percent of target destroyed."**

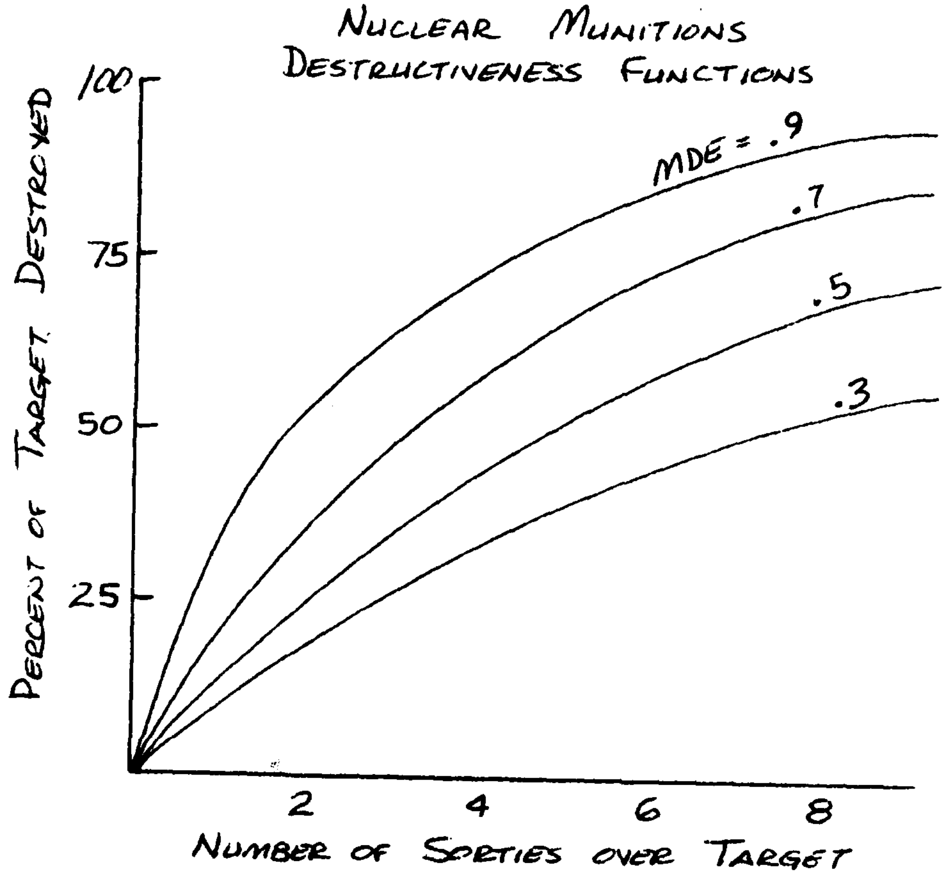

FIG V-2-C

SASI - Surface-to-Air Survivability Index. A measure of an aircraft's ability to avoid and/or negate (through ECM) enemy Surface-to-Air Defenses (SAD). The SASI is used with Surface-to-Air loss functions to determine number of aircraft shot down by enemy SADs. For this factor to work, each ground unit and air base must be assigned a quantity of SAD batteries which will provide point defense against air attack. Additionally, a theater-wide SAD Battery figure must be established for each side to simulate encountering intermediate defenses on the way to the target. Both of these SAD quantities will be affected by enemy actions and their draw down should correspond roughly to the destruction inflicted by enemy air and ground attacks, singly and in the aggregate. Figure V-2-D shows how aircraft losses can be determined based on saturation of defenses.

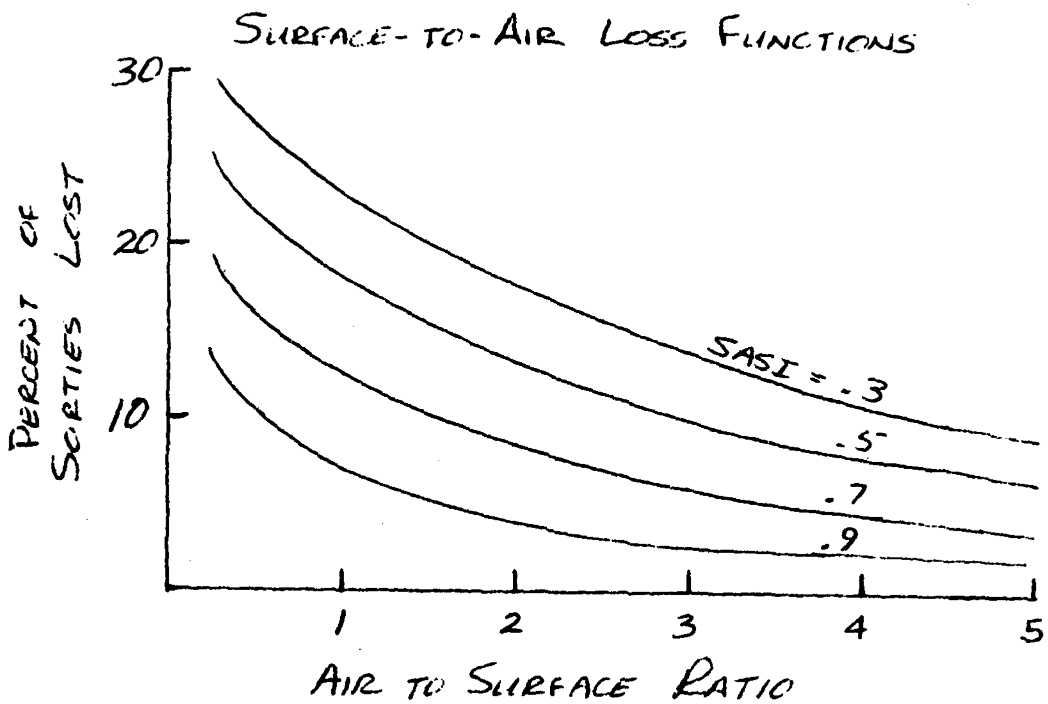

FIG V-2-D

* Air to Surface Ratio (ASR) is determined using the formula:

$$ASR = \frac{\text{Aircraft Sorties Over Defense Batteries}}{\text{Number of Batteries Encountered}}$$

AEI - Air Effectiveness Index. A measure of an aircraft's relative capability in an air-to-air engagement. For DRA and ASF types, this reflects an ability to engage and destroy enemy aircraft. For GAF and DRG types, this is a measure of ability to continue through to the target despite engagement by enemy aircraft. These indices must be used with a series of loss and disengagement functions to determine aircraft kills and attacks missions rendered ineffective. Figures V-2-E and V-2-F show how losses and disengagements are figured using AEIs and relative strengths of opposing air assets. These functions apply to missions indicated and detailed application of this concept will be discussed later.

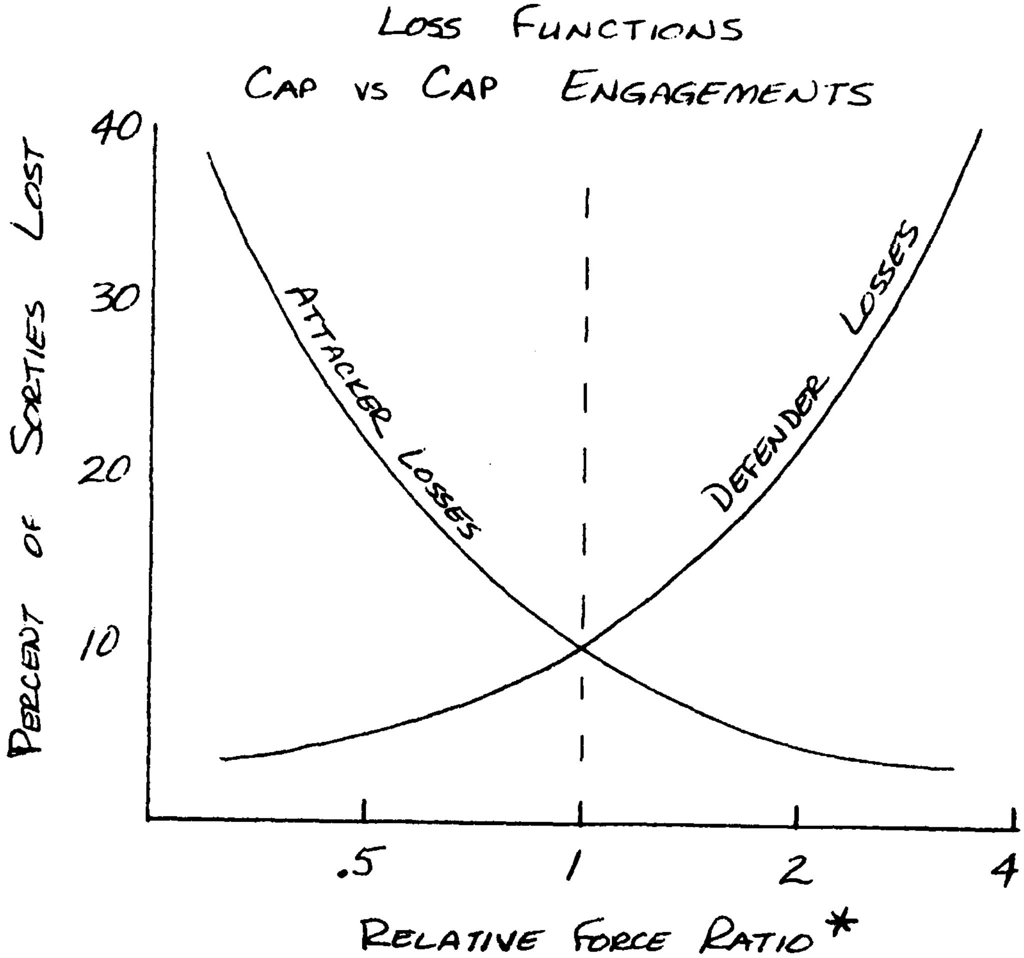

FIG. V-2-E

* Relative Force Ratio (RFR) is obtained by the formula:

$$\text{RFR} = \frac{\text{(Attacker CAP Sorties X Individual AEI)}}{\text{(Defender CAP Sorties X Individual AEI)}}$$

Where Blue is the Attacker Based on Doctrinal Differences

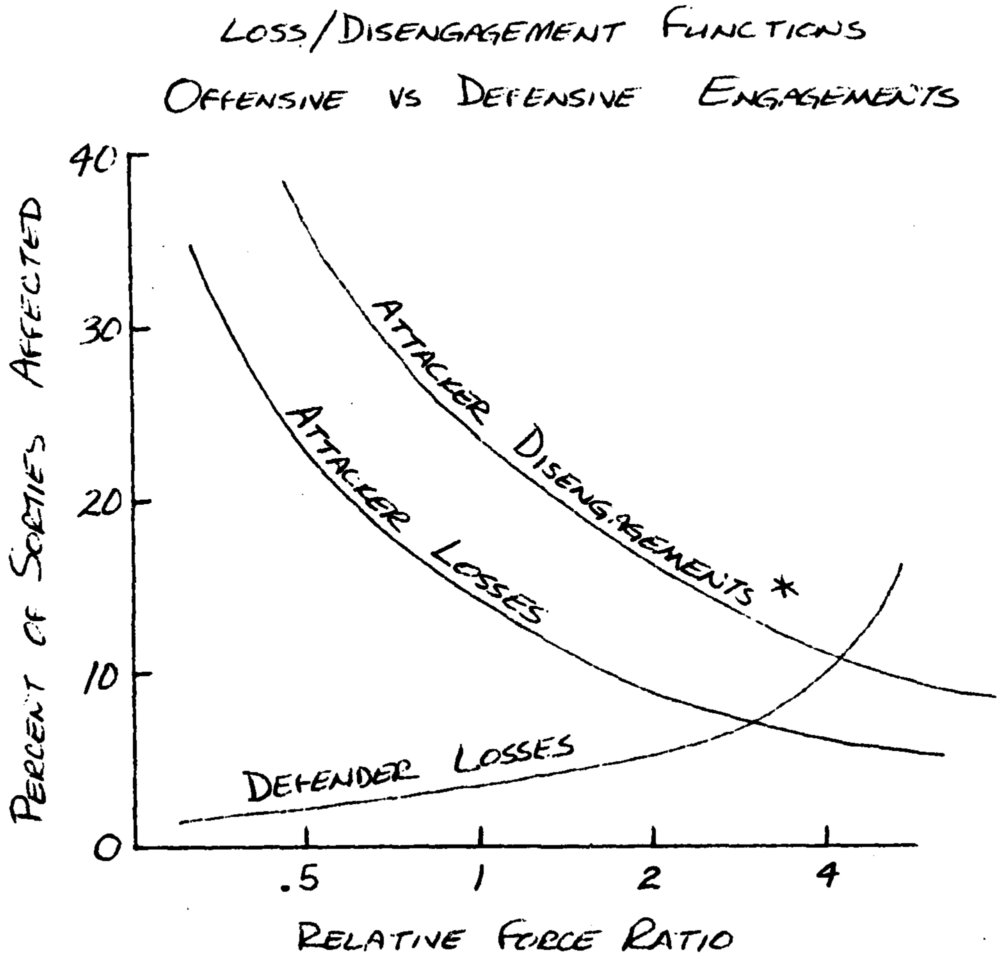

FIG V-2-F

Attackers Include STR, BAI, CAS, and AIO Sorties

Defenders Include CAP and DCA Sorties, Applied Where Appropriate

* Disengagements are attacking aircraft which are forced to Jettison Weapons and return home, rendering them ineffective.

AIR BASES AND DISPERSALS

Each side in the MTM must be provided with a number of MOBs, COBs, and ROBs roughly corresponding to actual quantities available in the Central European Theater. Each base must be assigned an arbitrary number of surface-to-air defenses in relation to the importance and quantity of assets to be protected. All aircraft basing assignments should be internally computed using dispersal levels set by players. Division of the game day into two periods - day and night - means that the quantity of aircraft required to support designated night sorties must remain on the ground during the day period and vice versa. These aircraft, plus approximately 1/3 of the aircraft committed to current period operation, represent the air assets which will be on the ground and vulnerable to enemy air attack at any time. The quantity of aircraft destroyed on the ground at any base will be the "percent of target destroyed" value from computations based on Figure V-2-A, B, or C times the number of aircraft on the ground at the base. Additionally, base status will be reduced by the same factor as well. For gaming purposes, facility repair and reconstruction at each base can be set at a rate of 20% per day. This factor will require restrikes during a conflict to keep enemy bases at less than full effectiveness.

AIR ORDER OF BATTLE

Both the blue and red sides must be provided with an initial quantity of air assets, based on real-world balances and reflecting the emphasis of opposing doctrines. For peacetime assignments, all the assets will start out at each side's MOBs. As tensions increase, basing assignment will be a function of player dispersal decisions. Initial quantities of DRF aircraft will be configured for both DRA and DRG roles in proportions corresponding to expected real-world conditions. Rerole of these assets following initiation of hostilities will be a function of strategy and battle results. Augmentation schedules must be set up to reflect actual capabilities of both sides to reinforce the theatre. Figure V-3 provides an overview of typical initial quantities and augmentation of air assets for both sides.

AIR ASSET AND AUGMENTATION LISTINGS

	GAF	DRG	DRA	ASF	REC	GAF QRA	DRG QRA
BLUE 2 ATAF	292	231	160	26	60	13	9
BLUE 4 ATAF	289	307	85	75	76	15	23
BLUE TOTAL	581	538	245	101	136	28	32
RED NW FRONT	149	224	298	0	56	0	58
RED WC FRONT	438	322	566	0	116	60	48
RED SW FRONT	64	150	174	0	36	16	0
RED TOTAL	651	696	1038	0	208	76	106

	GAF	DRG	DRA	ASF	REC	DAILY TOTALS
BLUE D+1	24	0	24	0	0	48
BLUE D+2	0	48	0	24	24	96
BLUE D+3	66	24	48	0	48	186
BLUE D+4	0	72	24	66	0	162
BLUE D+5	48	24	24	24	0	120
BLUE TOTALS	138	168	120	114	72	612
RED D+1	72	56	80	0	0	208
RED D+2	56	72	48	80	0	256
RED D+3	44	48	24	66	32	214
RED D+4	32	56	32	56	24	200
RED D+5	24	48	32	42	0	146
RED TOTALS	228	280	216	244	56	1024

FIGURE V-3

SORTIE APPORTIONMENT

As shown in Figure IV-5, certain categories of missions require certain types of aircraft. The measure of combat power available for each category is the total number of sorties assigned to that category each day. For a given ATAF or Front, total sorties available can be computed for each type of aircraft, i. e., GAF, DRG DRA, and ASF (REC assets will be considered elsewhere). Then, the total sorties for GAF and DRG can be divided among STR, BAI, CAS, and AIO (plus chemical and nuclear missions as well, if authorized). Within each category, a set quantity of sorties can be assigned to hit targets in order of priority. The number of sorties assigned to a given target will depend on its criticality and the amount of destruction desired, and final effects will be dependent on target area weather, SSM assistance, and enemy actions/defenses. Similarly, DRA and ASF sortie totals can be divided among CAP and DCA missions, with DCA missions providing coverage of all airspace within a two hex radius of their assigned air bases. Number of sorties apportioned to each category is based on the air commander's overall strategy and where he wants to place his emphasis. Figure V-4 shows a sample apportionment and subsequent allocation.

The simplified example in Figure V-4 shows DRF assets split into quantities of DRG and DRA roles so that exact sortie apportionment is possible. This ideal situation is rarely achieved in the real world, and mismatches between target percentages and sortie apportionment will occur. Proper rerole of DRF assets can minimize the mismatch.

SAMPLE APPORTIONMENT AND ALLOCATION

	GAF	DRG	DRA	ASF	TOTALS
Aircraft Available	140	180	100	60	480
Sorties Available	300	300	250	150	1000

Mission Category		% Target	# Sorties Available for	
Counter-Air Operations		75		
STR	35		350	X
CAP	30		X	300
DCA	10		X	100
Offensive Air Support		20		
BAI	15		150	X
CAS	5		50	X
Interdiction		5		
AIO	5		50	X
		APPORTIONMENT	ALLOCATION	

FIGURE V-4

BLUE-RED INTERACTION IN THE AIRLAND BATTLE

The conceptual air play model proposed herein is designed to be compatible with the MTM, but to operate on a somewhat different basis than strict adherence to a time driver. This will enable all pertinent factors to be incorporated and will provide realistic results while emphasizing operational art level decision-making.

For game execution purposes, using sorties as a measure of air combat power during each day allows the air side of the game to be computed independently of game time, thus simplifying calculations and eliminating redundancy. This section will explain how blue-red interactions can be set up to provide realistic results which will affect both the air and land wars.

Since the game day is broken into two air operations periods, it is possible to arbitrarily set two air execution times daily where all air results can be figured (0900 and 2100 hours are appropriate). As game time reaches 0900, the entire day air operation cycle can be calculated, and the same holds true for the night cycle at 2100 hours. In effect, the MTM time driver "freezes" at 0900 and 2100 hours until all air operations are calculated and results are applied where appropriate. Once the air calculations are complete, game time resumes at the present rate and the battle continues, with air results figured in.

Each category of air combat mission will be "flight-followed" in the paragraphs below, showing how results can be calculated by applying the factors from Chapter IV and performance characteristics in this chapter. This concept is based on aggregation and deaggregation of sorties as a function of airspace occupied and mission type. All examples will be from the blue day perspective - the red side would be a mirror image of the same concepts, and the night cycle would merely repeat the calculations.

COMBAT AIR PATROL

CAP sorties for two ATAF and four AFAF are aggregated to give total CAP strength for the theatre. This figure is matched against total CAP sorties for red (NW front plus WC front plus SW front). Using relative force ratios and loss functions as shown in Figure V-2-E, total losses can be calculated, and then deaggregated to each ATAF and front proportionate to their percentage of overall CAP effort. The resulting CAP forces are used for further calculations of other mission interactions. The unique situation where two ATAFs face three fronts requires some internal bookkeeping for follow-on mission interaction computations, based on the situation shown in Figure V-5. WC front aggregate assets must be split based on percentage of area divided between two ATAF and four ATAF, and then combined with NW and SW front aggregates to match up:

2 ATAF vs NW Front + WC "Upper"

4 ATAF vs SW FRont + WC "Lower"

STRIKE

As shown in Figure V-1, STR sorties must penetrate enemy CAP, Theater Surface to Air Defenses (SAD), DCA, and point SAD to hit their targets. For each ATAF, all STR sorties must be aggregated and losses plus disengagements figured for enemy CAP (results from CAP vs CAP calculations), then losses from theatre-wide SADs. Following this, losses are distributed through all STR sorties on a per-target basis corresponding to percentage weight of effort assigned to each target. Then each target action is calculated separately using STR sorties remaining after losses from CAP and SAD. These sorties must go through enemy DCA and point SAD, take losses and disengagements as calculated from the loss functions, and emerge with Effective Sorties Over the target (ESOT). Target destruction is then calculated based on munitions delivery effectiveness factors. Throughout these calculations, weather effects are applied where appropriate based on Figure V-6.

ATAF - FRONT RELATIONSHIP

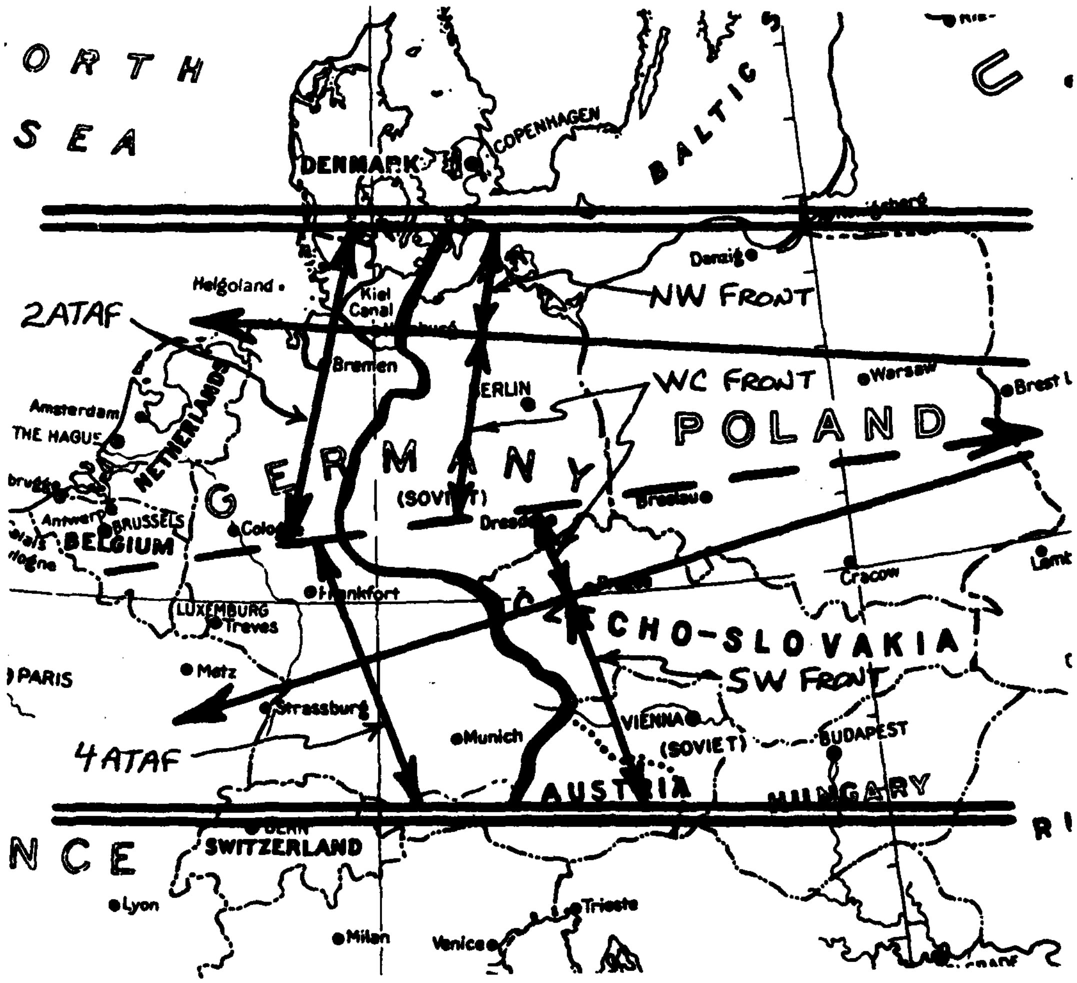

FIG. V-5

BATTLEFIELD AIR INTERDICTION

BAI missions are aggregated in the same way as STR missions to penetrate enemy CAP and theater SAD. However, once deaggregated and in the target area, only point SAD will inflict losses. Remaining ESOTs are then used to calculate destruction. Again, weather factors must be included.

INTERDICTION

AIO missions also penetrate enemy CAP and theater SAD in the aggregate mode. Once deaggregated, only point SAD will affect remaining ESOTs in the target area. Destruction is figured in the normal manner with weather included throughout all calculations.

CLOSE AIR SUPPORT

All CAS sorties must be aggregated to penetrate enemy CAP to strike their targets. Once past the CAP, these sorties can be deaggregated to face individual target SADs, resulting in a remaining number of ESOTs, which are then used to determine destruction, again with weather affecting the results.

FORCE RECONSTITUTION

Following calculations of both day and night air results, the ESOT figures can be used to derive the number of air assets available for sortie generation the next day. Aggregating remaining CAP sorties, disengaged sorties, and ESOTs for each aircraft type (GAF, DRA, DRG, ASF) and comparing these figures with original total <u>sorties</u> available for each aircraft type provides a percentage sortie loss for each type which can then be applied front or ATAF-wide to the __assets__ which were available to generate the original sortie figure for the day. Once the original assets are reduced by this percentage, the new asset totals are available for computation of sorties for the following day's operations. Figure V-6 shows sample calculations for GAF and ASF aircraft.

__GAF RECONSTITUTION__

Start of Day 1	GAF Aircraft	260	
	GAF Sorties	602	
Day 1 Results	GAF Losses	62	
	GAF Disengagements	103	540 "Live" Sorties
	GAF ESOTs	437	

$$\frac{540}{602} = 89\%$$ of Surviving GAF Sorties

Thus: 260 x .89 = 233 GAF Aircraft Available for Day 2

__ASF RECONSTITUTION__

Start of Day 1	ASF Aircraft	312
	ASF Sorties	821
Day 1 Results	ASF CAP *vs* CAP Losses	78
	ASF CAP *vs* STR, BAI, CAS, AIO Losses	16
	ASF DCA Losses	13

Remaining ASF Sorties: 821 - 107 = 714

$$\frac{714}{821} = 86\%$$ Surviving ASF Sorties

Thus: 312 x .86 = 271 ASF Aircraft Available for Day 2

FIGURE V-6

WEATHER

Since weather is all-pervasive in its effects on combat missions, the various effectiveness factors for types of aircraft (see Figure V-2) must be adjusted based on weather encountered in the model. Figure V-7 provides the types of adjustments which must be applied during calculations to reflect real-world capabilities when weather is less than ideal. It can be seen that poor weather is an advantage for ground-attack aircraft trying to avoid air intercept, but is a disadvantage when encountering SADs and trying to deliver munitions.

WEATHER FACTORS

Factor	AEI Multiplier		SASI Multiplier	MDE Multiplier
Type A/C	GAF DRG	ASF DRA	GAF DRG	GAF DRG
Good	1.0	1.0	1.0	1.0
Marginal	1.2	.9	.8	.6
Poor	1.5	.7	.6	.2

FIGURE V-7

SSM ENHANCEMENT

Special Support Missions provide STR, AIO, and BAI missions with increased abilities to penetrate to and strike targets. This enhancement can be applied in a straightforward manner to the appropriate percentage of targets calculated from Chapter IV through an enhancement multiplier. Those missions tagged as SSM enhanced can have their AEI and SASI factors increased by a multiple in the 1.2 to 1.5 range, which will result in more ESOTs due to less attrition from enemy air and ground defenses.

NUCLEAR ASSETS

Aircraft committed to QRA for nuclear employment represent a unique resource which is exercised only at the direction of the highest levels of government in any conflict. As stated earlier, minimum quantities of assets required on QRA are established and must be maintained. For gaming purposes, this minimum can be exceeded at the discretion of air commanders within the theater, with the approval of the theater commander. Resources designated for QRA are not available for conventional or chemical missions and cannot be flown until nuclear OK is given. Conversely, QRA resources are the only aircraft which can be flown on nuclear missions - sortie generation and missions will be calculated using the same scheme as conventional aircraft once nuclear OK is received.

To incorporate realistic factors involved in increasing QRA commitment, any increase in QRA levels should simulate the extensive preparation and planning required to transition an aircraft from conventional to nuclear-capable status. This can be accomplished in a gaming context by setting a one day delay (QRA "Prep") between the order to increase QRA levels and the time the added aircraft will be available for missions if required. This factor will force air commanders to include nuclear possibilities in their planning so as not to be caught in an untenable position if the nuclear threshold should be crossed.

Since sortie counts per target for nuclear missions are so small, special handling of effectiveness factors and loss/disengagement functions may be required for N-designated missions. This area needs to be carefully managed to provide results which are reasonable in terms of expected losses, target coverage, and destructiveness of this level of weaponry.

RECONNAISSANCE ASSETS

As indicated previously, REC missions can be played deterministically from each side rather than interactively. This will simplify game play and allow more time for critical decisions affecting air combat power. At the start of each day, an overall quantity of REC sorties is made available to air commanders who determine where to use them to gain intelligence on enemy capabilities. Number of sorties per REC target is assigned based on how critical the information is to planning. Augmentation can be accounted for but draw down rates will still apply. Reconnaissance is a service which provides inputs for decision-making. Intelligent, timely management of REC assets can enhance air power effectiveness.

CONCLUSION

This chapter has presented the essential conceptual elements necessary to design an air war model compatible with the MTM. Figures used are not intended to be absolutes, but to show relative strengths and weaknesses as well as advantages and disadvantages of opposing resources, doctrine, and tactics. As this model moves from concept to reality, numerous adjustments will be required in all the interrelated effectiveness factors and functions to insure that game results are fairly representative of expected real-world outcomes.

CHAPTER V

ENDNOTES

1. Numerous concepts developed in this chapter are modifications, adaptations, and permutations of features found in the Air War College _Theater War Exercise_ (TWX) as well as the McClintic Theater Model (MTM). Their incorporation into this particular systematic approach to the problem at hand is the author's.

CHAPTER VI

PLAYING THE AIR WAR

INTRODUCTION

To provide the type of learning experience desired, i. e., that future high level Army commanders come away from this game with an understanding of how the Air Force manages its assets in a conflict, it is necessary to insure that player-machine interface be minimized. The goal is to have players make decisions, communicate those decisions to the model, and then let the model provide results upon which further decisions can be made.

At the operational art level, air decisions are fairly straightforward. Below this level, there are thousands of actions required to insure that the decisions are carried out and reported in a manner which will allow subsequent decision-making to be informed and effective. This chapter will attempt to define the type, timing, and quantity of information required to play the air war properly, and will show the types of inputs required from players once their decisions are made.

ORGANIZATION

Proper play of this game requires three air players on both blue and red sides. For blue, the players assume the roles of COMAAFCE and TWO ATAF and FOUR ATAF commanders. For red, the three players assume the roles of TAA commander for each of the three SU/WP fronts in the Central European theater. It can be seen that the blue side should be more tightly controlled, since both ATAF commanders are subordinate to COMAAFCE, whereas the three TAA commanders are at equal level and subordinate to their own front commanders. Thus, it is more likely that the red side will show more variance in management of air resources. However, this is strictly a function of the personalities of players involved, and it is not possible to predict this factor with any certainty. Regardless of the players, both sides require certain information so that air decisions can be formulated, entered into the model, and allowed to interact.

DECISIONS AND INFORMATION REQUIREMENTS

The air game is played on a 24 hour cycle, with two periods (day and night) as previously described. At the start of each day, the first decision facing both sides is how to apportion the assets. For blue, this is a COMAAFCE decision; for red, each TAA commander must make this decision. Blue COMAAFCE can direct each ATAF to have identical apportionments or he can split efforts depending on the threat perception. Additionally, the decision on relative weight of effort to be split between day and night operations must be made at this time. Figure VI-1 shows a worksheet format which can be used to insure all categories are accounted for. All possible categories are shown. Until the chemical and/or nuclear thresholds are crossed, the C- and N-designations will not come into play; however, they must always be a part of long-range planning.

APPORTIONMENT WORKSHEET

(Blue) / (Red) Day/Night
Counter-Air/Air Superiority . . . . ___/___ %

Day/Night
STR . . . ___/___ %
CAP . . . ___/___ %
DCA . . . ___/___ %
CSTR . . . ___/___ %
NSTR . . . ___/___ %

(Blue) / (Red)
Offensive Air Support/Support of Ground Troops . . . ___/___ %

Day/Night
BAI . . . ___/___ %
CAS . . . ___/___ %
CBAI . . . ___/___ %
CCAS . . . ___/___ %
NBAI . . . ___/___ %

(Blue) / (Red)
Interdiction/Isolating the Battlefield . . . . ___/___ %

Day/Night
AIO . . . ___/___ %
CAIO . . . ___/___ %
NAIO . . . ___/___ %

SUBTOTALS ___/___ %

TOTAL 100%

FIGURE VI-1

Once the apportionment goals are set, these must be translated into sorties allocated to each category. To achieve this, each ATAF and front commander must have available a listing of all his aircraft assets by type and the number of sorties available from each type aircraft for the coming day. This listing is a consolidation generated by the model as a function of all factors which apply to sortie generation.

Two key factors affecting sortie generation are: (1) Dispersal level, and (2) QRA assets. The first decisions required daily are whether to change dispersal of assets based on tension or hostility level, and whether to expand the quantity of assets committed to the QRA nuclear mission. Once these two decisions are communicated to the model, then daily sortie availability can be calculated. With this listing available, total quantities of sorties can be allocated to each category goal. Any quantity mismatches can be handled by rerole of DRF assets from "A" to "G" or vice-versa (with associated sortie penalty), or for the blue side, by allotment (temporary transfer of control with no sortie penalty) of assets from one ATAF to the other. Thus, the second decision which must be communicated to the model is any DRF asset rerole required to meet allocation requirements. Once this is done, the model must respond with adjusted sortie figures for each category so that sortie allocation can be finalized. Allocation can be accomplished using a worksheet similar to Figure V-1. Only one rerole decision is allowed for each 24 hour day. The apportionment and allocation decisions are the two most important ones to be made by air commanders and will have the greatest effect on the outcome of the air war.

Once the allocation decisions are finalized, these sortie assets must be assigned to targets. To accomplish this, adequate intelligence must be available to both air and ground commanders to develop prioritized target listings. On the air side, listings of enemy air fields, their status, and quantity and types of assets known or suspected to be there are critical items to be able to select proper targeting for a counter air/air superiority campaign. A special air intelligence report covering these types of information must be available to air commanders on both sides. Its veracity can be upgraded by proper use of reconnaissance assets available each day. On the ground side, a similar intelligence report tailored to ground commanders' needs should enable them to develop target listings which can be struck by air assets. Essentially, the air commander is responsible for targeting for counter air/air superiority operations, the ground commander is responsible for targeting for offensive air support/support of ground troops, and both are responsible for identifying interdiction/isolating the battlefield targets. Once these prioritized target lists are developed each day, it is a simple matter for air commanders to assign quantities of sorties against each target according to mission category, until all sorties for both periods of the day are used up. Thus, if 180 day sorties are assigned to the BAI category and must be used to cover 20 targets, it can be seen from Figure V-2-A that any less than approximately 20 sorties over a target results in very little damage. Accounting for possible losses, it might be wise to assign 30 sorties to each of the first six targets and let the other fourteen go unstruck, rather than assign nine sorties to each of the 20 in the list.

One critical factor which must be considered is weather. Based on forecasts, it may be wise to commit the majority of assets to good weather areas rather than spread them evenly throughout a theater which would have both good and bad weather in target zones.

These types of decisions are the gut issues which decide how an air war will go. The right decision at the right time can achieve a tremendous victory; conversely, the wrong decision at the wrong time can prove disastrous. Players involved in a scenario using the model described in this study will come away with a true appreciation and deep understanding of what is required to manage an air war as part of the overall Air-Land Battle.

MEASURES OF EFFECTIVENESS

The ultimate measure of effectiveness in the Air-Land Battle is victory on the battlefield. For the air side, there are different interim measures which can be used to provide an idea of how the air war is going. The first of these is exchange ratio, or the air-to-air losses sustained each day. Each side knows how many ASF and DRA aircraft (assigned to CAP and DCA only) it has lost and should be provided with an intelligence addendum of pilot reports on enemy aircraft shot down in DCA and CAP roles. Dividing enemy losses by friendly losses yields the air-to-air exchange ratio, which is a measure of how effective friendly aircraft are against enemy aircraft in the aggregate. The second effectiveness measure is force drawdown, which is figured in terms of percentage of overall air assets on both sides. Again, losses of friendly forces are compared with losses of enemy forces (through intelligence addendums), but on a percentage basis of total air assets available. This comparison, tracked on a day by day basis, gives air commanders the "Big Picture" of how the overall air campaign is going, can be used to project relative positions of strength into the future, and can serve as an indicator of the need for a change in strategy if projections are unfavorable.

A third measure is based on the concept of sortie generation rates *vs.* assets available. By taking total sorties available each day and dividing by total number of aircraft which were used to generate those sorties, and tracking this ratio throughout the conflict, it is possible to develop a feel for how badly your air power is being eroded as a result of enemy counter-air operations.

INPUT/OUTPUT

As can be seen from the foregoing discussion, the primary objective of the air war model proposed in this study is to provide players with an understanding of the types of air decisions required at the operational art level. To this end, it is imperative that all player interface with the computer model require minimum time and be as simple as possible. To this end, a critical analysis of all input/output formats will be required to insure that they provide a conceptual parallel with the decisions required, are consolidated to the maximum extent practicable and provide the correct type and quantity of information upon which these decisions will be based. The bottom line is that the players must find themselves in a tiny universe bounded by established rules and interactions. They must have as much time as possible to think about the decisions they will have to make and as simple a task as possible to communicate those decisions into the model so that game play can take place at a reasonable rate.

CHAPTER VII

THE NEXT STEP

The title "Conclusion" was purposely avoided for this chapter. This study is intended to be the first step in the development of an air war model which can provide future Army leaders with a basic understanding of how the Air Force manages its assets in a conflict. The simplifications and assumptions used were a necessity in reducing the problem to manageable proportions. All interrelationships herein are conceptual in nature and much development work and refinement will be required to finalize them in terms of hard numbers and definite mathematical models.

Integration of the concepts defined in this study into the McClintic Theater Model will be a long, demanding task. However, the ultimate payoff will be a model that is both a reflection of reality and a valid teaching tool. The Army's commitment to the concept of the Air-Land Battle and total integration of battlefield firepower into the deepest reaches of the enemy's rear echelons requires that Army leaders at all levels have a comprehensive understanding of how critical the air side is in the overall Air-Land equation. The concepts in this study, properly integrated into the MTM, can be a key factor in achieving such a goal.

BIBLIOGRAPHY

Berg, Richard H., et al., Wargame Design. New York: Simulations Publications, 1977.

Collins, John M. U.S.-Soviet Military Balance: Concepts and Capabilities 1960-1980. Washington: McGraw-Hill, 1980.

Lomov, N. A., ed. Scientific-Technical Progress and the Revolution in Military Affairs. Moscow: 1973. Translated and Published by the US Air Force. Washington: Goernment Printing Office, 1974.

North Atlantic Treaty Organization. Allied Tactical Pamphlet 33(A): NATO Tactical Air Doctrine. Brussels: May 1979.

O'Mally, Jerome F., LTG, USAF, and Otis, Glenn K., LTG. Memorandum: USA and USAF Agreement on Apportionment and Allocation of Offensive Air Support. Washington: Department of the Air Force, 23 May 1981.

Pappas, A. D., COL, USAF. US Air War College, Combined Air Warfare Course. Personal Interview. Maxwell AFB: 16-17 March 1982.

Savkin, V. Ye. The Basic Principles of Operational Art and Tactics. Moscow: 1972. Translated and Published by the US Air Force. Washington: Government Printing Office, 1974.

"Soviet Aerospace Almanac 1982." Air Force Magazine, Vol. 65, No. 3, March 1982.

"The Military Balance 1981/82." Air Force Magazine, Vol. 64, No. 12, December 1981.

US Air Force. Air Force Pamphlet 200-21: Soviet Aerospace Handbook. Washington: May 1978.

US Air Force. Air Force Manual 1-1: Functions and Basic Doctrine of the United States Air Force. Washington: 14 February 1979.

US Air Force. Air War College. Combined Air Warfare Course. Instruction Circular, Vols. I and II. Maxwell AFB: January 1982.

US Air Force. Air War College. Theater War Exercise Handbook Vols. I, II, III, and Annex, plus supporting computer documentation printout. Maxwell AFB: March 1982.

US Air Force. Tactical Air Command. Tactical Air Command Manual 2-1: Tactical Air Operation. Langley AFB: April 1978.

US Conress, Congressional Budget Office. Assessing the NATO/Warsaw Pact Military Balance. Washington: Government Printing Office, December 1977.

US Department of the Army. Field Manual 100-5: Operations. Washington: 1 July 1976.

US Department of the Army. US Army Intelligence and Threat Assessment Center. Soviet Army Operations. Washington: Government Printing Office, April 1978.

US Department of the Army. US Army War College. Selected Readings: Warsaw Pact Strategy, Planning, and Operations. Carlisle Barracks: 1980.

US Department of the Army. US Army War College. Department of War Gaming. McClintic Theater Model, Vols. I, II, and III. Carlisle Barracks: July 1981.

US Department of the Army. US Army War College. Department of War Gaming. War Gaming Handbook. Carlisle Barracks: February 1982.

Weinberger, Caspar W. Soviet Military Power. Washington: Department of Defense, 1981.

DISTRIBUTION

US Army War College
Department of War Gaming
Carlisle Barracks, PA 17Ø13 (6)

US Air War College
Combined Air Warfare Course
Maxwell AFB, AL

HQ 87th MAC/Col McDonald
3851 Venoadaniels Rd
Birmingham, AL 35244

715 BMS/CC
Pease AFB, NH Ø38Ø1

US Army War College
Department of Military Strategy
Planning and Operations
Carlisle Barracks, PA 17013 (3)

US Army War College
Library
Carlisle Barracks, PA 17013 (2)

E

ED

82