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**SYNCHRONIZATION OF AIR DEFENSE ASSETS  
IN THE CORPS AREA OF OPERATION:  
THE CORPS ADA BRIGADE  
COMMANDER'S DILEMMA**

**A Monograph  
by  
Major Joseph S. Drelling  
Air Defense Artillery**



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Major Joseph S. Drelling  
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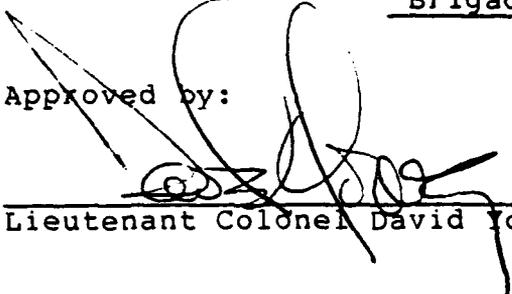
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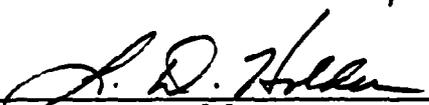
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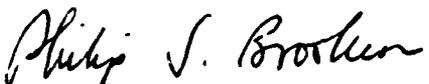
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Approved by:

  
\_\_\_\_\_  
Lieutenant Colonel David Young, M.A. Monograph Director

  
\_\_\_\_\_  
Colonel L. D. Holder, MA Director, School of  
Advanced Military  
Studies

  
\_\_\_\_\_  
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# ABSTRACT

*SYNCHRONIZATION OF AIR DEFENSE ASSETS  
IN THE CORPS AREA OF OPERATIONS:  
THE CORPS ADA BRIGADE COMMANDER'S DILEMMA*  
by Major Joseph S. Drelling, USA, 46 pages

This paper examines the AirLand battle tenet of synchronization and its application to air defense within the corps area of operations. Specifically, this paper addresses the changes occurring in tactical air defense units at corps and division level and the problems associated with effectively synchronizing these assets. Also examined are the problems inherent with trying to synchronize corps air defense operations with those being conducted in the corps area by agencies outside of corps. These agencies include air defense forces from sister services and echelons above corps (EAC) air defense assets.

This monograph first examines an historical example of successfully synchronized air defense operations. The historical example discusses air defense operations immediately following the invasion of Normandy. Next, the new corps air defense organization is examined and its role in the synchronization process explained. Finally, two command and control systems, which could support the corps ADA brigade commander's efforts, are evaluated.

The paper concludes that air defense operations in the corps area can be synchronized. Effective synchronization will require a decentralized C<sup>2</sup> system utilizing procedural controls instead of positive control of air defense fires. To allow effective synchronization the system will also have to present an accurate picture of the air battle over, and around, the corps area of operations. Finally, it will be important for both corps and division commanders to retain full control of their air defense assets so that they can be fully synchronized with the ground concept of operations. This is especially true of the high to medium altitude air defense (HIMAD) assets which will be a part of the corps ADA brigade.

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# I. Introduction.

At the tactical level of war, the air defense participants have certain objectives and roles in planning and executing air defense operations. Air defense commanders consider the factors of METT-T for different types of theaters and operations to plan and execute air defense. ADA planning and operations at the tactical level focus on air defense of corps and divisions. ADA defends maneuver units and designated critical assets within the corps and division sectors of the battlefield. To provide air defense, ADA units fight as members of the combined arms team in close, deep, and rear operations.<sup>1</sup>

-FM 44-100, U.S. Army Air Defense Operations

## Background

Currently, the United States Army Air Defense Artillery structure within the corps is undergoing a metamorphosis. The divisional air defense battalions are witnessing a transformation in structure and assets. Corps, which had no organic air defense capability, is currently receiving an air defense brigade which will provide the commander with a capability to protect his critical assets and to reinforce divisional air defense assets. The improved capability at both division and corps level will be significant.

After the cancellation of the SGT YORK Division Air Defense (DIVAD) Gun program in September 1985, the United States Army Air Defense School (USAADS) initiated a program

to modernize the concept of air defense in the forward area. The concept eventually evolved into the Forward Area Air Defense System (FAADS), a system of systems. Since the air defense assets in the division structure were considered inadequate to face the qualitatively improved threat, the FAADS concept was developed to correct that deficiency and carry divisional air defense forward to the 21st century. But changes at the division level did not solve the corps commander's air defense problem.

At the corps level air defense assets were nonexistent. The only air defense assets available within the corps were at division level. Thus the corps rear area was left virtually unprotected except for incidental coverage from theater assets. To resolve this shortfall the corps air defense brigade was created. This brigade provides the corps commander with his own organic air defense capability.

The corps ADA brigade will be used to reinforce the divisional air defense battalions or to protect other assets as defined by corps. To meet the requirements of our AirLand Battle doctrine both corps and division air defense assets must be able to fight a synchronized battle with both air and maneuver forces.

Within the corps area of operations a variety of air defense assets will require effective synchronization. These assets will include a minimum of two divisional FAADS battalions, the corps air defense brigade, and possibly some theater assets located within the corps sector. By its

nature the air battle is inherently a joint operation. On top of the ground based air defense assets in the corps area lie the U.S. Air Force assets dedicated to fighting the air battle. Thus, the goal of this monograph is to answer the following question: Can the Air Defense assets in the corps area of operations be effectively synchronized?

I will attempt to answer this question by first examining how the air defense assets at Normandy beach were organized and synchronized. Then I will compare the structure from the Second World War to the structure being employed in the heavy corps today and evaluate how effectively the current structure will be able to synchronize the air battle. Finally, I will evaluate two fire distribution systems which could be utilized to help synchronize the efforts of all air defense assets in the corps area. The systems to be evaluated will include one centralized and one decentralized system. As appropriate, I will discuss the application of automation within the systems and explain how it could assist the effort. Finally, I will summarize my conclusions and recommend the system which I feel will best aid the corps air defense assets in synchronizing the air battle.

## Synchronization

First it is necessary to clarify synchronization. Our current operations manual uses the following definition:

"Synchronization is the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point."

-FM 100-5, Operations<sup>2</sup>

To be accomplished effectively, synchronization requires a command and control system, a commonly understood concept of operation, and flexibility to adapt to unexpected changes in the operation. When applied to air defense operations synchronization is required in two arenas. First, the air defense effort must be synchronized with the ground effort. Without adequate synchronization the ground forces may face heavy attrition from massed air attacks. Due to the limited quantity of air defense assets available the commander will have to identify the critical time and place to position the air defense assets he does have; there are insufficient assets available to protect everything. Second, the various air defense assets themselves must be synchronized to fight the air battle effectively. This includes all Army air defense assets from the short range assets in the forward area to the medium-to-high altitude assets in the rear area. Additionally, this includes Air Force assets dedicated to fighting the air battle.

From the corps perspective only a portion of these assets will fall within the corps area of operations. The

only dedicated air defense assets the corps commander can be assured of having are those controlled by his corps ADA brigade. The subordinate divisions will have their own dedicated FAADS battalions which will support their division commanders' priorities. Theater high-to-medium altitude air defense (HIMAD) assets may lie within the corps boundaries but will not necessarily be controlled by the corps commander; some theater HIMAD assets will be reinforcing corps ADA assets. Air bases generally lie in the communications zone (COMMZ) behind the corps rear boundary but Air Force assets can be expected to fight part of the air battle in the skies over the corps area. Though coordination is required to synchronize these assets effectively, the corps commander does not directly control air force assets fighting in his area.

The air-ground coordination problem is not new. As we will see, the problems of synchronizing a variety of air defense weapon systems using a common airspace during the Second World War parallel those of today.

## II. Historical Perspective.

31 August 1861: "The Washington Artillery of New Orleans fires on a Union observation balloon over Ball's Cross Roads, near Washington, forcing the balloon down."<sup>3</sup>

-First recorded successful air defense engagement

### Normandy Landings

One of the largest concentrations of air defense forces ever assembled for a single purpose occurred in the vicinity of the Cotentin Peninsula and Normandy landings starting on 6 June 1944, D-Day. First Army conducted its amphibious landings on Omaha Beach and on Utah Beach. Realizing that the forces on the beaches would be vulnerable to air attacks, the planners "established an air defense umbrella of fighter aircraft over the beachheads and began landing AAA (antiaircraft artillery) during initial assault waves."<sup>4</sup> First Army's organic AAA was the 49th AAA Brigade. The brigade included "the 11<sup>th</sup>, 16<sup>th</sup>, 18<sup>th</sup>, and 20<sup>th</sup> AAA Groups, and 29 battalions."<sup>5</sup> Not only did AAA units land at the beachheads but two AAA battalions, the 80<sup>th</sup> and 81<sup>st</sup> Airborne AAA Battalions, "landed inland from Utah Beach with the 82<sup>nd</sup> and 101<sup>st</sup> Airborne Divisions."<sup>6</sup> By 1 August 1944 the AAA assets on the Normandy beachhead and Cotentin peninsula had grown considerably in size with the addition of the 38<sup>th</sup> AAA Brigade which was supporting the newly established Third Army.

On 1 August 1944. Third Army's 38<sup>th</sup> AAA Brigade had "seven Antiaircraft Artillery Groups, six Antiaircraft Artillery Gun Battalions, eight Antiaircraft (Self-propelled) Battalions and seventeen Antiaircraft Automatic Weapon Battalions assigned or earmarked for assignment." The AAA groups included the 7<sup>th</sup>, 23<sup>rd</sup>, 24<sup>th</sup>, 27<sup>th</sup>, 112<sup>th</sup>, 113<sup>th</sup>, and 207<sup>th</sup>. Though the 38<sup>th</sup> AAA Brigade was larger than First Army's 49<sup>th</sup> AAA Brigade, seventeen battalions from the 38<sup>th</sup> AAA Brigade were attached to First Army's AAA brigade for initial operations on the continent.<sup>2</sup> As heavily laden with AAA assets as the First and Third Armies appeared, the picture is not complete without considering the Ninth Air Force AAA assets.

During the invasion, Ninth Air Force had the 9<sup>th</sup> Air Defense Command (ADC) to oversee its AAA operations. The 9<sup>th</sup> ADC initially consisted of the 51<sup>st</sup> and the 52<sup>nd</sup> AAA Brigades. Eventually, the 9<sup>th</sup> ADC would have assigned to it: (1) up to eight AAA brigades, with attached AAA groups, battalions, and operations detachments; (2) the 71<sup>st</sup> Fighter Wing (a part of the command headquarters) and two U.S. night fighter squadrons; (3) two signal air warning battalions and two fighter control squadrons.<sup>3</sup> The control and effective synchronization of this vast armada of air defense was a difficult challenge to meet.

### AAA Structure and Command Relationships

To gain a proper perspective of the control of AAA assets, it is important to examine the AAA structure within the armies, corps, and divisions during World War II (WWII). The army was "the fundamental ground force unit of strategic maneuver and ... the largest self contained ground unit."<sup>10</sup> However, the composition of the army was "not fixed but ... determined by the particular mission it [was] assigned and the specific situations in which it [was to] be involved."<sup>11</sup> This explains the differences in composition between the First and Third Armies' AAA Brigades. Prior to the invasion of Europe, Headquarters, European Theater of Operations (ETO) used the following planning factors for allocating AAA units within subordinate armies:

Per Division -	1 AAA Automatic Weapons (AW) Bn
Per Corps -	1 AAA Group HQ & HQ Btry 1 AAA Gun Bn 2 AAA AW Bns
Per Army -	1 AAA Brigade Hq & Hq Btry 3 AAA Group Hq & Hq Btrys 2 AAA Gun Bns 6 AAA AW Bns

-Third Army After Action Report<sup>12</sup>

The AAA unit chain of command varied from command to command. AAA units assigned to fighter commands followed

the chain of command below:

Fighter command  
Antiaircraft artillery command  
Regional antiaircraft artillery command  
(usually a brigade)  
Groups  
Battalions

-FM 4-100, Antiaircraft Artillery<sup>13</sup>

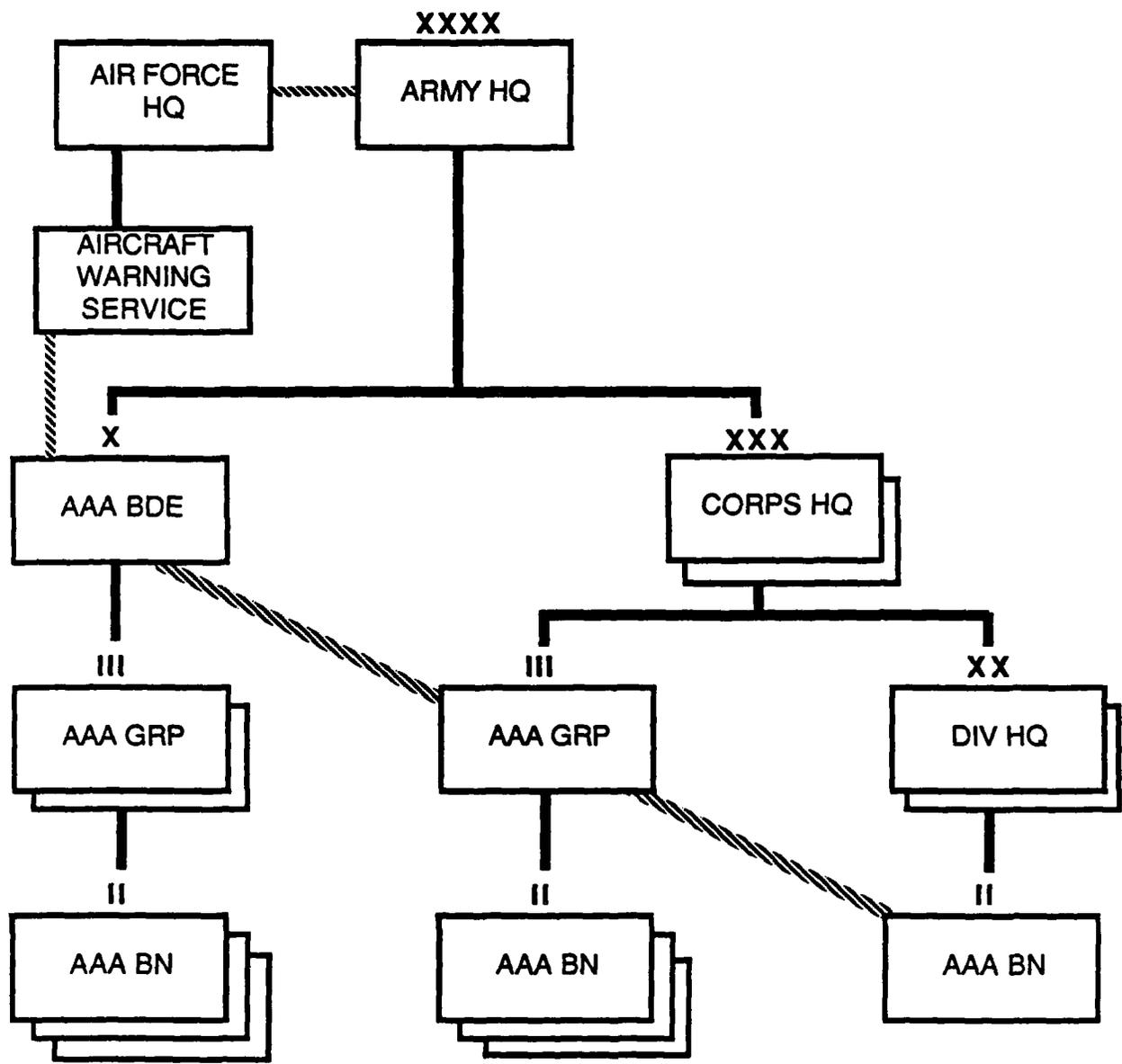
This type of chain of command was followed by the 9<sup>th</sup> Air Defense Command in the Ninth Air Force. The 9<sup>th</sup> Air Defense Command "provided air defense of the communications zone."<sup>14</sup> By agreement between the Ninth Air Force commander and the 12<sup>th</sup> Army Group commander all active airfields were included in the communications zone.

For AAA units assigned to an army or corps the chain of command was completely different. The command concept was briefly described in the 1943 version of FM 4-100, Antiaircraft Artillery, as follows:

"There is no direct chain of AAA command extending from an army to its component corps; that is, instructions originating within an army for corps AAA will be directed in the name of the army commander to the corps commander who will be responsible for issuing appropriate orders to his AAA."<sup>15</sup>

Thus, all of the AAA units assigned within an army did not have a direct chain of command from the AAA brigade at army level down to the individual firing units. All AAA assets assigned to a level of command (ie: corps) did have a

complete chain of command. The problem was that there was no functional linkage between AAA headquarters at different levels of command (ie: army and corps). See figure #1, below, for a diagram of the AAA command structure. The AAA brigade at army level directly controlled only the AAA groups which remained at army level. The AAA groups which were attached to subordinate corps headquarters were, effectively, separate organizations. The AAA group at corps only controlled the AAA battalions which remained at corps level. The AAA battalions attached to division level were also separate organizations. Generally, the chain of command was complete from the AAA battalion level down to the individual firing units. The chain of command above battalion level was dependent on the organizational structure of the supported unit.



C<sup>2</sup> Authority
  Coordination

FIGURE #1: WWII ANTI-AIRCRAFT DEFENSE STRUCTURE

While the AAA chain of command did not directly connect the entire AAA structure within the army, the brigade commander was still responsible for coordination of all AAA assets within the army. "Antiaircraft command and control remained under the Army chain of command through brigade to units, with close coordination being exercised with the fighter wing at the fighter control center."<sup>16</sup> Thus, the AAA brigade was a key coordination element for the Army commander. As today, the brigade commander was also responsible to act as a special staff officer for the supported force (Army then, Corps today) commander.

#### Synchronization of Army and Ninth Air Force AAA Assets

A major problem which had to be solved following the landings on 6 June 1944 was the synchronization of the Ninth Air Force and 12th Army Group AAA assets. Prior to the invasion the IX ADC had been responsible for the defense of the Ninth Air Force bases in England. This did not become a problem until the bases were forward deployed onto the continent and into army areas. The question was quickly raised concerning who would control the AAA assets defending the airbases; IX ADC or the local AAA ground forces. Due to the scale of the problem, the resolution of this issue required a decision from the highest levels. "This issue was ultimately decided on 19 January 1945, when SHAEF instructed that an Army Group Rear Air Boundary be established, that the army assume responsibility for the air

defense of all installations forward of that boundary and that IX Air Defense Command be responsible for the air defense of all installations rear of the boundary."<sup>17</sup> Though resolved by command decision, the resolution of the AAA control problem led to an early form airspace management. But the Army Group Rear Air Boundary did not fully resolve the synchronization problem.

Synchronization requires a coordinated effort. Effective synchronization of AAA units during WWII required an early warning net and coordinated engagement procedures. The early warning during WWII was primarily provided by the Aircraft Warning Service (AWS), a system supported by the Signal Corps. The mission of the AWS was "to supply early information of enemy aircraft in the form desired by the interceptor commander."<sup>18</sup> Though the AWS was directly subordinate to the Air Force interceptor command, the AWS did have an army Antiaircraft Artillery Officer assigned to its Information Center. His primary purpose was to provide liaison between the Air Force and army AAA forces. This included passing AAA unit locations, antiaircraft artillery information service data, aircraft track information, and control measures. The AAA officer was also there to advise the Information Center regarding control measures for AAA assets. The AWS helped to coordinate engagement procedures between the Air Force and AAA units.

The AAA officer working in the AWS Information Center

performed a variety of services which helped to synchronize the efforts of AAA units and IX Air Force. He was the direct link between AAA assets and Air Force assets. To help synchronize air defense efforts, the AAA officer worked in close cooperation with the Controller in the AWS Information Center. Airspace management techniques could be coordinated in advance and modified when necessary. With his direct communication to AAA assets, the AAA officer could help these forces to be more responsive to changes in the air battle. Through the use of coordinated airspace management techniques and early warning the AAA officer could also help to reduce potential fratricide.

The controller was the air force interceptor commander's representative and the tactical commander of his region while he was on duty. He was responsible for all assigned or attached interceptor aircraft and AAA weapons in his region except for those assigned to ground force headquarters. The controller was responsible for the defense of a given airspace (region) and allocated targets that entered that airspace to the various air defense assets under his control.

Though not his primary mission, the AAA officer could be used to help synchronize Air Force air defense efforts with the ground battle. The AAA officer had the communications necessary to coordinate directly with army AAA forces which, in turn, could coordinate with their associated ground force commander. While the Aircraft

Warning Service was not perfect, it did help to synchronize air defense efforts between air and ground elements.

### Synchronization of Army AAA Assets

Though the AAA forces of World War II did not have to work with today's air defense missile systems, the synchronization problems were similar. World War II AAA forces consisted of four types of battalions: gun, automatic weapons, searchlight, and barrage balloon. Gun battalions were equipped with either the 90MM M2 or the 120MM M1 and were responsible for high altitude aircraft up to approximately 40,000 and 57,000 feet respectively. The gun battalions were the high-to-medium altitude air defense (HIMAD) of their time. The automatic weapons battalions were responsible for the low altitude short range air defense (SHORAD). Barrage balloon battalions were responsible for low and very-low altitude defense of specific assets. Searchlight battalions provided illumination for night AAA gun and night fighter aircraft engagements.

The senior force AAA commander was responsible for the coordination of all subordinate AAA assets. At army level this was the AAA Brigade Commander. As previously discussed, the brigade commander did not have a direct chain of command which connected all subordinate AAA assets FM

4-100 summarized the brigade commander's responsibilities as follows:

"The AA brigade commander is responsible for the tactical employment of the troops under his command. During operations he keeps himself informed as to the situation of his own and enemy forces. He is responsible for coordination of the missions and dispositions of the groups and battalions under his command."<sup>29</sup>

Being the senior AAA officer in the army, the brigade commander was the AA officer of the army. As the AAA officer of the army, the brigade commander was the army commander's primary advisor on AAA matters and was "responsible for the coordination and control of all AA units in the army."<sup>30</sup> This responsibility included both assigned and attached units. Other stated responsibilities which allowed the brigade commander to become the primary AAA synchronizer in the army were:

- (1) Prepares plans for the use and coordination of AAA and of all other ground elements of AA defense, both active and passive.
- (2) In cooperation with the army air officer and other members of the special staff, prepares plans for coordination of activities of aviation with those of all elements of the ground AA defense.
- (3) Coordinates the activities of the Anti-Aircraft Artillery Intelligence Service (AAAIS) within the army and with adjacent units.
- (4) In conjunction with friendly aviation, prepares recognition codes and establishes routes of approach for recognizing friendly aviation that must pass over areas defended by AAA.

Thus the brigade commander was the focal point of army AAA synchronization forward of the army group rear boundary. He was responsible to ensure that detailed coordination took place between the AAA forces and the ground and air forces. This coordination included allocation of forces, identification of rules of engagement (ROE), and threat information. Based on the army commander's plan the AAA defense plan would "provide for the attachment of AAA to the various corps, the remainder being held under army control. It (would) specify missions of the army AAA and the rear limits of the areas or elements assigned to the AAA of the several corps." This allowed the AAA brigade commander to mass the AAA assets in the Army in support of the ground maneuver plan. While not directly commanding the AAA assets, the brigade commander was able to influence the missions assigned to all army AAA assets.

Synchronization of WWII Corps AAA Assets

Within the corps, the senior air defense commander was normally the AAA group commander. His responsibilities paralleled the AAA brigade commander's at army level. The group commander synchronized the AAA assets within the corps area of operations by assigning them complementary missions while massing assets at critical areas. This

synchronization was accomplished through the Antiaircraft (AA) Defense Plan which was issued as an annex to the corps operations order.

The AA defense plan addressed all areas necessary for effective AA planning. Some of the key areas included: 1) enemy aviation, 2) friendly troops (aviation and AAA), 3) AAA fire, 4) passive defense, and 5) early warning<sup>24</sup>. This plan included specific subparagraphs for corps AAA units and division AAA units. Though the AAA group commander did not command the divisional AAA battalions, he did influence their missions through the AA defense annex to the corps operations order. Thus all orders to subordinate AAA units were made via the corps commander instead of through a separate AAA chain of command.

For example, within a corps area of concentration the corps AAA weapons were synchronized by splitting responsibility for protection based on the altitude of the threat aircraft. The guns provided protection against high flying observation aircraft and the automatic weapons provided protection against low flying aircraft and dive bombing attacks.~ Corps AAA assets could be used to reinforce divisional AAA assets or to perform complementary missions in support of the divisions. Though not labeled synchronization, these efforts attempted to arrange AAA assets in time and space to produce maximum combat power at the decisive point.

Another aspect of AAA synchronization was the system used to provide AAA early warning information. The

Antiaircraft Artillery Intelligence Service (AAAIS) was supervised by the AAA Searchlight battalion commander.<sup>26</sup> The AAAIS was the early warning system used to provide tactical early warning information to AAA units. Besides passing aircraft track information to army AAA units, the AAAIS also shared warning information with the Aircraft Warning Service which primarily supported air force air defense efforts. The early warning provided by the AWS was primarily at an operational and strategic level. Early warning of both hostile and friendly aircraft is critical to the synchronization effort. During WWII, as is still true today, some type of early warning network is required. Without an early warning system air defense effectiveness would be based primarily on the abilities of the individual crews to acquire targets early, properly identify friend versus foe, and engage if hostile.

With this understanding of air defense operations during the Second World War it will be easier to recognize the parallels in today's air defense organization. Today's corps air defense brigade commander faces challenges similar to those faced by his counterpart in the 1940's. As we will see, today's corps air defense structure bears a strong resemblance to the AAA structure of yesterday.

### III. Synchronization of Today's Corps Air Defense Assets.

#### Current Corps ADA Command and Control Structure

The corps air defense brigade coming online today is being structured in the same fashion as the AAA group that was attached to corps during World War II. The corps brigade will be an evolving structure through the turn of the century but will include a combination of high-to-medium altitude air defense (HIMAD) and short range air defense (SHORAD) battalions. All battalions in the corps brigade will be directly subordinate to the brigade without an intermediate group headquarters as existed in WWII. Under the proposed structure the corps ADA brigade would include a headquarters and headquarters battery, three pedestal mounted stinger battalions, a chaparral battalion, and a hawk battalion. Initially, the hawk battalion will be the only asset controlled by the corps commander which will provide HIMAD coverage. Following the turn of the century, the corps ADA brigade will eventually include three mobile surface to air missile (MSAM) battalions. The MSAM battalions will replace several of the battalions in the brigade and will have a HIMAD capability. All of these assets will be new to the corps.

Identical to the air defense structure of the 1940's, the corps air defense brigade will not include the divisional air defense battalions. The FAADS battalion in

each division will be directly controlled by the division commander. Though the corps ADA brigade commander does not command the divisional FAADS battalions, he will still be responsible for their coordination as a part of the overall air defense effort in the corps. The C<sup>2</sup> control structure of air defense within corps is shown in Figure #2 below:

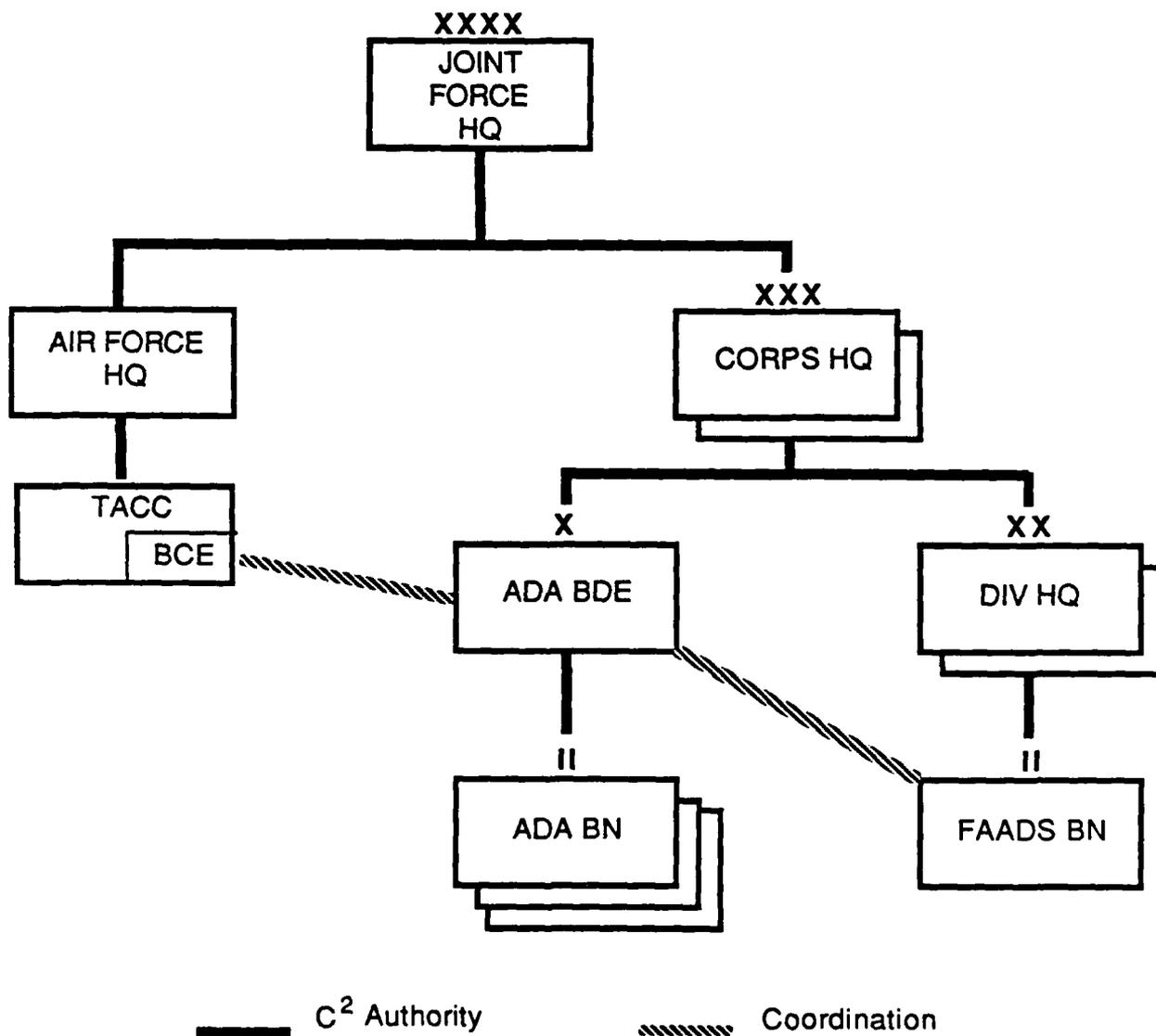


FIGURE #2: CORPS AIR DEFENSE C<sup>2</sup> STRUCTURE

### Synchronization with EAC and Joint Air Defense Assets

Though the corps ADA brigade, being the senior air defense element, is the air defense proponent for the corps, it is not normally the senior controlling authority for air defense fires. Within a unified command overall responsibility for air defense would normally be assigned to the joint force air component commander (JFACC). The JFACC would be designated the Area Air Defense Commander (AADC). All air defense assets within the unified command are subordinate to the AADC. This would include joint air-to-air and surface-to-air assets. "The AADC or his designated representative establishes air defense command and control procedures."<sup>27</sup> Two of the measures used by the AADC to control air defense fires are rules of engagement (ROE) and weapons control status. Normally, the AADC determines the weapons control status for all fixed wing aircraft and delegates the authority for establishing rotary-wing weapons control status to the maneuver force commander.<sup>28</sup> All air defense assets within the theater, to include ADA assets assigned to corps and division, must operate within these constraints. The ROE and weapons control status define when air defense systems can engage hostile aircraft. If the corps commander disagrees with the determinations made by the AADC then he can change the control measures to a more restrictive level. The corps commander cannot lower the control measures to a level less restrictive than that defined by the AADC. The control measures established by

the AADC help to synchronize air defense efforts throughout the theater.

A variety of airspace control measures are also used to help synchronize air defense efforts within a theater. The following four airspace control measures are key to air defense operations within the corps area of operations: positive control, procedural control, fighter engagement zone (FEZ), and missile engagement zone (MEZ). Positive control relies on positive identification, tracking, and direction of aircraft within a given airspace; it is conducted with electronic means.<sup>29</sup> Conversely, procedural control relies on a combination of previously agreed and promulgated orders and procedures.<sup>30</sup> Normally, positive control is exercised on all HIMAD assets in a mature theater. For ADA assets this means that targets are assigned, by a centralized authority, to specific units for tracking and possible engagement. Positive control also requires that the HIMAD unit be given authorization to fire before engaging any aircraft (except in self-defense). Procedural control is a more decentralized form of operation and control. Fighter engagement zones and missile engagement zones are designated airspaces within which only the responsible system, either missiles or fighters, may engage aircraft. All four of these airspace control measures may affect air defense operations within a corps area.

For effective synchronization, the location of the

Corps ADA brigade HIMAD assets must be properly coordinated with the AADC. For these HIMAD assets to be of value to the Corps commander they must be responsive to his requirements. Thus it is imperative that the corps commander retain command, as defined in JCS Pub 1, of these assets. A key consideration of this is that the corps commander must be able to position his HIMAD assets where they will best support his concept of operations. This requires synchronization with EAC HIMAD assets controlled by the AADC. The corps ADA brigade commander must coordinate with the AADC to ensure that the AADC is aware of where the corps HIMAD assets are positioned. In turn, the AADC will be able to adjust the locations of his EAC HIMAD assets to take advantage of the corps HIMAD coverage. This synchronization will prevent unintentional duplication of coverage. This same coordination is necessary when the corps is moved to a new area of operations. When the corps moves, either the replacing corps HIMAD assets will assume responsibility for the coverage or the EAC HIMAD assets will have to be adjusted to fill the void.

#### Synchronization of Corps Air Defense Assets

Today the primary responsibility for the synchronization of air defense within the corps area of operations lies with the corps ADA brigade commander. The brigade commander plays two primary roles, both of which influence synchronization. He is the commander of forces

assigned to the corps ADA brigade and he is the air defense coordinator (ADCOORD), or special staff officer, for the corps commander. As the brigade commander he is responsible for task organizing his forces and assigning them missions; coordinating air defense planning with echelons above corps (EAC) ADA assets; and coordinating air defense planning with both adjacent corps ADA assets and subordinate divisional assets. As the ADCOORD he is responsible for coordination with joint air defense assets; recommending offensive and defensive counter air priorities; and the overall coordination of corps ADA. These responsibilities require him to coordinate with the following:

- Joint Forces Air Component Commander (JFACC)
- Tactical Air Control Center (TACC)
- Battlefield Coordination Element (BCE)
- Theater Army Air Defense Command (TAADCOM)
- Corps Commander/G-3
- Adjacent Corps ADA Brigade Commanders
- Subordinate Divisional FAADS Battalion Commanders

-FM 44-100, U.S. Army Air Defense Operations<sup>1</sup>

There are a number of specific functions which the brigade commander must accomplish to synchronize air defense operations effectively within the corps area. Probably the most important of all is to recommend and execute the corps air defense plan. To develop this plan properly requires extensive coordination as described in the previous paragraph. A second function would be to command and control assigned units; inherent in synchronization is the requirement for a functional command and control system.

Third. influence and execute the airspace control plan; this would require detailed coordination with joint and EAC air defense assets. Fourth. influence the ground course of action; this ensures synchronization of the air defense effort with the close, deep, and rear battles. Fifth. provide early warning to ADA units and air raid warning to other corps units; critical to any successful effort. Sixth. coordinate with the divisional air defense battalions; key to successful execution of the overall corps air defense plan. These synchronizing functions are viewed as a major part of the overall responsibilities of the ADA brigade commander.

#### Synchronizing Corps ADA Brigade & Divisional FAADS Battalions

Since the divisional FAADS battalions do not fall under the control of the Corps ADA brigade, but do operate in the corps area of operations, their operations require direct coordination. It is imperative that air defense operations at corps and division level be synchronized. To effect this synchronization, the brigade commander must understand the concept of operations in the corps area. By thoroughly understanding the corps commander's intent, the brigade commander can properly coordinate with the divisional FAADS battalion commanders to ensure that the concept of operations is properly supported. The brigade commander can weight the main effort with additional air defense assets or

use his assets to fill gaps unable to be covered by divisional assets. The ADA brigade commander explains his concept of air defense operations in the air defense annex of the corps operations order.

Effective synchronization of air defense assets within the corps area of operations is a difficult challenge which requires a considerable effort by the brigade commander. To be effective he must ensure that the corps air defense forces have no duplication of effort, are responsive to changes in the air battle, effectively operate against low and medium-high altitude threats, and ensure adequate coverage of the commanders' (corps and division) priorities. To be able to accomplish this monumental task he needs a command and control system which will support these requirements and help him to fight the air battle efficiently.

While synchronizing the ADA assets with the corps ground maneuver plan the ADA brigade commander can also support a corps deception plan. One example of this might be to take advantage of the fact that the 20MM Vulcan is organic only to the divisional battalions. By positioning a division's Vulcans in an area separate from the division, air defense assets could be used to deceive the enemy as to the location of a division. Of course, the corps brigade would have to assume responsibility for air defense coverage of the division from which the Vulcans were removed.

## IV. Command and Control Systems.

There are two primary approaches to solving the synchronization problem faced by the ADA brigade commander. The first is to have a fully centralized C<sup>2</sup> system with positive control over all ADA weapon systems in the corps area of operations. The second is to use a C<sup>2</sup> system which is decentralized and based primarily on procedural controls. Either system will have to meet requirements for responsiveness, ability to handle the threat, and early warning. Also, any C<sup>2</sup> system should be easily supportable in the field and require a minimum of resources.

### Theoretical Considerations

Command and control systems exist on the battlefield to help reduce what Carl von Clausewitz identified as friction, chance, and the fog of war. These three concepts interact to test the commander's will and to prevent operations from being executed as planned. If not properly considered, these concepts can prevent effective synchronization.

Clausewitz described friction as, "Countless minor incidents -- the kind you can never really foresee -- combine to lower the general level of performance, so that one always falls far short of the intended goal."<sup>33</sup> Due to its nature, friction can never be eliminated but it can be overcome. To help overcome friction the commander must be aware of what friction is doing to his operation. An

effective C<sup>2</sup> system can keep the commander aware of how friction is hindering his efforts and allow him to correct for it.

The fog of war is caused by a combination of chance and uncertainty. Clausewitz wrote that, "War is the realm of uncertainty; three quarters of the factors on which action in war is based are wrapped in a fog of greater or lesser uncertainty."<sup>34</sup> He also wrote that, "Chance makes everything more uncertain and interferes with the whole course of events."<sup>35</sup> Clausewitz did not directly link friction with uncertainty but it is clear that friction is one cause of uncertainty. The only way to totally overcome this fog of war is to obtain perfect information. Though no C<sup>2</sup> system will provide perfect information, the commander needs the best picture of the battle that he can reasonably obtain. That picture needs to provide relevant information on both friendly and threat forces and activities.

### The Threat

The air threat the corps commander faces is multifaceted. It includes high performance fixed wing aircraft, stealth aircraft, electronic countermeasures (ECM) aircraft, remotely piloted vehicles (RPVs), attack helicopters, tactical ballistic missiles (TBMs), airborne operations, and airmobile operations. Across the corps area of operations the air threat is not homogeneous. FM 44-100 briefly describes five unique zones in the corps area of

operations (See Appendix A). The type of operations and air threat vary within each zone. The five zones in the corps area of operations include:

- Deep Combat Zone
- Close Combat Zone
- Brigade Rear Zone
- Division Rear Zone
- Corps Rear Zone

Though these zones are described in a linear fashion, they provide a conceptual framework for understanding the air battle over the corps area. The concepts would also apply to a nonlinear AirLand battlefield.

The deep combat zone, which includes all operations beyond the forward edge of the battle area (FEBA), is characterized by highly mobile operations. The primary air threat in this zone is the attack helicopter; fixed wing aircraft are also a threat but to a lesser degree. Threat air operations in the deep combat zone will primarily be focused on our armored vehicles, attack helicopters, and sustainment capabilities.

The forward area is broken into two zones: the close combat zone and the brigade rear zone. The close combat zone extends back approximately five kilometers from the FEBA, generally contains highly mobile operations, and has the attack helicopter as the primary threat. The brigade rear zone, also known as a part of the division forward area, extends from the close battle zone back to approximately 15 kilometers behind the FEBA. This zone is characterized by mobile operations with the primary threat being fixed wing aircraft whose targets are our C<sup>2</sup> nodes and

brigade support area(s) (BSA).

The rear area is also broken into two zones: the division rear zone and the corps rear zone. The division rear zone extends from the brigade rear zone back to the division rear boundary; approximately 50 kilometers behind the FEBA. Operations in this zone generally include frequent moves. The primary threat remains fixed wing aircraft; in this zone the targets include reserves, division support area(s) (DSA), and C<sup>2</sup> nodes. The corps rear zone includes the area from the division rear boundary to the corps rear boundary; approximately back to 130 kilometers behind the FEBA. Operations in the corps rear zone include infrequent moves. The primary threat here are fixed wing aircraft; their targets include theater reserves, depots, the corps support command (COSCOM), and C<sup>2</sup> nodes.

As can be seen the corps ADA brigade commander must take a variety of considerations into account in planning his defense. The command and control system which supports the brigade commander's efforts must be able to operate effectively in all five of these zones.

#### Centralized Command and Control System

A centralized command and control system with positive control over all ADA systems within the corps area would probably provide the brigade commander with the most control but would be difficult to implement. On the positive side,

the brigade commander would have direct control of all dedicated air defense assets under this system. To be effective this system would have to establish an electronic data link with all ADA assets in the corps area of operations. This system would have to integrate all air defense sensors, correlate their track information, identify all tracks, prioritize the threat aircraft, and then be capable of assigning tracks to fire units. To be able to assign tracks properly, the system would also have to be able to plot all air defense assets with appropriate coverages, identify the operational status of each unit, and display all current airspace control measures. With these capabilities the brigade commander would be able to ascertain weaknesses in the coverage quickly and adjust unit responsibilities to correct them. By integrating sensors distributed throughout the corps area the system would provide a detailed picture of the air battle over the corps area. This system would allow the commander to assign tracks to any air defense asset under his control. A centralized system would allow the brigade commander to synchronize air defense efforts in the close, deep, and rear battles in an effective manner. It should also help to prevent fratricide by providing positive control over air defense fires.

With its many advantages, the centralized C<sup>2</sup> system still faces some difficult problems. Probably the most difficult problem to overcome is that the corps does not own all the air defense assets which may be operating in or over

its area. Generally, EAC assets positioned within the corps area will not be released to the corps commander's control; similarly, neither will air force assets. Another problem is that aircraft flying low level or nap of the earth are difficult to track. Future aircraft, with stealth technology and other advanced systems, will only aggravate this problem. Thus it will be exceptionally difficult to gain a complete air picture and to conduct an effective centralized battle based solely on that picture. A third consideration which would inhibit a centralized system would be the problems associated with maintaining timely and responsive communications throughout the corps area. Finally, the system would be vulnerable to both ECM and to direct attack.

Associated with the communications problem is the determination of whether an air force asset, an EAC asset, a corps asset, or a divisional asset would engage a particular hostile track. Normally these assets should be sufficiently separated, in accordance with a well thought out air defense plan, so that the problem is minimized. Also, airspace control measures such as the fighter engagement zone (FEZ) and the missile engagement zone (MEZ) help to resolve these problems. To resolve any potential conflict, the brigade commander must have direct links, both voice and data, to the controlling center for EAC air defense assets. In the case of a conflict between EAC HIMAD assets and corps HIMAD assets, this link would allow the AADC to make the

determination based on the overall situation. All things considered, it appears that a centralized C<sup>2</sup> system with positive control would be difficult to implement and unresponsive to low altitude threats over the corps area.

#### Decentralized Command and Control System

A decentralized C<sup>2</sup> system using procedural controls would provide the corps with the most flexible air defense. This system would place the decision making authority, for engaging aircraft, at lower levels. All air defense engagements would be based on predetermined, well defined procedures and rules of engagement (ROE). The air defense forces actually conducting the engagements would make the decision concerning whether or not to fire. The procedures and rules of engagement would be defined by the AADC and clarified, as necessary, by the brigade commander. Though this system would not be as dependent on communications for fire control, it would still require a picture of the air battle. This system would also utilize an information system like that described earlier except that it would not be used for positive control. The information collected would help the brigade commander synchronize the air battle, manage tracks (by exception), provide early warning to air

defense units, and provide supported units with air raid warnings. This system would also be responsive to changes in the air battle because of the flexible nature of procedural control. Additionally, this system would be more effective against the low altitude threat common to forward areas.

A major characteristic of this system is that the brigade commander does not positively control all air defense fires. This is not necessarily a disadvantage though. In the forward area, where the corps will usually operate, the air threat generally consists of helicopters and close air support aircraft like the MI-24 Hind and the SU-25 Frogfoot. These aircraft operate at low level and generally require a decentralized system to handle effectively. Due to their low altitude operations they are difficult to track continuously on radar. This difficulty, in conjunction with the limited time available for engaging aircraft in the forward area would confound an air defense system based strictly on positive control. In forward areas it is essential that procedural controls be used (as they are today) to manage air defense fires. If procedural controls are used concurrently with clear ROE and a good early warning network, fratricide problems can be minimized. By providing well thought out procedural controls, effective early warning, and managing targets only by exception, the brigade commander can use a decentralized system most effectively to synchronize the air defense battle.

## V. Conclusions and Recommendations.

Operating in a complex environment which includes divisional, corps, EAC, and joint air defense assets, the corps ADA brigade commander faces a difficult task in trying to synchronize these assets in the corps area. But the problem is not new; AAA commanders during the Second World War faced a similar problem. The main differences then were that the aircraft flew slower and the surface to air missile did not exist. The techniques used to synchronize air defense efforts during the Second World War are still generally applicable today. Some of those techniques include airspace management control measures, boundaries, early warning from long range and short range radars, and direct coordination between units.

World War II proved that corps reinforcement of division ADA works. A key to synchronization within the corps will be the forward positioning of ADA assets the brigade commander can release while still providing coverage for corps priorities in the rear area.

Effective synchronization within the corps must start at the top and work its way down (ie: corps to division). With today's longer range weapons, faster aircraft, and the unlikelihood of attaining air superiority, a more effective C<sup>2</sup> system is required to synchronize air defense assets in

the corps area. This system will help to reduce Clausewitz's fog of war and overcome the friction so common to the battlefield. To accomplish these tasks, the system must provide early warning, responsiveness to changes in the air battle, synchronization with the ground battle, and support the commander in defense planning. The associated early warning system must integrate sensors throughout the corps area and be capable of detecting all aircraft, to include those using nap of the earth techniques and/or stealth technology. A reliable aircraft identification system is also required to prevent fratricide problems. The identification system must be able to identify army, joint, allied, and hostile aircraft accurately with a high degree of confidence.

Today there is an ongoing effort in the air defense community to resolve the identification problem. Noncooperative target recognition (NCTR) systems are being developed and fielded on some of the new air defense weapon systems. NCTR systems will help bring us closer to the goal of positive identification of all aircraft. Once a reliable identification system is fielded with a high degree of confidence in its capabilities we will be able to use the concept of the joint engagement zone (JEZ). The JEZ will allow the same airspace to be used simultaneously by both missiles and fighters in an air defense role.

The command and control system should be designed to

interface electronically with both SHORAD and HIMAD army air defense assets and also with joint assets such as the airborne warning and control system (AWACS). A capability to work in a combined operations area would also be valuable. Due to the nature of the forward area the system should utilize a decentralized C<sup>2</sup> system based on procedural control techniques. This C<sup>2</sup> system should also be capable of managing individual tracks, by exception, when necessary.

All air defense assets in the corps area of operations should be addressed in the corps air defense plan. The corps ADA brigade commander must coordinate with EAC assets which may either lie in or provide coverage over a portion of the corps area of operations. He must also integrate divisional air defense assets into the corps air defense plan to avoid duplication of effort and to ensure adequate coverage of the commanders' (both corps and division) priorities. Additionally, the brigade commander should include recommendations concerning the use of passive air defense measures such as camouflagage, dispersion, and protective construction.

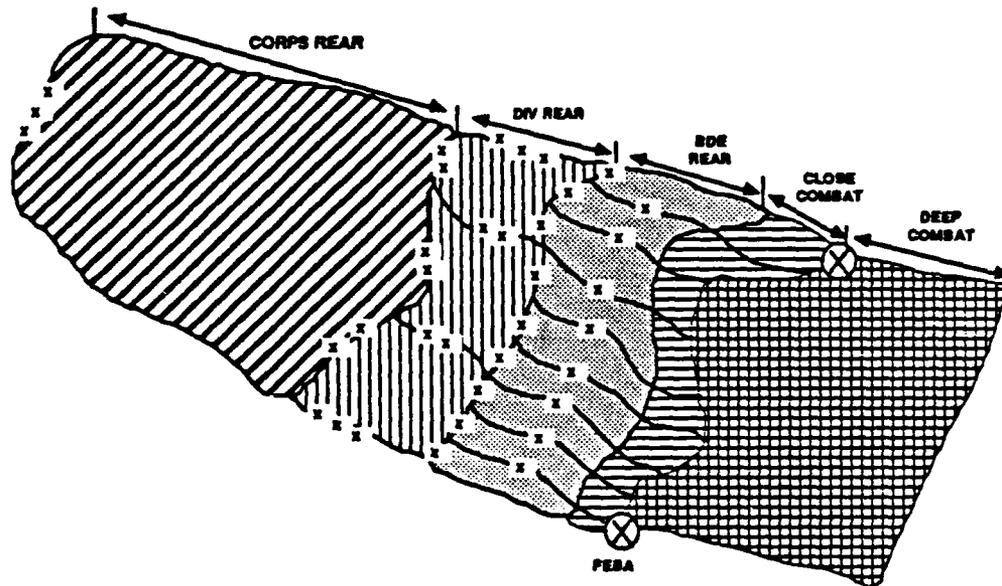
To synchronize the air defense efforts with the ground operations plan, corps and division commanders must retain command (as defined in JCS Pub 1) of their air defense assets. This includes the HIMAD battalions assigned to corps. These assets provide the corps commander with a new capability to protect his force from aircraft flying out of the envelop of SHORAD protection. Retaining positional

control of all organic air defense assets is particularly essential to responsive air defense of the corps commander's priorities. This assures the corps commander that the air defense assets assigned to him will fully support his concept of operations. To clarify this, it should be understood that the HIMAD battalions assigned to corps would still be able to engage targets in accordance with the procedural controls defined by the AADC but their priority effort would be to support, and protect, their parent corps.

In conclusion, the AirLand Battle tenet synchronization requires a concentrated effort by all combat, combat support, and combat service support forces to ensure that the maximum relative combat power is placed at the decisive point. To support this, the complementary nature of counterair operations must be retained. Inherently, synchronization includes the efforts of or of all joint and combined forces assigned to, or in support of, the commander. The expanded air defense capability at corps and division can support that effort by conducting synchronized air defense operations which support the corps scheme of maneuver. It is our challenge to ensure that the doctrinal utilization of these assets provides the best available protection for the force.

*FIRST TO FIRE!*

## AREAS OF THE BATTLEFIELD



### EACH AREA IS UNIQUE

	TYPE OPERATIONS	MAIN AIR THREAT	PRIMARY FOCUS OF AIR THREAT
☒	<b>HIGHLY MOBILE</b> • DIRECT GROUND FIRE • ARTILLERY • AIR DELIVERED ORDNANCE	HEL > FW	TANK/BFV/TV HELICOPTERS DEEP SUSTAINMENT BASE
☐	<b>HIGHLY MOBILE</b> • DIRECT GROUND FIRE • OBSERVED AND UNOBSERVED ARTILLERY • AIR DELIVERED ORDNANCE	HEL > FW	TANK/BFV/TV HELICOPTERS
☐	<b>MOBILE</b> • UNOBSERVED ARTILLERY • AIR DELIVERED ORDNANCE	FW > HEL	<b>CRITICAL ASSETS</b> • CLUSTERED • BARELY DISCERNIBLE (BN CP/BN TRAINS)
☐	<b>FREQUENT MOVES</b> • AIR DELIVERED ORDNANCE • OCCASIONAL SSMB	FW > HEL	<b>CRITICAL ASSETS</b> • CLUSTERED • DISCERNIBLE (RESERVES, ASPs, DISCOM)
☐	<b>INFREQUENT MOVES</b> • AIR DELIVERED ORDNANCE • OCCASIONAL SSMB	FW > HEL	<b>CRITICAL ASSETS</b> • CLEARLY DISCERNIBLE • (THEATER RESERVES, DEPOTS, COSCOM)

# GLOSSARY

## ACRONYMS AND ABBREVIATIONS

AA	antiaircraft
AAA	antiaircraft artillery
AAAIS	antiaircraft artillery intelligence service
AADC	area air defense commander
ADA	air defense artillery
ADC	air defense command
ADCOORD	air defense coordinator
AWACS	airborne warning and control system
AWS	aircraft warning service
BCE	battlefield coordination element
BDE	brigade
BN	battalion
BSA	brigade support area
COMMZ	communications zone
COSCOM	corps support command
DIVAD	division air defense
DSA	division support area
EAC	echelons above corps
ECM	electronic counter-measures
ETO	European Theater of Operations
FAADS	forward area air defense system
FEBA	forward edge of the battle area
FEZ	fighter engagement zone
GRP	group
HIMAD	high-to-medium altitude air defense
HQ	headquarters
JEZ	joint engagement zone
JFACC	joint force air component commander
METT-T	mission, enemy, terrain, troops, and time available
MEZ	missile engagement zone
MSAM	mobile surface to air missile
NCTR	noncooperative target recognition
ROE	rules of engagement
RPV	remotely piloted vehicle
SHORAD	short range air defense
TAADCOM	theater army air defense command
TACC	tactical air control center
TEM	tactical ballistic missile
USAADS	United States Army Air Defense School
WWII	World War II

## ENDNOTES

<sup>1</sup>Field Manual 44-100, U.S. Army Air Defense Operations, (Coordinating Draft), (Washington, D.C.: HQ, Department of the Army, June 1988), p. 5-1. Hereafter cited as FM 44-100.

<sup>2</sup>Field Manual 100-5, Operations, (Washington, D.C.: HQ, Department of the Army, May 1986), p. 17.

<sup>3</sup>US Army Air Defense Command, Historical Data Book, (Colorado Springs, Colorado: HQ, US Army Air Defense Command, 26 September 1969), p. I-1. Hereafter cited as USAADC Historical Data Book.

<sup>4</sup>FM44-100, p. D-3.

<sup>5</sup>USAADC Historical Data Book, p. I-24.

<sup>6</sup>USAADC Historical Data Book, p. I-24.

<sup>7</sup>Third United States Army, Part 8. Antiaircraft Artillery Section After-Action Report, (APO 403: HQ, Third United States Army, Approximately June 1945), p. AAA-2. Hereafter cited as Third US Army AAA AAR.

<sup>8</sup>Third US Army AAA AAR, p. AAA-2.

<sup>9</sup>Office of Air Force History, Condensed Analysis of the Ninth Air Force in the European Theater of Operations, (New Imprint), (Washington, D.C.: Office of Air Force History, 1984), p. 77. Hereafter cited as Ninth Air Force.

<sup>10</sup>Armed Forces Staff College, Organization Combat Characteristics and Techniques of the Armed Forces, (Norfolk, VA: Armed Forces Staff College, 1947), p. 80. Hereafter cited as AFSC.

<sup>11</sup>AFSC, p. 80.

<sup>12</sup>Third US Army AAA AAR, p. AAA-2.

<sup>13</sup>Field Manual 4-100, Antiaircraft Artillery Field Manual: Organization and Tactics of Antiaircraft Artillery, (Obsolete), (Washington, D.C.: United States Government Printing Office, 1943), p. 1. Hereafter cited as FM 4-100.

<sup>14</sup>US Army Air Defense School, Air Defense: An Historical Analysis, Volume II, (Fort Bliss, Texas: US Army Air Defense School, June 1965), p. 83. Hereafter cited as USAADS, Volume II.

<sup>15</sup>FM 4-100, p. 2.

<sup>16</sup>USAADS. Vol II. p. 84.

<sup>17</sup>Ninth Air Force. p. 79.

<sup>18</sup>Field Manual 11-25. Signal Corps Field Manual: Aircraft Warning Service. (Obsolete). (Washington, D.C.: United States Government Printing Office, 1942). p. 1. Hereafter cited as AWS.

<sup>19</sup>FM 4-100. p. 9.

<sup>20</sup>FM 4-100. p. 14.

<sup>21</sup>FM 4-100. p. 14.

<sup>22</sup>FM 4-100. pp. 14-15.

<sup>23</sup>FM 4-100. p. 45.

<sup>24</sup>FM 4-100. p. 67.

<sup>25</sup>FM 4-100. p. 46.

<sup>26</sup>FM 4-100. p. 10.

<sup>27</sup>FM 44-100. p. 6-6.

<sup>28</sup>FM 44-100. p. 6-7.

<sup>29</sup>FM 44-100. p. 6-6.

<sup>30</sup>FM 44-100. p. 6-7.

<sup>31</sup>FM 44-100. p. 5-4.

<sup>32</sup>PHONCON with COL Zigmund J. Roebuck, Commander. 35th Corps Air Defense Artillery Brigade. 7 Nov 88.

<sup>33</sup>Carl von Clausewitz. On War, ed. and translated by Michael Howard and Peter Paret. (Princeton: Princeton University Press, 1976), p.119. Hereafter cited as On War.

<sup>34</sup>On War. p 101.

<sup>35</sup>On War. p 101.

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