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This study attempts to determine if joint electronic warfare can be employed to suppress enemy air defenses within twenty kilometers of the forward edge of the battle area. The investigation is focused on an analysis of why joint electronic warfare is needed to suppress enemy air defenses.

The investigation reveals that the quantity and diversity of Soviet ground air defense systems have increased to the point that close air support will be ineffective without augmented electronic warfare support. Since Air Force electronic warfare support assets are limited, an alternate source must be sought for this capability. Within 20 kilometers of the forward edge of the battle area, Army EW could possibly provide this support. However, more work is required on the part of the Army and Air Force to make joint EW an effective means of suppressing enemy air defenses.

The Suppression of Enemy Air Defense Within Twenty Kilometers of the Forward Edge of the Battle Area

Charles L. McCoy, MAJ, USAF
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas 66027

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A Master of Military Art and Science thesis presented to the faculty of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

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

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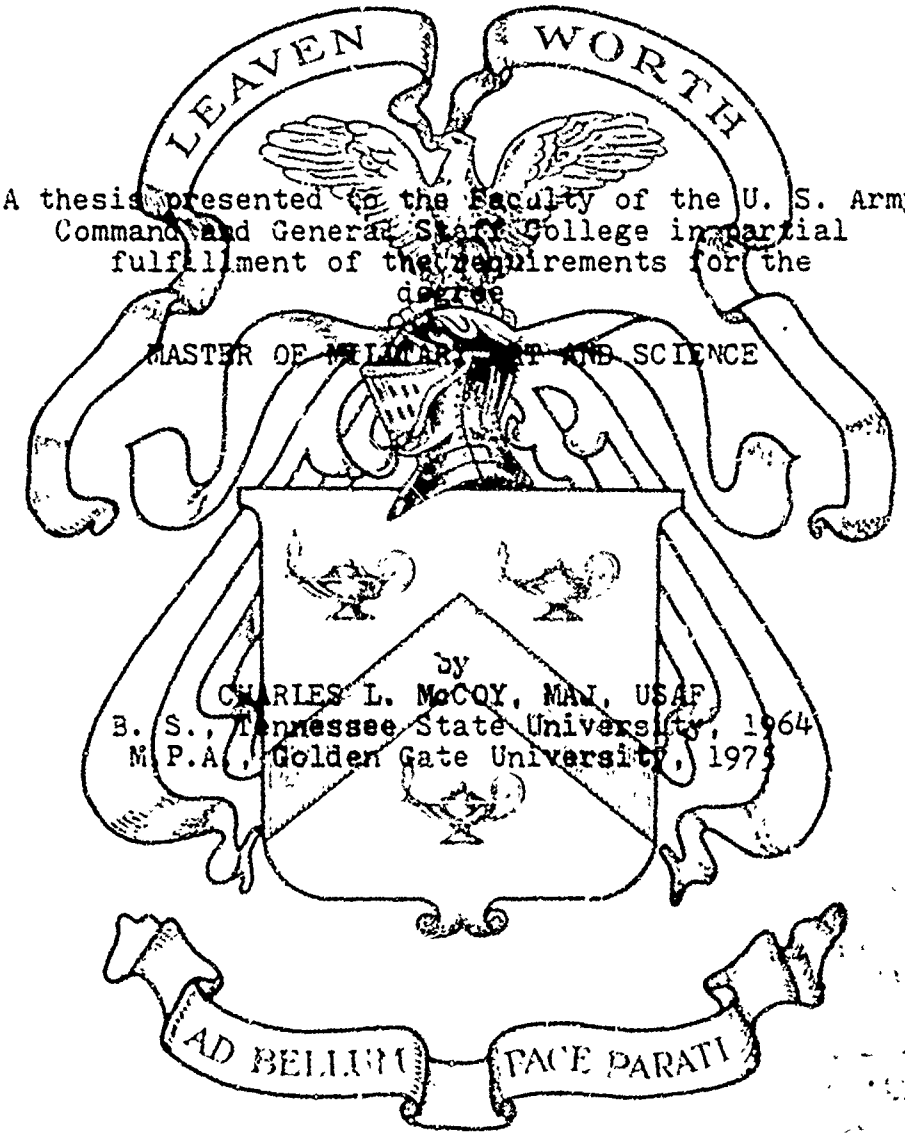

by

CHARLES L. McCOY, MAJ, USAF
B. S., Tennessee State University, 1964
M.P.A., Golden Gate University, 1973

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Joseph R Breen, Member, Graduate Faculty

Ronald O. Schaffer, Member, Consulting Faculty

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ABSTRACT

THE SUPPRESSION OF ENEMY AIR DEFENSE WITHIN TWENTY KILOMETERS OF THE FORWARD EDGE OF THE BATTLE AREA, by Major Charles L. McCoy, USAF, 121 pages

This study attempts to determine if joint electronic warfare can be employed to suppress enemy air defenses within twenty kilometers of the forward edge of the battle area. The investigation is focused on an analysis of why joint electronic warfare is needed to suppress enemy air defenses.

The investigation reveals that the quantity and diversity of Soviet ground air defense systems have increased to the point that close air support will be ineffective without augmented electronic warfare support. Since Air Force electronic warfare support assets are limited, an alternate source must be sought for this capability. Within 20 kilometers of the forward edge of the battle area, Army EW could possibly provide this support. However, more work is required on the part of the Army and Air Force to make joint EW an effective means of suppressing enemy air defenses.

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CHAPTER 1

INTRODUCTION

In recent years, after achieving nuclear parity with the United States, the Soviet Union embarked upon a program to modernize its conventional forces. In doing so, it has produced a capable fighting force. From indications, the objective of the Soviets is to create a force that can defeat any adversary under varying field conditions to include nuclear warfare. For example, forces within the Warsaw Pact appear to be well prepared for immediate combat and possess the ability to conduct a short war without additional support.[1] Equipment introduced appear to be highly mobile, possess great fire power and include new mobile air defense systems and improved anti-aircraft guns[2], which presents a multi-dimensional problem to U.S. planners and tacticians. The introduction of new mobile air defense systems to a Warsaw Pact similar force, which is a Soviet model, will seriously degrade any attempts to destroy such a force from the air.

To wage successfully a mid-intensity level conflict against a Soviet model force, a combined arms approach will have to be employed. In the case of the United States, this means an air-land team of the Air Force

and Army units. This team will be employed near the forward edge of the battle area and devote extraordinary effort to containing the enemy's advance and follow-up destruction of him.

For an air/land team to function as a combat effective entity in the engagement of enemy forces near the forward edge of the battle area, each member of the team must ensure that it employ tactics and equipment to enhance the team's overall combat power and effectiveness. This aspect of air/land employment becomes extremely important, and critical, when one considers the integration of close air support in the scheme of land force maneuvers, and the impact that enemy air defense artillery, in particular, can have upon air operations if it is allowed to operate unchallenged.

The air defense capability of Soviet ground forces appear to be quite formidable, in terms of both quanity and diversity, as compared to any past force, and offer considerable immunity from air strike. It has been built based upon "lessons learned" from the Vietnam War and the Middle East War. As a result, the density of Soviet radars appear to be increasing. At the same time, radar operating frequencies are expanding across the entire electromagnetic spectrum, i.e., tracking and control radars for surface-to-air missile weapon system operate in E-band, G-band, H-band and I-band; the guidance command operates at a lower frequency in C-band

and D-band, thus presenting an increasingly complicated problem to those who seek to degrade or impede these radar performances.3

STATEMENT OF THE PROBLEM

How to suppress enemy air defense within twenty kilometers of the forward edge of the battle area?

The problem of degrading and ultimately suppressing enemy air defense artillery is not as bleak as it appears, but it will require some innovative thinking and cooperation on the part of both the Air Force and Army. In pursuing a solution to this problem, the author will answer the following questions in the remainder of the study:

1. What will be the enemy air defense artillery (ADA) threat to U.S. forces in a future mid-intensity conflict (within 20 kilometers of the forward edge of the battle)?

2. What are the implications of the enemy ADA threat upon close air support and Army air operations within twenty kilometers of the forward edge of the battle area?

3. Do U.S. forces currently possess the capability to engage and suppress enemy air defense systems (within 20 kilometers of the forward edge of the battle area)?

4. Are the U.S. Air Force and U.S. Army electronic warfare missions complementary? If not, how can they be made compatible to achieve a suppressive effort that will allow close air support to be performed successfully

(within twenty kilometers of the FEBA)?

5. What are the specific air defense artillery implications in Central Europe today, and what effect will a consolidated electronic warfare effort have upon this environment within twenty kilometers of the FEBA during the course of a "short war", i.e., fifteen days or less?

PURPOSE OF STUDY

This study has one goal, to evaluate the joint electronic warfare capability of the U.S. Air Force and U.S. Army to suppress the enemy defense artillery threat within twenty kilometers of the forward edge of the battle area. In accomplishing this goal, the author will (1) provide the reader a basic outline of the enemy air defense artillery capability; (2) investigate how the U.S. Air Force and U.S. Army may mutually support the suppression of enemy air defense with electronic warfare; and (3) provoke the reader to give additional thought as to how he may employ electronic warfare assets within his command to make a contribution to the suppression of enemy air defense. Additionally, the author will recommend how U.S. air-land electronic warfare may be employed in a selected portion of Central Europe.

SIGNIFICANCE OF PROBLEM

Suppression of enemy air defense within twenty kilometers of the forward edge of the battle area has

significant implications for both the Army and Air Force; if they plan to operate as a combined arms team in this region of the battlefield. With an overwhelming amount of enemy air defense in operation, Air Force close air support will be seriously affected and possibly degraded to a point of ineffectiveness; without close air support, the Army will be left with the entire task of stopping advancing enemy ground forces. Therefore, the creation of an environment that will permit close air support operations is critical in the scheme of maneuvering an air/land team.

Close air support simply cannot provide the required support at an acceptable loss rate in a Soviet model air defense environment (to be discussed in Chapter Six of this study). Therefore, a concerted effort has to be made on the part of the Air Force and Army to suppress enemy air defense artillery by integrating the suppression of enemy air defense artillery in all air/land plans. Ideally, since air defense efforts are directed against aircraft, close air support should provide for its own protection; but this is not possible for several reasons. One reason is the number of air defense systems involved. Another reason, and probably the most important, is the configuration of today's fighter aircraft, which only permits the carriage of counter air defense measures (missiles, electronic countermeasure pods, etc.) at the expense of reduced weapons loads. The foregoing

limitation on aircraft and a known shortage of resources in both Services prevent the dedication of a significant number of assets to enemy air defense suppression. A joint approach to this problem is the only hope for a near term solution.

Enemy air defense suppression takes many forms, to include: individual weapon system destruction; degradation of the ADA command and control nets; reduction of enemy warning time, time required in the employment of more complex air defense systems; and weapon systems isolation, which occurs if command and control is degraded to a point that specific weapons systems cannot be brought to bear at the optimum time and place. All of these will be available to a U.S. air/land team, if it has a well coordinated electronic warfare program to degrade enemy ADA. Coordination and cooperation are the key features to this approach; thus the reason for this study; to explore just how the Army and Air Force may accomplish the arduous task of suppressing enemy air defense artillery.

The following assumptions and limitations apply to this study. They were imposed to limit the document's scope, volume and technical complexity.

1. Assumptions:

   a. The reader has a basic knowledge of radar, radio and electronic warfare fundamentals.

   b. All electronic warfare equipment and enemy air defense artillery systems will function

as designed.

c. Availability of friendly electronic warfare assets will not be a factor, except where quanities of systems are limited due to initial procurement. It is assumed that electronic warfare assets presently in the Army and Air Force inventories will be available.

d. The distance from the FEBA in this study coincide with the approximate maximum range of U.S. Army divisional artillery fires and electronic warfare. U.S. Army divisions in conjunction with close air support will form the basis of the air/land team during future conflicts. As a result, this study is confined to the region of the battlefield where joint participation is most likely to occur.

e. Established joint electronic warfare procedures will apply.

f. Mid-intensity (defined in the Definition Section of this study) conflict will be the level of conflict used for analysis.

g. At some time in the future, the U.S. Army and U.S. Air Force will be required to operate in a Soviet modeled air defense

environment.

2. Limitations:

   a. Doctrine will not be an issue in this study. The issue is: how to effectively employ Army and Air Force electronic warfare assets to degrade air defense artillery found in Soviet model armies.

   b. Enemy air forces and their defense capability will not be addressed. A permissive air environment will exist for the purposes of this study.

   c. U.S. Air Force aircraft operating within twenty kilometers of the forward edge of the battle area will have a limited self-protection electronic warfare capability.

   d. Enemy air defense artillery of concern is confined to guided systems.

The preceeding assumptions and limitations, imposed by the writer, narrows the scope of this study to the point that individual aircrews and maneuver commanders can visualize where they fit in the air defense suppression equation, and induce each individual to search for additional approaches to cope with the enemy ADA threat.

DEFINITION OF TERMS

To establish a common base between the writer and the reader the following key terms and definitions are provided. The definition and context used here will prevail

throughout the study to enhance the reader's understanding. The Joint Chief of Staff(JCS) Publication 1, Dictionary of Military and Associated Terms, 3 September 1974, is used as the reference to provide standardized Department of Defense definition of the selected terms. Where terms are extracted from sources other than JCS Publication 1, the source is indicated.

1. Area of Influence (NATO). The portion of the assigned zone and area of operations where in a commander is directly capable of influencing the progress or outcome of operations by maneuvers of his ground-gaining elements or by delivery of the firepower with fire support normally under his control and command. It is a geographical area the size of which depends upon the mission organization and equipment of the force involved.

2. Electromagnetic Radiation. Radiation made up of oscillating electric and magnetic fields and propagated with the speed of light. Includes gamma radiation, x-rays, ultra-violet, visible and infrared radiation, and radar and radio waves.

3. Electronic Warfare. Those military actions involving the use of electromagnetic energy to determine, exploit, reduce or prevent hostile use of the electromagnetic spectrum and action which retains friendly use of the electromagnetic spectrum , . . . there are three divisions within electronic warfare: . . . electronic

warfare support measures, . . . electronic countermeasures, . . . (and) electronic counter-countermeasures.

4. Electronic Warfare Support Measures. That division of electronic warfare involving actions taken to search for, intercept, locate, and immediately identify radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support measures provide a source of information required for immediate action . . . .

5. Electronic Countermeasures. That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum . . . electronic countermeasures include:

a. Electronic Jamming: The deliberate radiation, reradiation or reflection of electromagnetic energy with the object of impairing the use of electronic devices, equipment, or systems being used by an enemy.

b. Electronic Deception: The deliberate radiation, reradiation, alteration or reflection of electromagnetic energy in a manner intended to mislead an enemy in the interpretation or use of information received by electronic systems. There are two categories of electronic deception:

1. Manipulative Deception - the alteration of friendly electromagnetic radiations to accomplish deception.

2. Imitative Deception - the introduction of radiations into enemy channels which imitate his own emissions.

6. Electronic Combat (extracted from Air-Land Forces Application Agency Manual, Electronic Warfare Procedures for Employment in Joint Operations). There are essentially two parts to offensive electronic combat. The first part is intelligence collection and target acquisition (ESM). The second part is electronic jamming and/or deception (ECM). ESM enhances combat power while ECM is a form of combat power and the integration of these with other weapons systems will enhance the potential of both.

7. Electronic Counter-Countermeasures. Action against enemy ECM to ensure effective use of the electromagnetic spectrum. It encompasses the tactics and special equipment used to allow our electronic dependent weapon systems or emitters to work effectively when the enemy is employing ECM.

8. Defensive Electronic Warfare (extracted from FM 100-5, Operations). Tactics which conceal emitters or decieve the enemy as to their identity and location. The commander has several means available to manage the electromagnetic spectrum. They include:

a. The Communications-Electronic Operating

Instructions (CEOI), which are used to assign specific frequencies to specific elements of command. A frequency changing CEOI is highly effective in defeating hostile ESM activities by increasing the difficulty in identifying targets for exploitation.

b. Emission Control (EMCON), which is used by the commander to restrict use of the electromagnetic spectrum to certain critical systems or prohibit use altogether (partial or complete silence). This tactic prevents the enemy from collecting data on our emissions during a specific period and eliminates the probability of unintentional interference by friendly emissions with those from critically important systems.

c. Manipulative Electronic Deception (MED), which is employed to alter an electromagnetic profile of a unit or weapon system or to simulate a notional one to support a commander's countersurveillance or operations security (OPSEC) plan.

9. Joint Force. A general term applied to a force which is composed of significant elements of the Army, the Navy, or the Marine Corps, and the Air Force, or two or more of these services, operating under a single commander

authorized to exercise unified command or operational control over such joint forces.

10. Mid-Intensity Conflict (extracted from USACGSC Course 5 syllabus, Strategic Studies, Vol. II, academic year 1978). War between two or more nations and their respective allies, if any, in which the belligerents employ the most modern technology and all resources in intelligence; mobility; firepower (including nuclear, chemical, and biological weapons); command, control, and communications; and service support; for limited objectives under definitive policy limitations as to the extent of destructiive power that can be employed or the extend of geographic area that might be involved.

11. Battlefield Interdiction (concept extracted from TACM 2-1, Tactical Air Operations). A descriptive term that describes that portion of the air interdiction mission which ahs direct or near-term effect on ground forces. It is close air support (CAS) against enemy forces not yet in contact, but between the fire support coordination line (FSCL) and the forward edge of the battle area. It is also interdiction beyond the FSCL which has a direct or near-term effect on surface operations either in response to Air Force target nomination or at the request of the ground force commander.

12. Suppression of Enemy Air Defenses (derived from the Air-Land Forces Application Agency's concept of joint suppression of enemy air defenses). Actions taken to

degrade, neutralize, or destroy enemy ground air defense artillery.

In the above chapter, the problem was identified; the significance of the problem was highlighted; a hypothesis was made; assumptions and limitations that would permeate the study were outlined; and key terms were defined.

In Chapter Two, relevant literature pertaining to Army/Air Force electronic warfare and suppression of enemy air defenses was identified. Abstracts of the literature that had an impact upon this study are included here. The information contained in these abstracts was used as a point of departure for the remainder of the study.

CHAPTER 1

END NOTES

1. John Erickson, Soviet Military Power, 1973, p. XIV.
2. Ibid. p. 71.
3. "U.S. Seeks Counters to Soviet Radars", Aviation Week and Space Technology, (21 February 1972), p. 45.

CHAPTER 2

REVIEW OF RELATED LITERATURE

INTRODUCTION

In the author's review of literature on the suppression of enemy air defenses (SEAD), one thing was very evident: the Soviets learned their combat lessons well and constantly strive to apply those lessons in equipment development and combat operations. Nowhere is this more evident than in the provisions made to shield ground forces from air attacks. The Soviets apply the principle of defense in depth when deploying air defense systems to protect the Soviet army. It is very indicative of tactics used to defeat both the German Army and Air Force during World War II. Soviet air defenses are echeloned on the battlefield just as are other forces. Every tactical command echelon of the Soviet army, from the front to the tank and infantry regiments, has an organized air defense unit which is integrated into the total air defense system.[1] The United States failed to appreciate or ignored this capability until being confronted with elements of the system in North Vietnam.

Basic SEAD operations began in World War II with the belligerents of that conflict suppressing each other's air defense nets through the employment of electronic warfare (EW). However, SEAD as we know it today: deliberate action taken to destroy, degrade, or obscure

enemy surfaces air defences for a period of time to enhance the effectiveness of friendly air operations[2], had its beginning in the early stages of the bombing campaign against North Vietnam when the North Vietnamese began to challenge U.S. air superiority with the deployment of surface-to-air missiles.[3] To counter the losses being extracted by the surface-to-air missiles, the Air Force initiated the Wild Weasel program. The Weasels were specially configured tactical aircraft designed to ferret out the surface-to-air (SA) missile sites and destroy them. The value of such a program was questioned from time to time because it diverted tactical strike aircraft from their more traditional interdiction role. However, doubts as to the validity of such a program were laid to rest with the experiences of the Middle East War of October 1973. During the initial stages of this conflict, without defense suppression, the Israeli Air Force experienced a considerable aircraft loss to Soviet built Arab missiles; mainly SA-6s and SA-7s.[4] This conflict and the Vietnam experience clearly demonstrated the fact that air operations cannot be conducted at an acceptable loss rate on the modern battlefield without integrating SEAD in these operations.

Losses inflicted upon the Israeli Air Force while attempting to perform close air support in a dense Arab defense environment prompted both the United States Army

and Air Force to re-evaluate SEAD; because these losses had serious implications for the United States combined arms (air-land team) concept. Numerous studies followed the Middle East War to determine what to do about the Soviet army air defense. During the Arab-Israeli Conflict, the United States saw the total air defense capability of the Soviet army began to unfold. Combined with our Vietnam experience, which exhibited the capabilities of the SA-2, SA-7 and various anti-aircraft artillery, the United States gained an appreciation of the capabilities of the SA-3, SA-6 and ZSU-23/4, none of which had been previously demonstrated to the West. The results of all studies conducted were essentially the same: SEAD is a prerequisite to close air support to keep aircraft losses at an acceptable level.[5] As is the case with most studies that illuminate an existing problem, the services set about to solve the SEAD problem in a typical expeditous fashion by identifying forces and weapons systems capabilities. The result was a provision for SEAD in operations planning, and its identification as an adjunct to other more basic and classic missions. "As a result, each military service . . . developed, in varying degrees, its own doctrine, organization and tactics, usually with a proforma stipulation that its air defense suppression operations will be executed "in coordination with and supported by" the other services".[6]

Joint exercises over the years have made the Army

and Air Force realize that the services cannot conduct SEAD individually and achieve the required overall results that each service's manuals allude to. It is in recognition of this lack of interaction that prompted Headquarters, Tactical Air Command and the Army's Training and Doctrine Command to establish a joint team, the Air-Land Forces Application Agency (hereafter referred to as the ALFA Agency), to study air-land warfare and propose a solution to joint problems.

The establishment of the ALFA Agency was an important first step in solving joing related problems that will ultimately inhibit the effectiveness of the air/land forces in the future. In regards to SEAD, the ALFA Agency was given two objectives: "(1) Develop joint Army/Air Force concept and procedures to suppress the Soviet ground based mobile air defenses. (2) Quantify joint assets required and payoffs, if any, in reduced friendly aircraft attrition."[7] The ALFA Agency has published two documents that attempt to satisfy these objectives. The one document that has the greatest application to this study is Suppression of Enemy Air Defenses, Volume II: Joint Concept and Procedures. Another document uncovered in this search for literature that parallels this document is the summary sheet to Command and General Staff College (CGSC) course P312-2, An Introduction to Offensive Operations.

The ALFA Agency and CGSC documents are the most authoritative sources the author has found to date on the subject of joint SEAD. The ALFA Agency document contains the original joint SEAD concept; the CGSC document contains the original joint SEAD concept; the CGSC document is a concise summarization of the ALFA Agency concept. The latter document is provided in Appendix A for the reader.

The ALFA Agency apparently had some very explicit guidance in constructing the joint SEAD concept, because the concept is built around the respective doctrine of the Army and Air Force. There are both good and bad aspects of this approach. A good aspect of this approach is it forced the ALFA Agency to begin with some realistic assumptions. Assumptions that have been known for some time, but very rarely expounded or acknowledged by either the Army or the Air Force. The key assumptions ALFA made follows: (1) If a joint SEAD campaign is to be effective, it must be preplanned; (2) the nature of joint SEAD dictates that the Air Force be responsible for its planning; however, maximum Army cooperation and assistance must be readily available; (3) the Army and Air Force have some similar capabilities and each also has unique capabilities; (4) the requirement for cooperation and teamwork in such an important matter is apparent; and (5) the required coordination of the air-land battle takes place through the air-ground system, such as the Direct Air

Air Support Request System.[8] Within this framework of assumptions, the ALFA Agency developed a premise of how joint SEAD should be conducted.

Joint SEAD campaign is the name attached to the military action that will take place during the implementation of joint operations to suppress enemy air defenses. Immediately, the connotation is to envision some large scale, continuing operation. Such is not the case, the ALFA Agency attempted in its definition of the joint SEAD campaign to identify a premise that will encompass all situations requiring joint SEAD employment. The ALFA Agency defines the joint SEAD campaign as follows:

> A coordinated, concentrated, simultaneous, overwhelming attack using saturation tactics with the objective os suppressing the enemies' surface air defense throughout an extensive area for a limited time to permit exploiting the capabilities of friendly air support. A joint suppression campaign normally lasts for a period of hours and includes both preplanned and on-call SEAD. It supports, and is conducted currently with, other air operations.[9]

To deal with the situational nature of joint SEAD, the ALFA Agency goes further to state that:

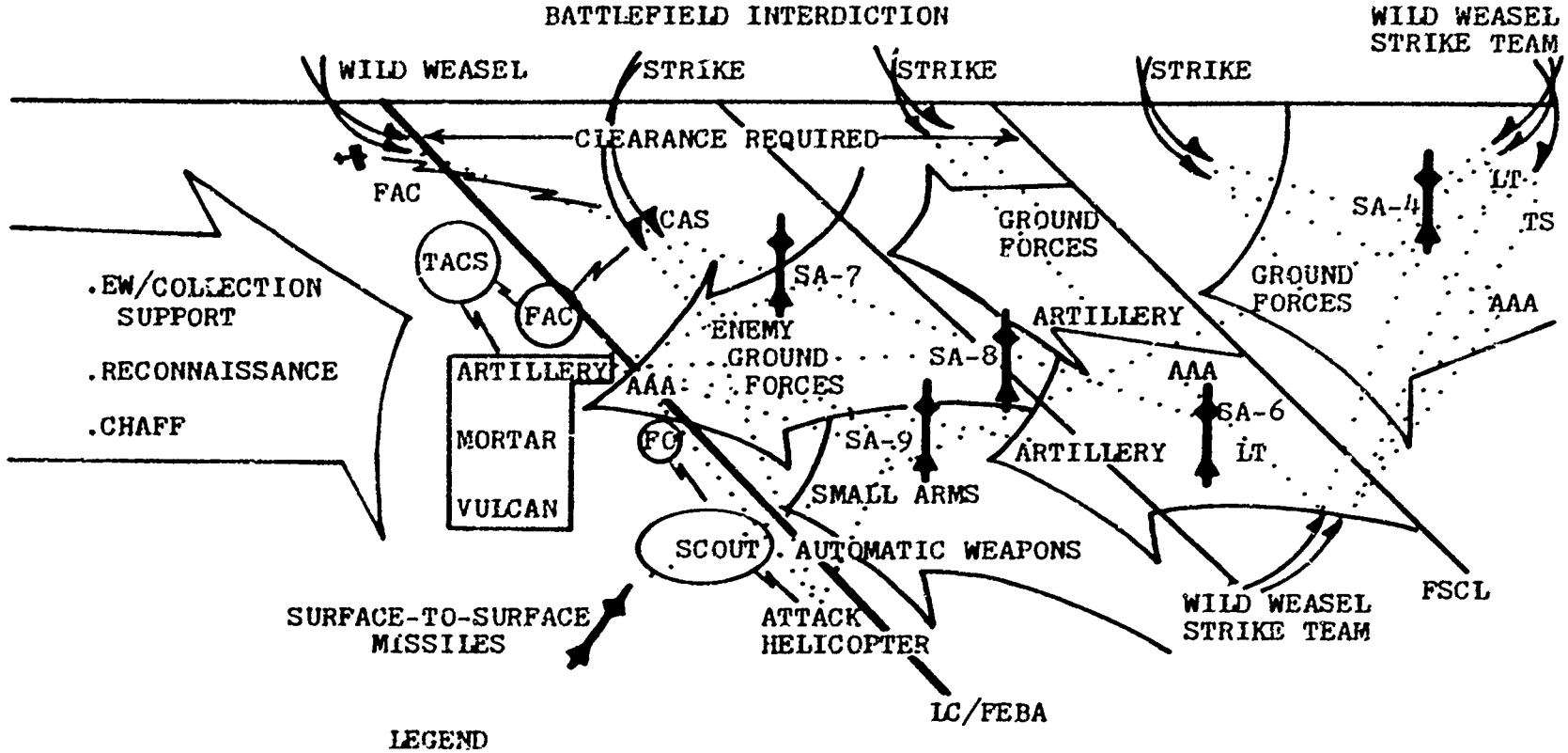
> Joint suppression may be characterized either as an all-out effort over an extended area and/or time period (SEAD Campaign) or a localized suppression effort in support of specific priority missions (localized SEAD). Regardless of the scope of the SEAD effort, it includes detailed planning with provisions for preplanned and on-call suppression. The employment of all assets is orchestrated to produce the desired results.[10]

As mentioned earlier, the ALFA Agency attempted to optimally employ the inherent capabilities of the Army and Air Force when it developed its joint SEAD (J-SEAD) concept. This thinking is reflected below in the J-SEAD employment scheme.

> The J-SEAD concept of employment recognizing the Army's capabilities near the (line of contact) LC and the Air Force's greater penetration capabilities . . . uses three areas to describe where one service or the other dominates in target acquisition and/or capability to bring firepower on a given target. This concept provides an understanding of who might nominate targets, who has the capability to strike the targets once nominated, and where targeting trade-offs occurred. This divisional concept is not intended to break up the battlefield into separate responsibilities, but is used to underscore the need for close Army/Air Force coordination in the conduct of suppressing enemy air defense operations.[11]

Each of the areas or zones identified for SEAD operations have very unique characteristics. Each is explained below and are graphically illustrated in figure 2-1.

The first area intended for a SEAD campaign begins at the line contact (LC) (synonymous with the forward edge of the battle area for the purpose of this study) and extends to a depth of approximately 5 kilometers, which coincides with the visual observation range of ground forces. This area is ideally suited to Army direct and indirect fire systems, to include Army attack helicopters. The major threat in this area is characterized by short-range air defense system, e.g., the SA-7, SA-8,



LEGEND

———	COMMUNICATIONS/COMMAND AND CONTROL
.....	ATTACK FIRES
LT	LONG TRACK
TS	THIN SKIN
AAA	ANTI-AIRCRAFT GUNS; e.g., ZSU-23-4

FIGURE 2-1. JOINT SUPPRESSION CAMPAIGN

SOURCE: ALFA, Suppression of Enemy Air Defenses

SA-9 and ZSU-23-4. Longer range surface-to-air missile systems will also influence air operations in this area, but their effects should be minimal except at medium-to-high altitude. The majority of air operations in this area will be in direct support of ground forces and normally conducted at relatively low altitude. For this reason, it becomes imperative that the low-altitude air defense systems receive the greatest attention in this area.

The second area of intended joint SEAD concept extends from the limit of visual observation to the range of friendly artillery or the fire support coordination line (FSCL). The FSCL will probably extend to the maximum range of the assigned Army divisional artillery weapons. The ALFA Agency estimates this to be a range of approximately 15 kilometers. This range will be at least 20 kilometers, which will allow ground commanders to take advantage of the maximum range of the M110AI (SP) 8 inch gun.[12] This idea is in consonance with the definition of a fire support coordination line. FM6-20, Fire Support in Combined Arms Operations, define a FSCL as a line beyond which all targets may be attacked by any weapon system (including aircraft and special weapons) without endangering friendly troops or requiring additional coordination with the establishing headquarters.[13] The threat in this area is essentially identical to that found in the first area with the exception that the SA-6 will

to be found here to reinforce the short-range, low altitude air defense system and cover the possible medium-altitude ingress and egress of close air support sorties. The ALFA Agency suggests that the threat in this area be suppressed primarily by tactical aircraft assisted by field artillery.

The third area of interest extends from the FSCL to the depth of the battlefield. The majority of this area is beyond the range of friendly field artillery, therefore suppression here will be left to the Air Force and its longer range air assets. The threat here will run the gamut of air defense systems. It will contain fewer low-altitude, short-range air defense weapons, but more long-range, high and medium-altitude weapons than the previous two areas. The SA-4 and semi-mobile SA-2s and SA-3s will be located in this area. Weapon systems in this area will be suppressed or attacked on a selected basis as missions in this area dictate.[14]

The division of the battlefield for SEAD is not a bad idea because in actuality that is the way battles are fought. The idea of using the Army-Air Force air-to-ground nets for coordination is good to a point. And, the preplanned localized and on-call SEAD employment is also good. However, the time involved in bringing suppressive measures to bear on enemy air defense weapons where SEAD has not been planned is of concern. The requirement for joint SEAD will be much more prevalent in situations where SEAD has not been preplanned because of the unpredictable nature of a

Soviet modeled army.

Soviet modeled army doctrine dictate that operations be conducted along an extended front and a breakthrough implemented to secure assigned objectives. SEAD will have to be planned for the entire front; however, once a breakthrough is initiated a new situation is created, a mass of enemy forces will transit the gap in the front at this point while remaining enemy forces will attempt to open other holes in the front. As the emphasis shifts along the front and close air support is employed, the requirement for SEAD is going to shift. Not all the possible variations of such a battle can be preplanned, but according to the ALFA Agency, on-call SEAD can handle this situation.

On-call SEAD is going to be the most difficult to implement. The ALFA Agency concept has made provisions for on-call and broken it out into two broad areas, Army request for SEAD, and Air Force request for SEAD. To implement either of these requests, a requestor submits his request through the Direct Air Support Request system. Since in the majority of instances, the Air Force would be requesting SEAD support, this is the on-call SEAD request that is of interest here.

Ideally, on-call SEAD would be performed by the unit being supported. However, when one analyzes the situation he finds the unit being supported is the one in trouble,

and probably is using all of its assets in support of its own survival. Therefore, the request for on-call SEAD will more than likely end up at a much higher level than originally initiated. The headquarters that finally accepts the request must then, in turn, find an agency to fill the request. This consumes an enormous amount of time. Time is very important, because the time involved in satisfying a request equates to reduced aircraft loiter time, or the time available to work with ground forces. With the exception of the A-10 aircraft, loiter time is critical. Excessive SEAD request times will have serious consequences for close air support. If air defense weapons cannot be suppressed promptly, either aircraft losses will be unacceptably high, target destruction will be low, sorties will be lost, or aircraft will have to expend their ordinance on air defense targets rather than close air support targets to insure their own survival. The integration and central control of on-call SEAD is the foremost problem with the joint SEAD plan.

Army divisions and echelons below do not have the electronic warfare assets or fire support resources to provide on-call SEAD. When a unit requests air support it is usually heavily engaged in combat and using all organic resources to defeat or repel the enemy. When this is the case, the request for immediate SEAD support will be deferred or possibly rerouted as a request for immediate

fire support. In both instances the response is less than ideal, and will probably result in lost close air support or at least delayed close air support.

In the chapter above, relevant literature pertaining to Army/Air Force electronic warfare and suppression of enemy air defenses was identified. Abstracts of the literature that had an impact upon this study are included here. The information contained in these abstracts was used as a point of departure for the remainder of the study.

The methodology used in the study is outlined in Chapter Three.

CHAPTER 2

END NOTES

1. F. P. Henderson, Air Defense Suppression System Requirements (U), November 1975 (Secret/Noforn), p. 1-1.
2. CGSC Summary Sheet to Course P312, Introduction to Offensive Operations, Corps Planning, Section X, Lesson 2.
3. "Wild Weasels Prepare to Fly F-4G", Electronic Warfare/ Defense Electronics, (Feb. 1978), pp. 70-73.
4. William D. White, U.S. Tactical Air Power: Missions, Forces and Costs, p. 69.
5. U. S. Army FM 100-5, Operations, p. 5-6.
6. F. P. Henderson, Air Defense Suppression Requirements (U), p. 1-14.
7. ALFA, Suppression of Enemy Air Defenses, Vol. I: Joint Study Report, 1 Feb. 1977 (Secret), p. I - 3.
8. ALFA, Suppression of Enemy Air Defenses, Vol II: Joint Concept and Procedures, 1 February 1977 (Draft), pp. 1-1 - 1-2.
9. Ibid., p. 3-3.
10. Ibid., p. 3-1.
11. Ibid., p. 2-4.
12. U. S. Army FM 6-20, Fire Support in Combined Arms Operations, p. B-A-3.
13. Ibid., p. 3-14.
14. ALFA, Suppression of Enemy Air Defenses, Vol. II, pp. II-1 thru II-29.

CHAPTER 3

METHODOLOGY

The United States, which has not conducted extensive joint electronic warfare operations against a well equipped enemy since World War II, does not have an abundance of information and examples available to indicate how successful defense suppression efforts could be against enemy ground air defenses in the intervening year. Historical information indicate electronic warfare campaigns of World War II, such as the one that supported the Normandy Invasion, were very successful in degrading Germany's air defense nets.[1] Since that time, the U. S. armed forces have fought individual campaigns.

For instance, the Vietnam War was separated into operations that were mainly Air Force oriented, Army oriented, and Navy oriented. Rarely were there any joint operations. Each service operated in a different air defense environment. When there were joint Army/Air Force operations, which is the subject of this study, they were conducted in a rather unsophisticated air defense environment. The major air defense threats were small arms, manually controlled light anti-aircraft (57 mm and smaller) and some surface-to-air missiles (introduced in South Vietnam near the end of the conflict). The Air Force, in its bombing campaign against North Vietnam, encountered the more sophisticated radar-guided air defenses.

The Middle East War of 1973 retaught the Army and Air Force the benefits of joint air-land operations. "Lessons learned" in this conflict reemphasized the importance of close air support to ground forces and the vulnerability of air forces to ground air defenses. As a result, the Air Land Forces Application Agency looked in depth at the air-land battle. It looked at the many facets of air-land operations and revalidated the concept of close air support. However, in revalidating the concept of close air support, it became evident that in an intense enemy air defense environment, electronic warfare can play a significant role in suppressing enemy air defenses. To exploit the advantages of friendly electronic warfare, the ALFA Agency looked at Army and Air Force electronic warfare to determine how they could mutually support each other in this environment. Joint electronic warfare procedures were developed as an initial doctrinal point of departure.[2] This concept, as yet, has not been tested except in exercises and simulations. It should be noted that when they are tested during range exercises, only approximately 25 percent of the Soviet electronic threat is replicated.[3] Since there is a lack of combat proven statistics to support or refute the validity of the ALFA Agency's joint SEAD, this study will be descriptive in nature. The author will address how best to apply Army and Air Force electronic to achieve the degree of aircraft (including helicopters) protection required to conduct air operations within 20 kilometers

of the forward edge of the battle area (FEBA). Also, in this chapter is an opinionnaire that attempted to assess the feeling of the students in the 1979 class of Command and General Staff College on joint electronic warfare and SEAD.

Chapter Four of this study will be devoted to defining the air defense weapons systems one can expect in a Soviet modeled army. This is important to demonstrate the proliferation and sophistication of Soviet air defense systems and provide an indication of the increasing complexity of the defense suppression problem.[4]

> "The Soviet Union and the Warsaw Pact Nations have tried to offset or reduce the USAF's combat power effectiveness through the use of extensive and sphisticated mobile air defenses - - defenses involving mixes of guns and missiles that provide overlapping coverage. Warsaw Pact air defenses now provide a mobile umbrella that accompanies each echelon of the pact armies, including forward deployed battalions. The variety and numbers of air defense weapons accompanying a typical Warsaw Pact army of four or five divisions are impressive."[5]

In Chapter Five, the compatibility of the Army and Air Force electronic warfare programs will be evaluated to determine if the two programs can function together to provide joint EW in SEAD operations within 20 kilometers of the FEBA.

In Chapter Six, the author, with the aid of a scenario set in Central Europe, will show why joint EW is required to make SEAD a reality.

Chapter Seven will present a summary and draw some

conclusions about the Army/Air Force EW capability to influence SEAD operations within 20 kilometers of the FEBA. This chapter will also include recommendations for the improvement of joint EW to enhance SEAD operations within 20 kilometers of the FEBA.

SUMMARY OF OPINIONNAIRE RESULTS

During the ocurse of this study, 78 students in the Army Command and General Staff College, Class of 1979, participated in an opinionnaire that attempted to ascertain the feelings of future Army and Air Force planners on the joint employment of EW to suppress enemy air defenses. At Appendix B are the results of this opinionnaire.

Beyond the fact that the Army and Air Force will function as a team in future conflicts with Soviet modeled armies, little conclusive information was gained from the opinionnaire. The overall results indicated that those responding were far from a consenus of whether the Army and Air Force shoudl work jointly to provide enemy air defense suppression for close air support. The ability of electronic warfare to suppress enemy air defenses was also a question. Remarks forwarded with the completed opinionnaires tended to indicate that coordinated fire support was the best way for the Army and Air Force to interact for the joint suppression of enemy air defenses.

The results of the opinionnaire are an indication that the Army and Air Force have a long way to go before joint

suppression, in any form, will be a reality.

The methodology used in the study was outlined above.

In Chapter Four, the Soviet tactical ground air defense threat is identified. It will include a description of the various Soviet ground air defense systems that will probably be employed to protect a Soviet modeled force, such as, the Warsaw Pact.

CHAPTER 3

END NOTES

1. V. Grankin and V. Zmiyevskiy, From the History of Radio Electronic Warfare, 1975, p. 16.
2. Air Land Forces Application Agency (ALFA), Suppression of Enemy Air Defenses (SEAD), Vols. I and II, Joint Concept and Procedures, Feb. 1977. These documents provide the rational for the Army and Air Force joint SEAD concept and identifies the specifics of the joint SEAD program.
3. Benjamin F. Schemmer, "New DOD Emphasis on Electronic Warfare and Counter C^3 at Budget Crossroads", Armed Forces Journal International, (February 1979), pp. 14-18.
4. Lt. Col. David Brog, "Defense Suppression As a Basic Operational Mission", Air University Review, (March-April 1978), pp. 9-12.
5. Ibid.
6. The division of service operations indicated in this section was observed first hand by the author during tours in Vietnam. Due to the nature of the Vietnam Conflict, there wasn't a FEBA in the classic sense as discussed in current military writing. This undoubtly dictated the degree of cooperation required in the suppression of enemy air defenses. Unfortunately for the U. S. Army and Air Force, they could have benefited from the combat experiences of joint operations.

CHAPTER 4

THREAT

This chapter is devoted to the air defense artillery capability of a typical Soviet modeled ground force. There are several reasons for discussing the Soviet air defense artillery capability. First, the Soviets have been the most prolific, of all nations, in their development and deployment of air defense systems. As a matter of fact,

> . . . the number of different deployed Soviet radar threat systems has increased almost linear over the past 20 years . . . By way of comparison, the number of threat systems that can now be found within several square miles of the forward edge of the battle area (FEBA) exceeds the total number of deployed systems in early World War II.[1]

Second, Soviet ground forces have the most complete air defense coverage of any nation. It provides a virtual umbrella over their ground forces. Third, Soviet air defense capability is being emulated in the development efforts of many countries. In essence, the Soviet Army possess the most formidable air defense capability of any army in the world, and as such, represents a worst case air defense threat. The systems that constitute the heart of the Soviet air defense artillery threat and that will influence air operations from the forward edge of the battle area to a depth of twenty kilometers in territory held by a Soviet modeled force will be identified.

Formidable is an oversimplification of the air defense

capability of a Soviet modeled army when one considers the quanity and variety of weapons involved. The systems of interest here are the guided and radar controlled weapons which provide overhead protection for Soviet maneuver ground forces.

The Soviets have developed an extensive array of air defense artillery over the years. An interesting aspect of this development effort is the philosophy adhered to in designing the air defense systems. They believe radar facilities designed for land forces should be mobile, responsive, rugged and possess the same trafficability as the units and formations they are supporting.[2] An examination of the air defense systems the Soviet have deployed indicate they have attempted to follow this philosophy, but for a lack of technical expertise, they have not been able to incorporate all these qualities into one system. As a result, a succession of systems have been developed and subsequently deployed that complement each other to achieve the desired effect. The succession of systems consist of an array of tactical Soviet air defense artillery that extends from the SA-2 to their latest development (unknown, but speculated to be the SA-11; information in an unclassified form not available on this system).

SOVIET GROUND AIR DEFENSE SYSTEMS

A synopses of the systems presently deployed with the

Soviet Army are presented in the following paragraphs[3]:

The SA-2 (Guideline), the first tactical surface-to-air missile system employed to support the Soviet Army, is a medium-range, high altitude system with a range of 40-50 kilometers. It is controlled by the Fan Song guidance radar that operates in the E/F-band and G-band of the radio frequency spectrum, depending upon series. This particular system saw combat in the Vietnam and Middle East Wars. In the initial phase of each conflict it enjoyed a measure of success; but due to its limited mobility, because of its semi-permanence, which makes it a lucurative target for air attack, and its susceptibility to electronic countermeasures, it became ineffective toward the latter stages of both conflicts.[4]

The SA-3 (Goa), deployed in 1961, complements the SA-2. It is a short range, low-altitude system with a range of 25 - 30 kilometers. It is believed to operate much as the U.S. Haw - defend against low-flying targets. It is controlled by the "Low Blow" guidance radar which operates in the I-band and G-band of the radio frequency spectrum. One additional feature of the SA-3 is that it is semi-mobile. The SA-3 can be disassembled, moved, and re-assembled much faster than the SA-2. This system has also been used in combat by Egypt in the last Middle East War.

The SA-4 (Ganef), first observed in public in 1964,

represents a dramatic change in Soviet tactical air defense capability. All components of this system are mounted on tracked vehicles, thus, it is highly mobile and can be brought into action rapidly. It is the first surface-to-air missile system that appears to be able to travel with the force it is supporting. However, little is known about this system. Experts believe, based upon photographs, the SA-4 when employed with the "Pat Hand" guidance radar has a range of approximately 70 kilometers. It is further believed the SA-4 will be used to close gaps in the SA-6 coverage.[6]

The SA-6 (Gainful), deployed in 1967, is the next tactical surface-to-air missile system in the Soviet SAM development sequence. The SA-6, like the SA-4, is tracked mounted which makes it highly mobile and ideally suited to Soviet operations. It appears the Soviets attempted to incorporate the capabilities of the SA-2, SA-3, and SA-4 into one system when they built the SA-6. The system has a high and low altitude capability of 60 kilometers and 30 kilometers, respectively, and uses several portions (G, H and I-band) of the radio frequency spectrum for command and guidance. The "Straight Flush" radar are the greatest assets of this system.

To complete the air defense coverage of guided weapons from the individual soldier outward and upward, the Soviets introduced SA-7 (Grail or Strella). The SA-7 is a low-altitude, short range weapon. It has a range of 3 kilometers. It is man portable and uses the infared from

its selected targets for guidance.

Apparently dissatisfied with the performance of previous surface-to-air missile systems or as a further diversification of the air defense threat, the Soviets introduced the SA-8 (Gecko) in 1975. This is another unknown system; however, from photographs, several interesting conclusions have been drawn about its capability and probable use. The SA-8 is classified as a highly mobile forward air defense system capable of totally autonomous operation. The SA-8 takes the mobility concept one step beyond the SA-4 and SA-6 by mounting the "Gecko" missiles, missile guidance, and the "Land Roll" radar, operating in H and J-band of the frequency spectrum, is supposedly capable of providing all the information required to effect an aircraft "kill". The SA-8 is expected to be used in a short-range, low-altitude role. It is further postulated the SA-8 is designed to fill the gap between the SA-7, SA-9 and SA-6, and probably has a range of between 8 - 16 kilometers.[7]

The SA-9 (Gaskin), like many of the other Soviet systems, has not been observed outside Soviet control. It is a technical unknown. However, again from photographs, the SA-9 appears to be a modified SA-7 mounted on an amphibious BRDM-2 vehicle that uses the ZSU-23-4 "Gun Dish" radar for target acquisition and possible missile guidance. This combination of an infared missile with possible radar guidance represents a departure from the design of

previous Soviet surface-to-air missile systems, with the exception of the SA-7, that rely solely upon electro-optics for guidance, it further complicates the suppression task. An employment scheme has not been identified for the SA-9, but it is expected that it will be used much like the SA-8. One thing is certain, it will have to be used as a short range, low-altitude weapon, because it has an estimated range of only 5 kilometers. It is postulated that it may replace some of the older low-altitude air defense weapons. It has been seen with Soviet units as low as the regiment, which suggest it will be found well forward in the battle area.[8]

The SA-10, if all reports emanating fr the U.S. press are correct, was designed to counter aircraft like the B-1. It is speculated that the SA-10 is now oriented against cruise missiles. It is also speculated to have: a 31 mile range capability between altitudes of 1,000 and 16,000 feet; a speed of Mach 6; and active radar terminal homing.[9]

To this point, only surface-to-air missile systems have been discussed as if they are the only electronically controlled air defense systems employed by the Soviets and Soviet modeled armies. Anti-aircraft artillery (AAA) guns are also an integral part of the air defense afforded Soviet forces, a fact documented in the histories of World War II, Vietnam, and the Middle East Wars. However, only one of these systems, the ZSU-23-4, is germane to this study and will be discussed below. The remaining guns are actually

gun complexes controlled by a central radar, which suggest they are not mobile enough to support Soviet operations doctrine; therefore they will not be far enough forward to influence air operations within 20 kilometers of the FEBA. The ZSU-23-4, commonly referred to as the "Gun Dish" (operates in the J-band of the frequency spectrum) in recognition of its fire control system, in contrast to other AAA, will travel with armored and mechanized divisions of the Red Army and other Soviet modeled armies. It is an integral, self-propelled unit that is postulated to be deployed throughout the multi-echelons of a typical Soviet army. However, its sphere of influence will be limited to the range its cannons, 3000 meters. Nevertheless, the ZSU-23-4 with its high mobility and lethality of four 23 mm cannons represent one of the most innovative air defense weapon in operation today.

Although brief, the preceding paragraphs have been an identification of the major weapon systems that constitute the air defense artillery threat within 20 kilometers of the FEBA when opposing a Soviet modeled army. The systems listed here when arrayed on the ground in a typical Soviet echelon arrangement represent a battlefield air defense capability that extends from approximately 27 kilometers in friendly territory to 80 kilometers in depth in unfriendly territory and zero to 30 kilometers in altitude. Figure 4-2, with the slant range of each

Soviet air defense weapon system plotted, graphically illustrates the overlapping coverage of the Soviet's air defense and how a target may be engaged by several different systems at one time, depending upon the target's altitude and location on the battlefield.

The diversity of the Soviets air defense capability presents an enormous air defense suppression task to an opposing force. However, there are only two elements of this threat that must be meticulously understood, and are the key features of the threat that must be focused upon during suppression operations planning. These elements are system capability and system operation. Unless a system has been observed extensively in combat or exploited in some manner, the latter is difficult to verify. Therefore, considerable effort must be expended to understanding the capability of the various air defense systems. In particular, it is important to know the operating radio frequency of a system's command and control radar, the operating envelope of the weapon system, and probable location of the weapon on the battlefield. If this information is known, suppression becomes a simple task of either building electronic warfare equipment to degrade the control radars, targeting weapon systems for destruction at the appropriate time, or developing tactics to avoid or nullify the weapon system's maneuver capability. Air operations are planned to operate at the fringes of a weapon system's maneuver envelope as much as possible.

There is not much more that can be done about the maneuver capability of a weapon short of destruction of individual missiles and shells. So that leaves only two aspects of a weapon system to deal with, its operating frequency and location in relation to where air operations will be conducted.

The strongest characteristic of Soviet air defense systems are the diverse operating frequencies of their weapon system control radars and the collective range of the radio frequency spectrum these radars span. Figure 4-1 summarizes the Soviet ground air defense threat in terms of frequency dispersion. Erickson in a United States Strategic Institute Report (73-1), entitled Soviet Military Power, appropriately summarized the problem that Soviet air defense control radars present when he wrote:

> . . . Soviet radar frequency coverage is spreading across the whole of the radio frequency spectrum-tracking and control radars for surface-to-air missile (SAM) complexes operate in E-band, G-band, H-band, . . . I-band . . . and J-band , the guidance command operates at a lower frequency C-band . . . [D-band, and H-band] , . . . thus presenting an increasingly complicated problem to those who seek to degrade or impede these radar performances.[10]

Soviet air defense systems, not unlike the systems of other nations, have strong and weak points, and it is as a result of understanding individual system capability that we are able to exploit the weak points of a system and defend against its strong points -- suppression. Probably the greatest and most challenging capability of

Soviet air defense artillery systems is their mobility. The mobility of the SA-4 and subsequent systems presents an underlying suppression problem far greater than either the proliferation or density of air defense systems.[11] The problem is: with their high degree of mobility they have the potential of saturating a victim's electronic defense warning system by either concentrating in a relatively small area or dispersing in a general area.[12] Thus, by bringing to bear a large quanity of electronic resources on a given target at a critical point in time they essentially neutralize the defenses of the target and make it easy prey for defense weapon systems.[13] Another advantage of mobility is: weapon systems gain a certain degree of suppression immunity from field artillery and air attacks as they move. Common sense says it is difficult to track and attack a moving target, but let us not forget that these are radar controlled or assisted weapons. Radars must either radiate or receive information by some other electronic means to effect a "kill". At either of these critical moments the opportunity to suppress arises and the benefits of mobility can be lost. However, the Soviets try to maintain the benefits of mobility and the resulting element of surprise as much as possible by using search and acquisition radars to provide target information to the shorter range air defense weapon system radar. The Soviets also use electro-optical tracking

devices on their ground air defense to enhance the surprise element. However, there is little that can be done about this capability.

The final part of the threat is the long range search, acquisition, and height finder radars that provide the shorter range air defense control radars with target information. The Soviets have historically employed these radars in their air defense nets to locate targets and subsequently hand targets off to individual weapon systems. This procedure has been followed so routinely that Western sources have associated certain acquisition radars with specific air defense systems. For example, the SA-2 "Fan Song" guidance radar uses the "Spoon Rest" and "Side Net" radars to initially locate targets for subsequent engagement; the SA-3 relies upon the "Side Net" for height information, but uses the "Flat Face" to search and initially acquire targets; the SA-4 and SA-6 uses the "Long Track" and "Thin Skin" radars for acquisition purposes. The "Long Track" and "Thin Skin" appear to be the forerunners of a new generation of tactical acquisition radars. As such, they probably provide all remaining air defense systems target information. These radars complete the Soviet threat. They also represent, along with the means the Soviets use to transmit (UHF, VHF, data link, telephones, etc.) target information to air defense weapons, a priority target in the suppression equation. Although they probably will not be located within 20 kilometers of the FEBA, they must be high priority targets if air defense suppression is to be

effective near the FEBA. The destruction of these radars will require the various deployed air defense artillery systems into autonomous operation, and force each weapon system to acquire its own target information. Making them more subjective to selective suppression. The acquisition radars are therefore the backbone of the Soviet air defense.

SUMMARY

The Soviets have deployed a diverse and sophisticated air defense net that will influence the air operations of an opposing force operating within 20 kilometers of the FEBA. The systems they have deployed provide a virtual protective umbrella over the Soviet Army. The systems are overlapping in coverage and complement each other throughout the various echelons of the Soviet ground forces. These individual Soviet air defense systems represent a real threat which require innovative thinking and sophisticated equipment to suppress.

In the above chapter, the Soviet tactical ground air defense threat was identified. Included was a description of the various Soviet ground air defense systems that will probably be employed to protect a Soviet modeled force, such as, the Warsaw Pact.

In Chapter Five, the Army and Air Force electronic warfare programs will be described from the standpoint of mission orientation. Subsequently, the two programs are evaluated for the possibility of employing Army/Air Force

electronic warfare to suppress enemy air defenses during close air operations.

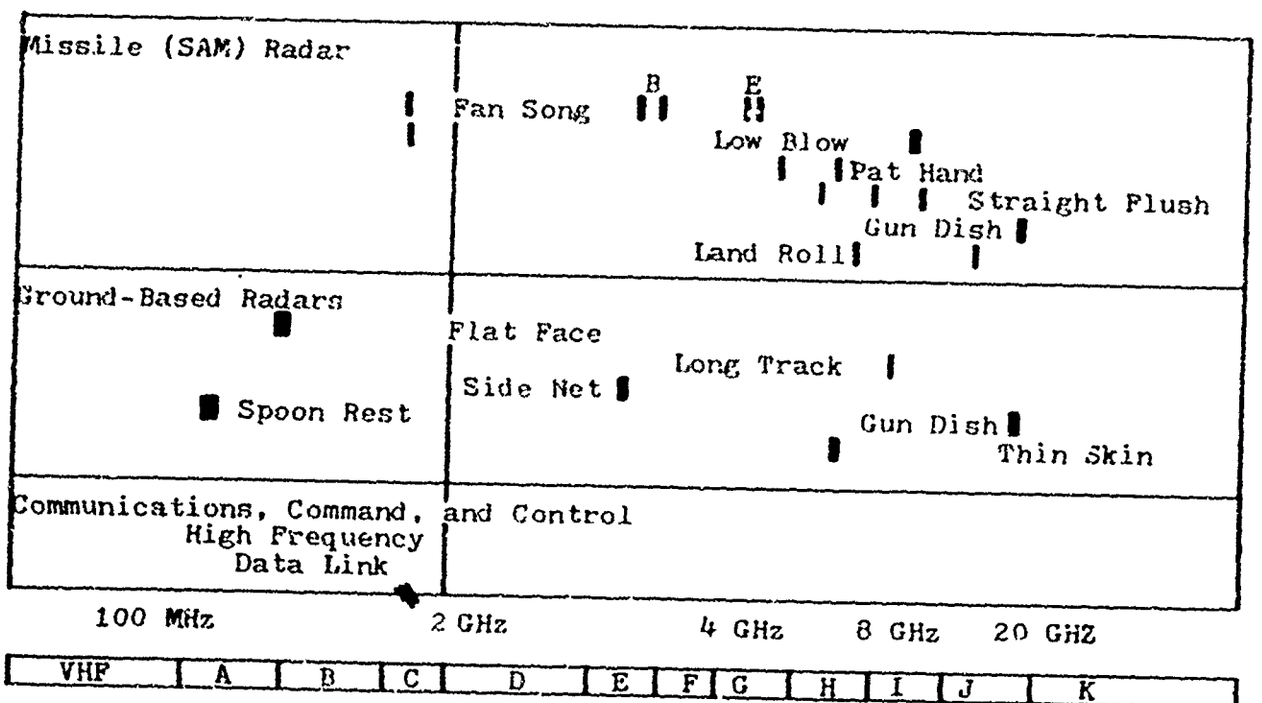


Figure 4-1. The Soviet Air Defense Threat versus Radio Frequency

SOURCE: Electronic Warfare/Defense Electronics, July 1978

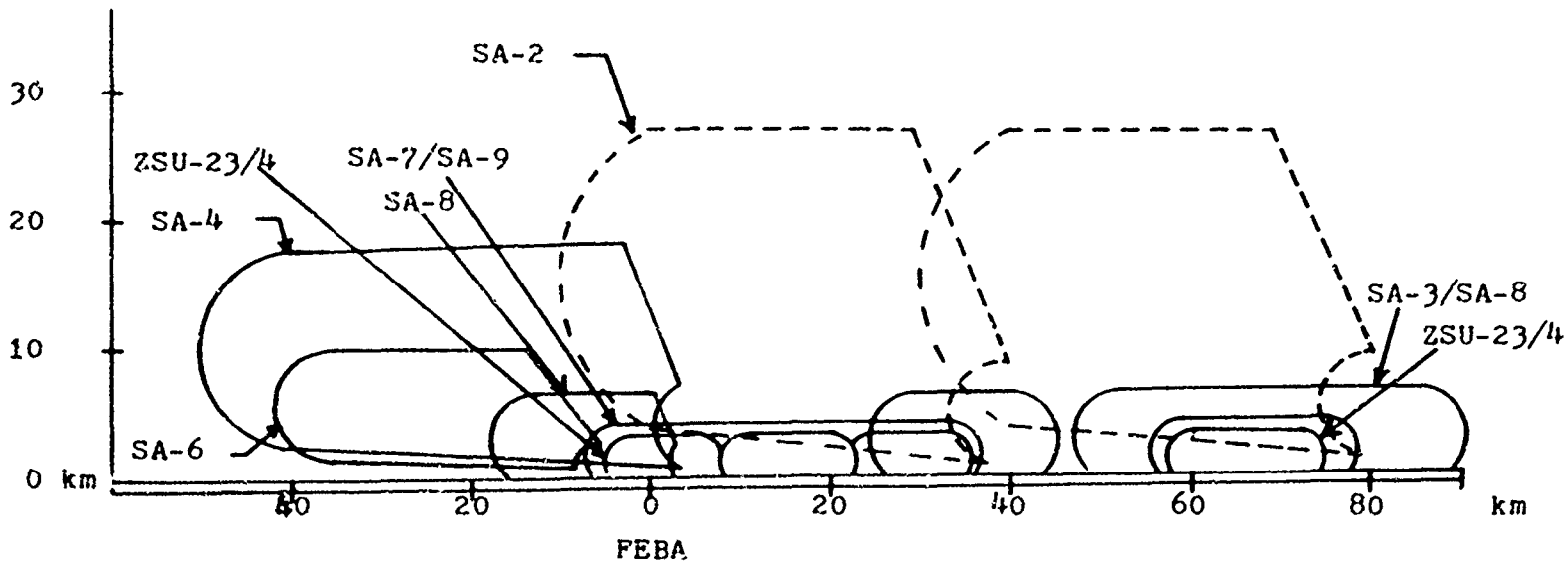


Figure 4-2 A Typical Soviet Surface-to-Air Threat Deployment

SOURCE: A composite made from various sources; e.g., Electronic Warfare/Defense Electronics (July 1978) and Soviet Army Operations (April 1978).

CHAPTER 4

END NOTES

1. "The Growing Threat - Simulation Breakthroughs: A Solution to Complex Combat Problem", Electronics Warfare/Defense Electronics, (July 1978), pp. 53-60.
2. K. M. Listov and K. N. Trofimson, Radio and Radar Technology and Its Application (1960), p. 446.
3. R. T. Pretty, Jane's Weapon Systems 1977 (1977), pp. 76-80 and pp. 516-520. This book was arbitrarily selected as a reference for the Soviet air defense threat. It contains an excellent unclassified narrative on all known Soviet weapon systems. However, if minute details are desired on the various systems listed in this chapter, recommend a classified source in your Intelligence Section be used as a reference. The information here is not detailed enough to plan a suppression mission, but it is complete enough to formulate the more general aspects of a suppression concept.
4. Edgar O'Ballance, The Electronic War in the Middle East 1968-70 (1974), p. 102.
5. "The Soviet Threat to NATO Aircraft", A chart in Electronic Warfare/Defense Electronics (July 1978).
6. Ibid.
7. Ibid.
8. Harry F. Eustace, ed., The International Countermeasures Handbook 1977-78, 3rd ed. (1977), p. 247.

CHAPTER 5

INTERACTIVENESS OF ARMY-AIR FORCE ELECTRONIC WARFARE

Within the last few years electronic warfare has taken on added importance in warfare. The Army and Air Force have deployed numerous systems to deal with the growing electronic threat. Each Service operates a variety of equipment that allows it to exploit, locate, and jam enemy electronic systems. A majority of the Services' electronic warfare systems are employed in an area from the forward edge of the battle area (FEBA) out to approximately 20 kilometers.

The Services, to date, have developed electronic warfare equipment and concepts to enhance their peculiar operations, because it is manifested in the way the Services perceive the mission of electronic warfare. Both the Army and Air Force have a different perception of how electronic warfare should be employed.

The Air Force primarily employs tactical electronic warfare as an aid in penetrating enemy air defenses and protecting aircraft for maximum weapons delivery effectiveness.[1] The emphasis is on the protection of the aircraft, which is basically defensive in nature. The EW effort is directed toward neutralizing the acquisition and fire control radar systems of the ground air defense. The idea: if a weapon can be denied acquisition and control

data, it will be essentially neutralized. So, the majority of the Air Force's tactical electronic warfare effort is dedicated against non-communications located in the upper portion of the electromagnetic frequency spectrum.

The Air Force also employs electronic warfare support measures for intelligence purposes to support electronic countermeasures operations. Electronic counter-countermeasures are generally passive in nature and are only used to protect airborne systems from enemy active countermeasures.

"Soviet doctrine advocates the application of electronic warfare as an element of combat power. Electronic warfare, in combination with rocket and artillery fire, will be used to selectively disrupt U.S. Army command, control, and weapon communications systems."[2] As a result, the Army perceives the mission of electronic warfare differently than the Air Force. The basic mission of Army electronic warfare is: to prevent the enemy from implementing his expressed doctrine of selective destruction and denial of Army command and control, and communications. Thus the major emphasis of Army electronic warfare is dedicated to protecting Army command, control, and communications systems, because,

> . . . U. S. Forces depend on command and control systems to conduct the battle. It is also essential that the commander see the battlefield and that combat information and intelligence flow through the closed loop control system without interference. Because the outcome of the first battle may depend upon . . . U.S. . . . electronic control, the first priority of the EW system must be to protect our command

> and control systems and those systems with which . . . the Army . . . see the battlefield. Regardless of the tactical situation, this priority will remain paramount as long as the enemy possesses and effectively uses jamming and target-acquisition capabilities.[3]

To implement this concept, the Army devotes its efforts to identifying and locating enemy command posts for destruction and disruption. Also, to enhance the survival of U.S. artillery and tactical air support, radars and communications associated with weapons must also be located and destroyed or jammed. In essence, the Army's electronic warfare concept strives to project combat power by denying the enemy the use of his command, control and communications nets. Thus, the major emphasis of Army electronic warfare is in the area of communications and the lower portion of the electromagnetic spectrum.[4]

What does this difference in electronic warfare mission perception imply? The way the Army and Air Force employ electronic warfare is not likely to change in the foreseeable future, because each Service has a basis for employing electronic warfare as it does. However, Arab employment of electronic warfare in the recent Middle East War provided some very vivid lessons which are pertinent to both the Air Force and the Army. As a result, the Army has become very concerned about electronic warfare. It has embarked upon an extensive program to develop and procure additional electronic warfare equipment and train for electronic warfare readiness to take advantage of lessons reinforced during the 1973 Middle East War. This

fact is evident by the on-going evaluations of the Combat Electronic Warfare Intelligence (CEWI) organizations at echelons of Corps and Division, and many other new development efforts. In dealing with the ever increasing electronic dependent weapons systems, there is no way of estimating where this effort will eventually lead. However, the indications are clear that Army electronic warfare will expand into areas that have traditionally been associated with Air Force electronic warfare. Out of necessity, as the Army places increasing emphasis upon helicopter air support near the FEBA and the enemy improves his low-altitude air defense capability, more attention will have to be devoted to helicopter protection. Thus, since Army electronic warfare is still developing, it appears this is an opportune time for the Army and Air Force to formulate plans and joint operating procedures that can capitalize upon this developing capability.

Both Services conduct electronic warfare out to approximately 20 kilometers from the FEBA, but recalling the missions of Army and Air Force electronic warfare above, each Service has different electronic targets of interest. However, a close examination of these targets reveals that in many cases they are a component of a larger general threat. For an example, typically within this range of the battlefield, the Army is interested in gathering information about the enemy. Electronic warfare is a key element in the collection of enemy information. It assists

the commander in "seeing the battlefield" and determining his course of action. Therefore, maximum effort is devoted to determining the strength, location, identification, and disposition of the enemy. Emphasis on signal intelligence (SIGINT) and electronic warfare support measures (ESM) help to satisfy this requirement. SIGINT and ESM also assist in determining the deployment of enemy weapons. Direction finding, which is a part of ESM, is instrumental in identifying noncommunication emitters associated with specific weapons systems.[5] Essentially "ESM provides the information required for immediate actions involving electronic countermeasures, electronic counter-countermeasures, avoidance, and targeting".[6] The Air Force needs timely information on the location of enemy ground air defenses to conduct air defense suppression and permit friendly air operations beyond the FEBA. With timely information on the location of enemy ground air defenses, aircraft self-protection electronic countermeasures can be planned and employed more efficiently. The Army and Air Force have a situation which is ready made for joint electronic operations, at least from the FEBA out to approximately 20 kilometers. However, to date, the two Services have not learned how to take advantage of their joint EW capability except through preplanned operations.

Joint electronic warfare on any basis other than preplanned is not the question. The question is how to

improve mutual electronic warfare support for the suppression of enemy air defenses during close air support operations. To realize the full potential of electronic warfare, both preplanned and immediate EW operations must be understood. At present, neither Service can readily implement immediate joint EW operation. Mainly, because (1) the close air support aircraft has a fixed electronic warfare package when he arrives in a target area; and (2) Army electronic warfare assets are generally deployed in support of some other operation. In addition, the technical data required to reconfigure Army assets may not be available and the assets may not be located where they can provide mutual support. For these and other reasons, preplanned joint electronic warfare must remain the rule for the time being.

If electronic warfare was fully accepted as a weapon by both Services, joint EW procedures could be easily implemented. Each Service has electronic warfare already working in concept with other support functions to increase combat effectiveness. For an example, U.S. Army electronic warfare and artillery team up to enhance fire support. SIGINT and ESM efforts provide field artillery with information that assist artillery in integrating and massing fires on lucrative targets. Close air support and Air Force electronic warfare team up to provide aircraft protection during the penetration of enemy air defenses. These are but two examples which illustrate how each Service integrate

the use of EW for their own purposes. These examples could serve as a model for joint EW procedures. At present, the joint EW employment procedures are both complicated and drawn out.

JOINT EW EMPLOYMENT

As alluded to earlier, joint EW can be employed either as preplanned or immediate.[7] Preplanned is employed in accordance with established and proven joint operational procedures. The leadtime for this type of EW approximates that of other preplanned joint operations. As a result, it does not strain the joint operations system. It is the preferred mode of operation, because (1) the technical support for electronic warfare systems can be preprogrammed and preplanned; and (2) EW assets can be prioritized for specific targets/threats.

Immediate joint EW is designed to be responsive. It is implemented much like immediate close air support. It uses many of the same agencies, facilities, and procedures used in immediate close air support. The procedures for immediate Army/Air Force EW support are presented here for the reader's review:

a. Requests for Immediate Army EW Support of Air Force Operations (see Figure 5-1)

Requests for immediate Army EW support of tactical air operations will normally originate with the Air Force flight/mission commander or the forward air controller (FAC). When the requirement for Army EW support arises, the following procedures apply:

(1) The originator will forward the request to the . . . Tactical Air Control Party . . . TACP.

(2) The TACP will:
(a) Forward the request to the . . . Direct Air Support Center . . . DASC.
(b) Monitor action taken.

(3) The DASC will fill the request or forward to . . . Tactical Air Control Center . . . TACC. If unable to fill with allocated Air Force assets, the DASC will advise EWCS of actions taken.

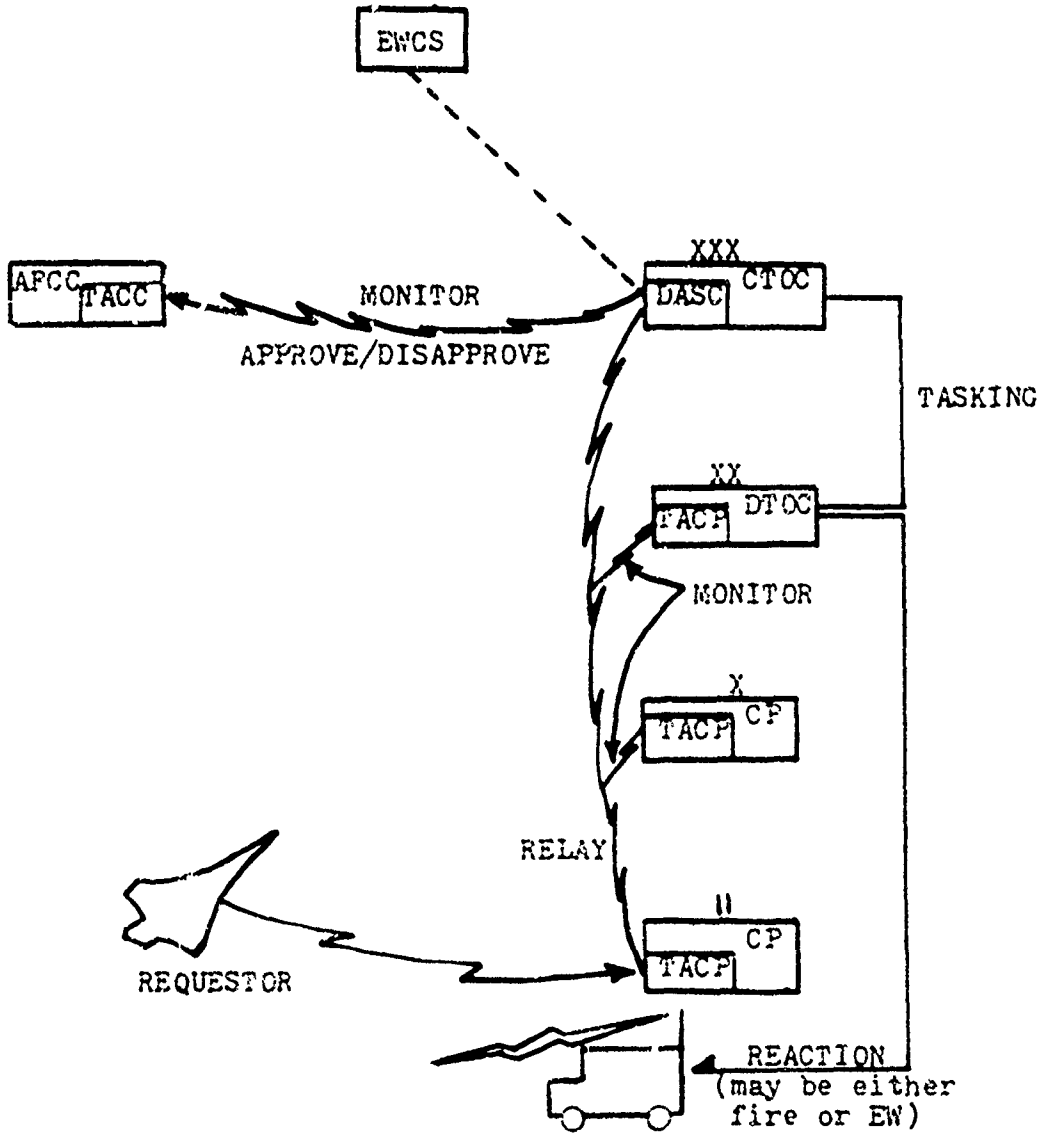
(4) The TACC will:
(a) Determine if Air Force EW can support the request.
(b) Request assistance from corps if required.
(c) Monitor action taken.

(5) The . . . Corps Tactical Operations Center . . . CTOC will:
(a) Determine if Army EW can support the request.
(b) Task appropriate CEWI unit.

b. Requests for immediate Air Force EW support of Army operations (see Firgue 5-2)

The requirement for immediate tactical air EW support will normally originate at division level or units operating in the division area. Requests for such support will be forwarded through operational communications channels to the division tactical command post. Upon receipt of a request for EW support, the procedures outlined below will be followed:

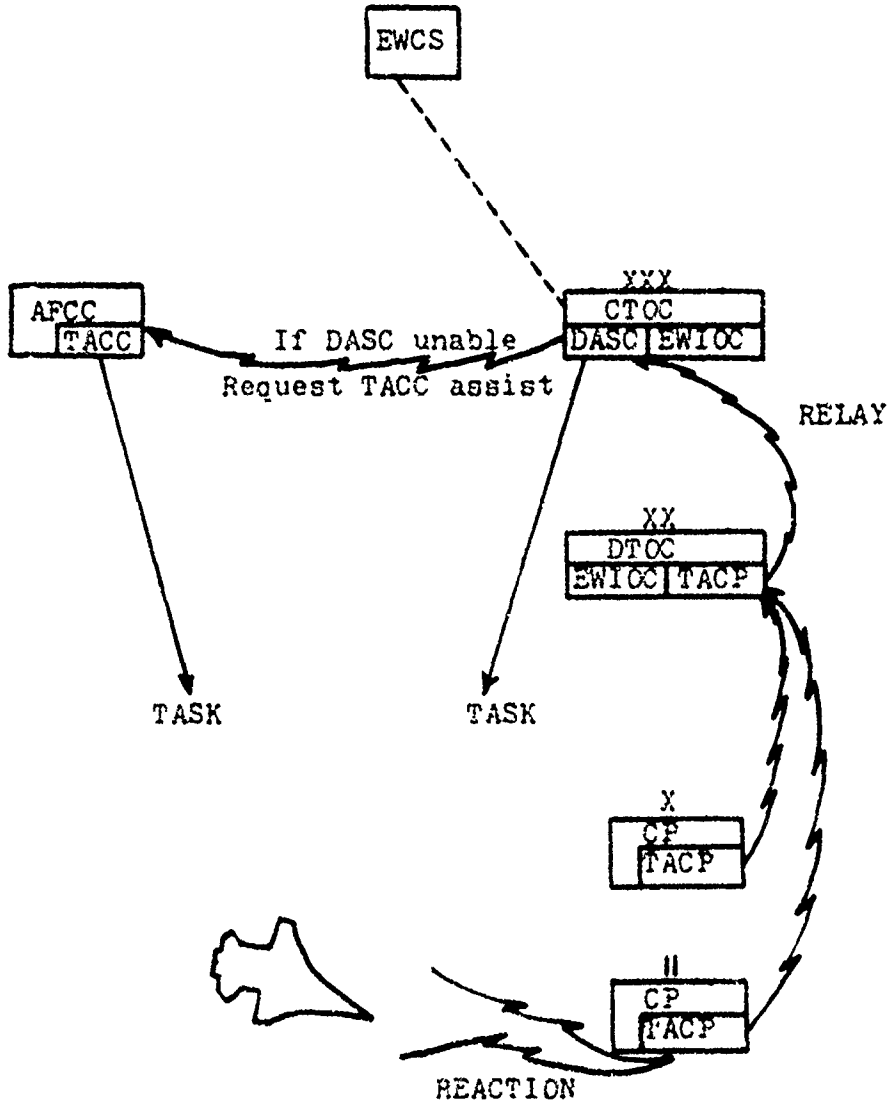
(1) The division G3 . . . (operations officer) . . . will:
(a) Evaluate requests for immediate EW support within the context of tactical situation to determine if EW action is appropriate.
(b) Coordinate with the G2 . . (intelligence officer) . . .
(c) Approve/disapprove the request.
(d) Task the EWIOC . . . (Electronic Warfare Intelligence Operations Center) . . . to act on the request.



—— Tasking
—➤ Air Request Net
----Info, as appropriate

Figure 5-1. Air Force Request for Immediate Army EW Support

SOURCE: ALFA, Suppression of Enemy Air Defenses



——— Tasking
▬▬ Air Request Net
---- Info, when appropriate

Figure 5-2. Army Request for Immediate Air Force EW Support

SOURCE: ALFA, Suppresion of Enemy Air Defenses

(2) The EWIOC will:
(a) Determine if support can be provided by Army resources. If Army resources are not available:
(b) Initiate request for Air Force EW support through the corps EWIOC/DASC.
(c) Advise requesting unit of action taken.

(3) The DASC will:
(a) Determine if Air Force EW assets assigned to the DASC can fill the request, and task if appropriate. The DASC will advise the EWCS of actions taken.
(b) If assets are not available forward request to the TACC.

(4) The TACC will:
(a) Determine if Air Force EW assets are available.
(b) Task appropriate units.
(c) Notify DASC of action taken.[8]

These procedures are less than optimum for implementing the EW required to suppress a rapidly changing enemy ground air defense. Reasons for immediate joint EW not being optimized are: (1) the threat data base of electronic warfare systems cannot be rapidly changed to accommodate the rigors of immediate EW. (2) The Army and Air Force have too few EW assets to divert from their primary respective Service support to respond to immediate request. (3) The procedures are super-imposed on the already overworked air-to-ground net. (4) Air Force EW expertise, in the form of an electronic warfare officer, is not a part of the TACP at echelons of corps and division. (5) The procedures assume an on-hand broad range of capabilities.

In the above chapter, the Army and Air Force electronic warfare programs were examined from the standpoint of mission orientation. Subsequently, they were evaluated for the possible joint employment in the suppression of enemy air defenses within 20 kilometers of the FEBA.

Chapter Six will be a scenario set in Central Europe to explain and illustrate (1) why the Air Force needs assistance in suppressing enemy air defenses, and (2) how joint Army/Air Force may be employed to achieve a greater degree of defense suppression.

CHAPTER 5

END NOTES

1. Air-Land Forces Application Agency (ALFA), Electronic Warfare Procedures for Employment in Joint Operations, (1 December 1976) pp. 3-5.
2. U. S. Army, Electronic Warfare Concept, (6 March 1978), pp. 1-2.
3. Ibid., pp. 2-7.
4. Ibid.
5. Ibid., p. 2-1.
6. Ibid., p. A-1.
7. Major James L. Hendrickson, in a 1978 CGSC thesis entitled: Joint U.S. Army/U.S. Air Force Planning and Employment of Electronic Countermeasures, consolidates in one document the various documents that will impact the implementation of joint electronic warfare. It is suggested that the reader seek out this document, because it highlights in detail the many problems surrounding joint electronic warfare.
8. Ibid., ALFA, EW Procedures, pp. 4-5 through 4-9.

CHAPTER 6

THE IMPLICATIONS OF CENTRAL EUROPE

A CENTRAL EUROPE SCENARIO

The Group of Soviet Forces in Germany (GSFG) has several implications for the North Atlantic Treaty Organization (NATO) and the United States, especially within NATO's central region. From intelligence and media reports, the GSFG is the most complete integrated Soviet capability outside Russia. Therefore, the GSFG is an ideal force selection to speculate about the impact of a Soviet modeled ground air defense against United States air operations within 20 kilometers of the FEBA.

The GSFG is composed of five armies and a supporting air army stationed along the border between East and West Germany. The respective armies and approximate location follows: the 2nd Guards Army with two motorized rifle divisions and a tank division is the northern most army. Directly south is the 3rd Shock Army consisting of four tank divisions and a motorized rifle division. South of the 3rd Shock Army is the 1st Guards Tank Army; it also has four tank divisions and one motorized rifle division. Adjacent to the 1st Guards Tank Army is the 8th Guards Army; it consists of three motorized rifle divisions and one tank division. The 20th Guards Army; located near

Eberswalde has three motorized rifle divisions. Protecting this force from the air is the 16th Tactical Air Army.[1]

Three points are always stressed when evaluating the GSFG. One, the number of tanks in the GSFG are of extreme concern to ground forces. It is estimated that the GSFG has approximately 3100 to 4000 tanks slated against the central region of NATO alone. Two, the probable axis of advance (Figure 6-1) into West Germany and maneuver plans are of interest to all NATO defending forces. And, three, Soviet tactical air assets and other support forces which may be supporting the tanks. Graham H. Turbiville, in an article entitled "Invasion in Europe - A Scenario", sees:

> Perhaps the most striking aspect of the GSFG Force deployment is the positioning of the 3rd Shock and 1st Guards Tank Armies - the main offensive punch of the GSFG Front. The Göttingen-Liege axis, the rough dividing line between NATO's Northern and Central Army Groups, if extended eastwards neatly demarcates the two Soviet tank armies. It is along this axis that the weight of the two armies' 3100 tanks would probably advance, seeking to split the two NATO Army Groups, isolate U.S., Canadian and West German Forces in Southern West Germany and send armored spearheads racing through the low countries to the channel.[2]

"Armored columns would break off from the main body and sweep North and South to cut off the retreat of allied units".[3] In the case of the United States and other units in the South, this means being enveloped by the elements

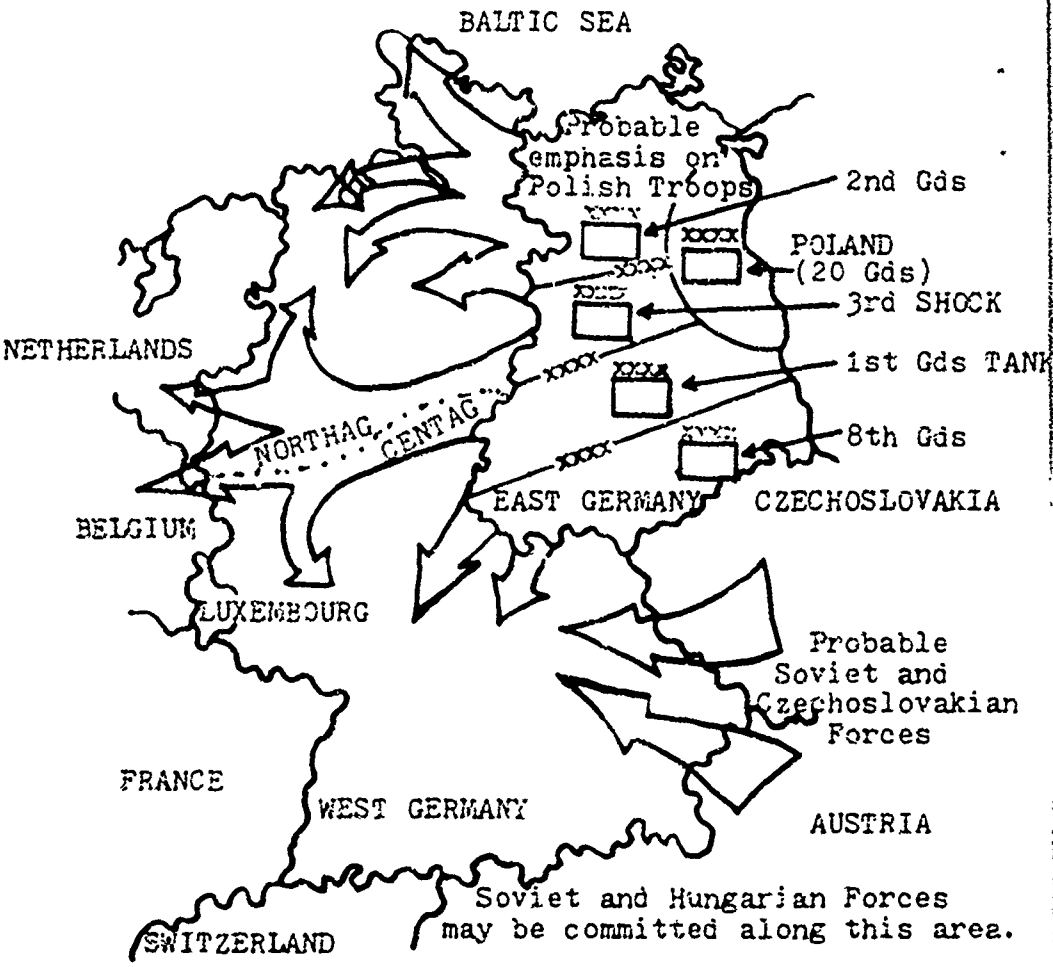


Figure 6-1. Probable Axes of Attack into Central Europe by the Group of Soviet Forces in Germany.

SOURCE: Graham H. Turbiville, "Invasion in Europe-A Scenario", Army, November 1976

of the 1st Guards Tank Army. the 8th Guards Army, and whatever other Pact forces that may be involved. Speed would also be a factor with Soviet offensive operations. Therefore, to achieve the envisioned objective of the front, the Channel, NATO strong points would be bypassed, virtually cutting off large pockets of NATO forces. It is estimated that a GSFG front would reach the Channel in about two weeks in a conventional war environment and less time would be involved if the GSFG employed nuclear weapons. Such an ambitious feat in two weeks suggests battlefield dynamics and demands unlike anything exhibited in previous conflicts.[4]

The above scenario, although hypothetical, is based on traditional approaches into Central Europe, World War II data, and conclusions drawn from observations made during numerous Soviet exercises. More uncertain than the ground scenario is the role of the 16th Tactical Air Army in a GSFG offensive. Their role is important; because depending upon the role of the Tactical Air Army, friendly air-to-ground support may be extremely limited. Air-to-ground support is one of the key elements of the United States air-land team concept.

In recent years, the Soviets have changed their emphasis in tactical aircraft designs. This accounts for the lack of consensus in a purposed scenario for the 16th Tactical Air Army. While the United States and the West

have continued to deploy essentially multi-purpose aircraft (with the exception of the F-15 and A-10), the Soviets have changed their tactical aircraft interest to specialized aircraft. Thus, United States aircraft are capable of performing long range interdiction, close air support, and air interception, with the object of winning a protracted air superiority campaign. The Soviets, in contrast, now design their tactical aircraft mainly for ground attack and close air support. This shift in philosophy was reflected in hearings before the Senate Armed and Services Committee in 1976, which indicated that Soviet tactical aviation in Central Europe had fewer multi-purpose aircraft than the United States, (a percentage of 37 versus 52) and more attack aircraft than the United States, 34 percent versus 24 percent.[5] It is postulated by many analysts that this trend will continue through the 1980s. The increase in offensive flexibility that the Soviets gain as a result of this change is significant. The Soviets now have considerably more air power options than in the past. They have essentially transformed from a defensive air force to an offensive air force, which is oriented to support the objectives of the Soviet ground forces. In the case of Central Europe, this means that an increased effort will have to be devoted to air defense.

One option available to Soviet air forces in a GSFG offensive is to initiate the opening phase of a war in

Europe with a large scale attack on NATO air bases and nuclear storage areas.[6] However,

> In order to have a seriously delibilitating effect on NATO air resources and nuclear options, the Soviet and Warsaw Pact Air Forces would have to have a large number of successes in a very short time. To quickly disrupt and even keep the U.S. Air Force the most potent NATO Air Army, on the ground . . . a doctrine aimed at achieving air supremacy through conventional preemptive air operations is the one for which the Soviet Air Force will be most suited in the future.[7]

This is a good and logical option because of the Soviet's favorable ratio of specialized aircraft to friendly multi-purpose and interceptor aircraft. Only 12 percent of U.S. aircraft in NATO are interceptors. Therefore multi-purpose aircraft slated for close air support and other roles must be diverted for air defense.[8] This is a tactic that will decimate a very necessary source of fire power for ground forces. It has been suggested that because of this imbalance in aircraft, that friendly air forces emphasize attaining limited air superiority. The maximum effort in this regards should be dedicated to knocking out Soviet ground based air defenses. A considerable effort will still be involved in prohibiting enemy air action behind the FEBA.[9] There are also other indicators that add credence to this speculation about Soviet air operations. For example, (1) Soviet ground units have an abundance of artillery available for fire support.[10] As a result, this could free Soviet aviation

from the necessity to provide close air support. (2) Soviet ground forces o longer depend upon Soviet aviation for aid defense; they now depend upon ground air defense systems. Both of these capabilities free Soviet aviation to do things other than support ground forces.

U. S. CLOSE AIR SUPPORT VERSUS SOVIET GROUND DEFENSES

If the above scenario approximates the manner in which the Soviets will conduct a war in Central Europe, U.S. air-to-ground support will be at a premium. For this reason and the importance of air-to-ground support to the air-land concept, close air support should be afforded protection. Given the Soviet ground air defense capability, this is an arduous task and requires the assistance of both the United States Army and Air Force.

To put this in perspective, contemporary Soviet military operations emphasize ground-based, mobile air defenses.[11] In Chapter Four the various Soviet electronically controlled ground air defense systems and their capabilities were identified. The air defense net that can be formed with these systems could result in an unacceptable loss rate for close air support operations. The effectiveness of the Soviet air defense systems are unknown at this time. However, there is data from the Vietnam War and the 1973 Middle East War which can lead one to some speculation as to Soviet ground air defense effectiveness. Analyses of

the war over North Vietnam snow that before electronic countermeasures were introduced in 1967-1968, one U.S. plan was lost to every 10 North Vietnam surface-to-air (SAM) missiles.[12] The Israeli Air Force losses in the first four days of the 1973 War were unexpectedly high; they lost an average of 2.7 close air support aircraft per 100 sorties on the Egyptian front and 5.7 close air support aircraft on the Syrian front.[13] It should not be unreasonable for the United States to expect similar losses in Central Europe. They may be slightly higher because the Soviet's air defense will have more depth in terms of different systems and quanity of weapons. It should be noted that in each of these conflicts the loss rate dropped significantly when U.S. ECM was introduced. In the case of Vietnam, the loss rate went to one aircraft per 75 SAMs launches.[14] The Israeli losses went to 1.0 aircraft per 100 sorties after new ECM equipment was introduced and a concentrated effort was dedicated to SEAD operations.[15]

The difficulty of dealing with the Soviet ground air defenses and providing close air support has been recognized by Commander-in-Chief of United States in Europe (CINCUSAFE). In addressing the problem of defense suppression, CINCUSAFE has concluded that a TRIAD of the EF-111A electronic warfare aircraft, the F-4G Wild Weasel aircraft, and the A-10 attack aircraft is required to form

the backbone of NATO's defense suppression, and permit the penetration of aircraft to accomplish close air support and interdiction.[16] The F-4G Wild Weasel would detect, identify, locate and suppress or destroy ground air defense control radars.[17] The EF-111A would stand-off along the FEBA and jam enemy air defense radars. The A-10 would provide the weapons to destroy the air defense weapon systems. This TRIAD has not materialized as previously expected, mainly because of funding difficulties. The EF-111A capability amounts to two aircraft for development and testing purposes. The F-4G is just becoming operational in the United States. Only the A-10 has been deployed to Europe in an operational status. This palces the A-10 along with other ground attack aircraft in Europe, in a vulnerable position. The implication of this situation is that the defense suppression anticipated from this TRIAD must be derived from means other than Air Force assets. Data from U.S. Air Force studies show that attrition rates against Warsaw Pact targets might run as high as 20 percent without effective electronic countermeasures, but could be reduced to only two or three percent with them.[18] The self-protection ECM pod carried by close air support aircraft cannot provide this level of protection.

At the risk of being slightly technical, the problem with the ECM pod can best be explained in the following manner. Today, the typical Soviet ground air defense

weapon system has:

> . . . an antenna gain of 25-30 dB; as much as six megawatts of power with . . . an optimized transmission rate; multi-spectral frequency coverage with optimized gain and band width ratios, . . . multiple electronic countermeasures built-in to counter the effects of electronic countermeasures (ECM), . . . and computerized interaction with an integrated air defense team with skilled operator augmentation.19

The self-protection ECM pod that attempts to counter this capability has the following characteristics:

> approximate zero dB antenna gain because of its omni-directional radiation, transmit approximately two kilowatts with a limited duty cycle of three to four percent, transmits in modes similar to threat, such as, continuous wave, pulsed, monopulse and conical scan, essentially computer operated, and can operate over a frequency spectrum of at least 2 to 18 GH_z. In the simplest case, where the ECM pod engages one threat and provides a jamming pulse each time the victim radar radiates, the jamming signal ratio is good.20

The opportunity to engage only one threat radar at a time will be a rare occasion in the Central Europe environment. Because of the limitations of the self-protection ECM pod, defense suppression efforts should be made to try and achieve a favorable pod engagement ratio; i.e., a situation that will require the pod to engage the minim number of air defense radars simultaneously, preferably one. Given the Air Force's defense suppression assets today, a short term solution to the problem of SEAD, especially within 20 kilometers of the FEBA is Army EW assistance.

During ground operations, from the FEBA out to 20 kilometers, Army EW constantly provides information on the enemy and his disposition. The location of weapon systems and an up-to-date picture of the enemy ground air defense threat is the best way the Army can assist the Air Force in the electronic aspect of ground air defense suppression. Knowledge of air defense weapon location would permit close air support aircrews the option of destroying, jamming, or avoiding the threat.

More importantly to close air support aircrews, it means that threats in the immediate area which influence their operations can be selectively jammed instead of allowing the ECM pod to attempt to jam all threat radars in the vicinity. If Army EW could be used in this manner it would improve the employment effectiveness of the ECM pod and enhance SEAD, especially within 20 kilometers of the FEBA. To give the reader an idea of what fighter aircraft ECM must attempt to suppress in Central Europe during air-to-ground operations, a description of Soviet army air defense is given in the following paragraphs.

The air defense organizations within the Soviet Army transcend the echelons of command and provide coordinated air defense coverage for all Soviet ground forces. Soviet air defense is an integrated effort implemented through a centralized command and control net that provides early

warning of impending enemy air attacks. The ultimate goal of Soviet air defense is the destruction of enemy air strikes as far forward as possible. Typically, to ensure coordinated and integrated air defense, Soviet fronts and armies will establish air defense zone to emphasize coverage at low-to-medium and medium-to-high altitudes. The air defense zone will normally cover an area of approximately fifity kilometers wide by one hundred kilometers deep. The air defense weapons protecting this zone include all ground air defense systems. The medium-to-high portion of the zone will be protected by army and front assets, generally surface-to-air (SA) missile systems such as the SA-2 and SA-4. The low-to-medium portion of the zone is assigned to the division and lower command levels.[21]

In a Soviet division, air defense weapons are found at divisional level and regiment level.

> Divisional air defense units will be employed by batteries in direct support of the engaged motorized rifle or tank regiments and will also protect division headquarters, critical support activities, and division reserves. Regimental air defense weapons will be employed as individual weapons, pairs or platoons in support of engaged motorized rifle or tank battalions. These systems receive missions from the Battery Commander in addition to monitoring the air warning net. They will be deployed well forward. and their primary targets will be enemy close air support aircraft and attack helicopters.[22]

The air defense regiment will provide the divisions with

medium altitude coverage, and it may be equipped with either the SA-6, or SA-8, or 57mm anti-aircraft gun (in the process of being replaced by the SA-6 and SA-8). The air defense batteries equipped with either the ZSU-23-4 or SA-9 provides low altitude coverage. Additional low altitude coverage is available to Soviet division in the form of the SA-7 which is assigned to individual soldiers.[23]

A Soviet division will normally operate over an area of approximately 20-30 kilometers wide by 40-60 kilometers deep and be protected by 20 SA-6s or SA-8s, 16 ZSU-23-4s, 16 SA-9s, and 112 SA-7s or 36 SA-7 (depending upon whether it is a motorized rifle or tank division respectively).[24] From a pure numbers' standpoint, this means there is on an average one air defense weapon per eight square kilometers in the motorized rifle division and one air defense weapon per 14 square kilometers in a Soviet tank division when occupying an area this size. There will also be army and front SA-2s and SA-4s providing medium-to-high altitude protection. Additionally, the Soviets essentially use a "two-up-one-back" approach to ground combat, i.e., two units of equivalent value forward and one trailing in support. So, in keeping with this and Soviet air defense doctrine, it can be anticipated that two-thirds of the division's air defense assets will be found within forty kilometers of the FEBA. When the Soviet division narrows its front

for "breakthrough" operations the ground air defense threat will become even more dense. Figure 4-2 graphically illustrate a typical Soviet ground air defense systems employment.

On a broader scale, in Central Europe, with Soviet armies consisting of up to five divisions, the ground air defense weapons density equation becomes even more complex. With several Soviet armies expected to attack along a common axis of advance, air defense coverage from adjacent divisions will overlap and complicate even further the density of enemy ground air defense weapons within any given area of the battlefield.

SUMMARY

If the preceding scenario approximates the action of a Soviet modeled Army, the implications are rather simple with respect to close air support. They are three fold. First, the Group of Soviet Forces in Germany are deployed and equipped to carry out the tactics according to Soviet doctrine. The GSFG will attack over a broad front under all conditions and force the United States or other forces to fight in a similar manner. Such a situation enhances the success of the GSFG's tactics of "breakthrough" and bypass. To disrupt or destroy forces engaged in either of these tactics, the United States must employ close air support, because each tactic emphasize force

massing and speed. Second, the supporting air arm of the GSFG will exert pressure on U.S. Forces in a conflict in Central Europe to the point that a considerable number of air assets will be consumed for air defense against attacking aircraft; thus, air assets originally planned and anticipated for close air support will be reduced. For example, it is estimated that the Warsaw Pact has approximately 1375 ground attack aircraft that it can employ for interdiction; but NATO has only 375 interceptors. Obviously many multipurpose aircraft will have to serve as interceptors, which will reduce appreciably the number of available ground attack aircraft. Third, close air support in Central Europe will probably pay an unacceptable price to Soviet ground air defenses unless adequate defense suppression is provided.

Presently, Air Force defense suppression assets are limited. Practically all close air support scenarios for Central Europe envision that EF-111As and F-4Gs will form the basis of the defense suppression effort; but this effort has not materialized. The F-4G is just becoming operational and older Wild Weasel aircraft cannot locate, detect and destroy the newer ground air defense systems. The EF-111A is still undergoing development and testing. An alternative to the defense suppression envisioned by the Air Force must be found for close air support. Firepower cannot do it, because should the Soviets attack in Central

lurope, the battlefield will be so target rich that there will not be enough friendly firepower to service all the enemy targets. Air Force electronic warfare cannot do it alone, because of the limitations cited in this study and elsewhere. However, within 20 kilometers of the FEBA where both the Air Force and Army conduct electronic warfare operations, the two Services should concentrate on providing joint EW for SEAD purposes. Air operations in this area of the battlefield will be conducted primarily to further ground objectives; therefore, the Services should capitalize on their unique capabilities to provide joint EW for the purpose of SEAD during close air support.

In the above chapter, a scenario set in Central Europe was used to explain and illustrate (1) why the Air Force needs assistance in suppressing enemy air defenses, and (2) how joint Army/Air Force may be employed to achieve a greater degree of defense suppression.

Chapter Seven will summarize the study with findings, observations and recommendations for further study.

CHAPTER 6

END NOTES

1. Graham H. Turbiville, "Invasion In Europe-A Scenario", Army, (November 1976), pp. 16-21, The basic scenario in Chapter Six is a summary of this article. It basically parallels the scenario used in the majority of the war gaming for Central Europe.
2. Ibid.
3. Ibid.
4. Charles Kamps, Jr., "The Next War", Strategy and Tactics, 69, (July/August 1978), pp. 15-20.
5. Robert P. Berman, Soviet Air Power in Transition, (1978), p. 54.
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7. Ibid., p. 73.
8. Hearings Before the Senate Armed Services Committee, Fiscal Year 1977 Authorization for Military Procurement, Research and Development, and Active Duty Selected Reserve and Civiliam Personnel Strengths, pt. 9, Tactical Air Power, 94:2, Washington, D. C.: Government Printing Office, 1976, pp. 4860-65. As cited by Robert P. Berman, Soviet Air Power in Transition, p. 54.
9. Berman, Soviet Air Power in Transition, p. 75.
10. The reader is referred to Combined Arms Combat Developments Activity (CACDA) handbook, HB 550-2, Organization and Equipment of the Soviet Army, dated 31 July 1978

for additional information on the quanity of field artillery pieces in Soviet ground units.

11. Berman, Soviet Air Power in Transition, p. 75.
12. Benjamin F. Schemmer, "New DOD Emphasis on Electronic Warfare and Counter C3 at Budget Crossroads", Armed Forces Journal International, (February 1979), pp. 14-18.
13. Berman, Soviet Air Power in Transition, p. 75.
14. Schemmer, Armed Forces Journal International, p. 15.
15. Breman, Soviet Air Power in Transition, p. 75.
16. "NATO's New Cautious Optimism", Air Force Magazine, June 1978, pp. 37-42.
17. "Wild Weasels Prepare to Fly F-4G", Electronic Warfare/ Defense Electronics, February 1978, 70-73.
18. Ibid., Schemmer, Armed Forces Journal International, p. 15.
19. "Can NATO Aircraft Survive a Central European Threat?", Electronic Warfare/Defense Electronics, May/June 1977, pp. 52-54.
20. Ibid.
21. Department of the Army, United States Army Intelligence and Security Command, United States Army Intelligence and Threat Analysis Center, IAG-13-U-78, Soviet Army Operations (April 1978), p. 5-22.
22. Ibid., p. 5-25.
23. Ibid.
24. Ibid., pp. 5-23-26.

CHAPTER 7

FINDINGS, OBSERVATIONS AND RECOMMENDATIONS FOR FURTHER STUDY

FINDINGS

The quanity and diversity of Soviet ground air defense systems have increased to the point that present fighter self-protection ECM is no longer an effective means of defense suppression. In addition, programmed EW support aircraft, such as the EF-111A, needed to assist fighter aircraft in the suppression of enemy air defenses, have not been procured. Therefore, an alternate source of electronic warfare support must be found for fighter aircraft.

An alternate source of electronic warfare support that the Air Force should consider in joint operations is the Army EW. Army EW complements Air Force ECM in many respects. For example, both the Army and Air Force conduct electronic warfare operations from the FEBA out to 20 kilometers. The two Services have overlapping generic electronic targets; i.e., they are both interested in air defense in one respect or another. The Services concentrate on complementary divisions of electronic warfare while performing their respective missions.

From a classical electronic warfare standpoint, the

Air Force concentrates upon electronic countermeasures to suppress enemy air defenses. The Army, however because it has a different mission, has developed its electronic warfare program around signal intelligence and electronic warfare support; direction finding in particular. These two capabilities of Army EW can make a significant contribution in the suppression of enemy air defenses. They are always on the ground opposite the enemy force and can locate his emitters. The knowledge of the location of enemy air defense weapons and how they are integrated can be invaluable to aircraft survival. It can assist aircrews in determining how to: (1) avoid defense, (2) vary ingress and egress routes, or delivery patterns to reduce exposure time to defensive weapons, or (3) selectively engage weapons with self-protection ECM. The capability to selectively engage weapons systems of an immediate nature will enhance the effectiveness of the ECM pod. With only one or a limited number of threats to engage, the ECM pod can concentrate its power. Therefore, the integration of the Army's direction finding capability with the Air Force's active EW capability is a viable approach for the suppression of enemy air defenses within 20 kilometers of the FEBA. However, the Army and Air Force will have to make some doctrinal changes and work more diligently at further integrating

joint operations to make this capability readily accessible on the battlefield.

Steps have been taken to improve the joint employment of electronic warfare and SEAD. The ALFA Agency has developed procedures for the joint employment of Army/Air Force EW and SEAD. However, the direct air support model has been used as the basis for these procedures. As a result, the joint procedures devised by the ALFA Agency emphasized preplanned operations. Preplanned operations are good from the aspect that they reduce confusion and can allow for the optimum integration of capabilities. But, the merit of emphasizing preplanned EW and SEAD operations is questionable in the face of new mobile Soviet air defense systems. Granted, there are provisions in the ALFA Agency concepts for immediate and on-call joint operations, but they could be cumbersome and slow to implement since the procedures are superimposed on the air-to-ground request system. Unless Soviet doctrine changes radically, preplanned operations will have little utility beyond the initial stages of a conflict with forces similar to the Warsaw Pact. The Warsaw Pact forces, for an example, will more than likely create a dynamic battlefield, which will reduce the effectiveness of extensive preplanning. Therefore, the Army and Air Force should be developing joint EW and SEAD capabilities that can be

readily implemented anytime close air support is being conducted.

Although this study has dealt with the joint employment of EW to suppress enemy air defenses within 20 kilometers of the FEBA, EW alone cannot totally suppress enemy air defenses. However, as it was demonstrated in North Vietnam, when ground-to-air weapons cannot be precisely located for destruction, electronic warfare can have a profound effect upon the vulnerability of aircraft to enemy ground defenses.[1] Electronic warfare is only a temporary means of suppressing enemy air defenses. To totally suppress enemy air defenses will require the integration of firepower, EW and good airmanship.[2]

OBSERVATIONS AND RECOMMENDATIONS

A-1. OBSERVATION

During the review of the Army and Air Force "how to fight" tactical manuals, numerous references were made to joint EW and SEAD operations. However, there were no procedures outlined as to how the Army and Air Force plan to carry out these operations, nor were there any reference to a document that contained the Army/Air Force EW or SEAD plan. The procedures which the Army and Air Force will most likely follow during joint EW and SEAD operations are contained in documents produced by the Air-Land Forces Application Agency. No other procedures on joint EW and SEAD were found during the course of this study to indicate

differently.

A-2. RECOMMENDATION

If the procedures formulated by the ALFA Agency are in fact the procedures that the Army and Air Force will use during joint EW and SEAD operations, then these procedures should either be referenced in the Services' tactical operations manuals, or they should be included as a basic part of these documents. If the ALFA Agency procedures are not the procedures to be used in Army/Air Force EW and SEAD operations, the Services need to develop procedures to address these two important areas. These operations are of such importance, that to slight either will probably mean ineffective close air support in a conflict with a Soviet modeled army. The enhancing effects of both operations are required to make the air-land concept effective.

B-1. OBSERVATION

The work to date by the ALFA Agency is an excellent beginning toward the integration that will ultimately be required to implement the air-land concept. However, more innovation must be incorporated in the joint EW and SEAD employment procedures to make them responsive to the needs of a dynamic battlefield. At the moment, preplanned is the basis of joint EW and SEAD operations. The ability to implement on a moment's notice should be the basis of joint EW and SEAD. Especially, when one considers that

the next mid-intensity battlefield will be fluid and protected by mobile air defenses.

B-2. RECOMMENDATION

The emphasis of joint EW and SEAD, in support of close air support operations within 20 kilometers of the FEBA, should be reoriented to emphasize immediate operations to correspond with the envisioned dynamics of the future battlefield. SEAD is of such importance to the survival of close air support aircraft, in light of increased surface-to-air defenses, that requests for immediate EW should be a direct air-to-DTOC communications link. The DTOC will more than likely coordinate any Army EW support that is provided within the division's area of influence. This would also be an excellent way for fighter aircraft entering the division's area to get the latest air defense picture, and make any last minute changes to ingress, egress and delivery patterns. The Air Force should provide electronic warfare expertise in the form of an electronic warfare officer (EWO) at the corps and division TOCs to provide a constant interface with Army EW expertise. This would better facilitate the implementation of joint EW.

C-1. OBSERVATION

Although not a part of this study, but a factor that impacts upon joint EW employment, is the availability of friendly EW assets. The quanity of EW assets that the Army

and Air Force have available in their respective inventories will actually determine how much each Service can support joint operations. The number of systems the Services have on hand in units disturbed the author. A rough calculation of the total number of systems available did not appear sufficient to carry out the operations envisioned for a war in Europe.

C-2. RECOMMENDATION

Deficiencies in equipment are rarely admitted in operational plans. Instead, deficiencies are corrected by making reference to cross-utlization. In Europe, for an example, the opportunity to cross-utilize critical assets will be low, because the battlefield will contain more targets than can be serviced by friendly forces. For this reason, plans and concepts should address probable available assets based on today's constraints as opposed to ideal quanities of assets. Other factors that add to the validity of this recommendation are maintain ability, equipment reliability and spare parts support. In the case of the latter, for overseas operations, parts must be shipped from the continental United States. Without addressing availability of assets, plans and concepts become too idealistic to be of much value.

D-1. OBSERVATION

Army electronic warfare is expanding into areas that have been traditionally associated with Air Force

operations. For example, attack helicopters are being equipped with countermeasures to enhance their survival against Soviet ground air defenses. Helicopters are being converted to jamming platforms. On the surface, this latter capability appears to have some application to tactical Air Force operations. The fact is the Army's EW program is expanding and systems are being deployed which may be of assistance in the SEAD effort within 20 kilometers of the battle area.

D-2. RECOMMENDATION

As the Army and Air Force develop and deploy new electronic warfare systems, the joint application of these systems should be exploited to their fullest potential. To insure this is always done the Army and Air Force must maintain close liaison during operational and development testing. In addition, more joint full-scale exercises against representative Soviet forces can highlight systems capabilities that may otherwise go unnoticed.

E-1. OBSERVATION

During the author's research, it was difficult to determine what role the 16th Air Army, GSFG, will play in a conflict in Europe. Soviet tactical aviation has changed its emphasis from defensive to offensive operations. This fact is supported by the number of special purpose aircraft being deployed. A planned counter obviously must be

under consideration to address the role of the 16th Air Army.

E-2. RECOMMENDATION

It is imperative that the role of the 16th Air Army be explicitly defined. Depending upon the role of the 16th Air Army, the present U.S. scenario for Central Europe could change drastically; especially, from a close air support aircraft availability standpoint. Since friendly ground air defenses have not kept pace with the increasing Soviet air threat, it may be that many of the aircraft presently programmed for close air support and interdiction will be tied up in air defense.

CHAPTER 7

END NOTES

1. General William W. Momyer, USAF (Retired), Air Power in Three Wars (WW II, Korea, Vietnam), (1 January 1978), p. 123. Gen Momyer was the Commander, 7th Air Force, Vietnam, from 1966 until August 1968. This book is an excellent account of the air war in Vietnam. Two quotes from this book summarize the difficulties involved in locating surface-to-air defenses and the value of electronic warfare in defense suppression. (1) "Despite . . . intense reconnaissance activity, it was practically impossible to determine precisely where the SAMs would be in advance of any given mission." (2) "The evidence is clear that ECM pods had a profound effect on our vulnerability to SAMs."

2. Edgar O'Ballance, No Victor, No Vanquished - The Yom Kippur War, 1978, pp. 277-306, vividly illustrates how ground artillery, by hitting critical antennas, were able to counter SAM-6s to a degree until effective ECM was developed.

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APPENDIX

APPENDIX A

JOINT SUPPESSION OF ENEMY AIR DEFENSES CONCEPT
(Extracted from CGSC Course P312-2, Offensive Operations, Summary Sheet)

A. Concepts.

1. General. The J-SEAD concept of employment, recognizing the Army's capabilities near the line of contact (LC) and the Air Force's greater penetration capabilities (fig. 1), uses three areas to describe where one Service or the other dominates in target acquisition and/or capability to bring firepower on a given target. This concept provides an understanding of who might nominate targets, who has the capability to strike the targets once nominated, and where targeting tradeoffs occurred. This divisional concept is not intended to break up the battlefield into areas of separate responsibilities, but is used to underscore the need for close Army/Air Force coordination in the conduct of suppressing enemy air defense operations.

(a) The first area to be considered in a suppression campaign is the area that extends from the line of contact to the limits of visual observation means organic to ground forces.

1. In this area, suppression is achieved primarily by ordnance from Army direct and indirect fire systems, to include Army attack helicopters. Army requests for tactical air support are processed the same as other close air support (CAS) requests in this area. Air Force requests for Army support are coordinated through the tactical air control parties (TACP) or by using prearranged quick-fire artillery channels.

2. Here the depth will normally not exceed 5 kilometers and is dependent on a variety of factors such as visibility restrictions, terrain, vegetation, weather, and contrast.

3. The threat here is characterized by a high density of first-echelon units and short-range, surface-to-air defense systems. Although not located here, longer-range, surface-to-air missile (SAM) systems will normally be able to cover this area and are a threat to friendly aircraft.

4. Because of the proximity of friendly forces, closer and more detailed coordination for SEAD is required. Coordination for attack on SEAD targets is the same as that required to employ CAS. Likewise, passing enemy air defense target locations between the Services must be a coordinated effort, with maximum consideration given to accuracy and timeliness.

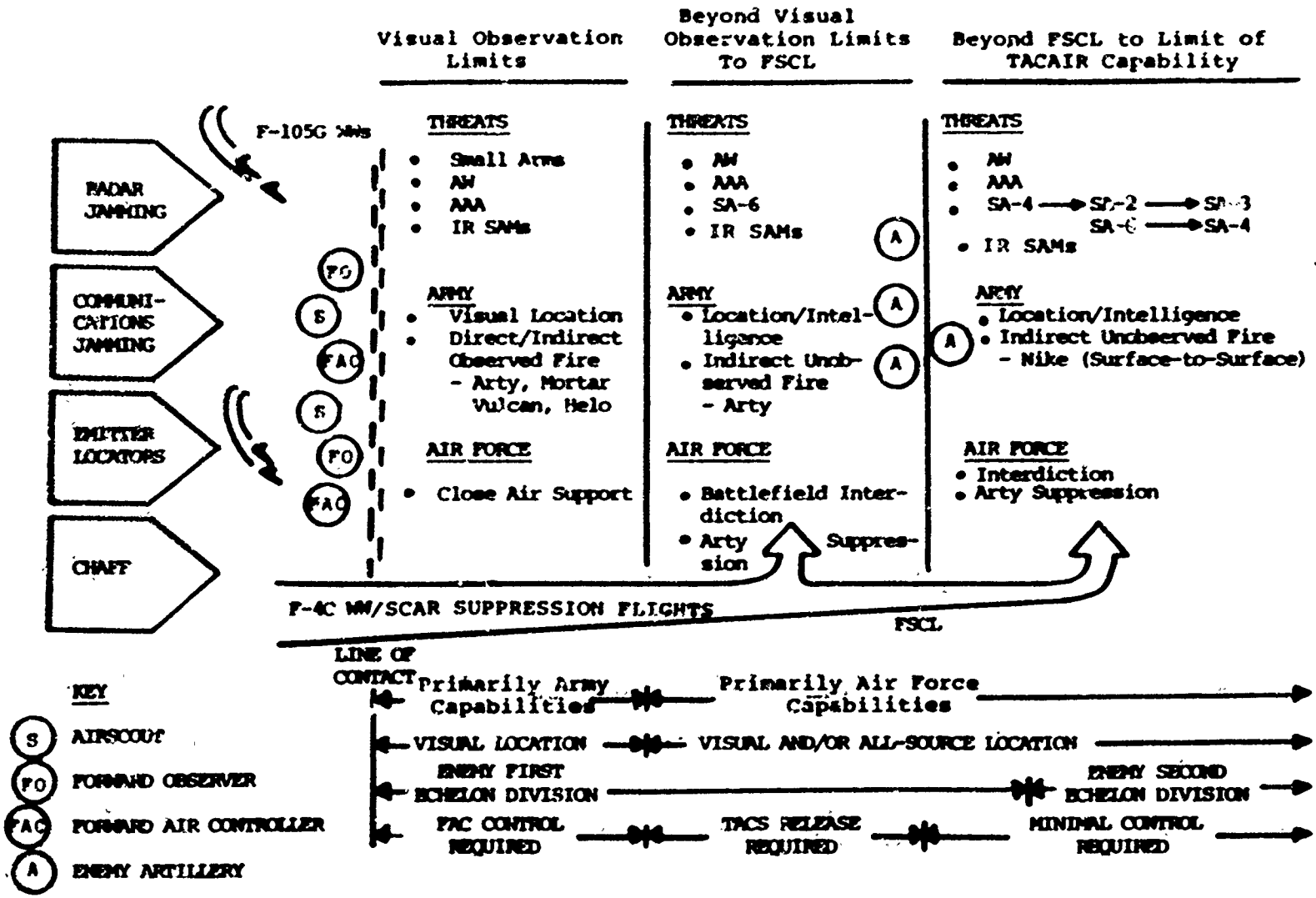

Figure 1: Surface Air Defense Suppression Campaign

(b) The second area extends from the limit of visual observation, that point where other than direct visual acquisition means were used to locate targets, continuing out to the range of friendly cannon artillery or the fire support coordination line (FSCL).

1. This area extends to a depth of approximately 15 kilometers from the LC and would include the range of most friendly field artillery in the indirect, unobserved fire mode. However, the FSCL may be considerably deeper than the range limit of tube artillery during the conduct of offensive penetration missions.

2. The threat is essentially the same as that previously discussed; however, SA-6 units may be found here as well as additional first-echelon units and the majority of the enemy's field artillery.

3. Here suppression is accomplished primarily by tactical air assisted by artillery. The effectiveness of unobserved artillery fire is limited by accuracy of target location data. Targets in this area cannot normally be visually acquired by surface forces, and target location data for indirect fire must depend on alternate means. Army intelligence-gathering means are limited in this area; therefore, passing of target locations from the Air Force to appropriate artillery and missile units in a timely manner is required. This area is within range of Air Force firepower in both visual acquisition and alternate acquisition modes and is subject to all forms of air attack.

4. Coordination requirements here are less than those within visual range; however, some clearance may be required. If so, this clearance will be exercised through the tactical air control system (TACS).

(c) The third area extends from the FSCL to the depth of tactical air employment. It is beyond the range of most friendly tube artillery.

1. Tactical air is the primary means of suppression. Long-range cannon artillery or surface-to-surface missiles will be employed only if within range, and if accurate and timely location data is available.

2. The threat includes all the enemy's capabilities but a lower density of short-range air defense systems and automatic weapons. However, more SAM sites are found in this area -- including, for the first time, SA-2's and SA-3's -- as well as the balance of the enemy's first-and second-echelon forces.

3. Minimal coordination between the Services will be required.

II. Strategy. The priority effort in a preplanned suppression campaign is suppression of SAM systems, with air defense command and control elements and antiaircraft artillery (AAA) following in priority. Once these units have been suppressed, the SEAD effort will be directed toward maintaining this suppression. With SAM's suppressed, aircraft tactics can be changed to permit medium-altitude ingress and egress, overflying the AAA, weather permitting.

B. Limitations.

The concepts and procedures for joint SEAD consider existing limitations in friendly detection, location, acquisition, command and control, and suppression systems. In addition to the specific limitations of both lethal and nonlethal systems, the general limitations addressed below tend to influence suppression techniques employed. When these limitations change, the SEAD concept should be revised to reflect the resulting capability changes.

I. Location Accuracy. Most enemy air defense systems are mobile and difficult to locate accurately. At the same time, precise locations are required by most suppression means in order to achieve satisfactory destruction without excessive use of ammunition. Airborne visual attack systems, terminal homing systems, and electronic countermeasure (ECM) systems require less precise location data but depend a great deal on site activity.

(a) Presently, several location systems must be used in combination to develop data from which the threat environment can be established. This takes time. However, near-real-time systems are too few and too limited in locational accuracy to be used alone for threat development or targeting. The present choice is too often either photo-confirmed targets that are 3 hours old or near-real-time locational data that is not accurate enough for targeting. Neither option is satisfactory. This dilemma forces reliance on visual means of target acquisition for the bulk of the attack effort.

(b) Attack systems dependent on locational accuracy for success are only as good as the input data. Visual attack systems are better prepared if accurate target location data is available, but this alone does not insure success. The probability of visually discriminating surface air defense weapons from a myriad of surface targets is small. The Wild Weasel (WW) aircraft provide a limited option in

the indirect attack mode with antiradiation missiles (ARM); however, the ARM is easily countered by the operator shutting down his radar.

II. Responsiveness. The combination of mobile systems and a doctrine that dictates frequent displacement requires that enemy air defenses be engaged as soon as they are located. Therefore, near-real-time data and the expeditious flow of target information is essential to the destruction of systems before they move. The integration of multirole systems for detection, location, and suppression requires extensive prior planning. Provisions must be made for expediting the flow of combat information at all levels from locator to suppressor.

C. Joint Suppression Procedures.

I. Execution. The joint suppression mission is executed as illustrated in figure 2. Several general considerations are necessary for successful execution of the suppression plan.

(a) Both lethal and nonlethal suppression means degrade hostile air defenses. Army and Air Force electronic jammers, emitter locators, intercept sites, and chaff resources support suppression activities. They, in turn, rely on previously gathered intelligence data for upgrading information.

(b) Normal ground combat operations and air battle activities continue, but a portion of the available tactical air and of Army direct and indirect fire resources are used for suppression. This reduces temporarily, those resources available to the commander for other tactical operations; but the tradeoff of assets to accomplish suppression will be redeemed later. The benefits of effective suppression translate into lower aircraft attrition rates and more friendly assets available to conduct follow-on air and ground combat operations.

II. Procedures. Specific procedures for the execution of joint suppression are delineated as follows.

(a) From the line of contact (LC) to the limit of visual observation (fig. 3). The enemy air defense threat in this area is characterized by intense enemy small arms and automatic weapon fire, AAA, and short-range, heat-seeking missiles. Most suppressive actions are by US Army means, including direct fire systems (visual target detection), indirect (observed and unobserved) field artillery and motar fires, attack helicopters suppressive fires, and air and ground jamming operations. The Air Force provides primarily

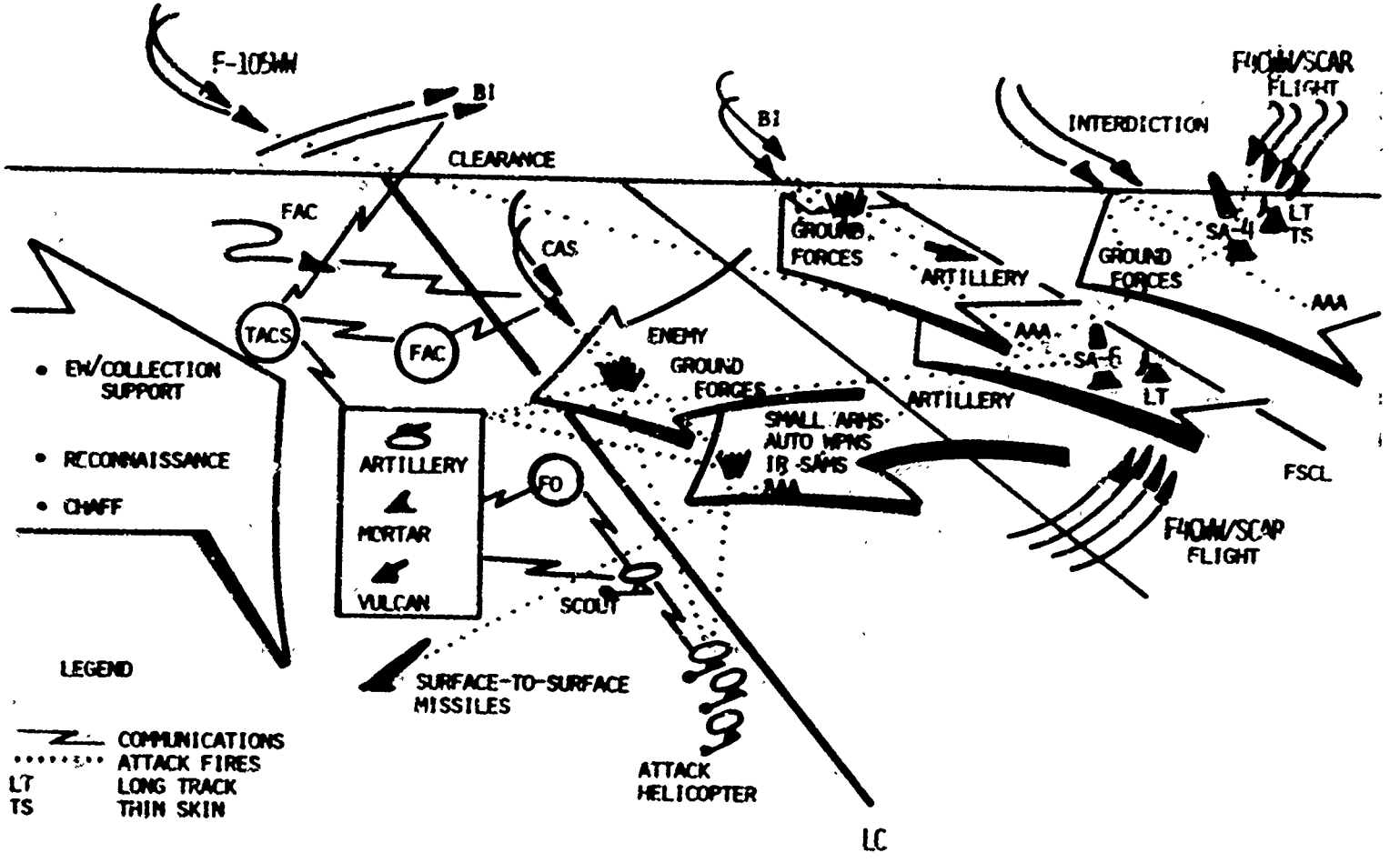

Figure 2: Joint Suppression Campaign

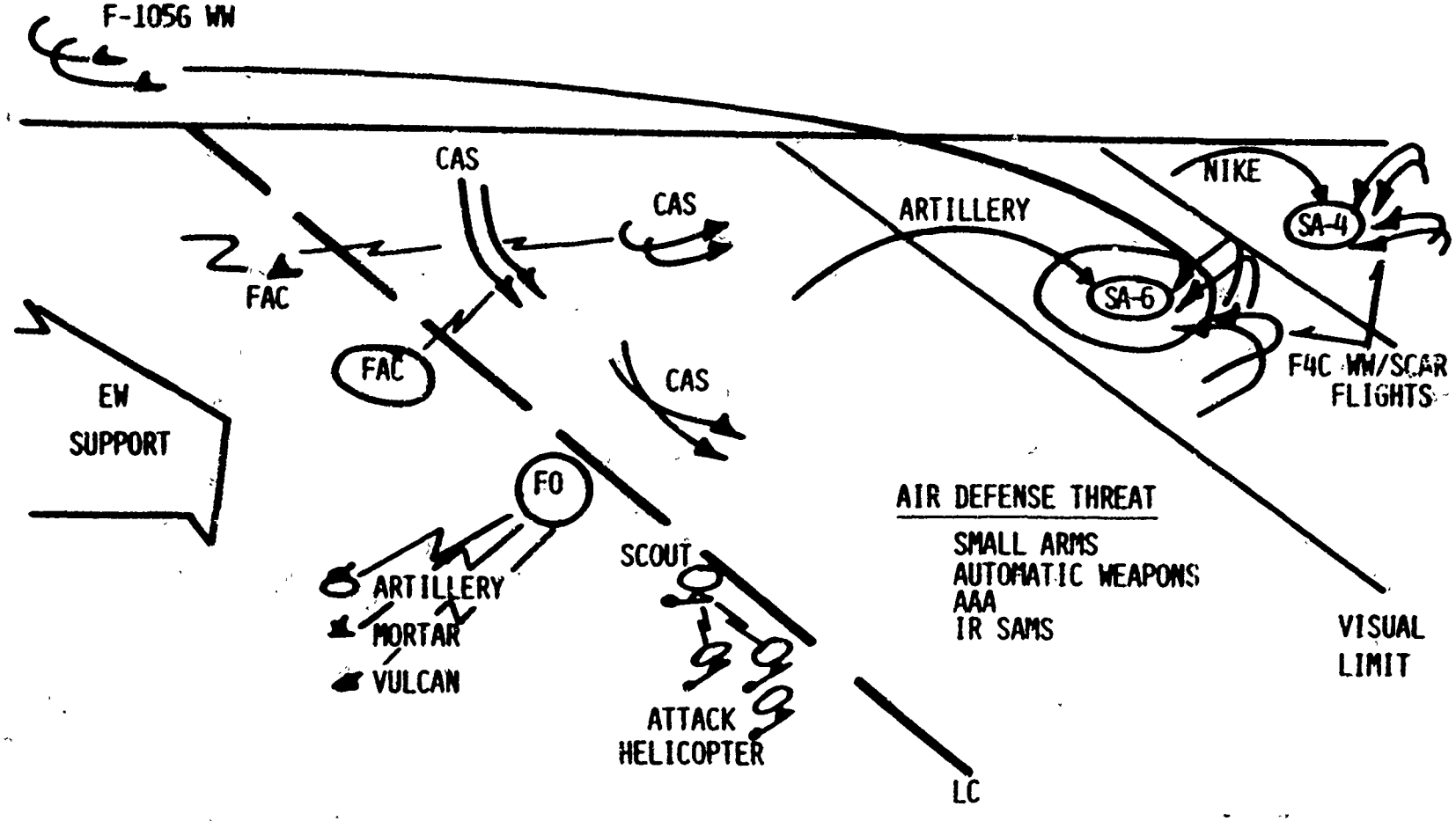

Figure 3: Suppression Within Visual Range

close air and electronic warfare support (including chaff) and detection/location information.

1. Through prioritization of organic and supporting firepower, the Army can degrade the air defense threat. Specific division and corp are allocated on a first-priority basis for a limited duration as specified in the suppression plan.

2. Enemy air defense targets visually acquired within this area are engaged as targets of opportunity (fire requested immediately). Targeting data derived from near-real-time SIGINT and direction-finding sources are passed by the most expeditious means to the fire support element (FSE) in the division tactical operation center (DTOC). Friendly ECM assets are simultaneously employed against lucrative command and control centers, fire control nets, and early warning broadcast nets.

3. Although the primary mission of the attack helicopter is the destruction of enemy armor, they attack enemy air defenses when the need arises. Specifically, the destruction or neutralization of threatening ZSU-23-4's and SA-9's is a must to enable the attack helicopter units to sustain their attack against armor.

4. Consistent with mission requirements, close air support aircraft avoid areas of high-risk, indirect-fire conflict. However, high-priority CAS missions will not be delayed because of potential conflicts with indirect fire support; concurrent attacks in areas where artillery fire is being delivered will be considered normal.

a. If hostile air defense systems are visually acquired by Air Force aircrews on CAS missions, these systems will be attacked whenever feasible. Also, suppressive artillery fires by Army forces in support of CAS strikes can be initiated through the forward air controller (FAC), who has access to the direct support artillery battalion's fire net.

b. CAS aircrews must, in turn provide highly accurate target location data to the FAC using coordinates and/or references to prominent terrain features. To achieve this degree of accuracy requires training and experience in target location, identification, and reporting techniques but is essential for accurate, indirect fire support.

(b) Visual limits to the FSCL (fig 4). This area

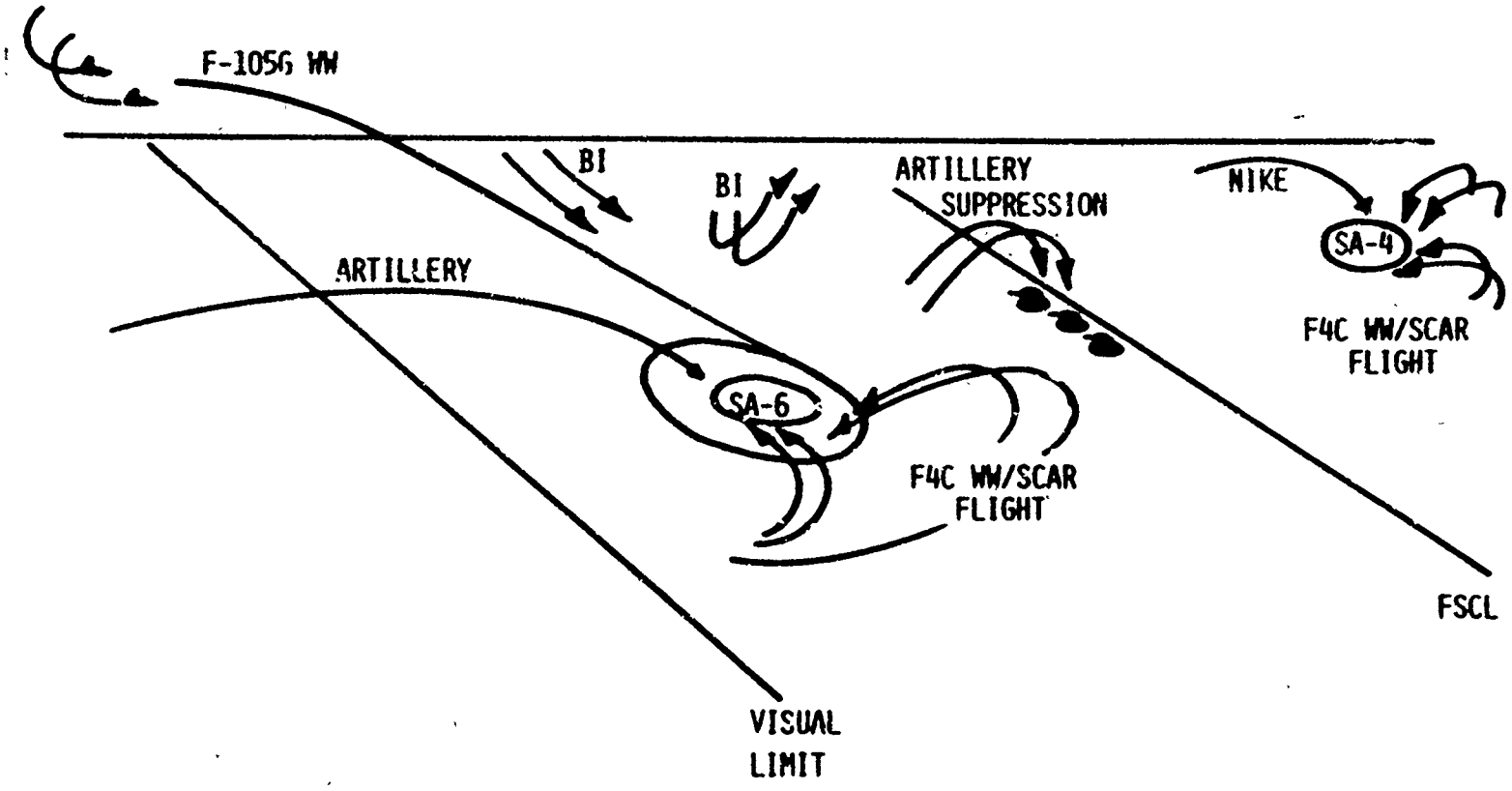

Figure 4: Visual Observation Limit to FSCL

extends from the limit of ground or air visual observation to the FSCL and is characterized by automatic weapons, AAA, and SAM threat systems. The Army's suppressive role here is primarily indirect field artillery fires. The Air Force provides battlefield interdiction, destroying and degrading enemy combat units, air defenses, artillery, and command and control elements.

1. Corps and division artillery are tasked to attack enemy air defense systems located by such means as SIGINT, long-range reconnaissance patrols (LRRP), photo/sensor reconnaissance, and pilot reports. The accuracy and timeliness of data and the threat potential determine suppression priority.

2. Air Force battlefield interdiction mission aircraft will attack defense systems whenever the opportunity occurs. Accurate and timely targeting data to Army artillery and Air Force Wild Weasel/strike control and reconnaissance (SCAR) flights are relayed through TACS channels. A portion of tactical air resources attack and maintain pressure on hostile artillery to release some friendly field artillery for SEAD on a priority basis. If this pressure is not applied, enemy artillery is free to fire at will upon friendly defensive and artillery positions. When tactical air degrades hostile artillery capabilities, friendly antitank, artillery, and helicopter operations are significantly enhanced. Support for battlefield interdiction (BI) missions in this area is also provided by friendly ECM and chaff resources.

(c) Beyond the FSCL (fig. 5). This area extends from the FSCL to the depth of tactical air operations. The threat here includes all of the SAM systems as well as the automatic weapons and AAA as found in other areas. SEAD in this area is accomplished primarily by tactical air, since Army capabilities are limited to long-range cannons and missiles.

1. The Air Force employs interdiction to destroy enemy surface elements, including rear units of the first echelon as well as second-echelon units. Enemy artillery has a high priority. Interdiction operations are supported by Wild Weasel and flights may be assisted by Army surface-to-surface missiles targeted in support of SEAD.

2. The accurate location of enemy air defenses is critical here due to the distances from detection means. However, SEAD targets at this depth, once located, are generally more lucrative since they are less transient.

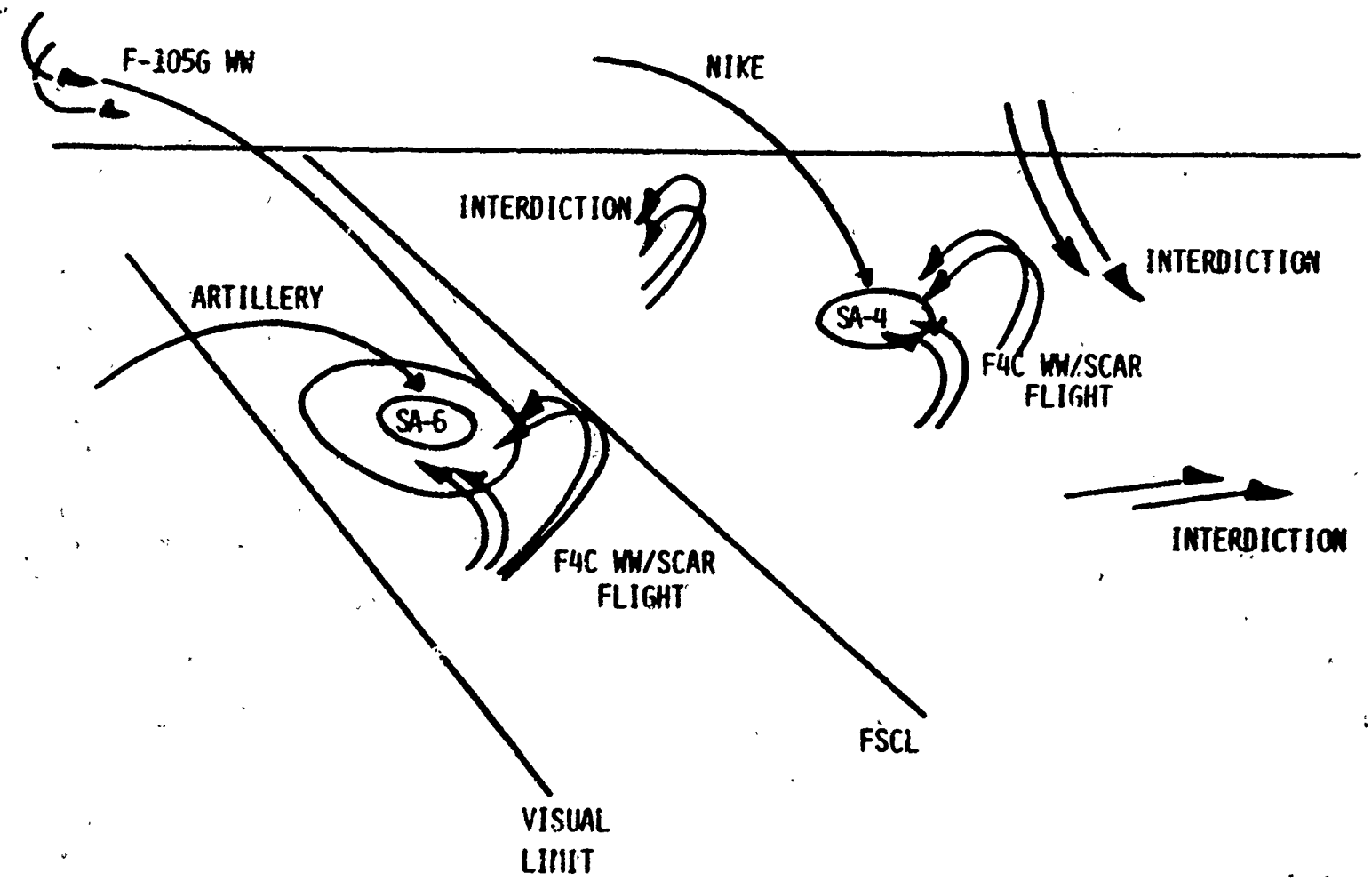

Figure 5: Beyond FSCL to Limit of Tactical Air Capability

In particular, the longer-range SAM systems and their associated radars should be assigned in high priority for attack.

3. The identification and location of SEAD targets are often provided through combined intelligence efforts. Army and Air Force resources employed in the SEAD effort use this data to plan and execute their missions. Air Force interdiction missions in this area may also visually locate surface air defenses. When presented with this opportunity, aircrews should attack these targets when it is feasible and priorities permit. Moreover, interdiction missions are expected to respond to on-call requests for support in attacking and destroying surface defense targets specifically identified by Wild Weasel or RF-4C SCAR aircraft.

III. On-Call SEAD.

(a) SEAD planning includes both preplanned and on-call employment of resources. The on-call effort is required to insure rapid response and availability of sufficient capabilities to satisfy high-priority requests.

(b) Air Force on-call SEAD support for the Army is available as immediate CAS or by diversion of preplanned CAS sorties. Procedures for requesting immediate CAS follow the routing depicted in figure 6.

1. Request for Army on-call SEAD normally originates with the airborne FAC or flight/mission commander.

2. Attack helicopter/scout teams provide on-call SEAD assistance when priorities permit. Enemy surface air defenses must be visually acquired by the attack helicopter crews, but accurate location data from the requestor should make this possiole (fig. 7).

3. Field artillery units tasked with a priority for SEAD establish quick-fire channels to expedite SEAD communications. Using the FM radio quick-fire channels, the requestor asks for SEAD support directly or by relay through the TACS (fig. 8).

a. It is possible for the requestor to ask directly for fire. Normally, however, the request is through the TACS (preferably the FAC or TACP) to the TOC, where a decision is made as to best available means of suppressing the target. The fire request is then passed via a quick-fire channel to the designated artillery unit (or attack helicopter).

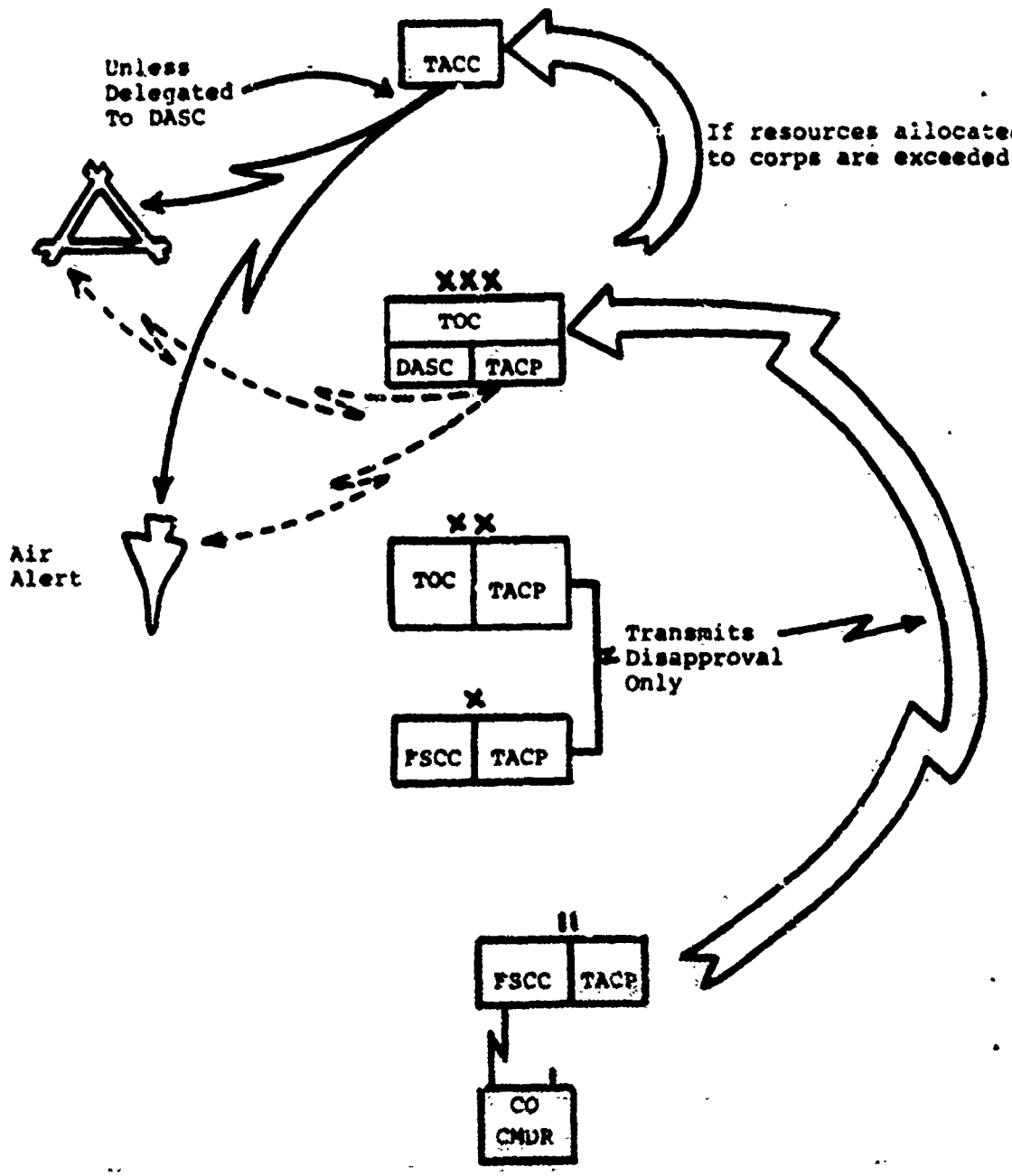

Figure 6: Immediate Close Air Support Request Channels

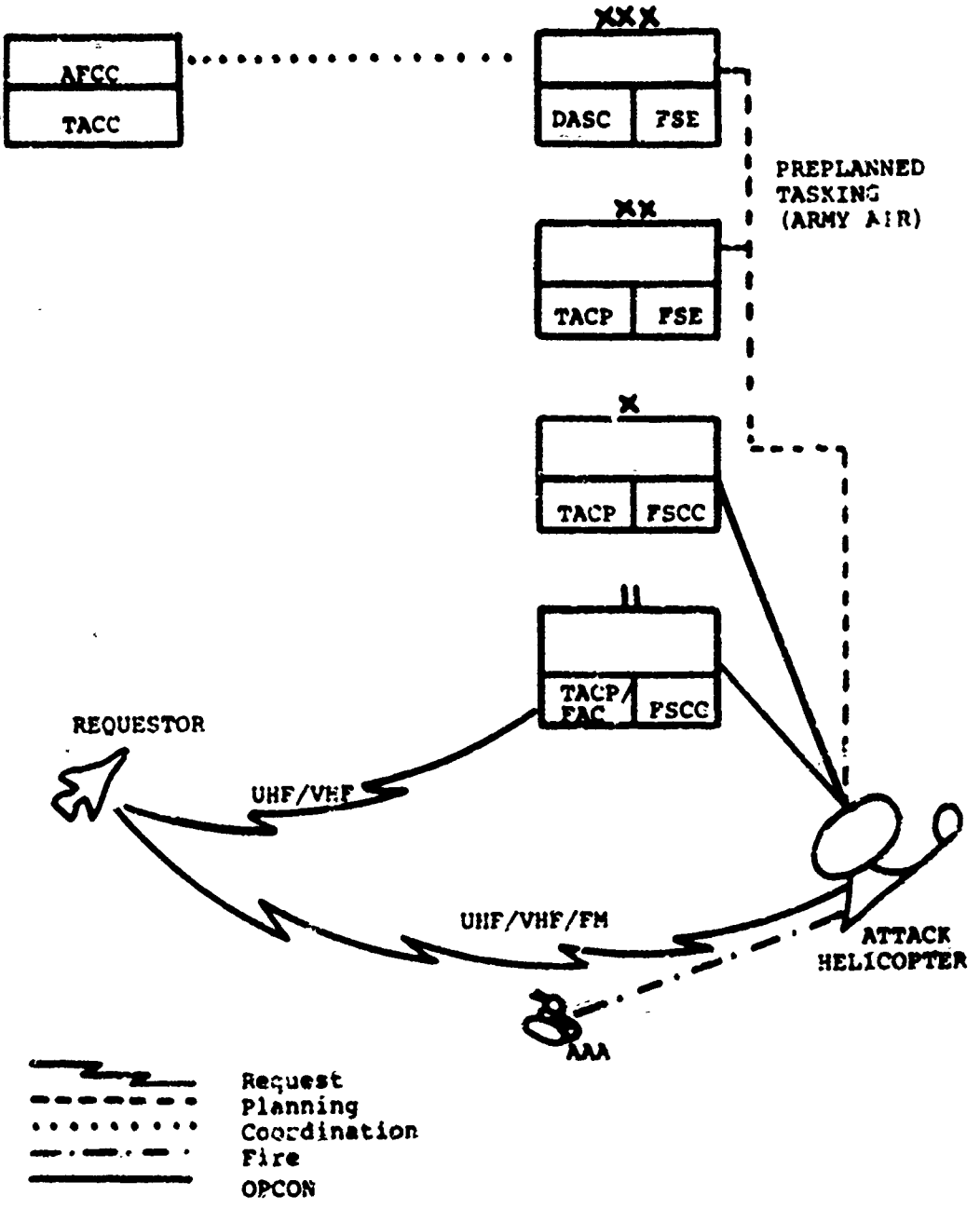

Figure 7: Air Force Request for On-Call Army SEAD (Attack Helicopter)

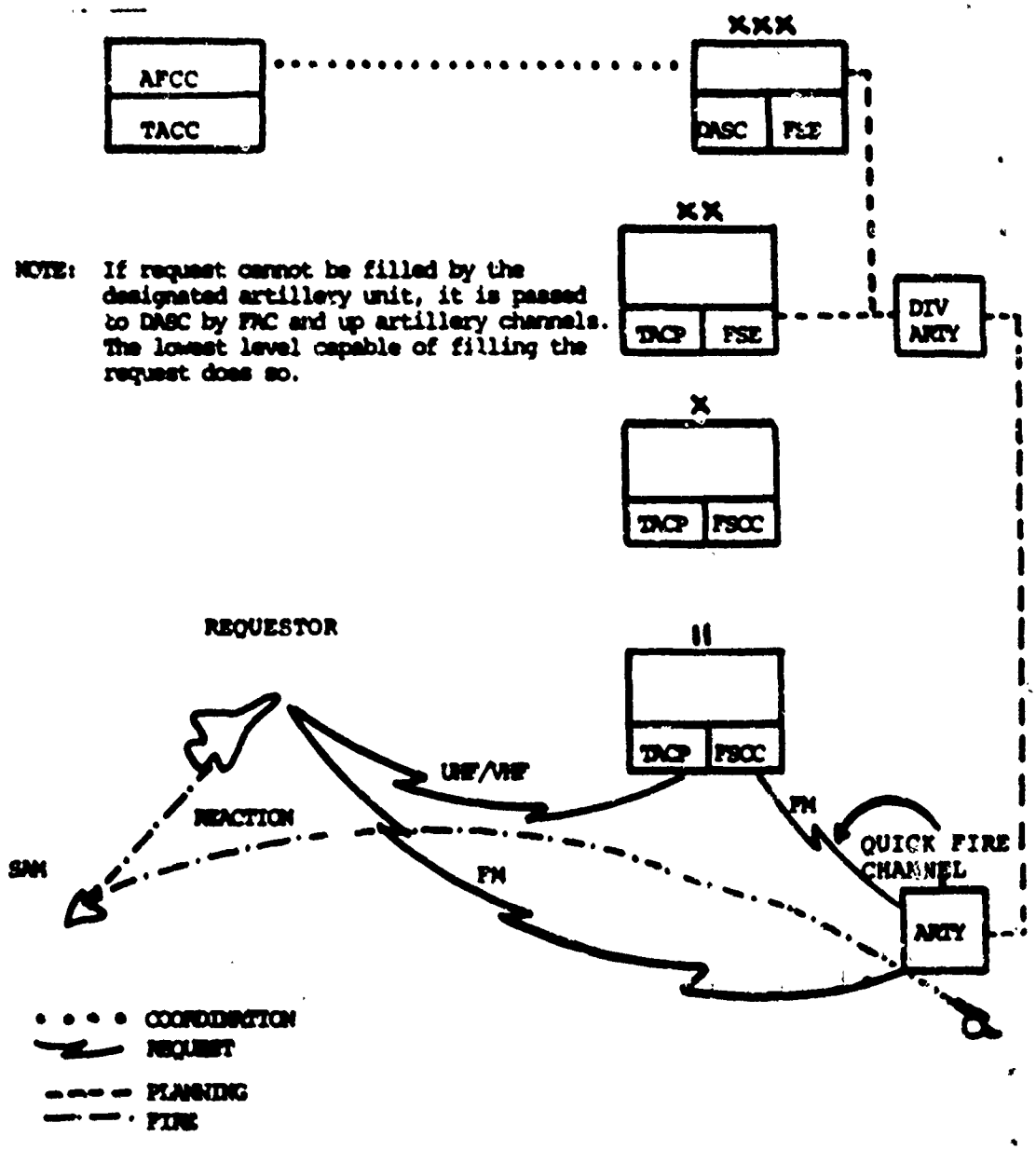

Figure 8: Air Force Request for On-Call Army SEAD Artillery

b. If not an appropriate artillery (or attack helicopter) target, the requestor passes the target information to the FAC or the TACP who in turn passes it to the DASC via the air request net.

4. Preplanning insures that Army ECM support for SEAD is also available on an on-call basis (fig. 9). A request for ECM support is received in the TACP or the DTOC. For those ground systems under operational control (OPCON) of the division, such a request may be approved in the DTOC, with tasking initiated through the division ATSE. The request is relayed to the corps ATSE if air assets or corps supported ground ECM assets are required. Tasking for corps is accomplished through the CTOC and the corps ATSE.

5. Other Army SEAD support, such as rangers or special forces, are not normally tasked for on-call SEAD.

6. If Army assets cannot engage the target, the DASC considers use of Air Force on-call assets or, if required resources are not available to the DASC, forwards the request to the TACC.

7. Once the decision to engage or not engage the target has been made, the action to be taken will be relayed back to the requestor.

IV. Localized SEAD.

(a) General. Joint procedures for localized SEAD are similar to the procedures used in a SEAD campaign; however, the SEAD requirement is limited to that necessary to protect selected high-priority missions. Localized SEAD is not an extensive effort.

(b) Planning. The planning is initiated by the TACC and is based on the expected execution of those selected tactical air assets. Army assets also may be requested, through coordination with the battle coordination element (BCE) at the tactical air control center.

(c) Tasking. The development and dissemination of tasking for localized SEAD will be the same as that employed for a joint SEAD campaign.

(d) Execution. Execution of localized SEAD is similar to execution of a joint SEAD campaign except that, where possible, direct communication is provided. The supported mission is then able to maintain contact to coordinate any last-minute changes or to initiate on-call SEAD.

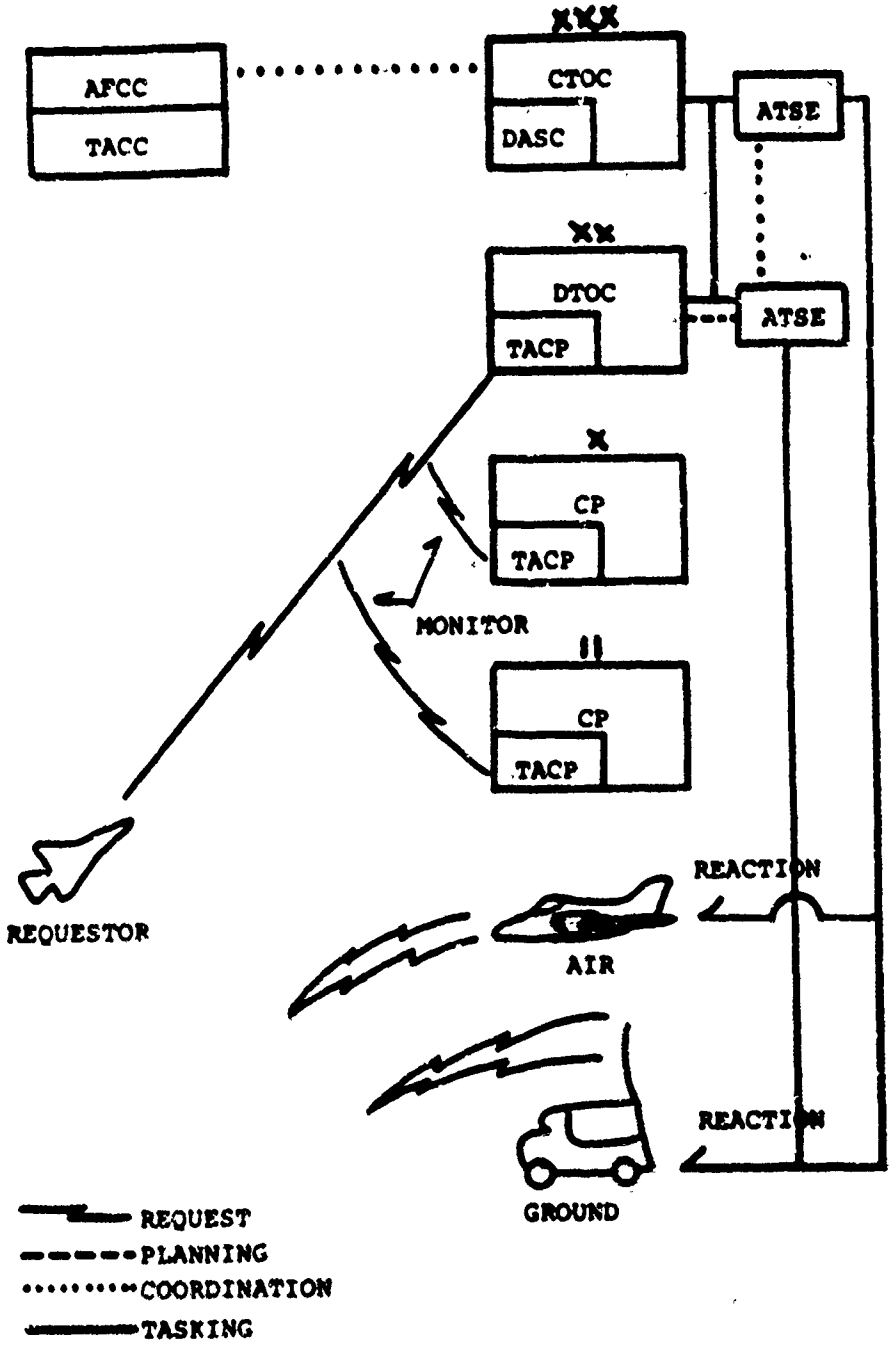

Figure 9: Air Force Request for Army On-Call EW Support

D. Summary.

Suppression of enemy air defenses is not an end in itself. Rather, it is an essential part of all operations employing airpower. By reducing aircraft losses and permitting use of optimum delivery profiles, SEAD enhances the effectiveness of airpower and contributes to winning the air-land battle. J-SEAD requires an integrated Army-Air Force effort to locate and suppress enemy surface air defenses. The location and detection effort is continuous with emphasis increased during the actual conduct of concentrated, overwhelming, simultaneous (or near simultaneous) attacks on a critical portion of the air defense systems. The payoff of the SEAD effort is the more effective support of ground forces with higher mission completion rates. Accordingly, it is by exploitation of the favorable conditions achieved through SEAD that the cost of the SEAD campaign is redeemed. Since J-SEAD is primarily an Air Force responsibiligy, the decision to suppress, the extend of the suppression effort required, and the planning for the suppression campaign rest with the Air Force component commander.

APPENDIX B

OPINIONNAIRE RESULTS

The following are the results of a survey administered to a group of students in the 1979 Class of the Army Command and General Staff College. The purpose of the survey was to try and ascertain the feelings of future military planners on the employment of Army/Air Force EW for the purpose of suppressing enemy air defenses. The choices of response to each postulation were: strongly disagree, disagree, undecided, agree, or strongly agree. For reasons unbeknown to the author, there were few strongly agree, or strongly disagree responses. Therefore, the results are simply expressed in percent of disagree, undecided and agree responses.

Question: As a result of lessons learned from the 1973 Middle East War, the U.S. Army and Air Force will fight future wars as a combined arms team.

Results: Four percent undecided; five percent disagreed; and 91 percent agreed.

Question: Both members of the Air Force-Army team must be effective in order to stop the advance of forces in Central Europe.

Results: 100 percent agreed.

Question: The major Air Force contributions to the combined arms concept will be in the form of air defense and air superiority.

Results: Seven percent undecided; 23 percent disagreed; and 70 percent agreed.

Question: The major Air Force contribution to the combined arms concept will be in the form of close air support and interdiction of second echelon ground forces.

Results: Nine percent undecided; 18 percent disagreed; and 83 percent agreed.

Question: Close air support is the most valuable of all air operations in blunting the advance of large armored forces.

Results: 10 percent undecided; 40 percent disagreed; and 50 percent agreed. Comments received in reference to this question indicated that close air support could best contribute

to the Army's efforts by destroying second echelon forces in a Soviet modeled force.

Question: A Warsaw Pact force is protected by an umbrella of ground air defenses that extend from ground level to the upper altitude limit of tactical aircraft.

Results: Three percent undecided; three percent disagreed; and 94 percent agreed.

Question: Enemy ground air defenses will pose a greater threat to close air support than enemy air forces because of the relatively low altitudes at which close air support is conducted.

Results: Five percent undecided; 12 percent disagreed; and 83 percent agreed.

Question: If close air support is to survivie and be effective it must be afforded protection from enemy ground air defenses.

Results: Three percent disagreed and 97 percent agreed.

Question: The Air Force has the responsibility for SEAD, therefore, it should protect its own close air support operations.

Results: 10 percent undecided; 50 percent disagreed; and 40 percent agreed.

Question: Army aviation will not be affected by enemy ground air defenses, therefore, the Army should not be interested in SEAD.

Results: One percent undecided; 98 percent disagreed; and one percent agreed.

Question: SEAD by definition is an encompassing operation that includes many forms of combat: from individual weapon system destruction by fires to degradation of system performance by electronic interference. The Army can best contribute to the SEAD effort with artillery fires and attack helicopter fires, within twenty kilometers of the forward edge of the battle area (FEBA).

Results: Nine percent undecided; five percent disagreed; and 86 percent agreed.

Question: The Soviet ground air defenses are extremely mobile, therefore, they will be extremely difficult to attack by fires.

Results: 16 percent undecided; 38 percent disagreed; and 46 percent agreed. This spread in responses appear to indicate there is much doubt about the capability of acquisition systems.

Question: Army aviation will be most affected by low-altitude, short range ground air defenses within twenty kilometers of the FEBA.

Results: Two percent undecided; seven percent disagreed; and 91 percent agreed.

Question: For joint SEAD operations, between the Army and Air Force, to be effective they must be preplanned to the maximum extent possible.

Results: Five percent undecided; three percent disagreed; and 92 percent agreed.

Question: Preplanned SEAD operations would be most effective against a predictable enemy with limited ground air defenses.

Results: Three percent undecided; 18 percent disagreed; and 79 percent agreed.

Question: The Soviets' tactics of "breakthrough" and bypass will generate more requests for immediate air support from ground forces than preplanned air support requests.

Results: Nine percent undecided; five percent disagreed; and 86 percent agreed.

Question: Many requirements will be placed upon artillery, attack helicopters and tactical air assets in a mid-intensity conflict; consequently many of these assets will not be available on a timely basis to provide SEAD support.

Results: 16 percent undecided; 14 percent disagreed; and 70 percent agreed.

Question: An alternative to attacking and destroying enemy ground air defenses is the employment of electronic warfare to confuse and degrade enemy air defense fire control radars and communication nets.

Results: Three percent undecided; 14 percent disagreed; and 83 percent agreed.

Question: Suppression with electronic warfare is much more

effective in a rapidly changing air defense environment than attempting to destroy individual air defense weapon sytems; because one electronic warfare system can degrade several radars at once without knowing their location.

Results: 30 percent undecided; 27 percent disagreed; and 43 percent agreed.

Question: Tactical aircraft should reduce their weapon loads (carry fewer bombs) and provide for their own defense since they have equipment to counter enemy air defense fire control radars.

Results: 29 percent undecided; 39 percent disagreed; and 32 percent agreed.

Question: Effective SEAD could become a reality with the successful integration of Army EW locating capabilities and Air Force suppression capabilities.

Results: 10 percent undecided; three percent disagreed; and 87 percent agreed.

Question: There is no direct two-way communications between Army ground electronic warfare units and close air support aircraft. This link should be established to coordinate the air and ground electronic warfare effort against enemy air defenses.

Results: 11 percent undecided; 21 percent disagreed; and 68 percent agreed. The majority of those responding disagree indicated there is communications to accomplish the required coordination through an airborne FAC.

Question: If the enemy's command and control net and acquisition radars can be jammed (electronic interference), individual air defense weapon systems will be forced into autonomous operation, thereby decreasing the probability of an aircraft "kill" (aircraft shot down).

Results: Three percent undecided; 16 percent disagreed; and 81 percent agreed.

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