CHAPTER 5

Communications

This chapter describes the communications systems needed for effective command and control of the Patriot battalion under field operating conditions. Several communications subsystems and nets are used to provide command and control in the Patriot battalion. The two basic categories of communications are voice and data. Voice communications take place over UHF, VHF, and high frequency (HF) radio as well as land line systems. Data communications are used to pass real-time data between systems and are transmitted over UHF and VHF radio.

★ Threat forces know that the key to success in combat is an effective communications system. The threat will use radioelectronic combat to disrupt as many command and control and weapon system communications as possible. Therefore, communications on the modern battlefield may be considerably degraded or totally ineffective.

REQUIREMENTS

★ The communications system for Patriot battalions must provide reliable, real-time and near real-time information to dispersed Patriot batteries, higher headquarters, adjacent ADA battalions, and supported units. The communications system must be redundant so that communications are available even when the primary system fails. To effectively defeat the air threat, the Patriot battalion must maintain communications to support—

- Control of the air battle.
- Command, administrative, and logistical lines with higher headquarters and subordinate units.
- Liaison with supported units or the units in whose area the Patriot battalion is operating.

CONTENTS

RESPONSIBILITIES

★ Each Patriot battalion commander is responsible for establishing an effective communications system. He exercises command and control of organic signal assets through his communications-electronics officer. Tactical signal communications responsibilities common to all communications-electronics officers are explained in FM 24-1 and FM 101-5. The doctrinal responsibilities for establishing communications also hold true for the Patriot battalion. Communications are established from higher to lower, left to right, and supporting to supported.

BATTALION COMMUNICATIONS

★ External and internal battalion communications are conducted through the use of radio and wire nets. A communications platoon organic to the Patriot battalion provides internal communications for the battalion command post and limited support to the firing batteries.

EXTERNAL COMMUNICATIONS

★ External communications are established with the ADA brigade, adjacent Patriot battalions, supported unit or unit in whose area Patriot is operating, and supporting units. Contingency operations capabilities also are available to communicate with a Hawk battalion or control and reporting center.

Brigade

★ Communications with brigade support control of the air battle and command, administrative, logistical, operations, and intelligence functions.

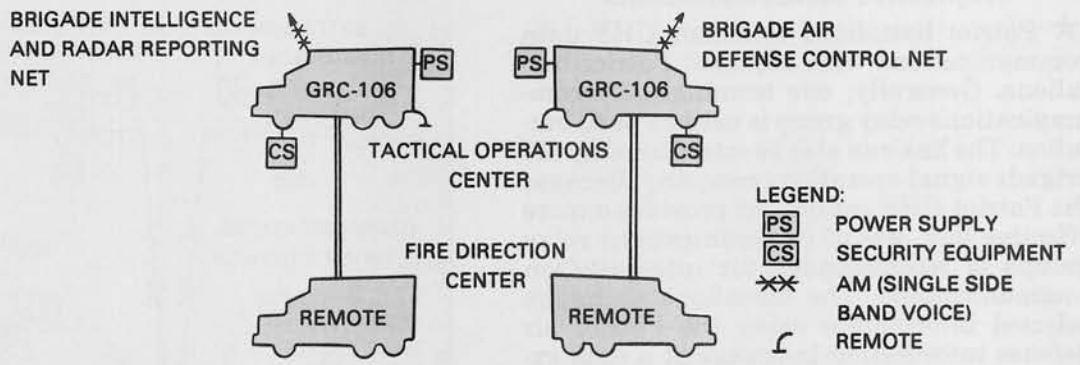
★ ***Control of the Air Battle.*** To support control of the air battle, UHF communications are used. The brigade signal operations company has the task of establishing the link between brigade and battalion. The brigade link may be terminated at a modulator/demodulator in either the information and coordination central or a communications relay group. The brigade signal operations company may terminate both ends of the link or the Patriot battalion may terminate its end. The advantage to using Patriot to terminate one end is that a more effective link would be established due to improved characteristics of the Patriot radio relay terminal—high-powered amplifier and highly directional antennas. The disadvantage is that fewer links are available for multirouting internal communications. This is particularly true when the information and coordination control terminates the link. The advantages to using the brigade signal operations company to terminate the link are the increased availability of Patriot radio relay terminals for multirouting and the potential to use UHF channels for command, administrative, logistical, operations, and intelligence functions by integrating into the battalion switchboard. The disadvantages are that less versatility is available in circuit routing and the possibility of single point jamming is increased.

★ Generally, three channels are used for control of the air battle. One channel is used for the automatic data link which uses Army tactical data link one. One channel is used by the brigade and battalion tactical directors for the identification function. This is called the intelligence and radar reporting line and is usually established on party line two. The third channel is used by the brigade and battalion tactical director assistants for the engagement function. This is called the air defense control line and is usually established on party line one. All voice circuits are terminated at the information and coordination central patch panel. The automatic data link is also terminated there either at the routing logic radio interface unit or a modulator/demodulator.

★ AM is used as a backup to the UHF voice system for air defense control and intelligence and radar reporting as shown in the illustration below. The firing batteries do not have the AM assets to operate in the battalion command net and air defense control or intelligence and radar reporting nets. Also

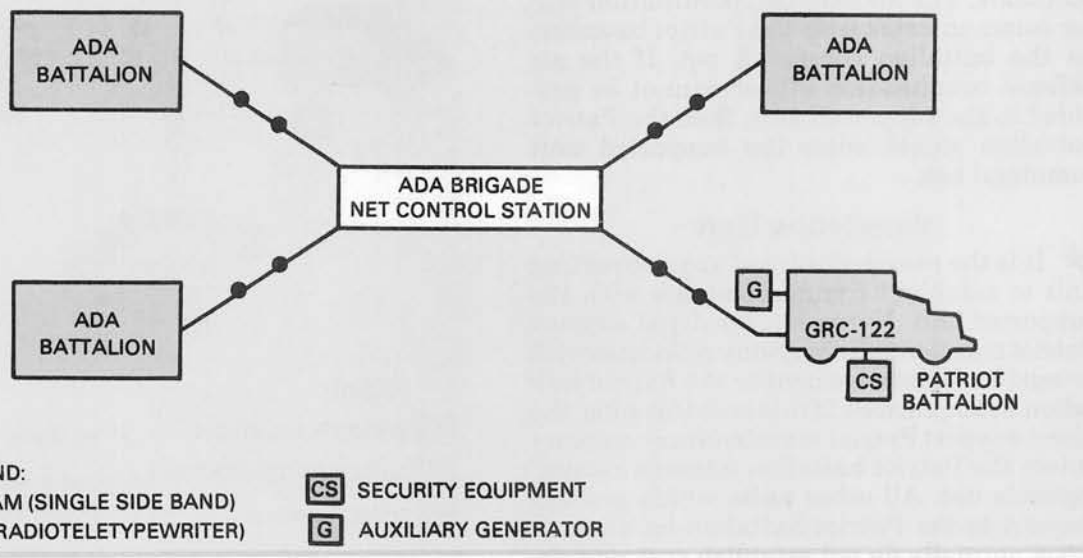
because of the more effective internal communications, only a backup between battalion and brigade is required.

★ **BACKUP AM AIR DEFENSE CONTROL AND INTELLIGENCE AND RADAR REPORTING NETS**



★ ***Command.*** The ADA brigade operates an AM command net in which the Patriot battalion participates. If UHF circuits are available, command communications use the UHF system as the primary means of communications. The ADA brigade also operates an AM radioteletypewriter net which also can be used for command message traffic. The brigade radioteletypewriter net is shown in the illustration below. The brigade station is the net control station.

★ **BRIGADE RADIOTELETYPEWRITER NET**



★ ***Administration, Intelligence, Logistics, and Operations.*** If UHF circuits are available, they should be used to tie-in brigade and battalion staff elements. If UHF circuits are not available, radioteletypewriter is the second means of communications.

Adjacent Patriot Battalions

★ Patriot battalions establish UHF data communications with adjacent Patriot battalions. Generally, one terminal of a communications relay group is used by each battalion. The link can also be established by the brigade signal operations company. Because the Patriot UHF equipment provides a more effective link, use of communications relay groups is recommended for interbattalion communications. The battalions exchange selected information using the Patriot air defense information language at a data exchange rate of 1200 bits per second. The information is exchanged to improve fire and track coordination.

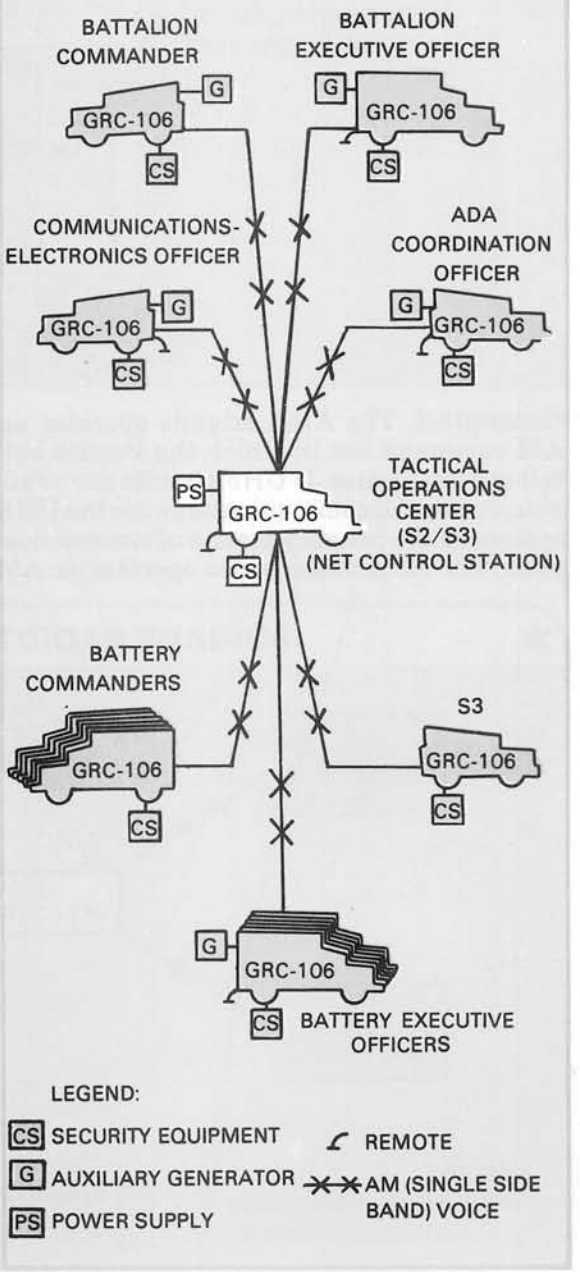
Supported Unit

★ Normally, Patriot battalions do not establish communications with the supported unit or the unit in whose area the battalion is operating. Rather, the Patriot battalion normally sends the air defense coordination officer to that unit to effect coordination of all functions. The air defense coordination officer communicates with the Patriot battalion on the battalion command net. If the air defense coordination officer cannot be provided to the supported unit, then the Patriot battalion would enter the supported unit command net.

Supporting Unit

★ It is the responsibility of any supporting unit to establish communications with the supported unit. Normally, the direct support Patriot maintenance company collocates with or sends a liaison element to the Patriot battalion headquarters. If this is not feasible, the direct support Patriot maintenance company enters the Patriot battalion administrative/logistics net. All other units which provide support to the Patriot battalion on an area basis normally do not establish communications with the Patriot battalion. The Patriot battalion must establish communications with these support units.

★ **BATTALION COMMAND NET**



INTERNAL COMMUNICATIONS

★ Internal communications are established with each Patriot firing battery. These communications support the battalion command function, headquarters battery command function, control of the air battle, and administration, intelligence, operations, and logistics. All radio communications could be augmented by messenger.

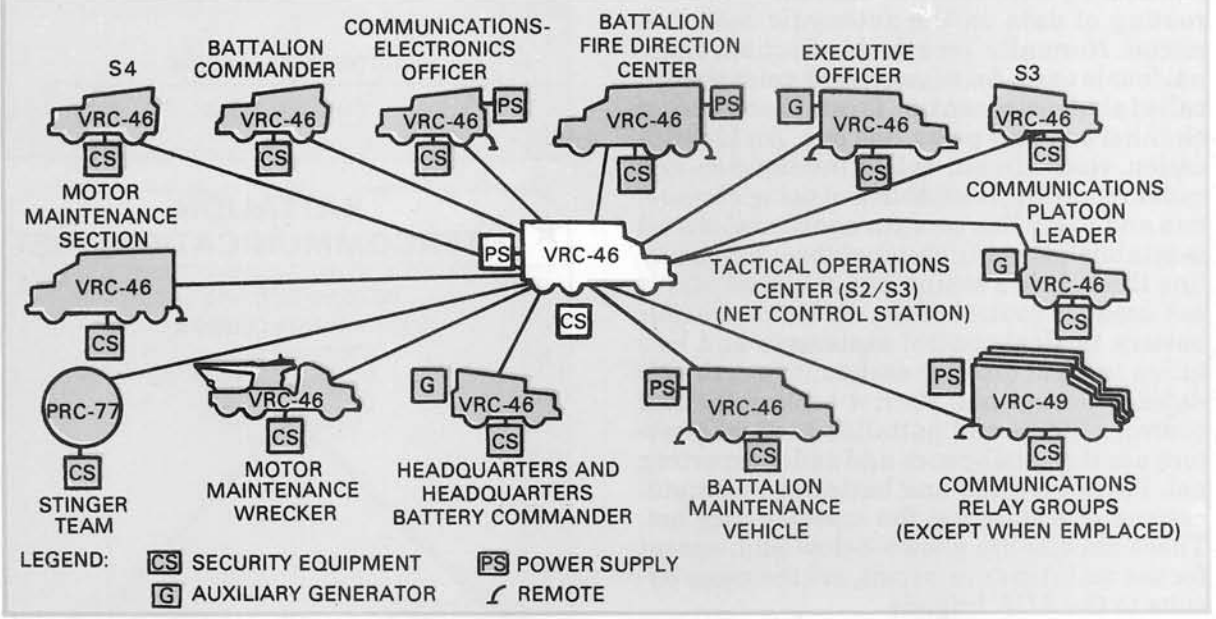
Battalion Command

★ The battalion command net (see the battalion command net illustration at left) is a high frequency net. AM is selected because of its electronic countermeasures resistance, long range, and nonline-of-sight transmission ability. All radios may not be required to operate in this net at the same time. Some should be held in reserve. Some radios may be required for back-up for the brigade voice air battle circuits.

Headquarters and Headquarters Battery Command

★ The purpose of the command net is to provide communications for the command function of the headquarters and headquarters battery. Each station operating in the net is shown in the headquarters and headquarters battery command net illustration. This net is primarily used during movements and between elements at separate positions. Wire is normally the primary means of communications between elements when emplaced.

★ HEADQUARTERS AND HEADQUARTERS BATTERY COMMAND NET



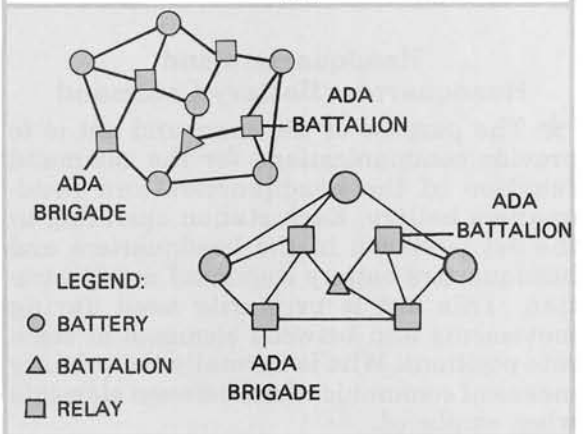
Control of the Air Battle

★ To support control of the air battle, UHF communications are used. Ideally, each firing battery and the battalion fire direction center use all three links available for UHF communications. The number of communications relay groups and number of links used at each is highly terrain dependent.

The air defense command and control structure is heavily dependent upon communications for efficient operations. In order to pass real-time air battle and air traffic information, automatic data links must be established. Several examples of multirouting schemes are shown in the battalion UHF

links/battalion (-) UHF links illustration.

★ **BATTALION UHF LINKS/ BATTALION (-) UHF LINKS**



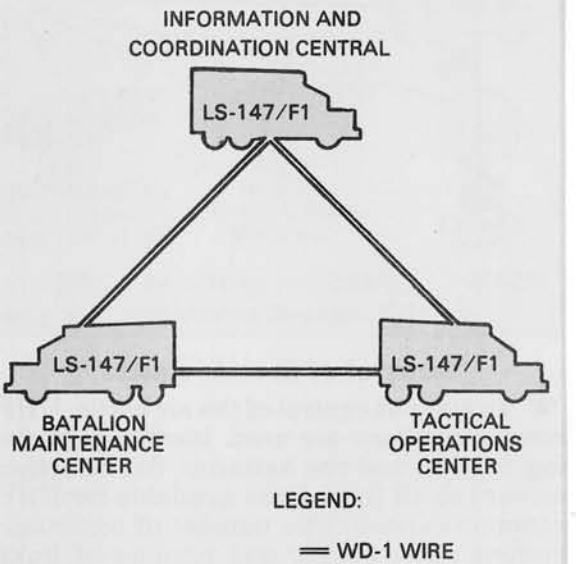
★ To effectively fight the air battle, each firing battery needs three UHF circuits. One channel on each radio is used for the multi-routing of data on the automatic data link circuit. Normally, for standardization, channel four is used. An engagement voice circuit, called air defense control, is established using channel one and party line one. An identification voice circuit, called intelligence and radar reporting, is established using channel two and party line two. An additional circuit is established using channel three and party line three. It is a maintenance circuit and is not used for control of the air battle. Patriot battery tactical control assistants and battalion tactical director assistants use the air defense control net. Patriot battery tactical control officers and battalion tactical directors use the intelligence and radar reporting net. Patriot battery and battalion communications operators use the maintenance net. These circuits are shown below and, except for the maintenance circuit, are the same circuits to the ADA brigade.

★ The information and coordination central is linked to the tactical operations center and maintenance center by wire (see the battalion intercommunications net illustration). This net allows for rapid communications between key elements of the tactical operations center and fire direction center. It can be used to cross tell time-sensitive air battle data such as a change in the airspace coordination order. Maintenance support can also be requested without leaving the information and coordination central.

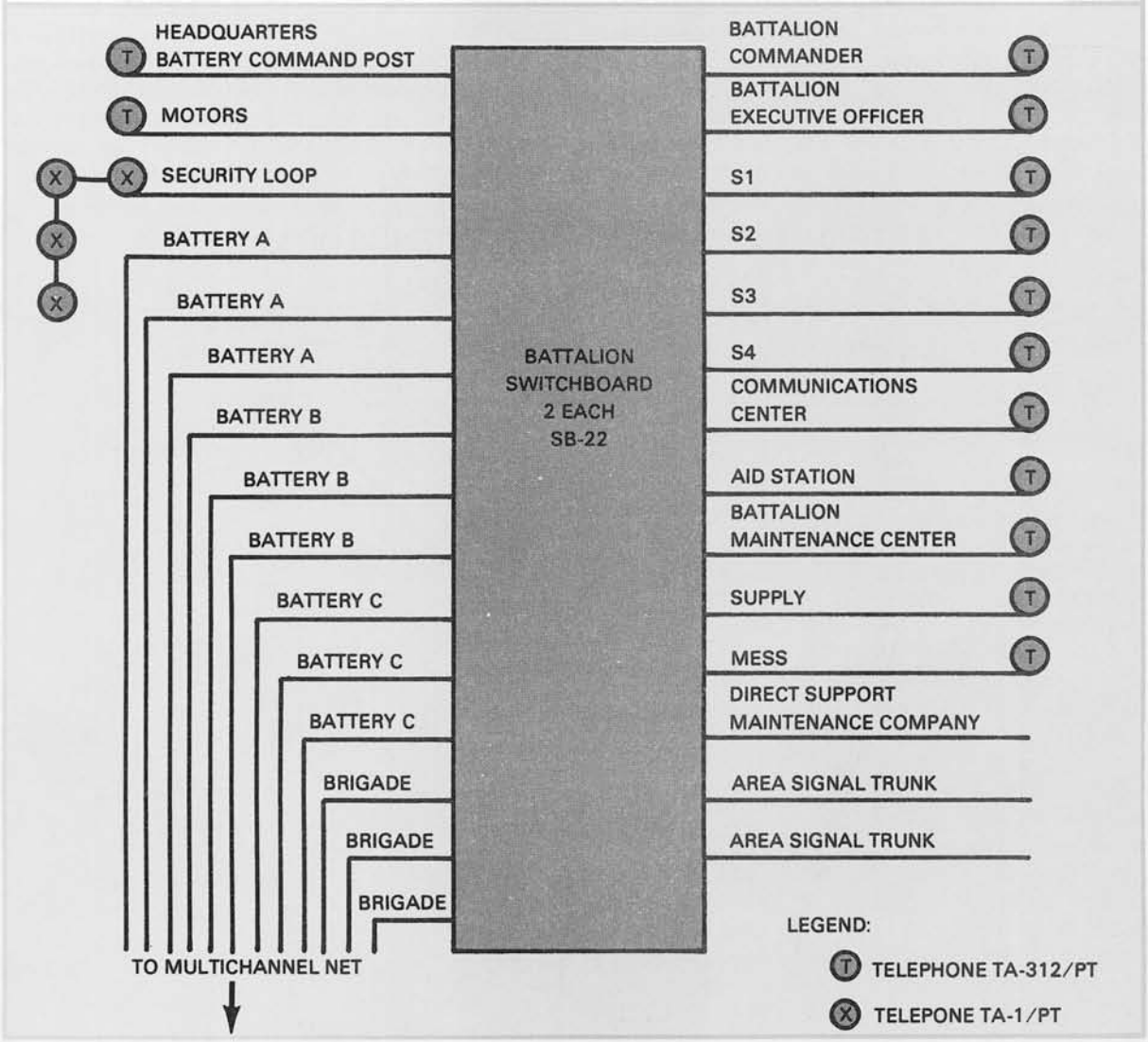
★ **UHF CIRCUITS**

AIR DEFENSE CONTROL	
PARTY LINE ONE	
CHANNEL ONE	
INTELLIGENCE & RADAR REPORTING	
PARTY LINE TWO	
CHANNEL TWO	
MAINTENANCE	
PARTY LINE THREE	
CHANNEL THREE	
AUTOMATIC DATA LINK	
CHANNEL FOUR	

★ **BATTALION INTERCOMMUNICATIONS NET**



★ **BATTALION WIRE NET**



Administration, Intelligence, Operations, and Logistics

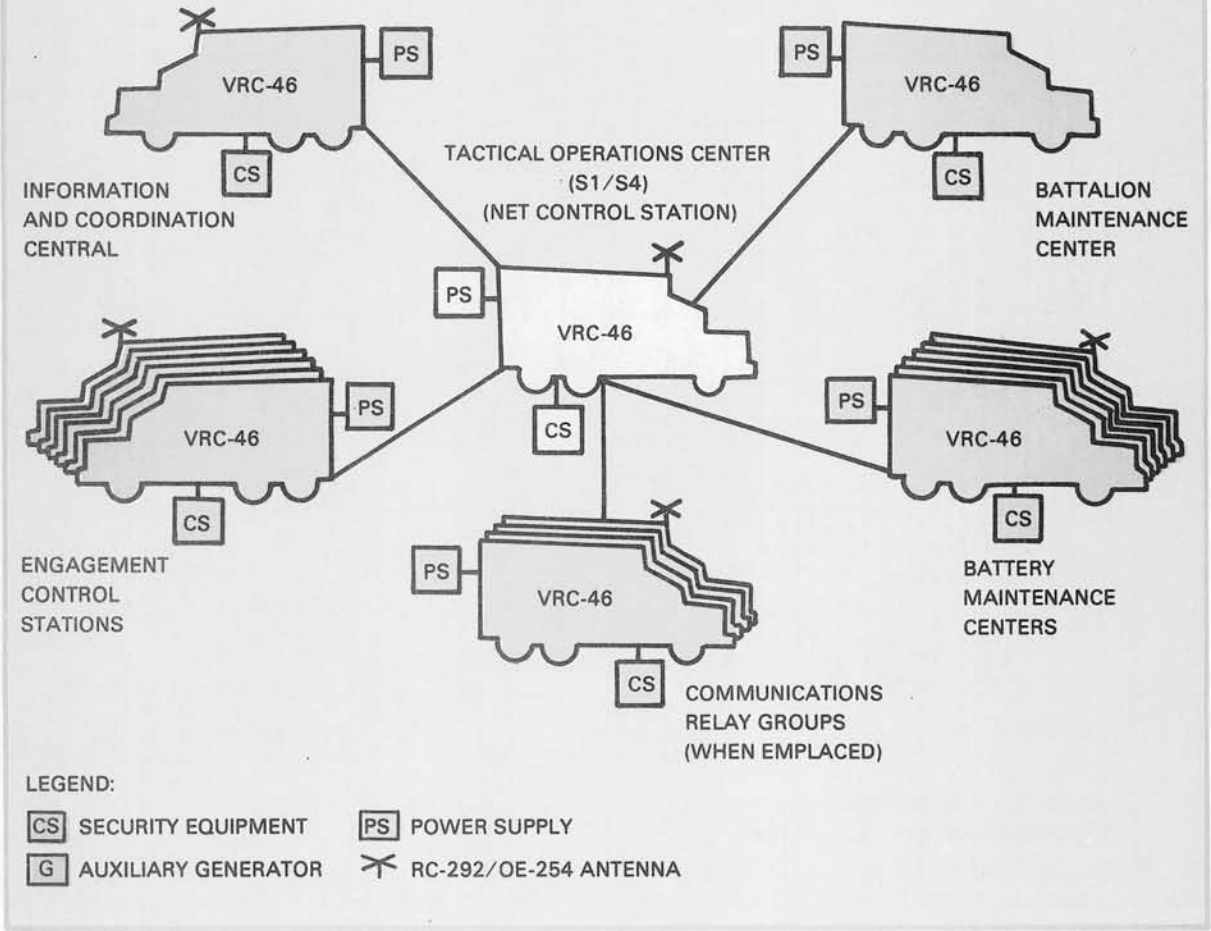
★ Normally, the UHF system which provides communications for control of the air battle also supports other functions. Since the UHF system is operational most of the time, it is also the primary means the staff has of providing command and control of the firing batteries. The total number of circuits is limited by the 12 external wire connections at the information and coordination central. These 12 circuits must be divided out to brigade and each battery. Generally, each battery has a minimum of one circuit and will frequently have two, three, or four. These UHF circuits are connected to switchboards at battalion and battery.

★ The battalion wire net is shown in the illustration above. The battalion wire net is

the primary means of communications between headquarters and headquarters battery elements. The switchboard also provides access to a minimum of one circuit to each firing battery.

★ A radio net provides back-up for administrative/logistics command and control. The purpose of this net is to provide communications for the administrative and logistics functions of the battalion when UHF will not suffice. (See the battalion administrative/logistics net illustration.) The net control station is located at the S1/S4 van. Every station in the net is cryptographically secure. Communications relay groups may operate as radio relays when required.

★ **BATTALION ADMINISTRATIVE/LOGISTICS NET**



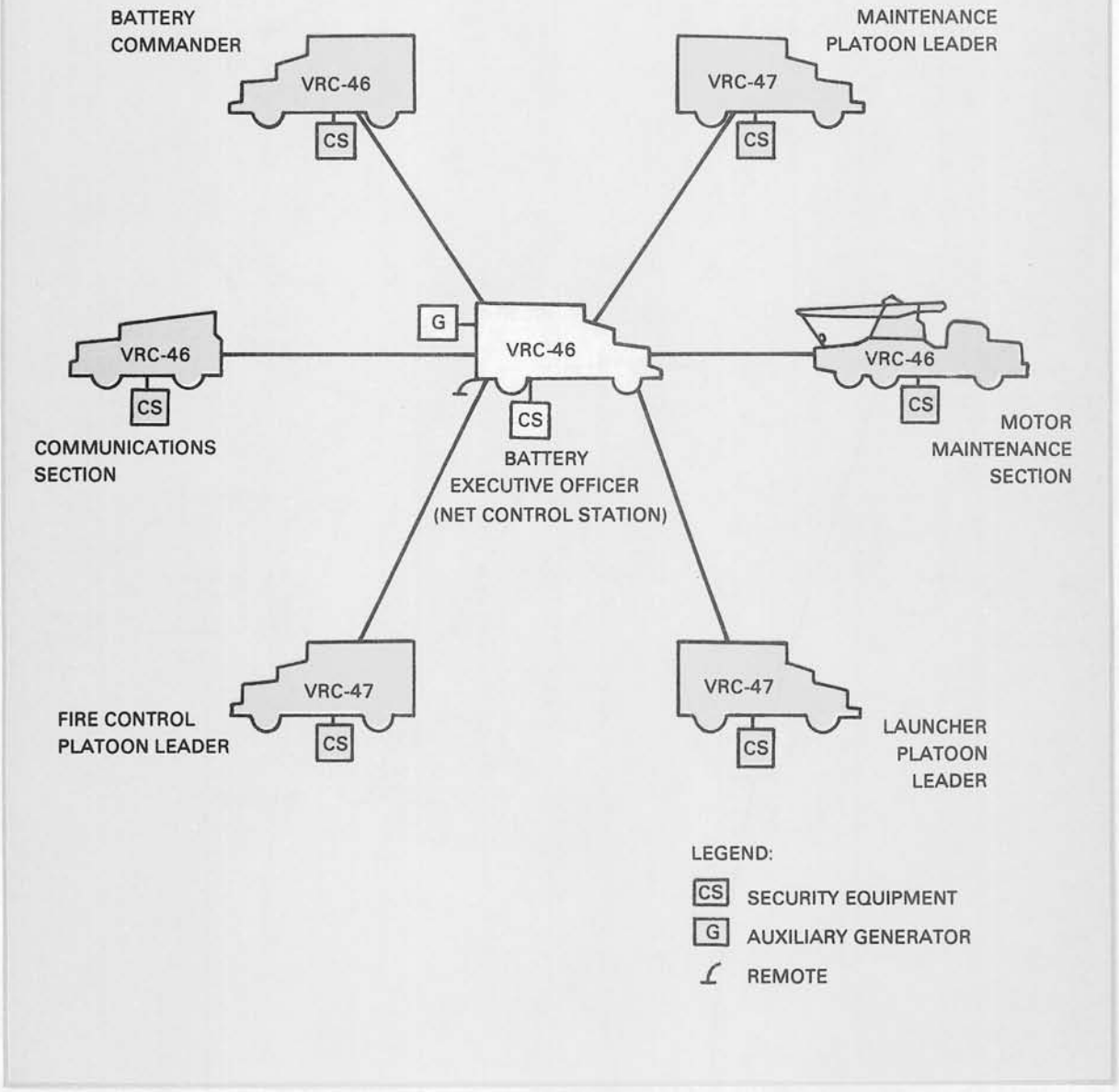
BATTERY COMMUNICATIONS

★ Firing battery communications are provided by the communications section. Each section has communications equipment. External communications have been previously discussed under the battalion communications section. The emphasis of internal communications is on support of the Patriot system and command and control of the battery.

FIRING BATTERY COMMAND NET

★ The purpose of this net (see the firing battery command net illustration) is to provide communications for the battery command function. The net control station is in the battery executive officer's vehicle. This net is primarily used during unit moves. Wire is used when the battery is emplaced.

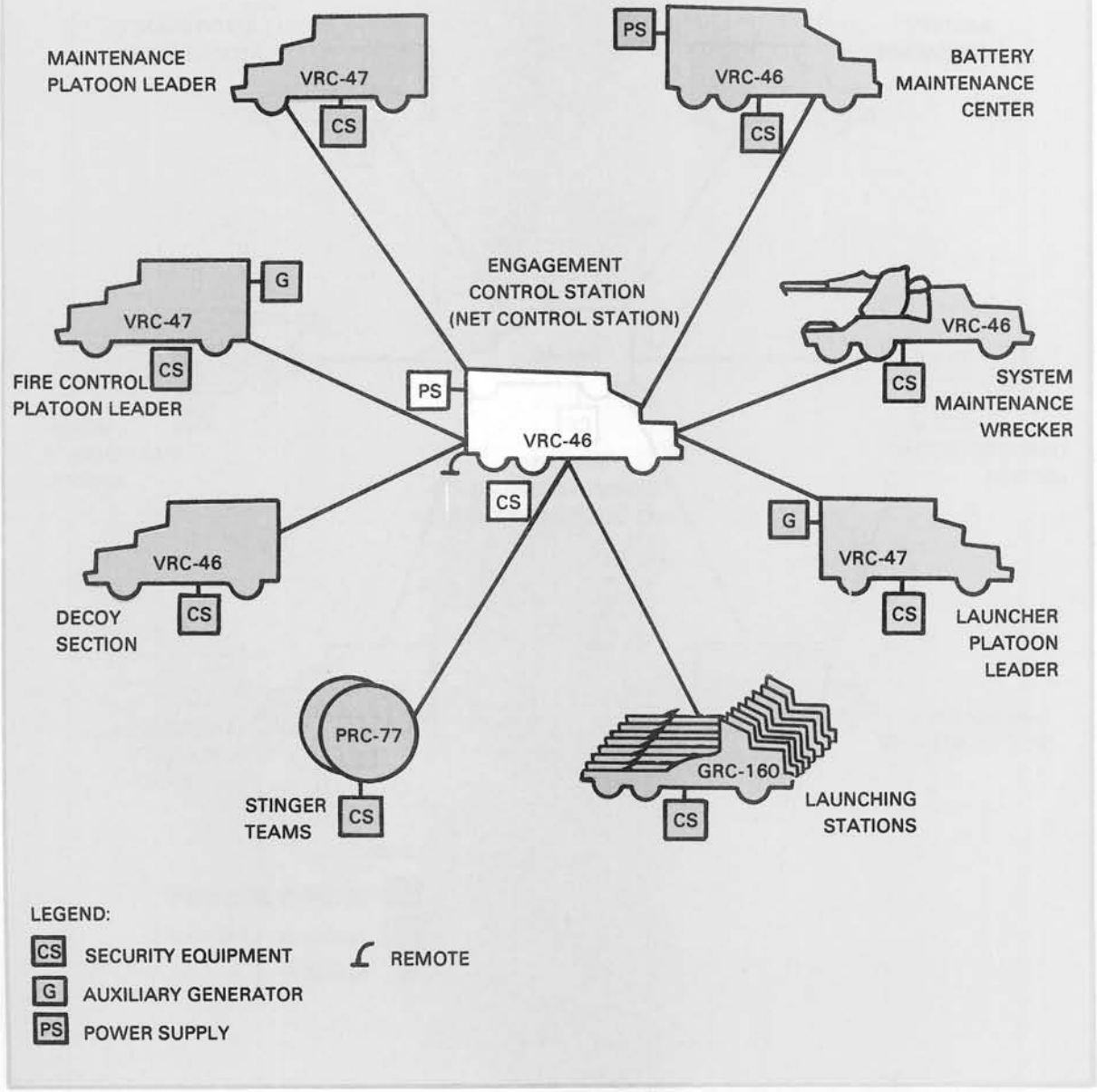
★ FIRING BATTERY COMMAND NET



FIRING BATTERY OPERATIONS NET

★ This net is used for command and control of the fire unit. The net control station for the firing battery operations net (see the firing battery operations net illustration) is the engagement control station. Each station in this net is cryptographically secure. Normally, all elements in this net, except the Stinger teams, use wire communications when possible.

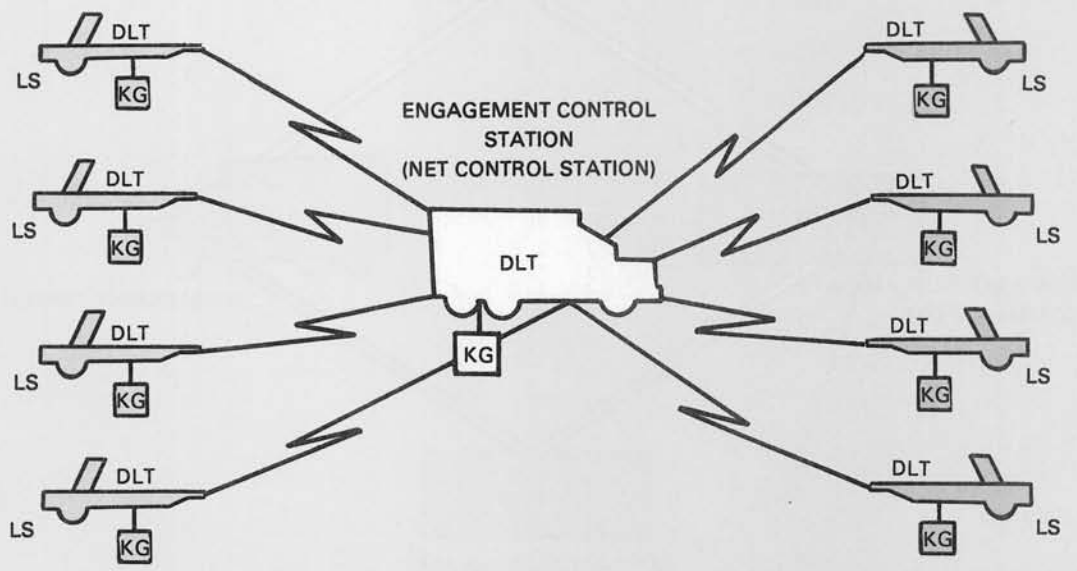
★ **FIRING BATTERY OPERATIONS NET**



FIRING BATTERY DATA NET

★ A data transmission link extends between the engagement control station and the launching stations to launch missiles and also to establish availability and maintainability of the guided missile. The net (see the firing battery data net [VHF data link] illustration) is controlled at the engagement control station by special purpose radio equipment which provides reliable transmission of low data rate messages over a short path in a severe electronic countermeasures environment. This equipment consists of VHF secure digital data radio modules and a standard communication security interface. The net operates with automatic control of the transmit/receive schedule. All command messages originate at the engagement control station, requiring a slaved response from the launching station in the form of a status message. The launching station is incapable of originating data communications. This is the first net which must be established during emplacement.

★ **FIRING BATTERY DATA NET (VHF DATA LINK)**



LEGEND:

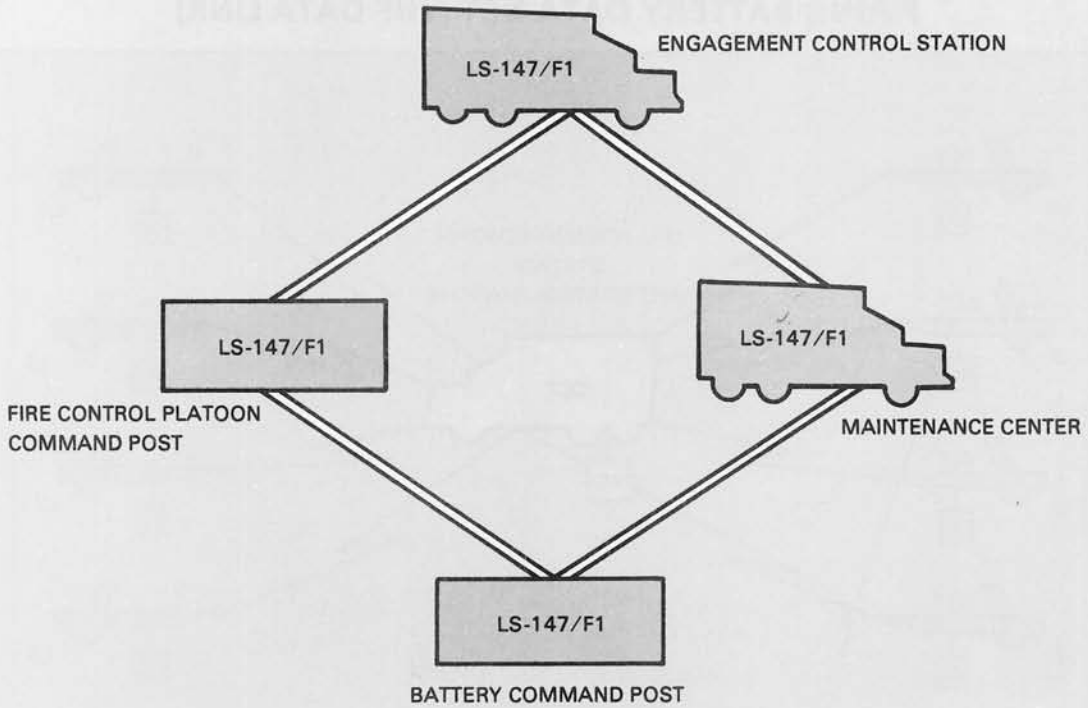
DATA LINK — DLT — DATA LINK TERMINAL

KG ELECTRONIC KEY GENERATOR — LS - LAUNCHING STATION

BATTERY INTERCOMMUNICATIONS NET

★ The engagement control station, maintenance center, fire control platoon command post, and battery command post are linked by wire (see battery intercommunications net illustration). This net allows for rapid communications between key elements of the firing battery. Time-sensitive air battle information can be passed using this net. Maintenance support can also be requested without leaving the engagement control station.

★ **BATTERY INTERCOMMUNICATIONS NET**



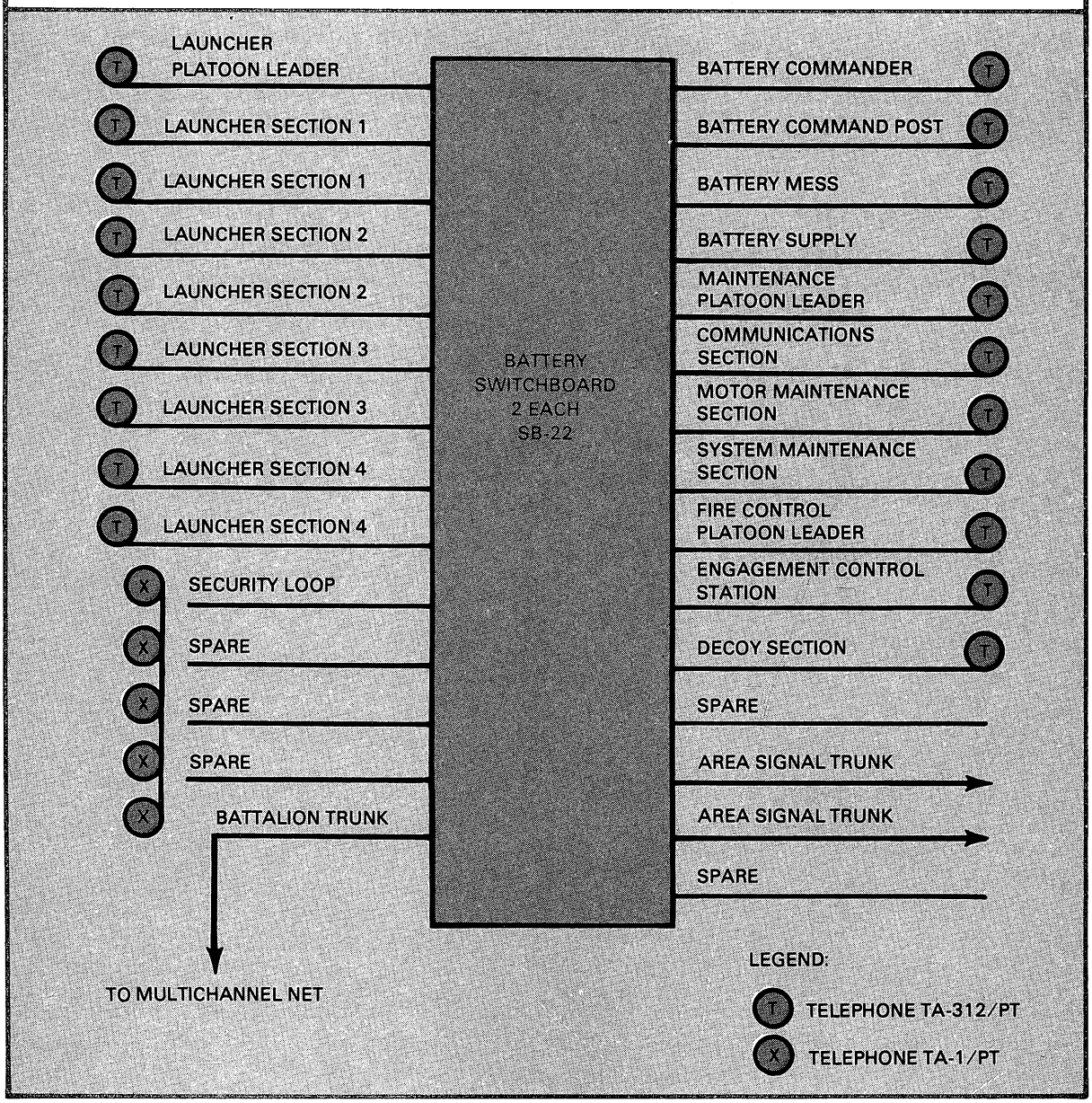
LEGEND:

═ WD-1 WIRE

BATTERY WIRE NET

★ The battery wire net is shown below. The battery wire net is the primary means of communications between elements of the battery. FM radios are used only during movement and until the wire net can be established. A minimum of one circuit to the battalion is available at the switchboard. Normally, the wire lines to the launching sections are run to ground defense positions. See chapter 8 for more details on ground defense.

★ **BATTERY WIRE NET**



CHAPTER 6

Operations

Effective employment of Patriot on the air-land battlefield, which maximizes its greatly improved ADA capabilities, requires sound detailed operational planning. Patriot commanders and operations officers require a thorough knowledge of the Patriot system and the tactics, procedures, and techniques for its employment. For optimum Patriot employment, they must be able to quickly and thoroughly analyze terrain, evaluate the threat, and understand the mission and tactical situation, using all the factors of mission, enemy, troops, terrain, and time (METT-T). Integral to Patriot operations are logistic and administrative planning factors as well as planning for other required support such as engineer assistance in positioning and siting. Extensive training and practiced application during exercises are necessary during peacetime in preparation for war.

Even with the addition of Patriot to the force, a shortage of ADA will continue to exist. ADA commanders must make the best possible operational use of the resources he has available. AD employment principles and ADA employment guidelines, as well as detailed planning guidance on Patriot employment, are discussed in this chapter.

CONTENTS

Section I — ADA MISSIONS AND FORCE ALLOCATION GUIDELINES

ADA TACTICAL MISSIONS AND RESPONSIBILITIES

This section describes the types of missions which can be assigned to a Patriot battalion. The ADA brigade commander selects the appropriate tactical mission for his subordinate battalions based on the mission he receives and on the tactical situation which confronts him. This section also describes how the supported commander's tactical operation may influence force allocation.

Specific responsibilities and command relationships between supported units and supporting ADA units are defined in the assignment of tactical missions. The assignment of a specific mission is inherent to command, and follows the command chain except in those situations where an ADA unit is placed in an operational command/operational control (OPCOM/OPCON) status. In that special situation, the commander exercising OPCOM/OPCON assigns the ADA unit its mission. There are three types of tactical missions which may be assigned to ADA units. These are—

1. ADA standard tactical missions.
2. ADA modified tactical missions.
3. Specific narrative missions.

It is important to note that there is no "normal" tactical mission for *any* ADA unit. Any tactical mission is possible and may be assigned to any ADA unit based upon the situation and the evaluation by the senior ADA commander.

ADA STANDARD TACTICAL MISSIONS

Standard tactical missions are those missions that apply to all types of ADA units, assign mutual responsibilities, and define specific command relationships between supported and supporting units as shown in the illustration on page 6-3. The "STANDARD" in standard tactical missions does not imply that these missions will always be assigned but rather that they are applicable to any type ADA unit. The use of standard tactical missions provides consistency in the rules and relationships between the ADA unit and the supported unit. However, assignment of one of these tactical missions does not negate ADA unit responsibility for its own administrative and logistical support. In some cases, certain logistical support may be provided by the supported unit to assist the ADA unit in accomplishing the mission. Such support depends upon the tactical situation and must be prearranged between the staffs of both units.

The four ADA standard tactical missions are—

1. *General support (GS).* An ADA unit with a GS mission provides support for the force as a whole. It is not committed to any specific element of the supported force.

2. *General support-reinforcing (GS-R).* An ADA unit with a GS-R mission provides support for the force as a whole and augments the coverage of another ADA unit. Additionally GS-R units are not committed to any specific element of the force.

3. *Reinforcing (R).* An ADA unit with a reinforcing mission augments the coverage of another ADA unit.

4. *Direct support (DS).* An ADA unit with a DS mission provides dedicated air defense for a specific element of the force that does not have assigned or attached ADA. The ADA unit is committed to that specific element of the force.

Standard tactical missions are not normally used below battalion level for Patriot units.

The specific command *relationship* and *responsibilities* formed by, and inherent to, the ADA standard tactical missions are shown in the ADA standard tactical missions illustration.

COMMAND RELATIONSHIPS AND RESPONSIBILITIES (ADA STANDARD TACTICAL MISSIONS)

	GENERAL SUPPORT	GENERAL SUPPORT-REINFORCING	REINFORCING	DIRECT SUPPORT
Who establishes AD priorities?	The supported commander.	(1) The supported commander. (2) The supported commander through the reinforced ADA commander.	The supported commander through the reinforced ADA commander.	The supported commander.
Who locates the Patriot battalion? [1]	The commander assigning the mission in coordination with the supported force ground commander.	The commander assigning the mission in coordination with the supported force ground commander.	The reinforced ADA commander in coordination with the supported force ground commander.	The DS ADA commander with approval of the local ground commander.
Who positions Patriot fire units? [2, 3]	Patriot battalion commander in coordination with the local ground commander.	Patriot battalion commanders in coordination with the reinforced ADA unit commander and the local ground commander.	Patriot battalion commanders with approval of the reinforced ADA unit commander and the local ground commander.	Patriot battalion commanders with approval of the local ground commander.
With whom to establish liaison?	As required by commander assigning GS mission.	As required, but including the reinforced ADA commander.	As required, but including the reinforced ADA commander.	Supported unit commander.
With whom to establish communications?	As required by commander assigning GS mission.	As required, but including the reinforced ADA unit.	As required, but including the reinforced ADA unit.	Supported unit.

NOTES:

1. The terms "locates/locating" specify the establishment of a broad operating area (commonly, a "goose egg"). Brigades identify battalion's area of operations.

2. The terms "positions/positioning" specify the selection of an exact point within the operating area. Battalions identify fire unit positions.

3. The terms "sites/siting" specify the placement of individual items of equipment on selected spots within the position and is the responsibility of Patriot battery commanders.

ADA MODIFIED TACTICAL MISSIONS AND SPECIFIC NARRATIVE MISSIONS

It is possible that none of the ADA standard tactical missions will apply in particular situations. In such cases, the ADA commander might issue a tactical mission with certain elements of the standard mission modified or deleted to form a modified tactical mission. Or he might avoid the use of a standard tactical mission altogether and issue a specific narrative tactical mission.

CLASSES AND TYPES OF AIR DEFENSE

Other considerations impacting on the allocation of ADA forces are the classes and types of air defense.

CLASSES OF AIR DEFENSE

Air defense is either active or passive.

Active air defense is direct action taken to destroy or reduce the effectiveness of enemy air operations. It includes the use of aircraft, surface-to-air weapon systems, ECM, and weapons other than ADA used in an air defense role. For further details about the use of small arms in air defense refer to FM 44-8.

Passive air defense includes all measures, other than active air defense, taken to minimize the effects of hostile air action. These include, but are not limited to, the use of cover, concealment, dispersion, movement, and emission control (EMCON).

TYPES OF AIR DEFENSE

Air defense artillery forces are allocated to provide two types of air defense—area defense and point defense. The type of air defense selected by the ADA commander to accomplish the mission is based on providing the greatest degree of protection to the supported commander's priorities within the constraints of available forces and the relative priority of each asset or area.

Area defense is designed for the defense of a broad area. Airborne AD resources have primary responsibility for providing area air defenses because of their flexibility, range, mobility, and reusability. In an area defense, no particular asset(s) receives priority of defense. A belt defense is a specialized application of an area air defense where HIMAD units are deployed in a linear configuration to provide for early attrition of the enemy as he attempts to penetrate to rear areas. This type of defense may be necessary to provide the best coverage of the force commander's priorities. No particular asset(s) receives priority of defense in a belt defense. However, fire units can normally be positioned within a belt to provide the best possible coverage of the ground commander's priorities while maintaining the belt defense. With limited ADA resources, spreading fire units in a thin line inhibits the ability to mass ADA fires. Belt defenses also are vulnerable at the flanks to fly-around tactics. Patriot battalions may be deployed in area or belt defenses.

Point defense is designed for the protection of a limited area, normally in the defense of the vital elements of a force or the vital installations of the rear area. A point defense is characterized by priority of defense being given to specific assets. These assets can either be mobile or static, and they can be either organizations or installations. Even though the ADA weapons involved in a point defense may provide air defense coverage over a wide geographical area, the term "area defense" does not apply because, in a point defense, specific assets are defended in priority. Patriot battalions may be deployed in point defenses.

AIR DEFENSE ARTILLERY SYSTEMS

An additional consideration for the proper employment of ADA forces is the type of ADA system that is to be employed in the defense. SHORAD systems are usually allocated to provide point defense of maneuver elements and other high value assets in both forward and rear areas. SHORAD systems include short-range air defense gun and missile systems, to include man-portable air defense missile systems. SHORAD units may be assigned or attached to corps and ADA brigades. In addition, each division has an organic SHORAD battalion, each armored cavalry regiment has an organic SHORAD battery, and each separate brigade has an organic Stinger platoon. HIMAD systems are deployed throughout the area of operations. Their employment is based on the needs of the force commander to which they are assigned or attached. This normally

results in HIMAD employment in both area and point defenses. For point defenses, priorities may include specified organizations, critical facilities, or installations.

FUNDAMENTAL CONSIDERATIONS WHEN ORGANIZING FOR COMBAT

To provide sound air defense guidance to the supported commander and his own subordinate commanders, the ADA commander must understand the fundamentals of offense, defense, and retrograde operations as they relate to ADA force allocation. Regardless of the type of operation, ADA assets are *never* held in reserve.

ADA IN OFFENSIVE OPERATIONS

While air defense artillery will normally defend a variety of assets in any offensive operation, the top priority for air defense will most frequently be given to the attacking maneuver elements designated as the main effort. When a maneuver brigade is designated as an AD priority by the division commander, it should be supported by at least a battery-size SHORAD unit. As a general rule, a composite task force of ADA gun and missile systems will be required for effective protection. When a division is designated as an AD priority by the corps commander, it should be supported by at least one Patriot battalion. The Patriot battalion would still participate in the integrated theater air defense but would be positioned to afford increased protection to the division. Offensive operations on the modern battlefield will be extremely fluid. ADA elements can expect to support operations characterized by rapid transitions from defense, to the offense, to exploitation. Additionally, simultaneous deep strike operations and rear area battles will be conducted. Frequent, rapid changes in direction and location of the main effort and night combat must be anticipated. Each of these situations must be considered from the outset of the operation in determining the composition and employment of the supporting ADA force.

ADA IN DEFENSIVE OPERATIONS

The immediate purpose of any defense is to cause an enemy attack to fail; however, an underlying purpose of all defensive operations is to create the opportunity to initiate offensive operations. All activities of the defense, to include air defense, must contribute to that end. Corps, divisions, and sister services will organize and fight a synchronized defensive battle within a framework that consists of the following five elements:

1. A deep battle operation in the area of influence to create windows of opportunity for decisive action against leading enemy echelons.

2. A covering force operation to support the main effort by providing forward security.

3. A main effort in the main battle area where forces are positioned to conduct the decisive defensive battle.

4. Rear area combat operations to defend vital rear area assets such as lines of communications, support areas, command and control facilities, and long-range fire support units.

5. Reserve operations in the main battle area or in the covering force area to support the main effort.

There is no single technique for defense prescribed by Army doctrine; therefore, ADA forces are allocated to support any of several combinations of static and dynamic defenses. In its static forms, the defense is oriented on the retention of terrain through the use of firepower from fixed positions. For the defense

to succeed, these fixed positions require protection from air attack.

The dynamic forms of the defense focus primarily on the enemy and depend upon maneuver and firepower to destroy the enemy force. In this technique, the maneuver units will usually be established as priority assets for air defense. Corps, divisions, brigades, and battalions will normally combine static and dynamic forms in developing and executing defensive operations. Supporting ADA commanders must then allocate ADA resources to maneuver elements, fixed firepower positions, reserve forces, command and control facilities, and logistical elements in priority as determined by the supported commander.

RETROGRADE OPERATIONS

A retrograde operation is an organized movement to the rear or away from the enemy. FM 100-5 discusses the three types of retrograde operations:

1. delay,
2. withdrawal and,
3. retirement.

Each type of retrograde operation is characterized by difficulty of execution and risk.

Delay

A delay operation is conducted when there are insufficient forces to attack or defend, or when the defensive plan requires drawing the attacker into a vulnerable position. Delay operations are conducted by withdrawing to successive battle positions each time the enemy deploys for attack, thereby gaining time for reestablishment of the defense. In a delay, air defense artillery resources are frequently allocated to protect elements of the reserve, command posts, forward arming and refueling points, and maneuver choke points, such as bridges and defiles. These assets will be listed as AD priorities in the supported force operations order as determined by the commander.

Withdrawal

In the withdrawal, friendly forces voluntarily disengage from the enemy so that all or a part of their force may be repositioned by the commander. Withdrawal operations depend heavily on deception and security in execution and may be conducted in periods of darkness and limited visibility. Air defense artillery forces will usually be allocated to protect the same type assets as in the delay with special priority given to command and control facilities and reserves: assets which are vital to the execution of a successful withdrawal.

Retirement

A retirement is an administrative movement to the rear by a force that is not in contact with the enemy. The allocation of air defense forces in a retirement depends on the specific tactical situation dictating the operation. The leanness of air defense assets on the modern battlefield will frequently limit the amount of air defense provided for administrative movements.

Section II — DESIGNATION OF PRIORITIES AND DEFENSE PLANNING

DEVELOPMENT OF AIR DEFENSE PRIORITIES

Before any air defense artillery is used on the battlefield, air defense priorities must be established. To assist commanders in this task a step-by-step decision-making process has been developed. When this process is followed by the supported commander in close

coordination with the air defense artillery commander, the degree of support afforded by air defense artillery resources can be optimized. The product of the decision-making process is a prioritized list of selected force assets to be defended by the supporting ADA commander. Development of AD priorities is the basis for planning effective air defenses to meet the needs of the supported commander within the constraint caused by the limited number of available ADA resources.

The first step of the decision-making process is conducted by the supported commander during his estimate of the situation. As he generates courses of action and evaluates his assets, he determines which of these assets require ADA protection. This determination is made by evaluating each asset.

CRITICALITY

Criticality is the degree to which the asset is *essential to mission accomplishment.* Assets are categorized in priority as those which, if damaged—

- Are *capable of preventing* the execution of the plan of action.
- Will cause *immediate and serious interference* with the execution of the plan of action.
- Can *ultimately cause serious interference* with the execution of the plan of action.
- Might cause *limited interference* with the execution of the plan of action.

VULNERABILITY

Vulnerability is the degree to which the asset can survive on the battlefield. Consideration should be given to the asset's hardness, its specific mission in the overall operation, the degree to which the asset can disperse or displace to another position, the degree to which it can provide its own air defense, the amount of engineer mobility and survivability support available, and the amount of protection afforded by passive air defense measures.

RECUPERABILITY

Recuperability is the degree to which the asset can recover from inflicted damage in terms of time, equipment, and available manpower to again perform its mission.

THREAT

The probability of an asset being targeted for attack by enemy air must be assessed if economical allocation of ADA resources is to be achieved. Targeting information provided by intelligence estimates, past enemy attack methods, and enemy doctrine are all useful in determining which assets require active air defense protection.

IMPACT OF AIRLAND BATTLE

The nature of combat in the air-land battle requires commanders to expand the scope of consideration in determining the need for providing air defense protection to any asset. Formerly, combat efforts focused on winning the fight only in the main battle area. The extension of the battlefield in depth, time, and resources, to include a deep battle, close-in battle, and rear area protection, forces commanders to redefine priorities for air defense to include all three battles. Assets that were formerly seen as most vital to main battle operations may not be so vital to the deep battle or to the rear area battle. Conversely, commanders must now consider certain type assets that were formerly not so vital to main battle operations as being high priority assets for the deep attack and for rear area protection.

In determining the need for providing active air defense protection to any asset, commanders should consider certain characteristics which make that asset a lucrative threat target. Since both sides recognize the relationship of winning the deep attack to the outcome of conflict, the enemy's targeting strategies emphasize the early destruction of those assets which contribute the most to deep attack. Some characteristics of deep

attack assets which provide the means for the commander to measure the need for air defense protection include the—

- Contribution the asset makes to the execution and cohesion of the defense or to the momentum of attacking units in the offense.
- Location on the battlefield where the asset makes its greatest contribution to the integrity of the second echelon forces as they prepare to join the battle.
- Effect at the FLOT resulting from destruction of the asset at its present location.
- Threat which the asset poses to enemy air operations which are vital to their deep attack capability.
- Effect on the ground operations that the Threat force desires to achieve by destroying the asset.
- Probability that the asset has been targeted by threat aircraft.

Based on these considerations, there may be times when close-combat elements will use self-defense and passive air defense measures while assets such as corps artillery units, Army aviation forward assets, division artillery, and critical nuclear delivery units will be given priority for active air defense protection. Intelligence acquisition assets, command and control facilities, and specific weapon systems which are vital to deep attack must be given careful consideration by the commander establishing air defense priorities. Failure to do so may result in the degradation of our forces' ability to conduct deep attacks. In the projected scenario of the air-land battle, this is tantamount to defeat.

THE PHASES OF DEFENSE PLANNING

One of the major challenges faced by commanders is the *proper* use of the limited number of air defense resources for the defense of critical forces and assets in the air-land battle. Air defense of the air-land battlefield must be properly planned so as to achieve a balance between defense effectiveness and economy of force. Two factors which impact directly on this problem are the inability of existing ADA resources to provide adequate air defense protection to all the vital assets and the lack of adequate defense planning frequently provided to those defenses. Recently, concepts such as habitual association and the simplistic application of ADA employment guidelines and principles to the exclusion of other factors have reduced defense planning to an unreliable, mechanical process. Such types of mental templating are doctrinally unsound. Proper defense planning is a command responsibility which begins with the establishment of air defense priorities and follows a sequential process of four phases:

1. Analysis phase.
2. Defense design phase.
3. Evaluation phase.
4. Implementation phase.

It is important to note that *defense design* which considers employment guidelines and principles is only one phase of the *defense planning* process and must be preceded by a formal or informal analysis. It is not the purpose of doctrine to dictate specific defenses for specific type assets—these will vary with the changing factors of each tactical situation. However, this section provides commanders with the basic framework from which to conduct effective defense planning in any tactical situation.

ANALYSIS PHASE

Following the establishment of air defense priorities, the Patriot commander begins the sequential process of planning the air defenses to protect those assets. Each air defense must be planned to fit the present and projected tactical situation. Prior to initiating any operation on the battlefield, the Patriot commander must conduct an estimate of the situation in which the factors of

METT-T are considered. The product of this analysis phase is a recommended initial allocation of Patriot units to defend the prioritized assets of the supported force commander. This initial allocation is refined throughout the other phases of defense planning. The allocation function is a brigade and AADCOM responsibility.

Mission

Mission analysis must consider the intent of the supported operation, essential specified and implied tasks to be performed, the degree of risk acceptable to the Patriot unit, constraints or limitations imposed on Patriot fires, probable follow-on operations, and the number and type of assets prioritized by the supported force commander. The Patriot commander analyzes the mission to determine the most effective allocation of air defense artillery resources to support the overall operation.

Enemy

An analysis of the enemy forces likely to be encountered is also critical to planning an effective air defense. Because of the wide variety of options normally available to threat forces for the air attack of friendly assets as compared to the Patriot units available to defend them, air defense planners must plan the defense of a prioritized asset to counter the *most likely* threat against that target. In the past, a worst case threat had been used. This normally resulted in an inefficient allocation of ADA resources. Factors that must be considered are the type aircraft most likely to be used against the asset, most probable avenue of approach, Threat attack tactics, probable ordnance, and likely ordnance release points. The availability of such intelligence permits the planning of a specific air defense for each defended asset designed to counter the most likely air threat. Such threat analysis is critical to the proper and economical allocation of Patriot units.

Terrain

An analysis of terrain is also critical in this initial defense planning phase. All aspects of the topography of the battlefield must be considered: trafficability, relief, vegetation, obtacles. Key terrain, terrain which is mission dependent and which would give either side an advantage if seized or held, must be identified. Dominant terrain surrounding the assets to be defended which provides identification points for the enemy to fix the target can be considered key terrain. It is particularly critical for Patriot units operating in division areas to analyze terrain and identify low-altitude avenues of approach into the divisional rear areas. In situations where specific low-altitude avenues of approach are identified, the Patriot commander may choose to concentrate his unit's coverage on that avenue of approach. Additionally, terrain must be analyzed to identify both friendly and enemy observations and fields of fire. For example, high ground that affords protection as well as line-of-site observation is critical to the positioning of the Patriot firing batteries. Further, considerations must be given to cover and concealment provided by terrain, the impact of weather on terrain, the impact of terrain on communications, and the degree of visibility afforded by terrain. Assets capable of dispersing and blending into the terrain to take advantage of natural concealment may require less active air defense protection permitting a greater allocation of Patriot resources to assets without effective passive air defense means. Engineer topographic units provide terrain data and maps directly to operational elements of the maneuver, weapons, and support systems. Topographic units provide expedient topographic products to meet the specialized needs of command, maneuver, weapons, and support systems. Topographic units can also provide a survey control network to insure weapon systems have accurate azimuth and siting data for effective target engagements.

Troops

This phase in the initial phase of planning is an evaluation of troops available. For the Patriot commander, this is a *total* assessment of his combat power; it involves consideration of such diverse factors as personnel strength, disposition of equipment, state of training, maintenance and supply readiness, adequacy of combat support and combat service support, troop morale, and the quality of his subordinate leaders.

Time

Time is needed to conduct reconnaissance, movement, and logistic support. Time is needed to war-game various courses of action. Some courses of action may be eliminated from consideration because they cannot be executed within the time constraints of the mission.

The commander considers the factors of METT-T, weighs them against the list of AD priorities, and develops an initial allocation of ADA resources to defend those priorities. Beginning with the highest priority asset, he decides how many of each type ADA resource to allocate to the air defense of each asset. Because the Patriot battalion fights as a single unit, the list of assets is reviewed to determine how many assets can be adequately defended. The list of AD priorities and the ADA resources recommended to protect them are presented to the supported force commander for approval. The force commander may approve these recommendations, reduce the list to increase the air defense protection for selected assets, or expand the list to increase the number of assets afforded ADA coverage. He must understand, however, expansion will reduce the effectiveness of the overall defense. It is in this phase of the process that the Patriot commander plays a critical role. As the air defense staff officer, he must provide the supported commander with the advice which can make the difference between adequate and inadequate air defense protection. Finally, those assets approved for active air defense coverage by the supported force commander are listed in the ADA annex of the operations order as air defense priorities.

DEFENSE DESIGN PHASE

After the decision has been made concerning the number and type of ADA resources to be allocated to each priority, the ADA commander begins the second phase of the defense planning process—defense design. Patriot defense design is the process of considering *AD employment principles, ADA employment guidelines,* and *Patriot defense design requirements* in conjunction with the weapon system capabilities to determine the position of specific fire units in the defense of each AD priority. ADA commanders at all levels must design defenses to accomplish the air defense mission for the specific tactical situation. Principles, guidelines, and requirements are provided to ADA commanders to *assist* in increasing the effectiveness of air defenses and enhancing ADA survivability. However, defenses are not designed simply to meet principles, guidelines, or requirements. Providing mass, mix, mobility, and integration in an air defense is pointless if Threat aircraft are permitted to release ordnance and destroy the defended asset prior to being destroyed. The focus for any defense must be the *protection* of the defended asset or area. Principles, guidelines, and requirements must be applied to defense design with this in mind. FM 44-1A provides classified data on system capabilities and planning data. It should be referred to frequently when designing defenses.

AD Employment Principles

Four AD employment principles provide the doctrinal basis for ADA defense design and underlie the effective employment of air defense weapons on the battlefield. The balanced application of these principles to fit the needs of the tactical situation can enhance the effectiveness of the air defense and increase the survivability of ADA. These principles are *mass, mix, mobility,* and *integration.*

Mass is the concentration of combat power. It is achieved through the allocation of a sufficient number of fire units to the defense of priority assets or areas to adequately defend them against the air threat. Mass can normally be achieved by deploying Patriot in battalion strength for a point defense, or an area defense 60 x 60 kilometers. Failure to adhere to the principle of mass risks being defeated in detail by the air threat and destruction of the defended assets.

The mixing of complementary weapon systems goes hand-in-hand with the pinciple of mass. By employing a variety of systems

in sufficient mass, AD complicates the problem of the attacker. He must consider the different characteristics of each weapon system in the formulation and execution of his offensive strategy. Patriot defenses should be mixed with Hawk and SHORAD in composite defenses.

To apply the principles of mass and mix in the dynamic environment of the air-land battlefield, air defense systems must be mobile. Frequent changes in unit positions will be required to defeat the enemy's reconnaissance cycle, thereby enhancing the survivability of Patriot units during suppression attacks. Patriot units in the tactical operations area should move at least twice daily because of the extreme ground and air suppression threat. The Patriot ICC and Patriot units in the rear operations area may move less frequently, but should move at least once daily for survivability. No more than two fire units or one fire unit and the ICC should be moving at any one time.

Integration is the close coordination of effort and unity of action which maximizes the operational effectiveness of an ADA defense while minimizing mutual interference among operating forces. ADA weapons must be fully integrated into the force commander's scheme of maneuver and into the battle for air superiority as well. Effective command and control procedures are implemented through liaison elements and communications links with higher and adjacent headquarters. Integration must also be thought of in terms of defense design, roles, and missions of all participating ADA units.

ADA Employment Guidelines

In conjunction with the AD employment principles, the six ADA employment guidelines are the desirable characteristics of an "ideal" air defense. They are provided as aids to Patriot commanders for positioning individual fire units when designing a specific defense. The commander incorporates a mix of these employment guidelines in his defense planning according to the tactical situation and the availability of AD assets. Applying all of the guidelines in all tactical situations is seldom possible. The size and shape of the asset, the number of fire units available, the adequacy of terrain for coverage and emplacement, and numerous other tactical considerations limit the commander's ability to satisfy all requirements equally. Unfortunately, defenses have often been designed which focus more upon meeting guidelines than upon providing adequate air defense coverage. Such is the case when a SHORAD defense of a critical asset is designed to optimize balance and mutual support with the net result that fire units are emplaced too close to the asset to provide protection from realistic ordnance delivery methods.

In the fluid, dynamic, high-intensity operations expected in future battles, rigidity, lack of originality, and lack of initiative can contribute to defeat. There can be no substitute for the exercise of common sense, flexibility, and initiative to insure that Patriot units successfully accomplish the mission to support the ground operation.

The ADA employment guidelines are as follows:

- Balanced fires.
- Weighted coverage.
- Early engagement.
- Defense in depth.
- Mutual support.
- Overlapping fires.

Balanced Fires. Units are positioned and oriented to provide approximately equal firepower in all directions. This guideline will be difficult to accomplish with less than a full Patriot battalion while still meeting other necessary employment guidelines. Balanced fires are employed to counter an omnidirectional threat.

Weighted Coverage. Units are positioned and oriented so that their combined firepower is concentrated towards the most likely air avenues of approach. Weighted coverage is employed when probable enemy attack

routes can be identified (due to terrain) or when insufficient assets are available to provide balanced fires.

Early Engagement. Units are positioned and oriented so that they are capable of engaging aircraft prior to ordnance release. The expected altitude of the threat will influence how far Patriot units are deployed from an asset or area boundary to achieve early engagement.

Defense in Depth. Defense in depth is that quality of defense which results from positioning mutually supporting fire units to absorb and progressively weaken the attack. Defense in depth subjects the attacking aircraft to an ever increasing volume of fire as it nears the defended asset. It is achieved by deploying ADA forces in mutually supporting echelons and adherence to all other employment guidelines. Defense in depth is maximized through the integration and coordination of all air defense weapons used in the defense. Defense in depth will also significantly reduce the effects of aircraft maneuvers on the ability of fire units to engage.

Mutual Support. Units are positioned and oriented so that one Patriot battery can fire into the dead zone of an adjacent Patriot battery. Mutual support may be provided by or for other ADA units. Mutual support affords a greater degree of survivability to the defense. The distance between batteries to achieve mutual support varies depending on speed and altitude of the threat and Patriot radar coverage. For planning purposes, 20 kilometers between Patriot firing batteries can be used.

Overlapping Fires. Units are positioned and oriented so that their engagement zones overlap. In many instances, because of terrain limitations, the size of the area to be defended or a scarcity of available weapon systems, it may not be possible to achieve mutual support. In that case the defense planner should plan for overlapping fires. In Patriot, overlapping fires are also necessary for triangulation, an ECCM feature.

Defense Design Requirements

The third set of factors the Patriot commander must consider in his defense design is the specific *defense design requirements.* These factors are based on a consideration of the factors of METT-T in conjunction with the specific weapon system characteristics. Defense design requirements are as follows:

- Supported force scheme of maneuver.
- Supported force AD priorities.
- Threat.
- Tactical and technical requirements.
- Terrain and weather considerations.
- Allocation of available fire units.

Supported Force Scheme of Maneuver. Supported force scheme of maneuver is the tactical plan to be executed by the supported force to seize assigned objectives.

Supported Force AD Priorities. Supported force AD priorities are those selected force assets which must be defended in priority by the supporting ADA unit. Development of these priorities is contained in section II.

Threat. Threat includes those characteristics of the enemy which are used to determine the appropriate ADA systems to defend the specific asset, and which are used by the selected ADA force to design the most effective defense for that asset. These include enemy location and strength, type of enemy aircraft and ordnance (including the capabilities and limitations thereof), past enemy attack characteristics, and enemy doctrine.

Tactical and Technical Requirements. Tactical and technical requirements of the defending ADA system are those capabilities and limitations peculiar to individual ADA systems and which impact on defense design. These will vary from weapon to weapon, but can include area requirements for emplacement, terrain slope and firmness requirements, line-of-site requirements, range and firepower limitations, and fire unit signature (electronics, visual, and smoke).

Terrain and Weather Considerations. Terrain and weather considerations are those factors of terrain and weather which impact both upon the threat and the effectiveness of the defending ADA system, and which thereby influence defense design. Again, these will vary from weapon to weapon but can include night and all-weather engagement capabilities, terrain which causes masking, ease of position access, cover and concealment afforded, and effects of inclement weather on terrain and Patriot system effectiveness. FM 44-1A shows performance in a rain environment.

Allocation of Available Fire Units. Allocation of available fire units refers to those considerations which determine how those ADA assets available are allocated for the defense. These include use of all ADA assets (ADA is never held in reserve), the operational status of available fire units and of individual items of fire unit equipment, and organization for combat.

EVALUATION PHASE

Regardless of the tactical situation or the type of ADA weapon systems involved in the defense, the commander who conducts the analysis and defense design phases will always have more than one alternative for providing ADA support. It is his responsibility to evaluate the alternatives to select the plan that provides the most effective, flexible air defense possible to the supported commander. This does not imply that any single plan will provide the degree of support desired by the force commander, or that it can adequately protect each of the designated AD priorities. Each alternative plan, however, must be evaluated against the criteria of the ADA mission—the degree with which a defense reduces or nullifies the effectiveness of attack or surveillance by hostile aircraft or missiles after they are airborne—and the best plan selected.

The evaluation of alternatives must consider the degree of air defense provided by each defense against the expected threat. This is best accomplished by preparing a detailed firepower analysis for each alternative defense design, based on the capabilities of each weapon system as detailed in FM 44-1A, and comparing these design characteristics against the projected threat ordnance release lines. Firepower template construction is also shown in FM 44-1A.

When the detailed defense design evaluation is not feasible due to time limitations or tactical constraints, the judgement and expertise of the commander and his staff must be relied on in the final analysis.

IMPLEMENTATION PHASE

Following the evaluation of alternatives, the commander decides on the specific defense that will be provided to the AD priority or priorities. The ADA commander, regardless of level, is responsible for briefing the supported commander on the capabilities and limitations of the selected defense. Should additional resources be required, the requirement should be identified and appropriate requests forwarded to the next higher commander.

Following this coordination, the ADA commander prepares essential operations plans and annexes to plans and disseminates this information to his subordinates. Each subordinate, in turn, follows the eight troop-leading steps to respond to the requirements of the commander issuing the operations order. These steps (modified as necessary to fit the level of command and the tactical situation) are as follows:

- Receive the mission.
- Issue the warning order.
- Make a tentative plan to accomplish the mission.
- Initiate the necessary movement sequence.
- Reconnoiter.
- Complete the plan.
- Issue orders.
- Supervise and refine.

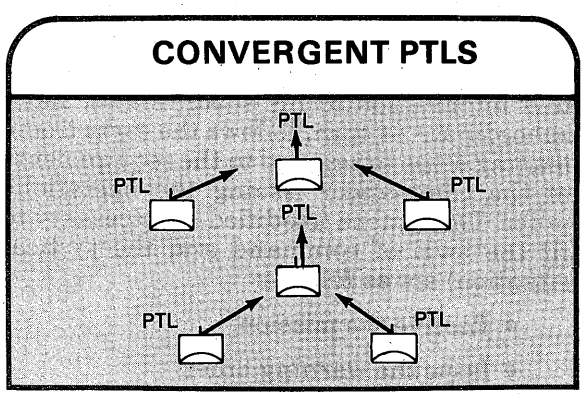
This process is simply a more detailed and specific application of the procedure which resulted in the establishment of AD priorities and established the initial allocation of ADA resources in the defense.

Section III — PATRIOT EMPLOYMENT

FIRING BATTERY EMPLOYMENT

Because Patriot is a sector system, the orientation of the firing batteries takes on additional importance. Conceptually, the firing batteries can be oriented so that their PTLs are parallel, convergent, or divergent.

Effective Patriot defenses can be designed by using the tactic of convergent PTL orientation which is shown in the convergent PTLs illustration. Using this tactic, the primary target line of each Patriot firing battery converges on the primary target line of one or more other Patriot firing batteries within the defense. Ideally, the primary target line of each unit will converge on that of all other units in the defense. The exact orientation of the battery PTLs depends on the tactical situation.



This tactic maximizes mutual support, overlapping fires, and defense in depth. It does so by sacrificing some of the additional area coverage which could be gained by parallel or divergent PTL orientation. However, the coverage provided by employing this tactic can be sustained longer because it is less sensitive to loss of units than the larger area coverage which can be obtained by using parallel or divergent PTL orientation. This latter, less dense coverage collapses rapidly as Patriot units are destroyed or otherwise are not available. More importantly, with convergent PTLs, the area or point defense is much more effective against raids using escort or self-screening jammer aircraft. The use of these ECM tactics increases the need for multiple unit coverage. Balanced fires, weighted coverage, and early engagement depend on the degree of convergence and positioning.

Positioning, specifically separation distance between batteries, proximity to the FLOT, and distance from an asset, is addressed in the following three major paragraphs. The illustrations on pages 6-15 through 6-30 depict a full, six firing battery battalion. Battalions with less than six operational batteries should modify these defense designs to maximize the effectiveness of available fire units. Commanders should vary their use of the planning factors rather than consistently using a standard deployment.

AREA DEFENSES

Typically, Patriot battalions establish area defenses in the tactical operations area. Against phase-one type attacks, the purpose of the area defense is to counter enemy attempts to penetrate to the rear operations area to attack deep strike assets. This equates to a belt defense as deployed in NATO. Against phase-two type attacks, the purpose of the area defense changes to protection of the front-line divisions.

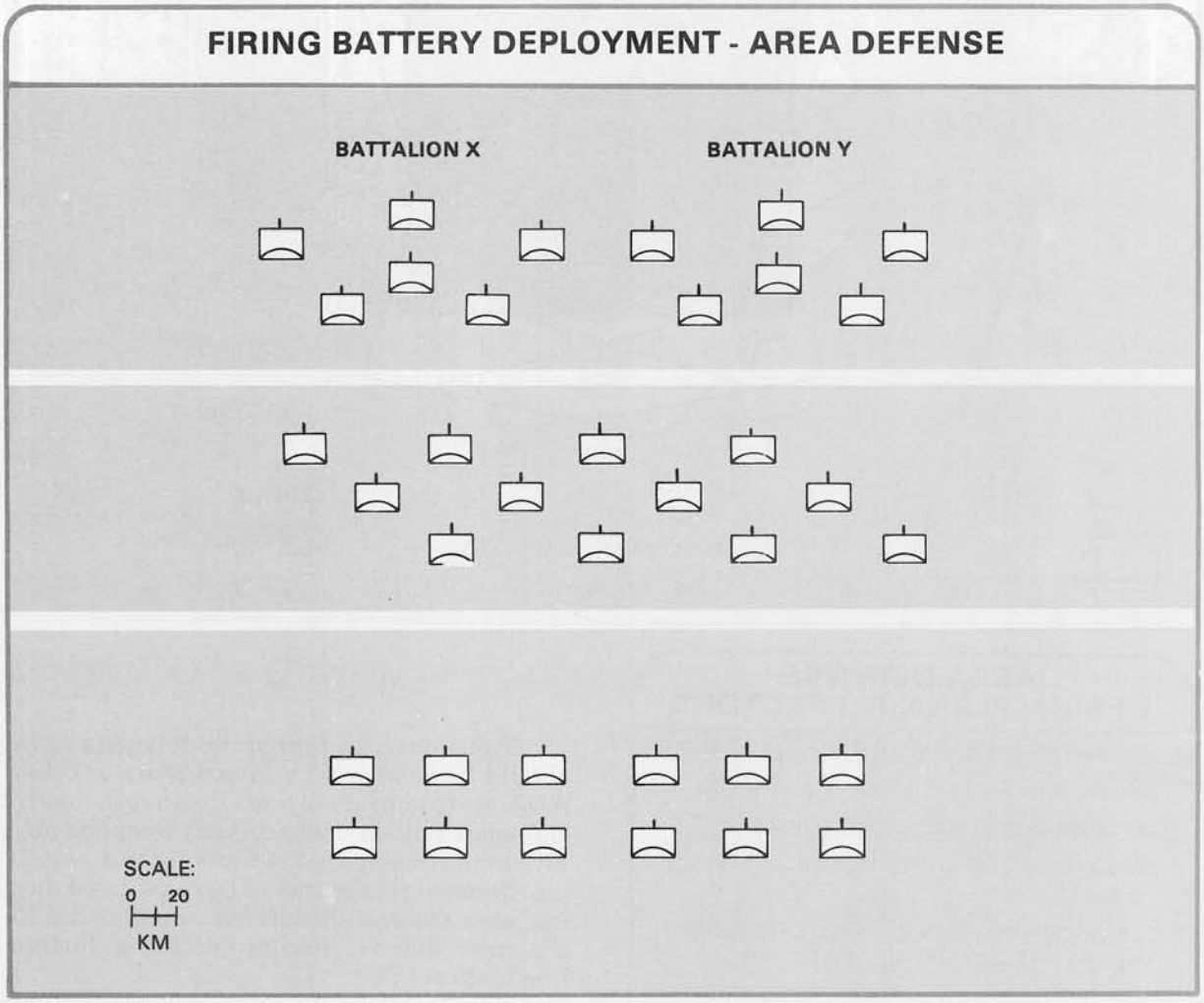
The best multibattalion area defense is one which provides contiguous all-altitude area coverage laterally and in depth throughout the area to be defended. However, the defended area must be sufficiently limited or

there will not be enough Patriot assets to provide such coverage. At times, especially under conditions of reconstitution, even contiguous, lateral area coverage may not be possible. In this case, an area can still be protected by weighting Patriot coverage in limited sectors but not providing contiguous battalion to battalion coverage. Such a defense is analogous to a division conducting defensive operations within an assigned sector. The force is deployed based on the factors of METT-T. Battalions are concentrated on avenues of approach. In the analogous air defense case, the keys to success will be concentrating Patriot coverage on very low- to low-altitude air avenues of approach and deceiving the enemy about the Patriot deployment.

EMPLOYMENT GUIDELINES

Battalions deployed in area or belt defenses should always position their firing batteries to achieve overlapping fires, defense in depth, and weighted coverage. Early engagement and mutual support are also desirable characteristics of an area or belt defense. The following illustration shows various positioning schemes which will achieve all five of the above ADA employment guidelines when combined with the convergent PTL orientation tactic. FM 44-1A explains in greater detail the effect of separation distance on effectiveness of the defense.

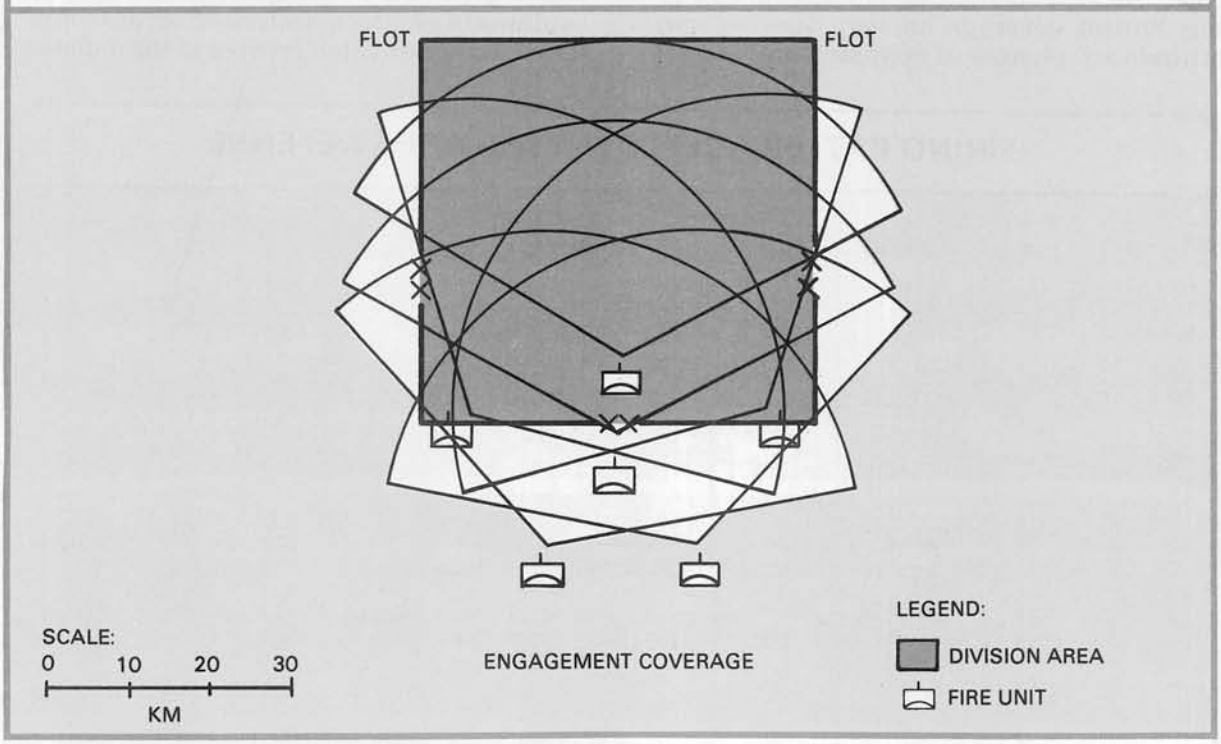
FIRING BATTERY DEPLOYMENT - AREA DEFENSE



AREA COVERAGE

The forward area defense engagement coverage illustration shows a type of firing battery deployment. This also shows the coverage over the defended area. The case illustrates coverage over a typical division-size area and is typical of the belt defense in NATO. This defense design deploys five of six firing batteries of the battalion in a five-pointed perimeter formation, looking much like a pentagon. Three of the five batteries are positioned forward (in the direction of expected attack) to provide early engagement and weighted coverage, while the other two are positioned further back to provide defense in depth. Density of firepower is increased by deploying the sixth fire unit in the center of the formation. The tactic of convergent PTL orientation has been applied.

FORWARD AREA DEFENSE ENGAGEMENT COVERAGE



AREA DEFENSE DESIGN PLANNING FACTORS

MAXIMUM SURVEILLANCE RANGE - SEE FM 44-1A

MAXIMUM INTERCEPT RANGE - SEE FM 44-1A

DISTANCE BEHIND FLOT - 40 TO 60 KM

SEPARATION DISTANCE BETWEEN BATTERIES - 20 TO 30 KM

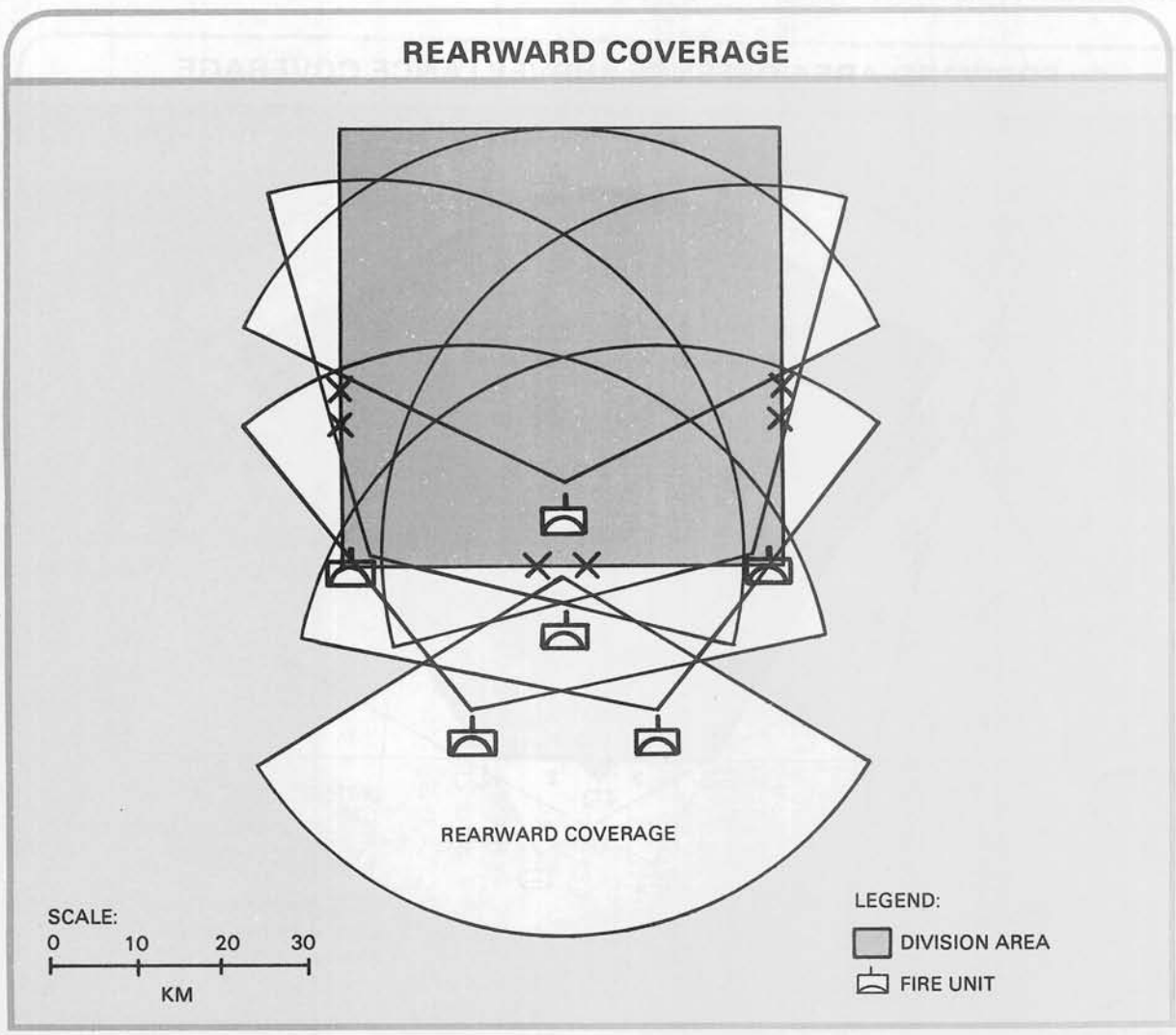
SEPARATION DISTANCE BETWEEN BATTALIONS - 40 TO 50 KMS (CENTERS OF MASS)

The area to the rear of the defense shown should be defended by interceptors or other ADA units to provide more defense in depth. Adjacent Patriot or other ADA weapons provide area coverage to the flanks of this battalion. Some of the factors to be considered during area defense design are summarized in the area defense design planning factors illustration.

PTL SELECTION

Variations in coverage can be easily achieved by shifting primary target lines or assigning secondary target lines for contingencies. For example, the coverage of a leftmost or rightmost unit in a belt defense might be weighted in the direction of an exposed flank. Terrain will often dictate the selection of PTLs. Radar coverage should be optimized for the battalion as a whole rather than for each fire unit. If there is little air defense protection behind the battalion, weighted coverage can still be maintained forward, but one unit might be assigned a target line to protect against attack from the rear (see the rearword coverage illustration). As suggested by this variation, the deployment pattern of five around one easily accommodates a tactic which calls for the center unit to provide supporting fires in virtually any direction. The S3 might consider reallocation of a number of LSs from perimeter units to the center unit. The center unit with additional LSs can position them so that additional firepower can be delivered more rapidly into any sector simply by reorienting the center unit's radar set and launching stations.

REARWARD COVERAGE

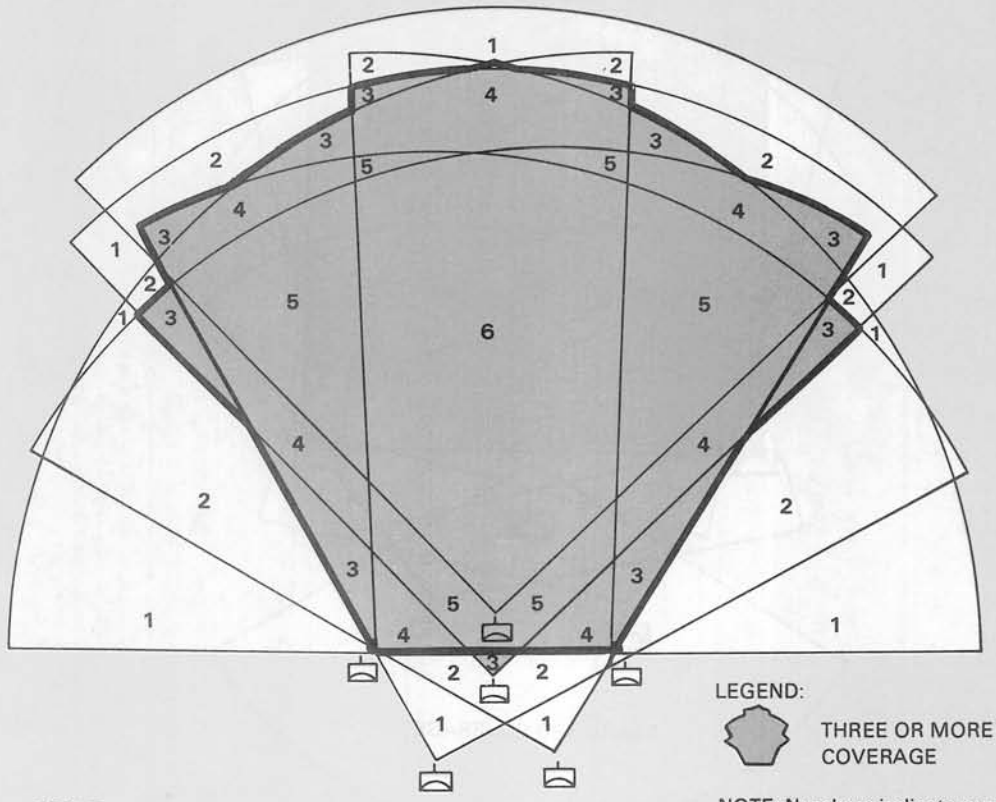


DEFENSE EFFECTIVENESS

Effectiveness of the very low- to very high-altitude Patriot defense depends on how well the applicable employment guidelines are met. Evaluation can be performed qualitatively against quiet (nonjamming) targets and jamming targets along medium- and very low- to low-altitude approaches into the defended area. High- and very-high-altitude approaches are not evaluated due to the improbability of the threat aircraft attacking at these altitudes. After completing this evaluation, weaknesses in the defense will surface. The AD planner then adjusts the deployment scheme of the Patriot battalion. Higher echelon planners may also allocate additional AD resources to offset shortcomings of the Patriot coverage.

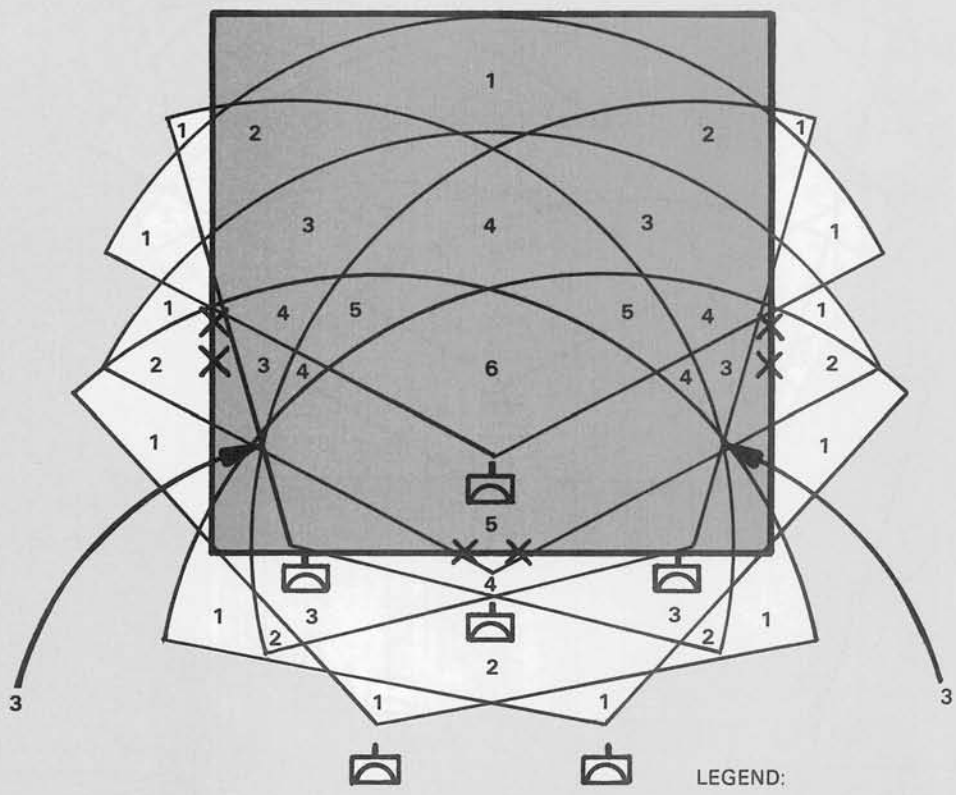
Against medium-altitude attack, proper siting minimizes near-in terrain masking and will generally enable the full planning ranges to be used in evaluation of the defense design. The forward area defense surveillance coverage illustration shows the surveillance coverage for a type of area defense deployment. The number of units providing coverage is shown in the overlap zones.

FORWARD AREA DEFENSE SURVEILLANCE COVERAGE



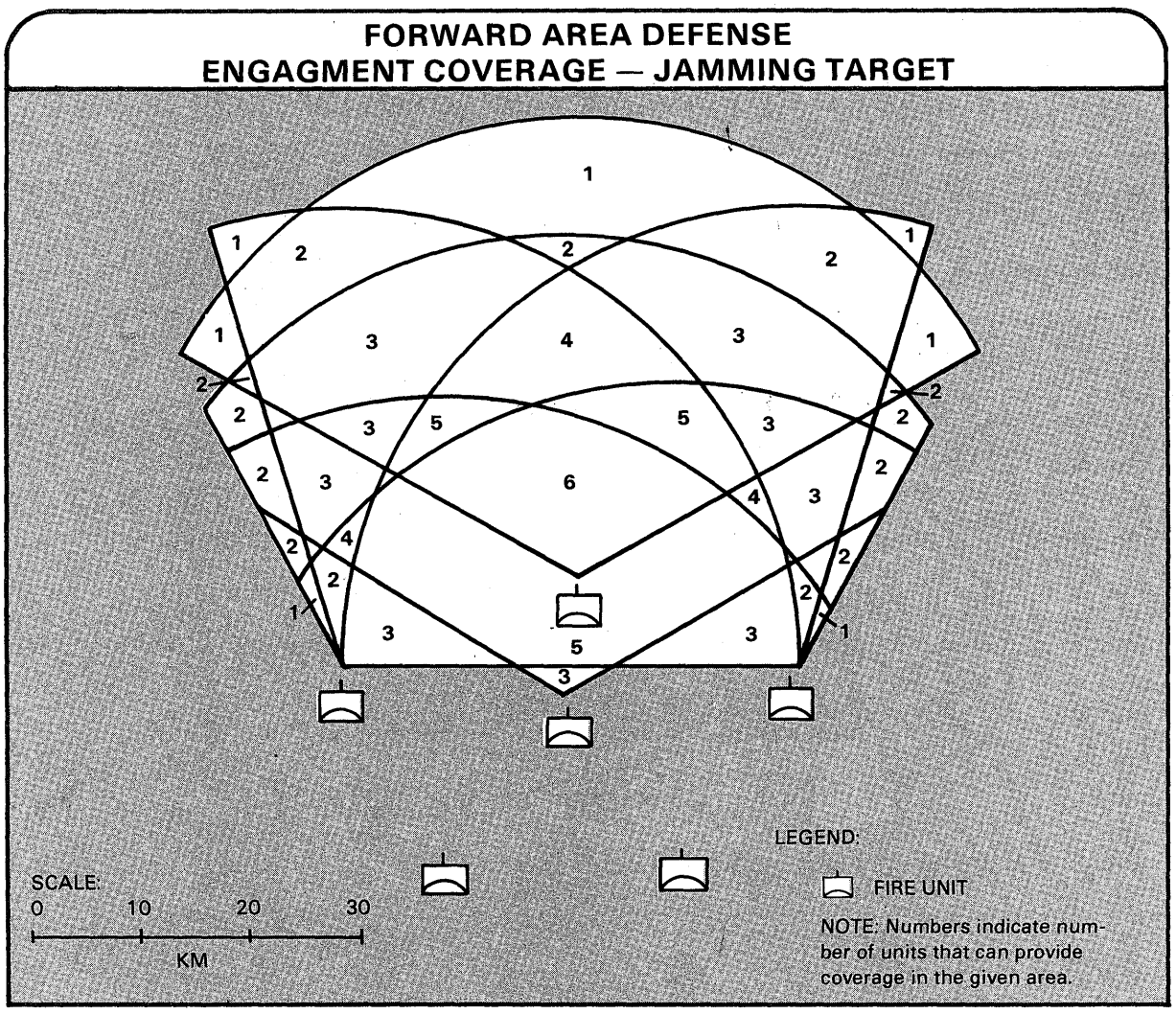
The forward area defense engagement coverage—quiet target illustration depicts an engagement coverage against a quiet target.

FORWARD AREA DEFENSE ENGAGEMENT COVERAGE-QUIET TARGET



Because the use of ECM will be a widely used enemy tactic, defenses are normally designed against jamming aircraft. When planning against a jamming target which requires triangulation to determine the target's actual position, the engagement coverage should be restricted to the area in which three or more fire units can provide

surveillance coverage. Coverage achievable against such a target is shown in the forward area defense engagement coverage-jamming target illustration by combining three or more firing batteries' surveillance coverage with engagement coverage.



The defense design rates high in the priority ADA employment guidelines required of an area defense. It rates good in these guidelines against either a quiet or jamming target since at medium altitude triangulation coverage is excellent. Against quiet targets, the defense rates fair in providing balanced fires in all directions from the perspective of a centrally located asset within the defended area (for example, the main CP in a division); and rates fair-to-poor in mutual support because the two rearmost Patriot units are not covered by another Patriot unit. Against jamming targets, balanced fires degrade because flank fires are withdrawn due to lack of triangulation coverage, and mutual support becomes poor since only one unit is supported by fires of other Patriot units. The area defense deployment versus medium-altitude targets illustration summarizes the qualities of the defense.

AREA DEFENSE DEPLOYMENT VS MEDIUM-ALTITUDE TARGETS

PRIORITY	EMPLOYMENT GUIDELINES	TARGET	
		QUIET	JAMMING
1	OVERLAPPING FIRES	GOOD	GOOD
1	DEFENSE IN DEPTH	GOOD	GOOD
2	WEIGHTED COVERAGE	GOOD	GOOD
3	EARLY ENGAGEMENT	GOOD	GOOD
4	MUTUAL SUPPORT	FAIR TO POOR	POOR
N/A	BALANCED FIRES	FAIR	FAIR TO POOR

Against low- and medium-altitude targets, defense in depth must be provided to the rear and flanks by other weapons capable of engaging at these altitudes (for example, another HIMAD battalion or interceptors). If coverage is not adequate to the flanks of rear, then one or more units of the battalion must orient to cover the vulnerable direction, or be capable of rapid reorientation to do all but very low-altitude attack. A Patriot battalion can provide coverage over an approximate geographic area of 60 by 60 kilometers against nonjamming targets and 50 by 50 kilometers against jamming targets. A greater area could be covered, but at the sacrifice of massed firepower, with much less triangulation capability against very low- and low-altitude jamming aircraft, and at the risk of much less stable coverage as units become nonoperational. Employed in conformance to the guidelines described, a Patriot battalion in the forward area defense will provide excellent medium- to very high-altitude air defense coverage over a typical division-size area of operations. Excellent very low- to low-altitude coverage is provided over the division rear area, however, very low- to low-altitude protection in the MBA and CFA still depends on SHORAD.

POINT DEFENSES

Typically, Patriot battalions establish point defenses in the rear operations area. Patriot battalions would be normally positioned in the communications zone or corps rear. Typical assets which could be defended by Patriot battalions include long-range delivery systems (aircraft and missile), long-range intelligence collection systems, EW systems, command and control facilities, and logistics complexes.

TYPES OF POINT DEFENSE

No less than one Patriot battalion should be deployed in a point defense. However, a single point defense by the Patriot battalion may afford protection to more than one critical asset based on the relative geographic location of the assets. There are basically two types of Patriot point defenses—a weighted defense and a balanced defense. The first type should be used only when there is *very high probability* the attack will come from a particular direction, and there are sufficient air defense weapons whose fires can be brought to bear in the event the attack comes from an unexpected direction. Should the situation lack either of these conditions, the balanced defense should be employed. The balanced point defense is the norm. In either case, Patriot units should be no further than 15-20 kilometers from any asset being protected. The Patriot defense should be oriented on the highest priority asset, resulting in that asset being at or near the center of the defense depending on terrain, attack

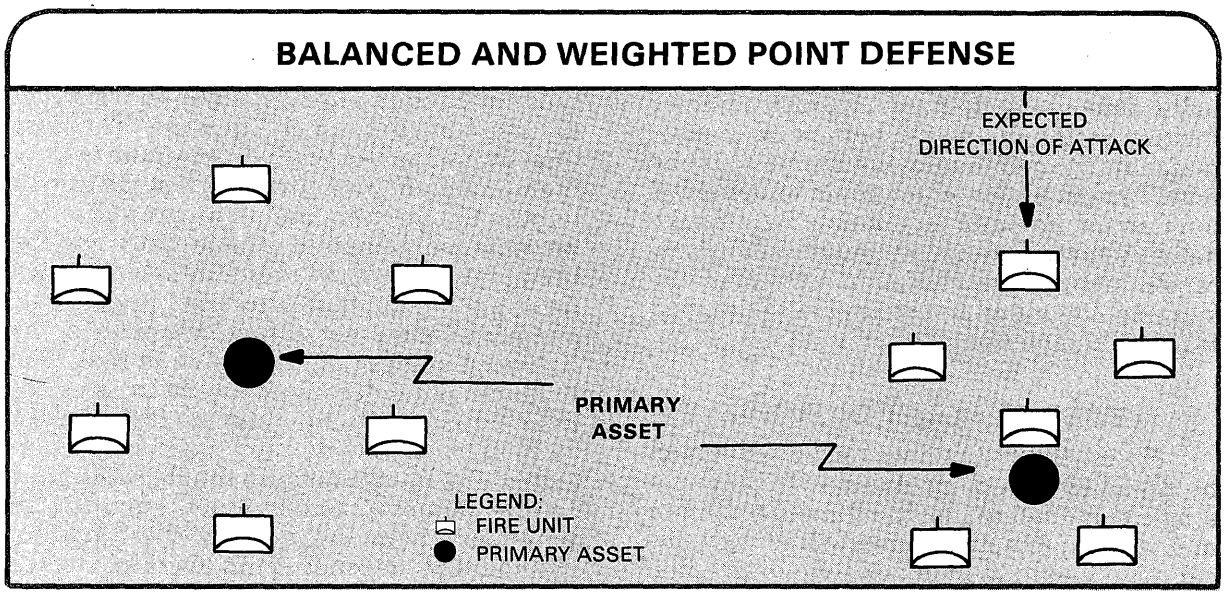
corridors, and relative geographic location of lower priority assets receiving planned protection. When designing the defense, a kill zone for Patriot should be established to take advantage of Patriot's high rate of fire. The size of this kill zone depends on the extent of convergent orientation. In a balanced point defense that uses the inward looking concept, the tactic of convergent orientation is maximized, thus achieving an *intense* kill zone.

If the defended asset is an air base, close coordination must be established between the Patriot battalion and the air base operations center. Normally, a base defense zone which encompasses the Patriot battalion will be established. The air base commander exercises operational control of all AD assets in the base defense zone.

FIRING BATTERY DEPLOYMENT

Firing battery deployment varies only slightly with the type of point defense. In both cases, early engagement, overlapping fires, and defense in depth are desirable characteristics of the defense. In the balanced point defense all six Patriot firing batteries form a perimeter 15-20 kilometers from the center of the primary asset being defended. In the weighted point defense, the majority of the Patriot firing batteries also forms a perimeter around the primary defended asset. However, one firing battery should be located inside the perimeter and usually oriented in the direction where weighted coverage will be provided. However, it could be oriented to protect the defense from attack from the rear, while perimeter units are oriented to provide the weighted coverage. Positioning and orienting the center firing battery in the defense accommodate the tactic described under area defense which calls for the center unit to provide supporting fires in any direction. The balanced and weighted point defense illustration shows the two deployments. Note that the weighted deployment is an elongated variation of the deployment suggested earlier for the area defense and provides for increased mutual support over that provided by a balanced point defense. Also note the positioning of the weighted point defense with respect to the defended asset. This is recommended to insure maximum all-unit coverage in the expected direction of attack. The center unit in the weighted defense is the exception to the planning factor which calls for Patriot units to be positioned 15-20 kilometers from the center of the defense.

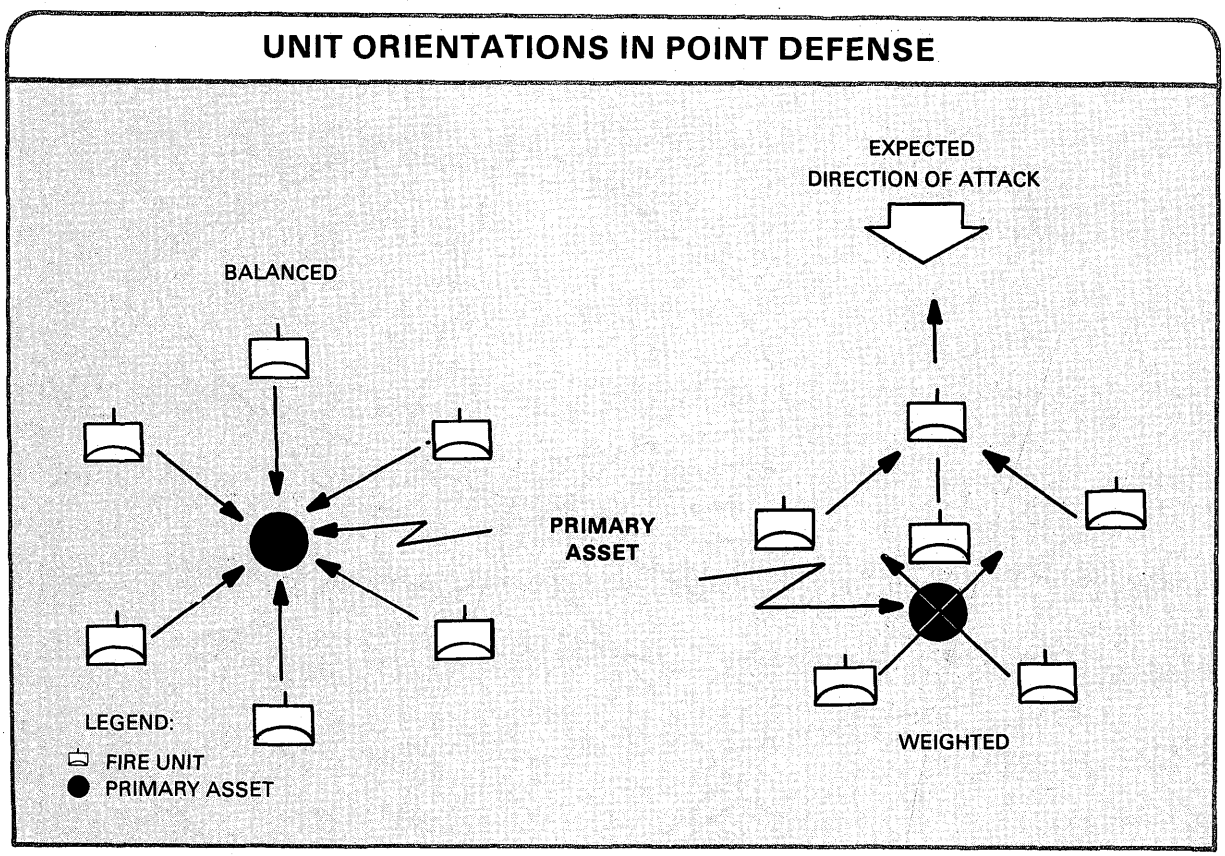
BALANCED AND WEIGHTED POINT DEFENSE



PTL SELECTION

Unit orientation, not deployment, is the primary difference in the two defenses. The following illustration shows the recommended orientations. They are stylized and have not been tailored to local defense conditions such as terrain. The tactic of convergent orientation applies in both cases. In the balanced defense, all target lines converge at the same point—the center of the defended asset.

UNIT ORIENTATIONS IN POINT DEFENSE



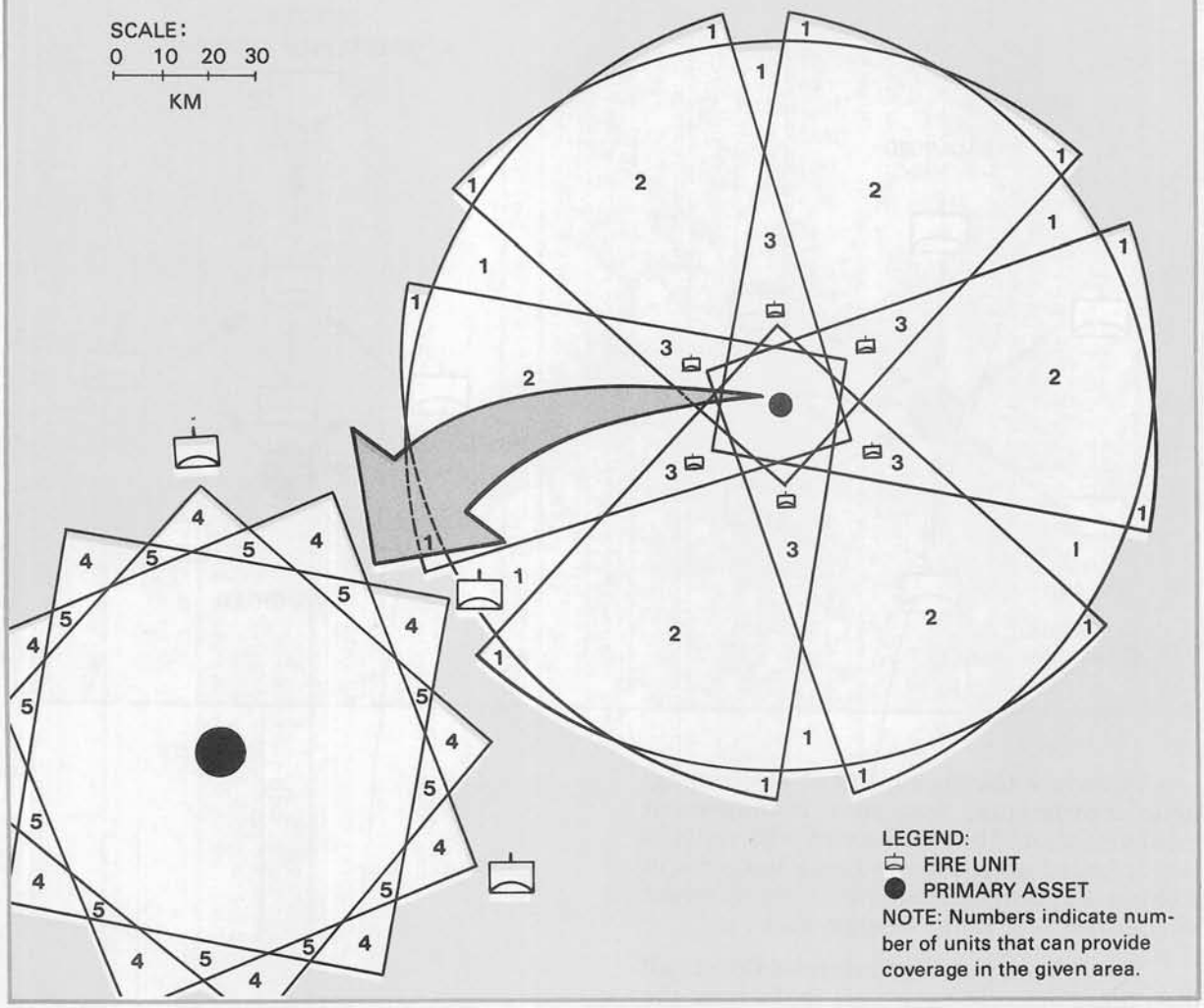
To reduce the possibility of electromagnetic interference, frequency management measures should be coordinated with units in the defended area. Patriot firing batteries in a balanced point defense should use different W-codes (sets of radar frequencies).

The defense provides balanced fires in all directions because each unit looks over the

asset and can engage targets attacking from the opposite side of the defense. In the weighted defense, all unit sectors will overlap the expected direction of attack.

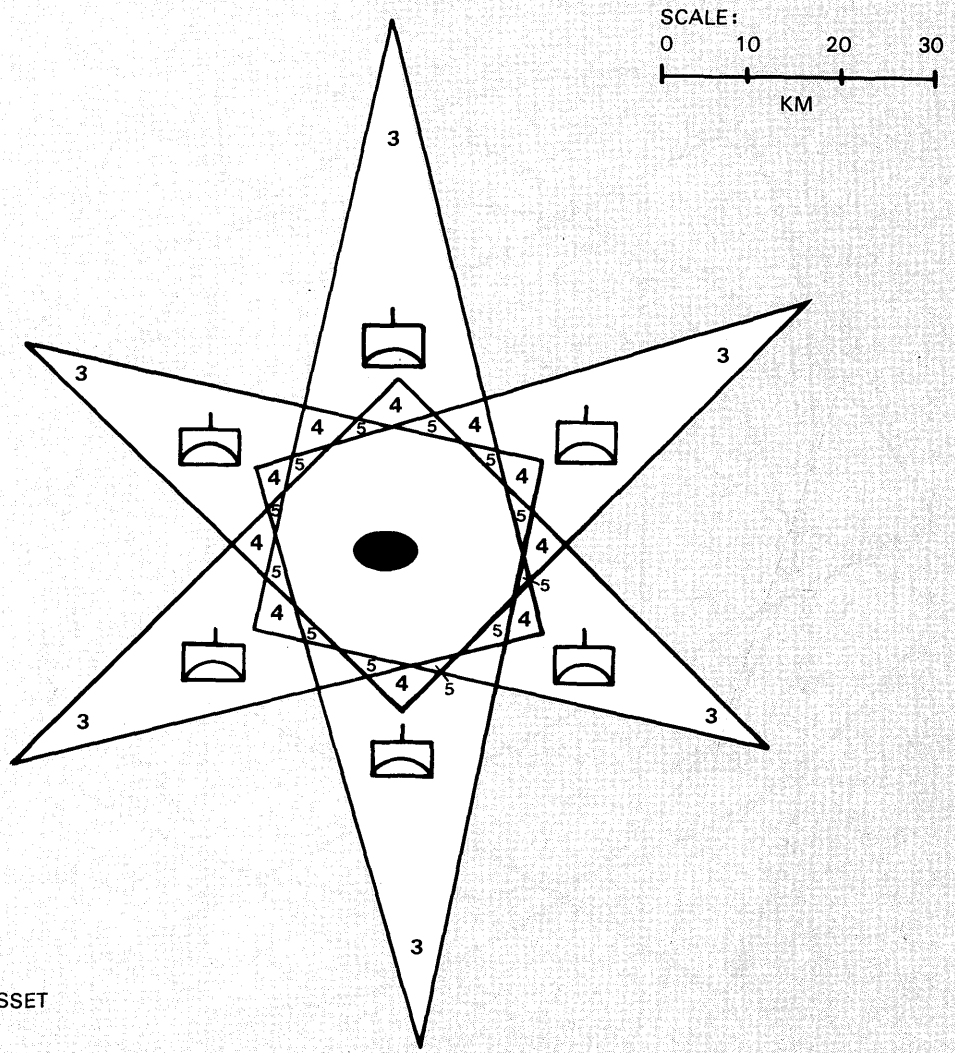
The balanced point defense surveillance coverage—medium altitude illustration depicts the surveillance coverage of a Patriot battalion deployed in a balanced point defense. Surveillance range will be greater than that of forward Patriot battalions because of the reduced SOJ threat.

BALANCED POINT DEFENSE SURVEILLANCE COVERAGE—MEDIUM ALTITUDE



The balanced point defense triangulation area—medium altitude illustration shows where multiple unit (three or more) coverage is provided by the balanced point defense. In these areas triangulation can be supported.

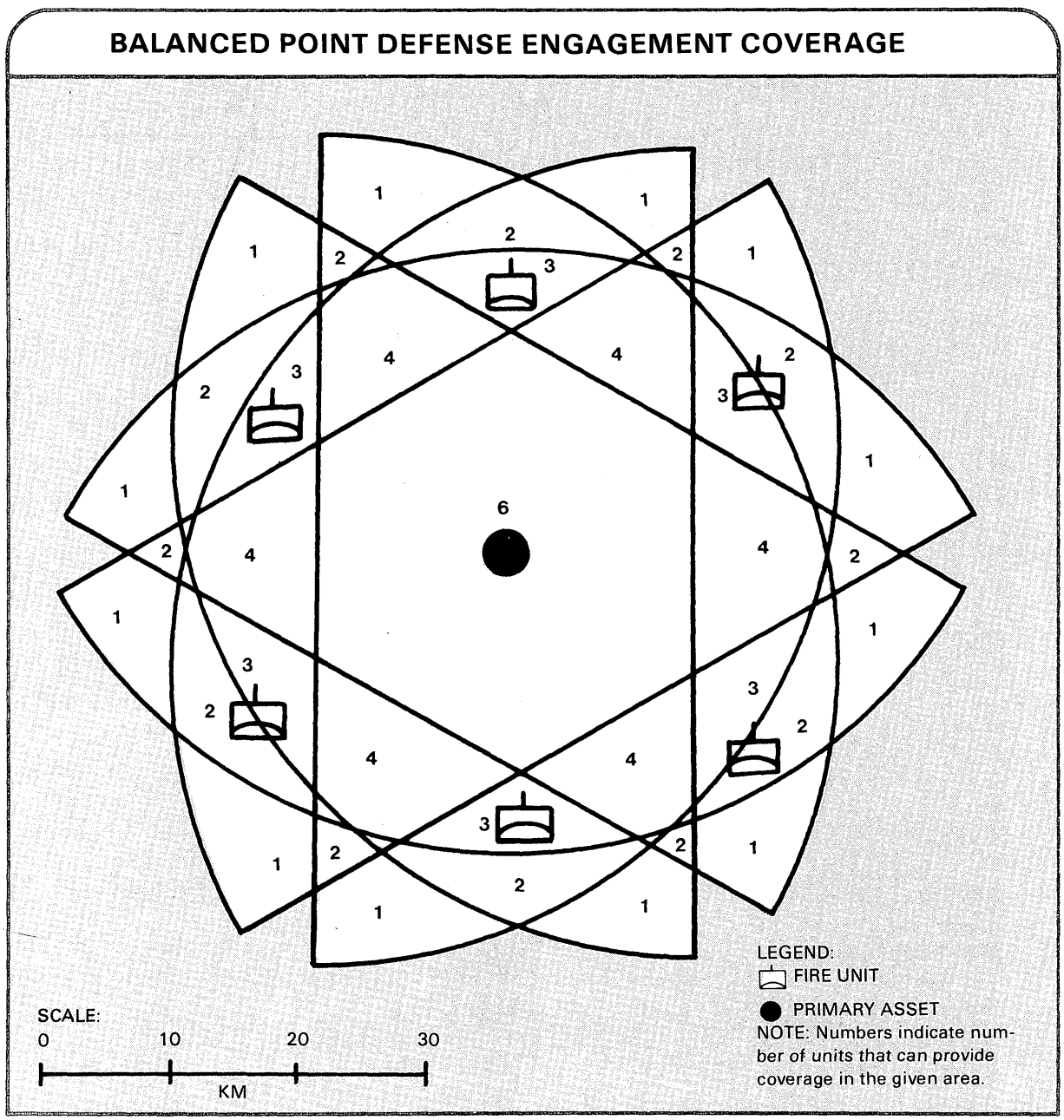
BALANCED POINT DEFENSE TRIANGULATION AREA — MEDIUM ALTITUDE



NOTE: Numbers indicate number of units that can provide coverage in the given area.

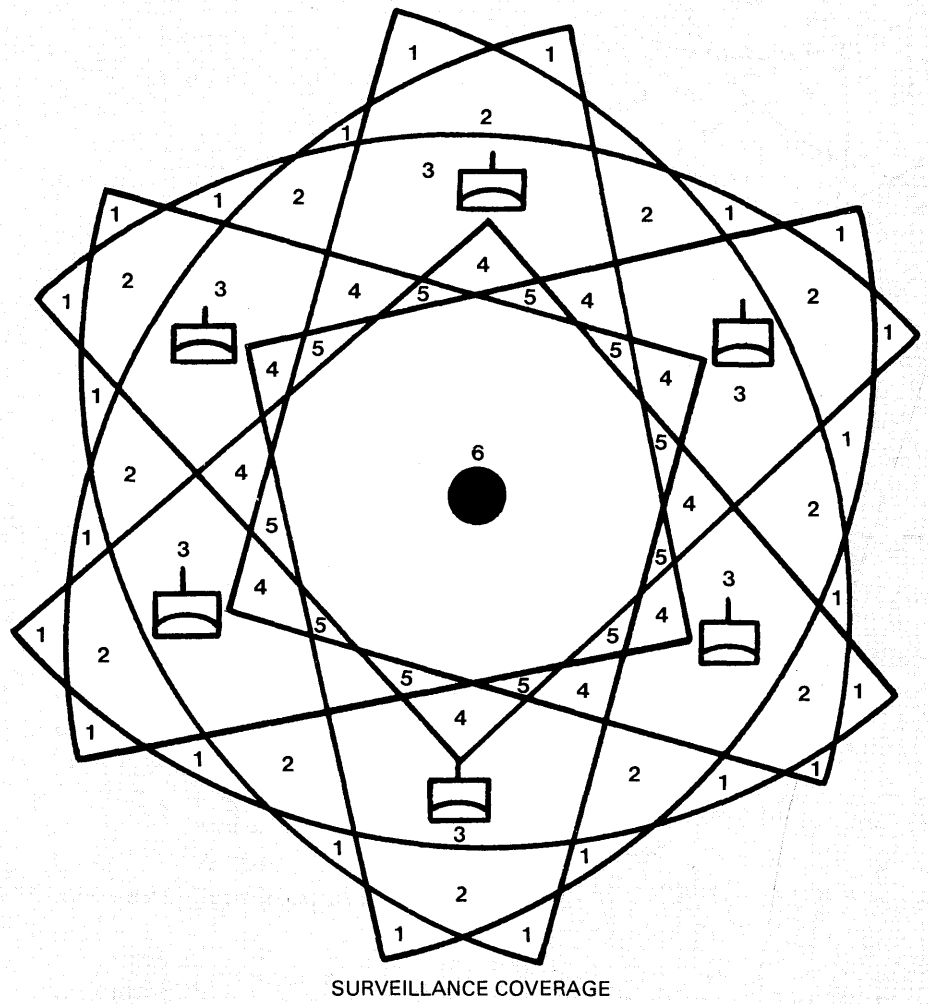
The balanced point defense engagement coverage illustration shows the engagement coverage of the balanced point defense against a medium-altitude threat. At medium altitude, triangulation is not hampered by terrain masking, therefore the full, high probability of kill intercept ranges can be achieved.

BALANCED POINT DEFENSE ENGAGEMENT COVERAGE

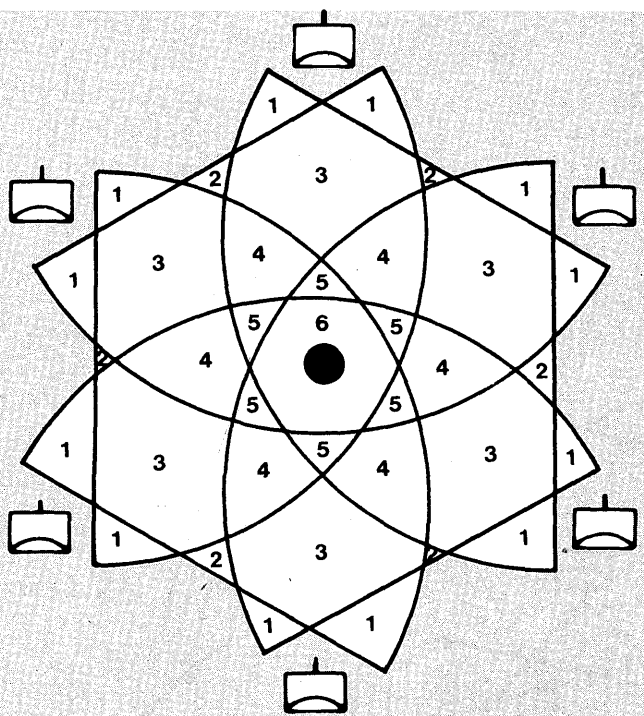


The balanced point defense—low-altitude coverage illustration on this page and page 6-28, shows the surveillance and engagement coverage against a very low- to low-altitude threat. Terrain masking and system performance are the limiting factors which reduce both the surveillance and engagement coverage.

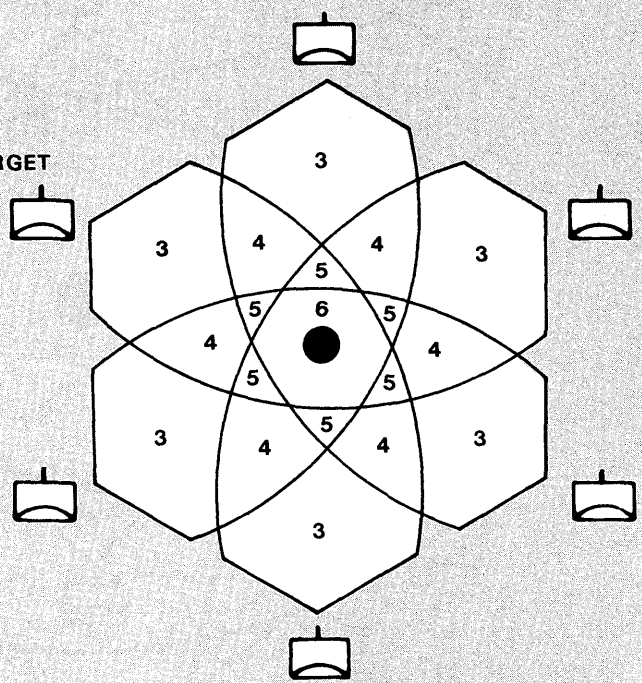
BALANCED POINT DEFENSE-LOW ALTITUDE COVERAGE



BALANCED POINT DEFENSE—LOW-ALTITUDE COVERAGE ILLUSTRATION (CONTINUED)



ENGAGEMENT COVERAGE — QUIET TARGET



ENGAGEMENT COVERAGE — JAMMING TARGET

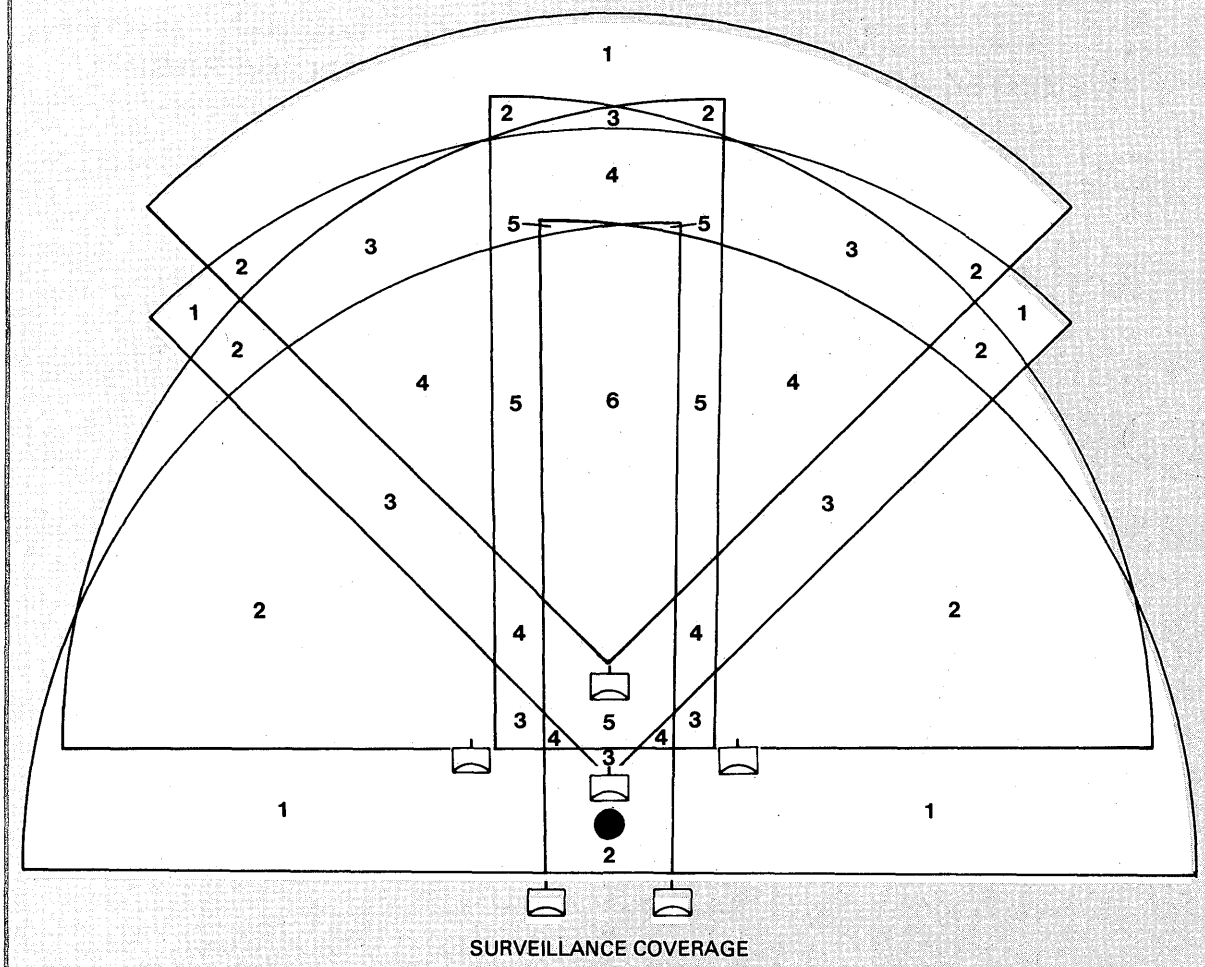
SCALE:
0 10 20 30
KM

LEGEND:
FIRE UNIT
PRIMARY ASSET

NOTE: Numbers indicate number of units that can provide coverage in the given area.

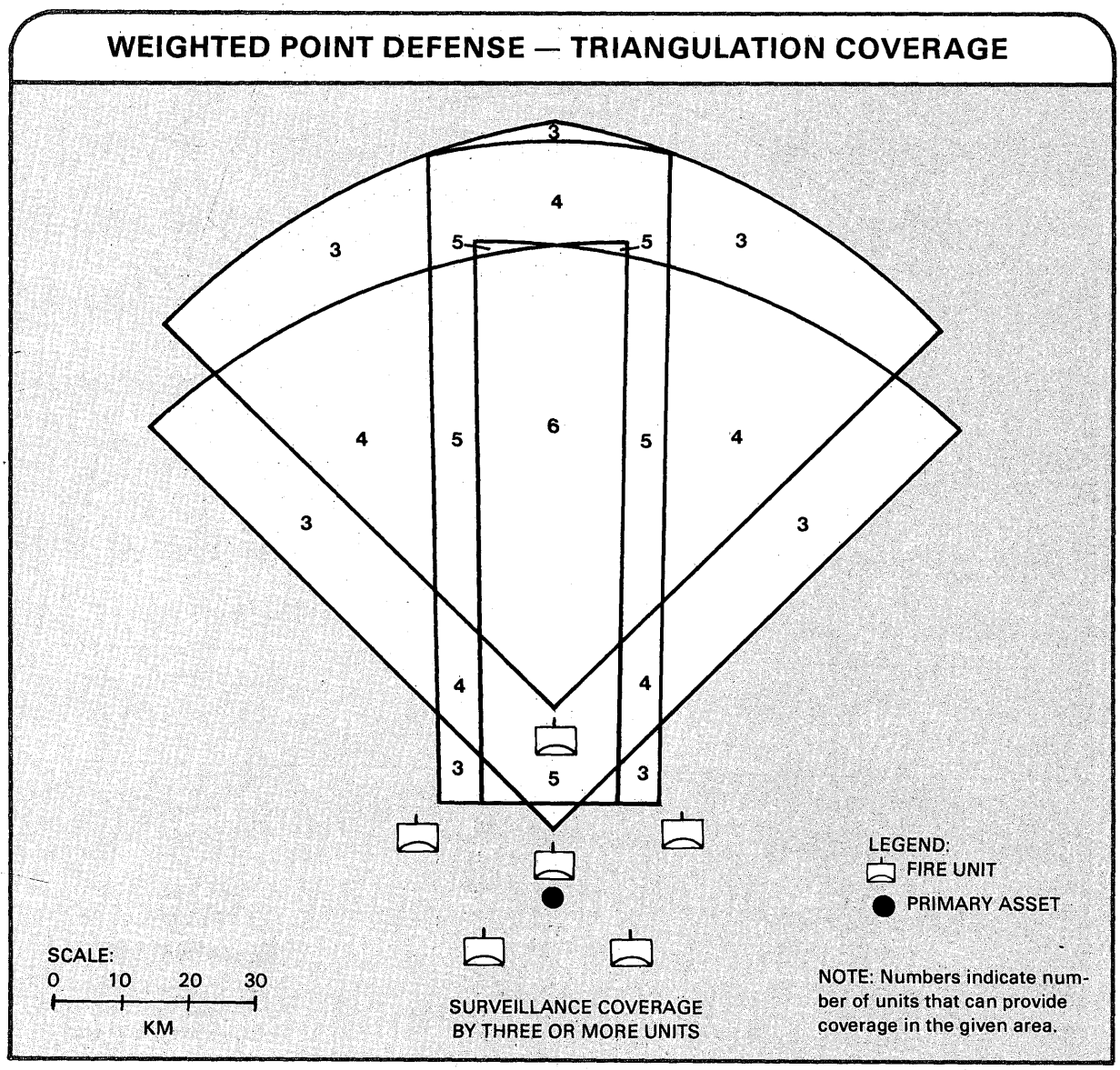
The weighted point defense—surveillance coverage illustration shows surveillance coverage of a weighted point defense against a medium-altitude threat.

WEIGHTED POINT DEFENSE — SURVEILLANCE COVERAGE



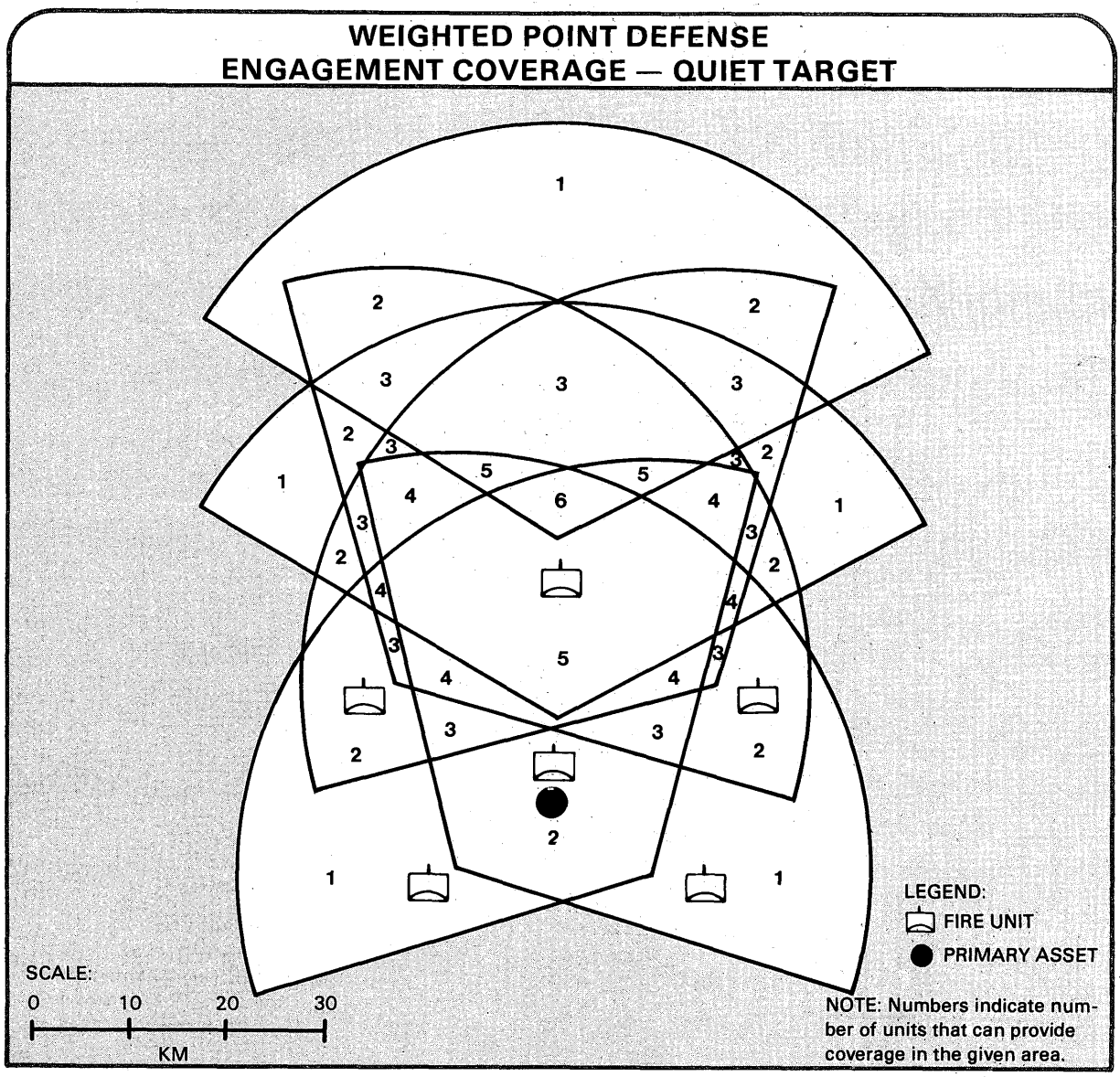
The weighted point defense—triangulation coverage illustration shows the areas of multiple unit (three or more) coverage where triangulation can be supported.

WEIGHTED POINT DEFENSE — TRIANGULATION COVERAGE

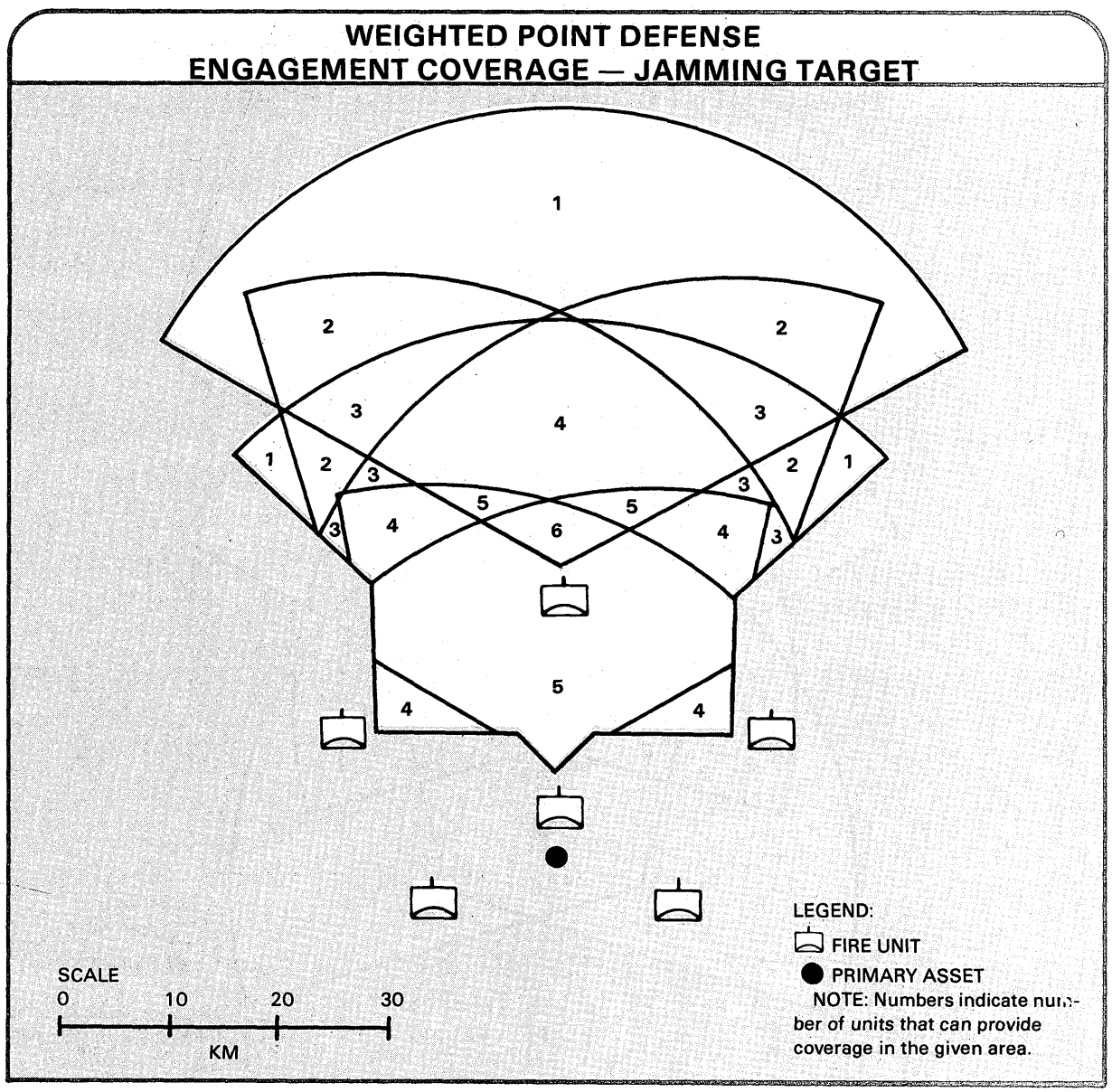


The weighted point defense engagement coverage—quiet target illustration shows the engagement coverage of a weighted point defense against a medium-altitude quiet threat. The weighted point defense engagement coverage—jamming target illustration shows the engagement coverage of the same defense against a jamming target. Since triangulation is excellent at medium altitude, the engagement coverage is virtually unchanged along the weighted direction.

WEIGHTED POINT DEFENSE ENGAGEMENT COVERAGE — QUIET TARGET

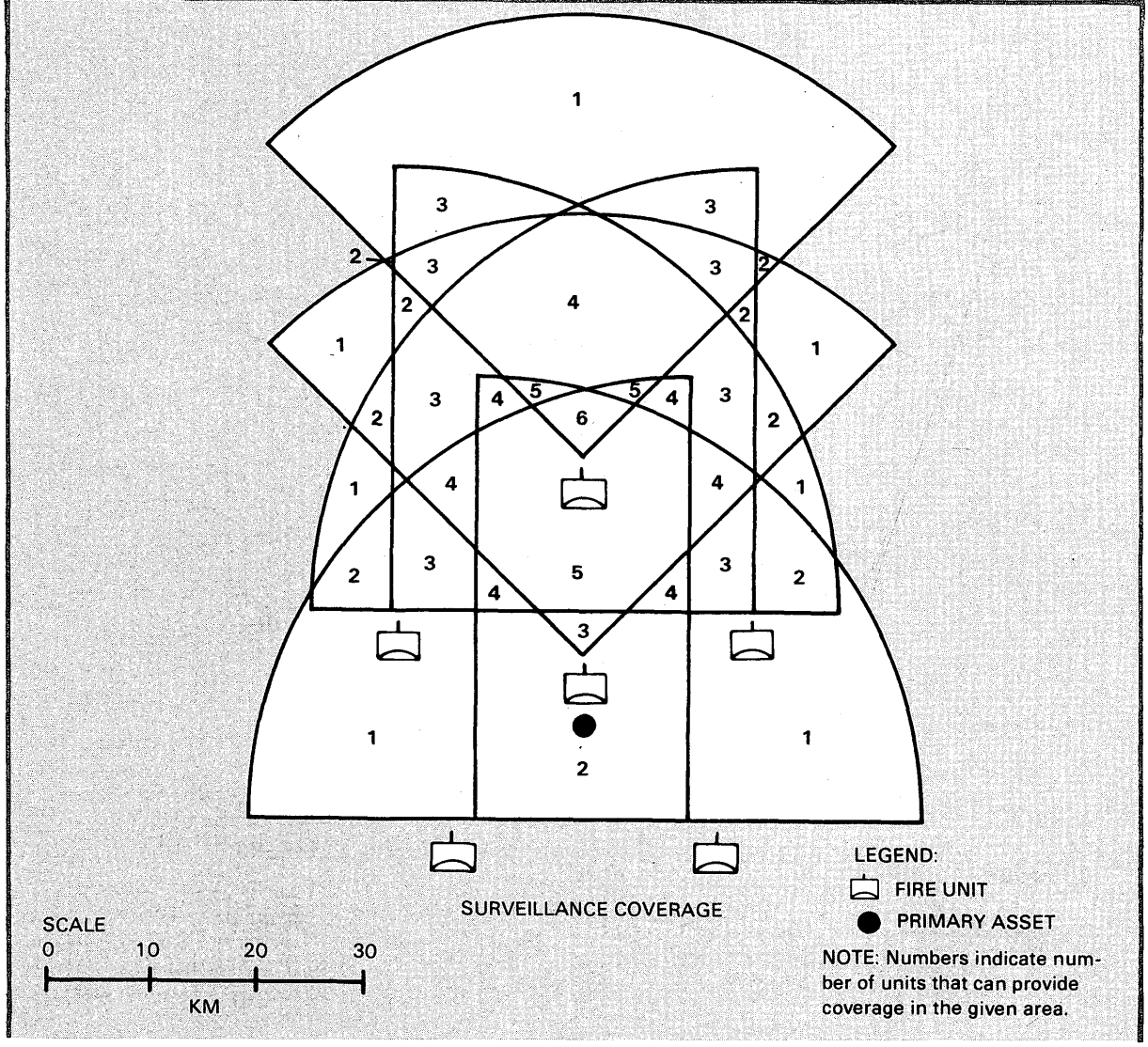


WEIGHTED POINT DEFENSE
ENGAGEMENT COVERAGE — JAMMING TARGET

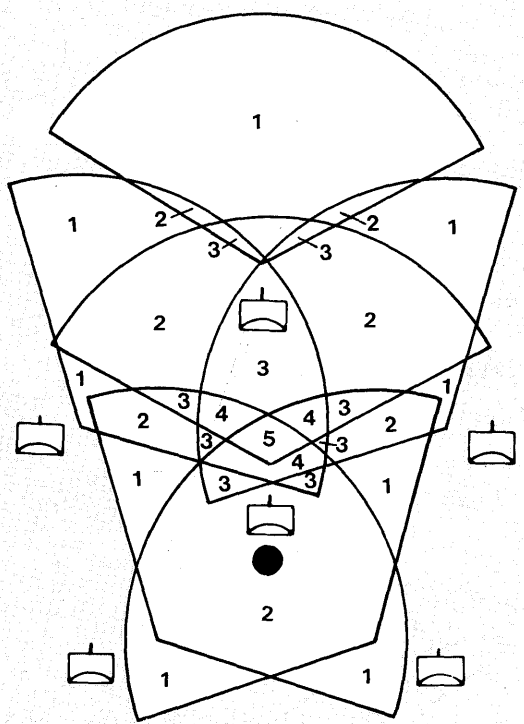


The weighted point defense—low-altitude coverage illustration on this page and page 6-34, shows the surveillance and engagement capabilities against very low-to-low-altitude quiet and jamming targets. Once again the limiting factors are system performance and terrain masking. As the engagement coverage against jamming targets clearly shows, this type of defense is extremely vulnerable to low-altitude attacks from other than the weighted direction.

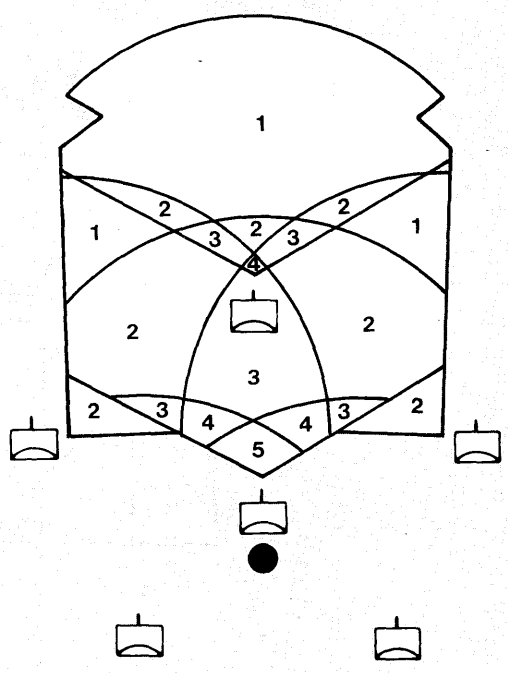
WEIGHTED POINT DEFENSE — LOW-ALTITUDE COVERAGE



WEIGHTED POINT DEFENSE—LOW-ALTITUDE COVERAGE (CONTINUED)



ENGAGEMENT COVERAGE—
QUIET TARGET



ENGAGEMENT COVERAGE
JAMMING TARGET

SCALE:
0 10 20 30
KM

LEGEND:
FIRE UNIT
PRIMARY ASSET
NOTE: Numbers indicate number of units that can provide coverage in the given area.

COMPOSITE DEFENSES

By adhering to the AD employment principle of mix, composite defenses are normally employed in both the tactical and rear operations areas. In the tactical operations area, these composite defenses are not as structured as those in the rear operations area. This is because the HIMAD and SHORAD commanders in the tactical operations area have their priorities established by different commanders. In the rear operations area, AD priorities are established by the force commander.

ALLOCATION OF FORCES

In the tactical operations area, a Patriot battalion (four or more *operational* fire units) and a SHORAD battalion are a sufficient composite force for protection of the divisional forces and for attrition of enemy deep strike aircraft. Where terrain is particularly difficult or in a particularly threatened area, four Hawk fire units may reinforce the ADA coverage. When only a Patriot battalion with less than four fire units is available, a full Hawk battalion is required for adequate coverage. In the rear operations area, a Patriot battalion (four or more *operational* fire units) and a SHORAD battery are an adequate composite force for a typical point defense. Particularly large or high priority point defenses may require the allocation of additional Hawk fire units, up to a full battalion. When only a Patriot battalion with less than four fire units is available, a minimum of four Hawk fire units is required.

TACTICAL MISSIONS

When all units participating in a composite defense are in the same brigade, the brigade assigns narrative missions to each unit and acts as overall defense coordinator. In the absence of a single brigade, Patriot battalion(s) should be given a GS mission. Hawk battalion(s) and SHORAD batteries are normally assigned a GS-R or R mission to support the Patriot unit. This will clearly establish planning and control relationships. The Patriot battalion S3 would be responsible for designing the composite defense (Patriot-GS, SHORAD- and Hawk-GS-R or R to Patriot). He would also be responsible for coordinating with the ADA brigade to recommend the employment of interceptors in the defense to insure that the composite defense will best integrate the interceptor contributions.

COMMAND AND CONTROL LINKS

Patriot and Hawk battalions in a composite defense would normally communicate with each other through the ADA brigade AN/TSQ-73 Missile Minder system. If the brigade FDC is not available, the Patriot ICC would communicate directly to the Hawk battalion AN/TSQ-73 and the Hawk battalion to the CRC. The Hawk battalion FDC would not attempt to control the Patriot battalion.

HAWK EMPLOYMENT

When Hawk and Patriot are employed together within the forward area, Hawk should be employed according to defense vulnerability. For example, Hawk should be employed to extend very low- to low-altitude area defense forward into brigade zones, especially when SHORAD defenses are weak. If divisional SHORAD defenses are adequate but defenses to the flank and rearward of Patriot coverage are questionable, then Hawk should be employed to provide defense in depth and mutual support, provide rear and flank coverage, and to fill in lateral very low- to low-altitude coverage, thus allowing maximum forward coverage by Patriot. In the rear operations area, Hawk is sited along low-altitude avenues of approach and to provide mutual support to Patriot units.

SHORAD EMPLOYMENT

In the division area, SHORAD units are employed according to the division's AD priorities. However, in rear operations area point defenses, a SHORAD battery reinforces the coverage of the Patriot battalion. Chaparral squads are positioned 2-3 kilometers to the rear of Patriot units to force suppressor aircraft higher in altitude, to provide mutual support and defense in depth, and to destroy or neutralize suppressor aircraft. This

employment of SHORAD, although a departure from traditional SHORAD employment, results in more effective defense of the asset(s).

Illustrations on pages 6-36 through 6-38 show examples of composite defenses.

COMPOSITE DEFENSE PLANNING FACTORS

ALLOCATE COMPLETE BATTALIONS (BATTERIES FOR SHORAD) OR MULTIPLES THEREOF

AADCOM/ADA BRIGADES

- ASSIGN TACTICAL MISSIONS TO PATRIOT, HAWK, AND SHORAD
- PATRIOT - GS
- HAWK AND SHORAD - R OR GS-R

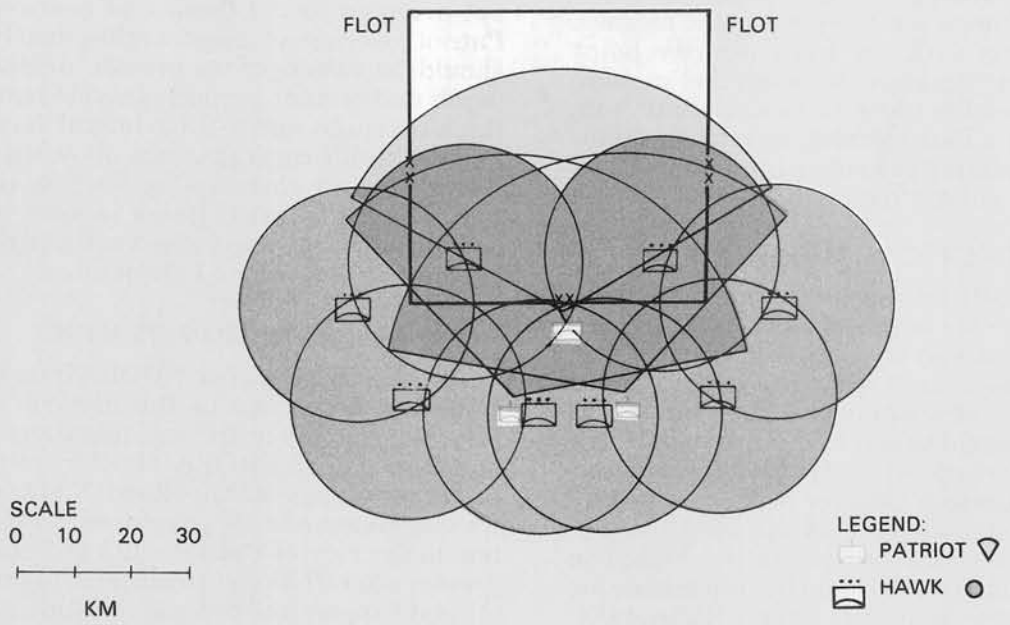
SELECT PATRIOT POSITIONS FIRST

SELECT HAWK/SHORAD POSITIONS BASED UPON MISSION, PATRIOT COVERAGE, AND BLUE AIR AVAILABILITY/EMPLOYMENT

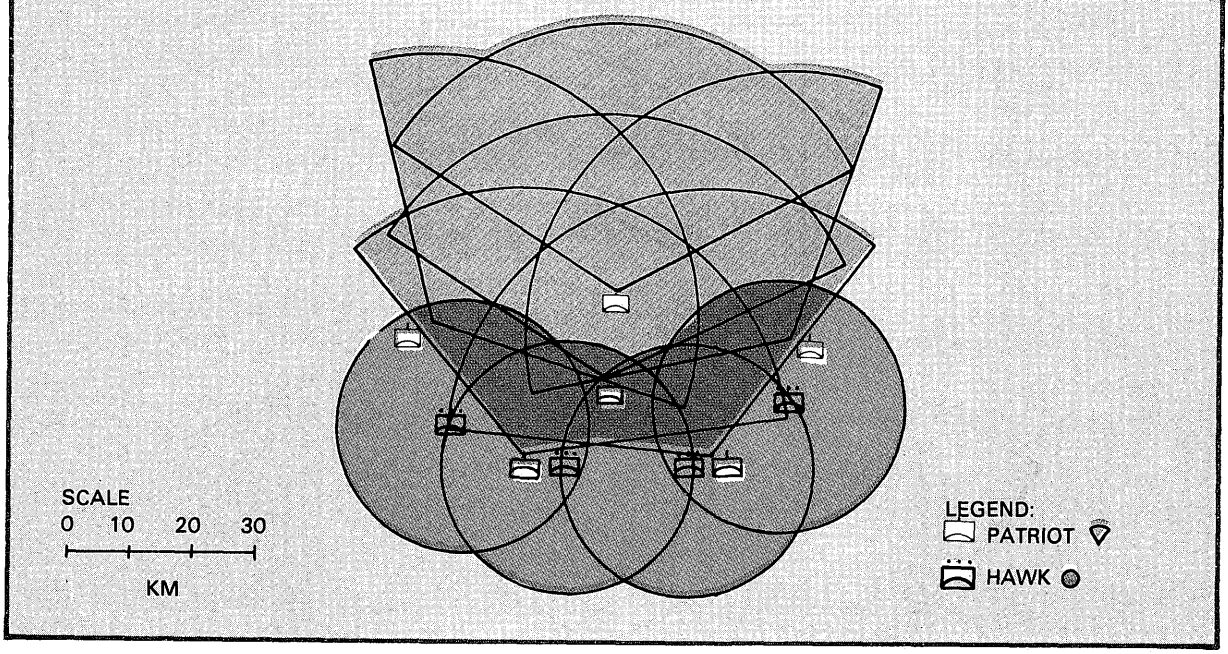
PATRIOT-HAWK FIRE UNIT SEPARATION DISTANCE

- AREA DEFENSE - 5 TO 10 KM (HAWK REINFORCES PATRIOT)
  10 to 20 KM FORWARD OF PATRIOT (HAWK REINFORCES SHORAD)
- POINT DEFENSE - 5 TO 10 KM

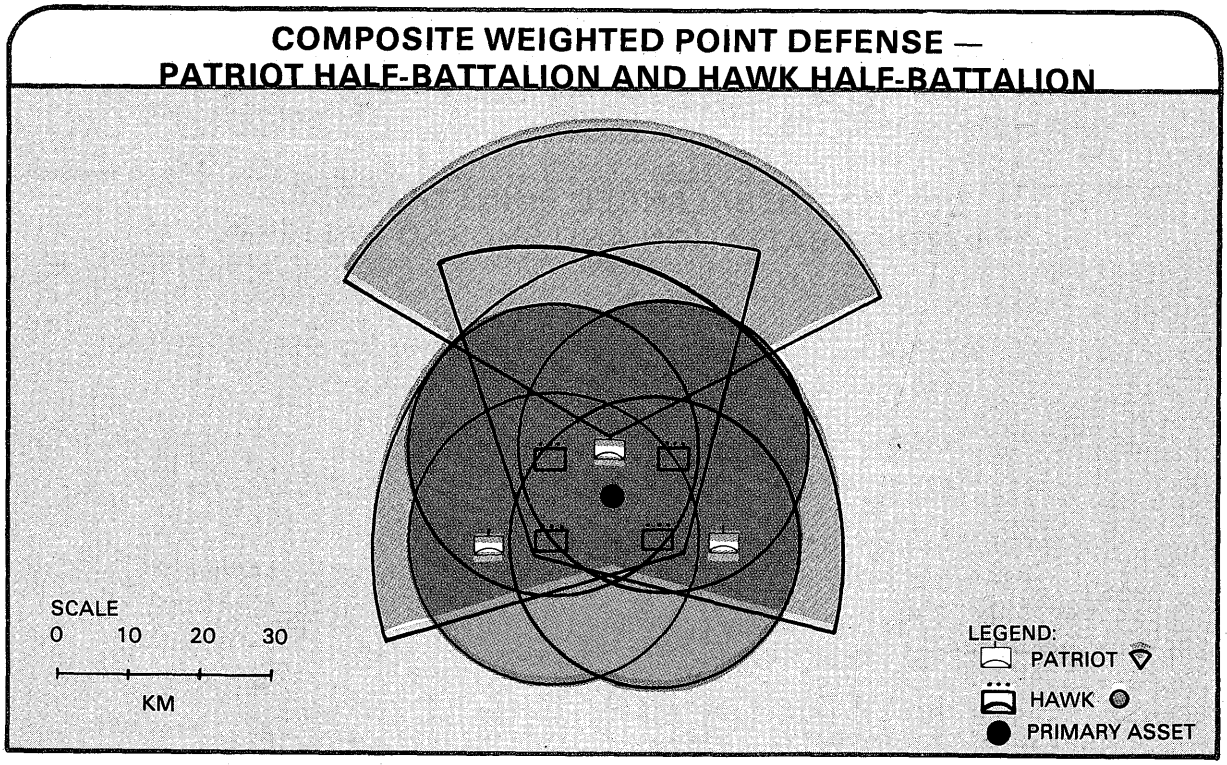
COMPOSITE AREA DEFENSE — PATRIOT HALF-BATTALION AND HAWK BATTALION



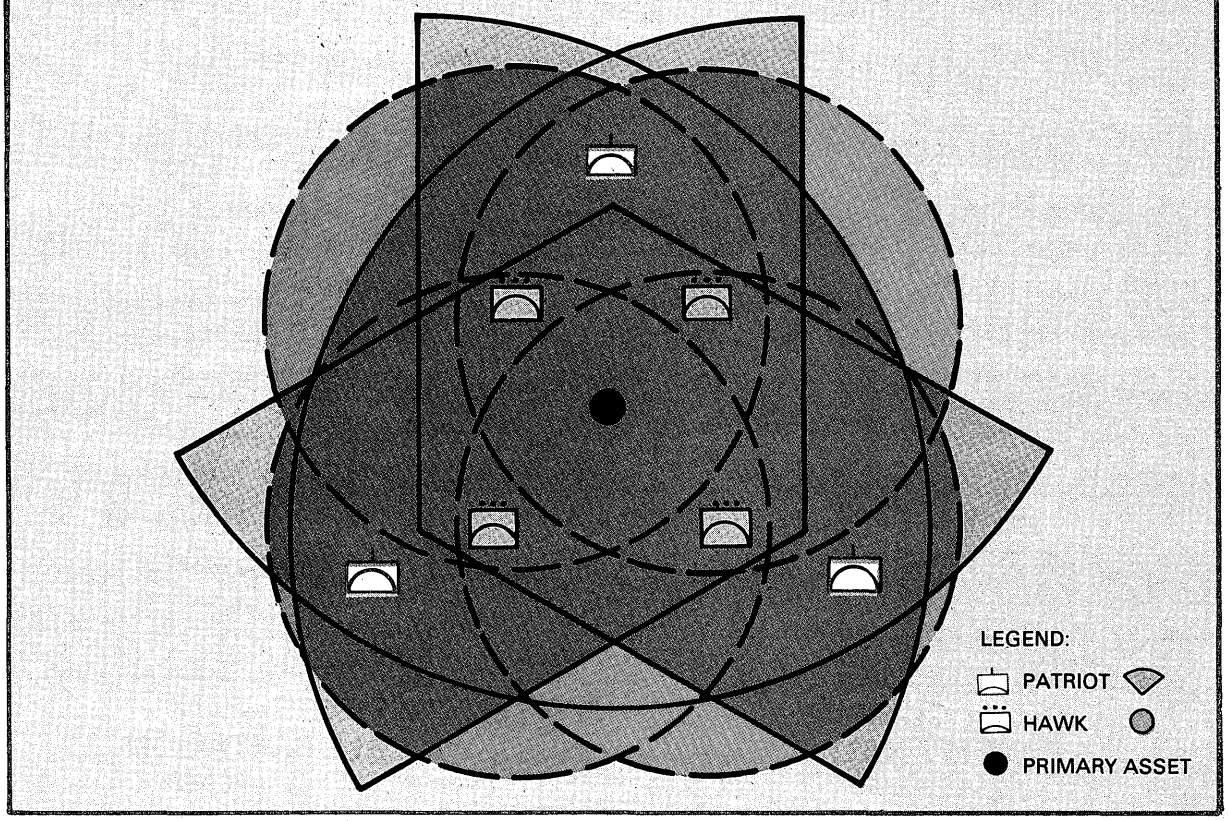
COMPOSITE AREA DEFENSE — PATRIOT BATTALION AND HAWK HALF-BATTALION



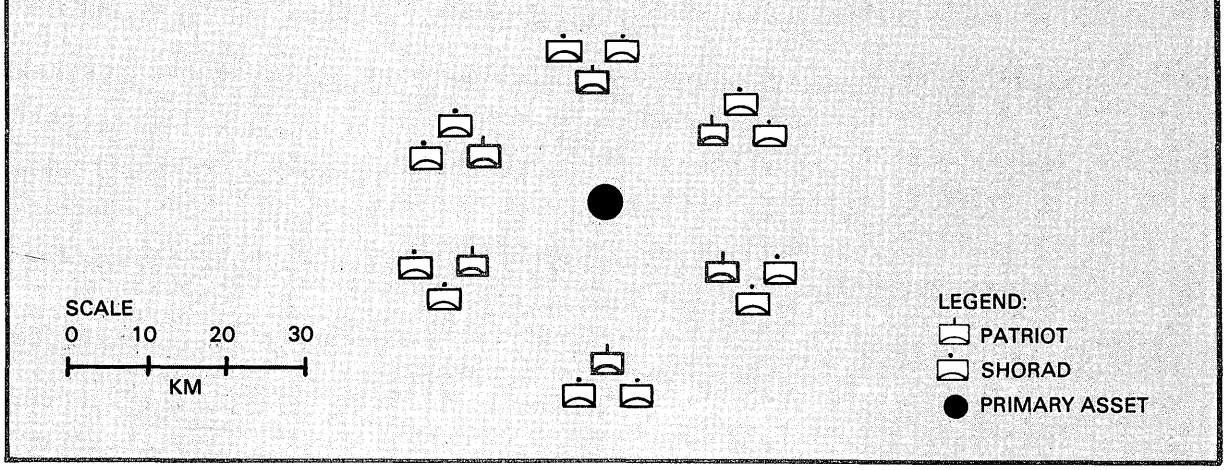
COMPOSITE WEIGHTED POINT DEFENSE — PATRIOT HALF-BATTALION AND HAWK HALF-BATTALION



COMPOSITE BALANCED POINT DEFENSE — PATRIOT HALF-BATTALION AND HAWK HALF-BATTALION



COMPOSITE BALANCED POINT DEFENSE — PATRIOT BATTALION AND SHORAD BATTERY



CHAPTER 7

Reconnaissance, Selection, and Occupation of Position

As with all other ADA units, reconnaissance, selection, and occupation of position (RSOP) is a way of life for Patriot units. As well as shooting and communicating, Patriot units are always moving. This chapter discusses the purpose of Patriot RSOP and some major considerations peculiar to movement of Patriot units. Procedures required to conduct the RSOP are included. Although all position requirements are not detailed, those essential to Patriot operations are. Requirements not detailed are those common to all Army units including other types of ADA units.

PURPOSE

The purpose of a Patriot RSOP is to move a Patriot unit into a position from which it can accomplish its mission. For a Patriot firing battery, this is a position from which the unit is able to deliver effective air defense fires against the enemy air threat. For the battalion headquarters, this includes a position from which the battalion fire direction center can effectively control the air defense fires of each firing battery and the battalion support elements can adequately support the battalion. Patriot units move to—

- Respond to major shifts of friendly forces.
- Reestablish defenses of critical assets when they move.
- Respond to changes in mission assignments.
- Displace to alternate positions for survivability.
- Insure overall defense integrity.

Patriot units are normally deployed as battalions and, in many cases, are part of a larger integrated air defense. As a result, when a firing battery conducts an RSOP, it is usually a part of a multilevel operation conducted by the air defense headquarters (usually an ADA brigade HQ) and the Patriot battalion, as well as the firing battery. This involves locating, positioning, and siting.

LOCATING

The location of the battalion is determined either by the defense or brigade commander. (The term "location," when used in this context, specifies the establishment of a *broad* operating area.)

★ CONTENTS

POSITIONING

The battery is positioned by the battalion commander. (The term "positioned," when used in this context, specifies an exact area within the operating area.)The battalion commander will commonly designate a four- or six-digit grid coordinate for the new position. Normally the battery commander will have some leeway in occupying the position, based on his ground reconnaissance.

SITING

Siting of equipment within the position is always accomplished by battery personnel. (The term "siting," when used in this context, specifies the placement of individual items of equipment on selected spots within the position.)

Based on time available, locating, positioning, and siting can become very centralized (in a peacetime environment) or very decentralized (in a rapidly changing, fluid wartime environment). RSOP procedures discussed in this chapter are based on a wartime environment in which positioning is accomplished by battalion and siting is accomplished by battery personnel.

GENERAL CONSIDERATIONS

The procedures used by Patriot units in performing RSOPs are almost identical to those performed by other units. Differences take into account the size and weight of Patriot equipment which affect all aspects of a Patriot RSOP. The procedures also account for the tactical and technical characteristics of the Patriot system which affect the positioning of the unit and the siting of each item of equipment.

★ **ROAD MARCH WEIGHTS AND DIMENSIONS**

EQUIPMENT	WEIGHT kilograms (pounds)	HEIGHT meters (feet)	WIDTH meters (feet)	LENGTH meters (feet)
Radar set	35,534 (79,008)	3.61 (11.83)	2.87 (9.42)	16.83 (56.08)
Engagement control station	16,963 (37,398)	3.53 (11.58)	2.62 (8.58)	9.65 (31.67)
Antenna mast group	14,742 (32,500)	3.66 (12.0)	2.44 (8.58)	10.37 (34.0)
Electric power plant with fuel trailer	15,132 (32,500)	2.63 (8.62)	2.46 (8.07)	14.38 (47.17)
Launching station	35,721 (79,380)	3.99 (13.1)	2.87 (9.42)	16.83 (56.08)
Information and coordination central with electric power unit	19,862 (43,789)	3.53 (11.58)	2.49 (8.17)	14.38 (47.17)
Communications relay group with electric power unit	17,867 (39,389)	3.53 (11.58)	2.46 (8.07)	14.38 (47.17)
Guided missile transporter	25,465 (56,140)	2.84 (9.33)	2.44 (8.0)	10.17 (33.38)

VEHICLE SIZE AND WEIGHT

Although the Patriot missile system is fully mobile with all tactical equipment mounted on wheeled trailers or vehicles, Patriot equipment is both oversize and heavy. For this reason, mobility is limited to road surfaces, bridges, and terrain that can be negotiated by these oversize vehicles. The illustration on page 7-2 provides a listing of weights and overall dimensions of Patriot equipment in a road march configuration. (All dimensions include authorized prime movers.)

VEHICLE WEIGHT CLASSIFICATIONS

As can be seen by the road march weights and dimensions illustration, personnel conducting either route reconnaissance or road movements and all vehicle drivers must be extremely conscious of the bridge classification system explained in FM 5-36. The Patriot vehicle expedient classification guide illustration lists vehicle classifications for the major items of Patriot equipment. Calculations were made for vehicle class number being 85 percent of the gross curb weight.

PATRIOT VEHICLE EXPEDIENT ★ CLASSIFICATION GUIDE

EQUIPMENT	CLASS NUMBER
RADAR SET	34
ENGAGEMENT CONTROL STATION	16
ANTENNA MAST GROUP	14
ELECTRIC POWER PLANT WITH FUEL TRAILER	14
LAUNCHING STATION	34
INFORMATION AND COORDINATION CENTRAL WITH ELECTRIC POWER UNIT	19
COMMUNICATIONS RELAY GROUP WITH ELECTRIC POWER UNIT	17
GUIDED MISSILE TRANSPORTER	24

SITING AND ALIGNMENT ACCURACIES

RADAR SET	
SITE:	± 40 METERS
ALTITUDE:	± 10 METERS
AZIMUTH:	± 2.8 MILS IF SURVEY LEVEL OF CONFIDENCE IS ENTERED INTO TAB 81 ± 5.8 MILS IF COMPASS LEVEL OF CONFIDENCE IS ENTERED INTO TAB 81
ROLL:	± .3 MILS
CROSS ROLL:	± .3 MILS
LAUNCHING STATION (RELATIVE TO THE RADAR SET)	
SITE:	± 10 METERS (± 10 PERCENT OF SEPARATION DISTANCE BETWEEN THE LAUNCHING STATION AND RADAR SET UNDER HASTY SITING CONDITIONS)
ALTITUDE:	± 2 PERCENT OF SEPARATION DISTANCE BETWEEN THE LAUNCHING STATION AND RADAR SET
AZIMUTH:	± 2 MILS

Survey

★ The effectiveness of a Patriot battalion depends on accurate siting and alignment of the battery radar sets and their respective launching stations. Accurate siting and alignment of the radar sets are essential for the battalion FDC to correlate targets, perform site calibration, and to triangulate. Therefore, without accurate siting and alignment information, a battalion FDC cannot effectively manage the air battle. Further, without accurate siting and alignment information for the launching stations and their respective radar sets, a battery's ability to acquire missiles with the radar set is jeopardized. Thus, it is incumbent upon the commander to assure the unit's proficiency in survey. The required siting and alignment accuracies for the radar set and launching station are shown in the illustration above.

★ The normal technique for obtaining survey data is to employ the battalion survey section. Alternate techniques are deliberate and hasty surveys conducted by the firing batteries. Site survey by an engineer or field artillery survey crew is another possibility. However, it is not very likely because the number of survey crews available in any theater is limited.

Battalion Survey Section

★ The survey section is responsible for providing survey data to the firing batteries for siting and orienting the radar sets and launching stations. A survey information center and two survey crews compose the survey section. Each crew has one position and azimuth determining system as the primary survey tool. Each crew also has a theodolite as the alternate survey tool, which is used only if the primary is inoperative. The survey section works under the operational control of the S3. The survey information center sends a survey crew to survey each battery position. Depending on the situation, the survey crew may go directly to the new position, to a rendezvous position to link up with the battery RSOP party, or to the current battery position. Once at the new position, the survey crew obtains grid coordinate data on the radar set and launching station sites identified by the RSOP OIC. The survey crew also provides azimuth data to a known data point to establish a north reference.

Deliberate Survey

★ When the battalion survey section is not able to provide survey data to the firing batteries, the battery should perform a deliberate survey. The following deliberate survey techniques from FM 6-2 exceed the minimum accuracy requirements when performed with an M2 aiming circle. Refer to FM 6-2 for detailed procedures.

Traverse from a Survey Control Point Closed on the Original or a Second Survey Control Point. Traverse provides highly accurate siting and alignment data. Two methods of distance determination can be used with traverse. Horizontal taping is the most accurate and preferred method. Subtending is an alternate method; however, with subtending, accuracy is relative to the size of the measured target. Therefore, subtending a 60 meter baseline is much more accurate than subtending a 6 foot range pole.

Simultaneous Observation of a Celestial Body. Simultaneous observation of a celestial body provides the ability to transfer azimuth control. It requires a base station with an accurately aligned M2 and radio communications between the base station and the flank (receiving) station.

Polaris-Kochab. Polaris-Kochab method of orienting the M2 aiming circle provides highly accurate alignment to true north.

Hasty Siting and Alignment

Hasty methods can be used to acquire siting and alignment data for the radar sets and launching stations. However, these methods are subject to larger errors than obtained using deliberate survey techniques and do not provide a self check for accuracy. Hasty methods should not be used unless the tactical situation does not provide the time for deliberate survey. Once emplaced with hasty techniques, the siting and alignment should be redetermined by deliberate survey as soon as possible. The hasty methods are—

- Resection (siting).
- Graphic resection (siting).
- Map spotting (siting).
- Declinated M2 aiming circle magnetic needle orientation (alignment).

The Survey Team

Accurate determination of unit siting and alignment data is dependent upon the survey team's proficiency with deliberate survey techniques. This proficiency is itself dependent upon survey team cohesion and frequent reiterative training. The formalization of survey duties into a unit TSOP is encouraged to reduce the time required for survey. The following illustration shows the composition of a typical survey team. These team members are part of the RSOP party shown on page 7-6.

★ COMPOSITION OF A TYPICAL SURVEY TEAM

SURVEY OFFICER	(ALSO RSOP OIC)	1
SURVEY NCOIC	(TI-59 COMPUTER)	1
M2 AIMING CIRCLE OPERATOR		1
TAPE MAN		2
FORWARD STATION OPERATOR		1
REAR STATION OPERATOR	(MANUAL COMPUTER)	1
		7

Planning the Survey

★ Planning the survey includes an evaluation of—

- Time available.
- Terrain.
- Weather.
- Trigonometric list of the destination area.
- Ability to transfer azimuth control via radio with simultaneous observation.

Based upon this evaluation, the survey officer decides upon the techniques to be used to conduct the survey. The deployment of the survey team may be in advance of the RSOP party's deployment. However, it normally deploys as part of the RSOP party since many personnel of the RSOP party perform two or more duties. To facilitate the survey planning, the battalion should acquire trigonometric lists of the survey control points in its area of operation. Trigonometric lists are generated and maintained by the survey section of corps and division field artillery battalions.

ROAD AND TERRAIN COMPETITION

Two aspects often overlooked in RSOP planning is the competition between Patriot units and other units of the supported force for use of roads and key terrain. Due to the type, size, and weight of equipment, Patriot flexibility is limited. Even though the number of vehicles in a Patriot unit is comparatively small, use of road nets within corps and division areas almost always requires clearance from the area commander. In many cases, this will also be true in the communications zone.

Equally important is the coordination required to insure that the positions selected for the battalion CP and firing batteries are available for occupation and use. Again, this requires close coordination with the area commanders. In a corps area, the corps air defense officer can assist in obtaining use of the required real estate, particularly if he is also the ADA brigade commander. When it is necessary to position a Patriot unit within a division area, the SHORAD battalion commander, as division air defense officer, serves both as a point of contact and an ally in coordination with the division G3 for obtaining use of real estate. The Patriot ADA coordination officer usually establishes liaison with the division ADA officer for this purpose.

Normally, necessary coordination for road clearances and use of real estate is made at ADA brigade or battalion level. However, in a particularly fast-moving situation, a Patriot battery commander might have to make the necessary arrangements with the local commanders.

MOVING TO NEW POSITIONS

The procedures used to conduct RSOPs are SOP items and must be part of every unit's tactical preparation. These procedures must be thoroughly understood and practiced repeatedly by unit personnel. SOPs must cover both day and night movements and occupations of position. They should include loading plans for each way in which a unit might move—rail, sea, air, and road.

The three RSOP phases are—

1. Conduct the reconnaissance and select the position.

2. Move the unit to the position.

3. Occupy, organize, and improve the position.

CONDUCT THE RECONNAISSANCE AND SELECT THE POSITION

Basic actions required to conduct the reconnaissance and select the position include—

- Receive the battalion movement warning order.
- Issue the battery movement warning order.
- Plan the reconnaissance.
- Prepare for movement.
- Reconnoiter and select the route and position.
- Plan and prepare for the occupation.

Receive the Battalion Warning Order and Issue the Battery Warning Order

The movement warning order is issued by the headquarters directing the move, modified as required at each command level, and issued to the next lower echelon. The movement warning order can be written or verbal and can be passed in person or over tactical communications. It must include (as a minimum) the new mission, the coordinates of the new position, and times of release for march order, crossing the start point (SP) and release point (RP), and assuming operational status at the new position.

Plan the Reconnaissance

Planning includes deciding—

- Routes to be used and positions to be examined.
- Composition of the reconnaisance party (see the composition of a typical RSOP party illustration).
- Extra supplies and equipment needed.

★ **COMPOSITION OF A TYPICAL RSOP PARTY**

OIC (SURVEY)	1
NCOIC (SURVEY)	1
CREWMAN (NBC)	1
CREWMAN (MINE DETECTION, EQUIPMENT GUIDES)	2
CREWMAN (SECURITY, SURVEY)	6
DRIVERS (EQUIPMENT GUIDES, SURVEY)	3
	14

Normally, the RSOP party organization is provided in unit SOPs to fit most tactical situations. When issuing the battery warning order to the RSOP leader, the commander should direct any changes he feels necessary. The actions taken to form the RSOP party must not affect the mission capability of the unit. The illustration above shows the make-up of a typical firing battery RSOP party. Those members of the RSOP party who are also on the survey party are identified. To provide for security while on the move and at the new position, the RSOP party should take three M249 machine guns.

Prepare for Movement

Preparing for movement includes briefing personnel on the mission, plans, and requirements and instructions on operations to be conducted during the absence of the commander. All elements of the standard five-paragraph order should be addressed in the briefings. Nonmission-essential equipment may be broken down at this time.

Reconnoiter and Select the Route and Position

★ As soon as the RSOP preparations are completed, the leader departs with the reconnaissance party. He reconnoiters the routes to the new position and the position itself.

Route reconnaissance. Route reconnaissance includes—

- Insuring that the route meets equipment, height, weight, and width requirements.
- Avoiding built-up areas when possible. If not, insuring Patriot equipment can pass through such areas.
- Noting possible ambush locations.
- Marking necessary fuel and rest stop locations.
- Determining if road markers or road guides are needed.
- Finalizing the route.
- Selecting alternate routes.

Position reconnaissance. Selected positions are reconnoitered for suitable sites. The position reconnaissance insures that the position—

- Provides immediate access.
- Provides concealment.
- Affords good radar coverage. (RSOP party prepares hasty coverage diagrams. See FM 44-15-1.)
- Meets equipment requirements (size, slope, firmness, etcetera). Engineer support is requested, if necessary.
- Is free of enemy ground forces and NBC contamination.

Sites within the position are selected for—

- Patriot equipment—which requires commanding fields of view and fire, dispersal to maximum cable length, concealment, and relatively level terrain.
- Position security—which requires mutually supporting ground fire, cover and concealment, all-around defense perimeter, and communications.
- Support elements—which require cover, concealment, and dispersion.

Plan and Prepare for the Occupation

Based on sites selected for Patriot equipment, plans are made for organizing the order of march of the main body of the unit as well as briefing guides as to routes from the RP to each site. Sequence of the order of march must allow for—

- Orderly access to the area relative to different items of equipment and equipment sites.
- Quickest emplacement times for critical items of equipment.
- Convoy protection in case of air attack or ambush.

MOVE THE UNIT TO THE POSITION

Unit SOPs provide the details of Patriot

road movements and should include responsibilities, road march procedures, convoy organization and formation, routes and guides, and both air and ground security measures to be taken during the road march. Significant events of road movement include—

- March order and load equipment.
- Assemble the march column.
- Cross the SP.
- Move to the new position.
- Clear the RP.

March Order and Load Equipment

The time when the Patriot unit is released from the air battle is called release time and is normally specified in the movement order. At release time, all mission-essential equipment can be march ordered. The march ordering of equipment is an activity in which significant amounts of time can be saved. This savings depends on the quality, type, and amount of crew drill training. The march order crew drill must be practiced regularly. Because many Patriot unit moves are conducted at night, crew drill must be practiced under blackout conditions. Remember, as much non-mission-essential equipment as possible should be march ordered and loaded prior to release time.

Assemble the March Column

The order of march is designated by the battery commander. This is normally an SOP item and is based on the factors in planning and preparing for the occupation. Stinger crews are positioned in the convoy to provide weighted coverage toward the front and rear. M60 machine guns are positioned to weight the front and rear of the convoy. M249 machine guns are positioned throughout the convoy. Vehicles must remain dispersed until shortly before the convoy departs. Frequently vehicles will be dispersed into two nearby assembly areas — one for the maintenance platoon and battery headquarters and one for the fire control platoon and launcher platoon.

Prior to departure, the drivers and air guards of each vehicle are briefed on the route of march, actions to be taken upon ground or air attack, convoy speed, planned halts, and actions to be taken when vehicles break down. During the briefing, strip maps should be distributed.

Cross the SP

Because the unit will usually have road clearance only for the amount of time needed to road march to the RP, the unit should cross the SP at the time specified in the movement order. Crossing the SP too early or late may result in two convoys competing for the use of the same route. Interval between vehicles is established at the SP.

Move to the New Position

Procedures in the unit motor movements SOP should be followed. Since Patriot units in convoy are vulnerable to both ground and air attack, security procedures must be routinely practiced. Radio silence should be maintained to reduce the possibility of compromising the new unit position and of the enemy detecting and attacking the convoy.

Clear the RP

The RP must be cleared by the entire convoy at the correct time so that there are no road clearance conflicts with other convoys. The RSOP party equipment guides meet the battery vehicles and quickly guide them to the correct sites. First priority goes to siting mission-essential Patriot equipment.

OCCUPY, ORGANIZE, AND IMPROVE THE POSITION

When the Patriot unit clears the RP, guides from the reconnaissance party lead each item of equipment to the site selected for it during the reconnaissance. The most critical task is to make the unit operational as soon as possible. Tasks that are accomplished during occupation and organization of a position are—

- Emplace the Patriot system.
- Establish communications.

- Assume operational status.
- Improve the area (camouflaging and revetting).
- Establish local security.
- Select alternate positions.
- Prepare hasty radar coverage diagrams.

Emplace the Patriot System

Once the main body reaches the position, all unit efforts are focused on rapidly attaining a minimum engagement capability. Teamwork is the key to becoming mission capable as rapidly as possible. The only personnel not assigned emplacement tasks are the security forces.

Establish Communications

The battery normally monitors the battalion AM command net while on the move. However, every effort is made to maintain radio silence. Since communications systems are integral to the Patriot system, data link terminal and UHF communications are established simultaneously with the emplacement of the Patriot system. Priority of effort should go first to establishing data link terminal and then UHF communications. Data circuits are established prior to voice circuits.

Assume Operational Status

All Patriot mission-essential equipment is emplaced and integrated with the engagement control station. The firing battery must also be integrated with the battalion FDC via the UHF system. The battery is then prepared to conduct ADA operations in an integrated battalion defense.

Improve the Area (Camouflaging and Revetting)

Erecting camouflage systems will reduce the possibility of visual detection. Normally, positions will not be occupied long enough to make the construction of revetments worthwhile, unless engineer equipment is readily available. Improving the position should continue as long as the position is occupied. Additional operations security measures are found in chapter 8.

Establish Local Security

★ Members of the reconnaissance party provide initial security of the new position. They select perimeter defense positions, establish sectors of fire for M60 machine guns, and prepare range cards. All personnel not needed to prepare the Patriot system for operation are integrated into the ground defense. Once the unit becomes operational, members of the fire control and launcher platoons will replace many of those ground defense personnel from the maintenance platoon and battery headquarters. Stinger teams are deployed as the main body arrives. This results in one launching station taking more time to be emplaced; however, there is no adverse impact on the firing battery reaching minimal engagement capability. Ground defense is explained in greater detail in chapter 8.

Select Alternate Positions

Alternate positions are positions generally close to the primary position from which the unit can accomplish its mission if the primary position becomes untenable or unsuitable. Tentative alternate positions are selected during the map reconnaissance of the primary position. RSOPs for alternate positions are conducted as soon as the unit has become operational at the primary position.

Prepare Hasty Radar Coverage Diagrams

Radar coverage diagrams are graphic representations of radar target detecting and tracking capabilities. FM 44-15-1 explains how to prepare radar coverage diagrams. Hasty coverage diagrams are forwarded to the battalion S3 where they are evaluated to determine if there are any gaps in the battalion defense. The masked terrain maps which are generated by the Patriot system support fire direction decisions; however, they do not support defense planning.

FIRING BATTERY POSITION REQUIREMENTS

★ Primary areas selected in a new position are those for the fire control platoon, launcher platoon, and battery support elements. In addition, sites are selected for security forces and the Stinger teams. The site selected for the radar set provides the basis for siting other major items of equipment. Guidelines for site selection are listed below.

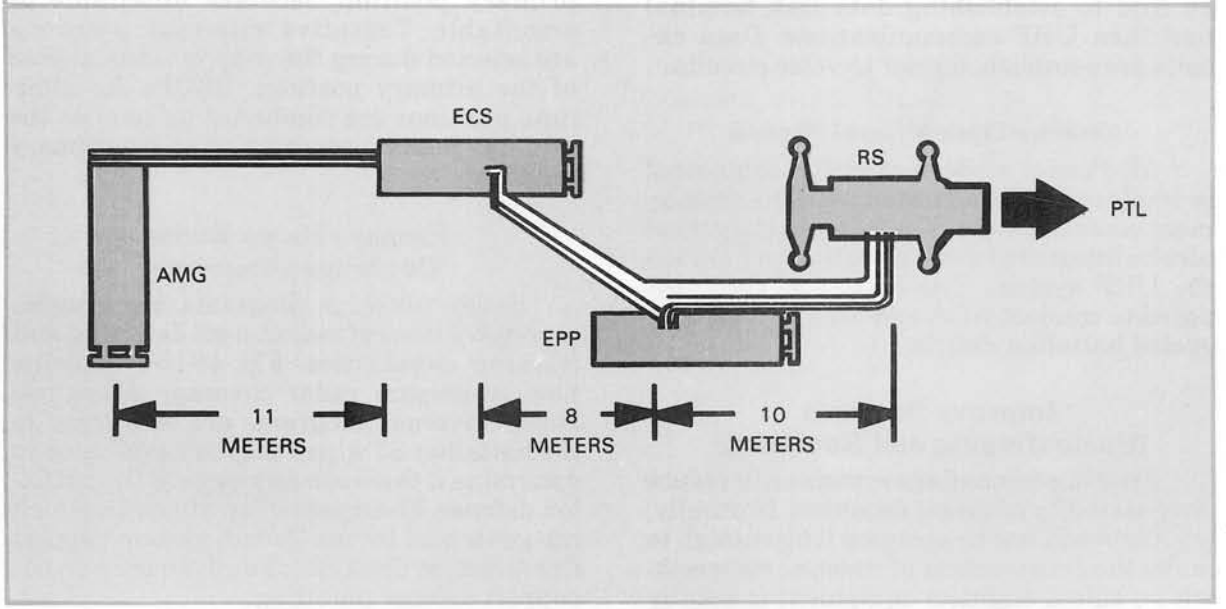
FIRE CONTROL PLATOON

★ The typical emplacement configuration for the fire control section is shown here. Note that the engagement control station, electric power plant, and antenna mast group are sited to the rear of the radar set, thereby keeping them out of the primary and secondary search sectors of the radar set. The section requires an area approximately 30 meters by 35 meters. Data and power cable lengths limit the distance the radar set, engagement control station, electric power plant, and antenna mast group can be set apart. (Cable lengths are shown in cable lengths illustration.)

CABLE LENGTHS

CABLE	TOTAL LENGTH meters (feet)	USEABLE LENGTH meters (feet)
POWER	23 (75)	16 (52)
RADAR/WEAPON CONTROL INTERFACE UNIT	38(125)	30 (100)
ELECTRIC POWER PLANT SIGNAL	23 (75)	16 (52)
ANTENNA MAST GROUP	15 (50)	11 (35)

TYPICAL EMPLACEMENT CONFIGURATION FOR THE FIRE CONTROL SECTION



Radar Set Considerations

The radar set must have an unobstructed field of view along the primary and secondary sectors of fire. Continuous-wave clutter sources, such as generators, should not be located in radar field of view. A radiation hazard exists in the track sector 120 meters forward of the radar set. Terrain slope must not exceed 10°. Radar set site universal transverse mercator grid coordinates must be determined through resection, map spotting, or measurements from benchmarks if engineer survey data is not available. If sited in a tree line on the forward slope of a hill, siting must still allow for reorientation to secondary target lines.

Engagement Control Station Considerations

★ The engagement control station is sited to the rear of the radar set and in a concealed area, if possible. Orient the door away from the radar set to minimize any RF hazard.

Antenna Mast Group Considerations

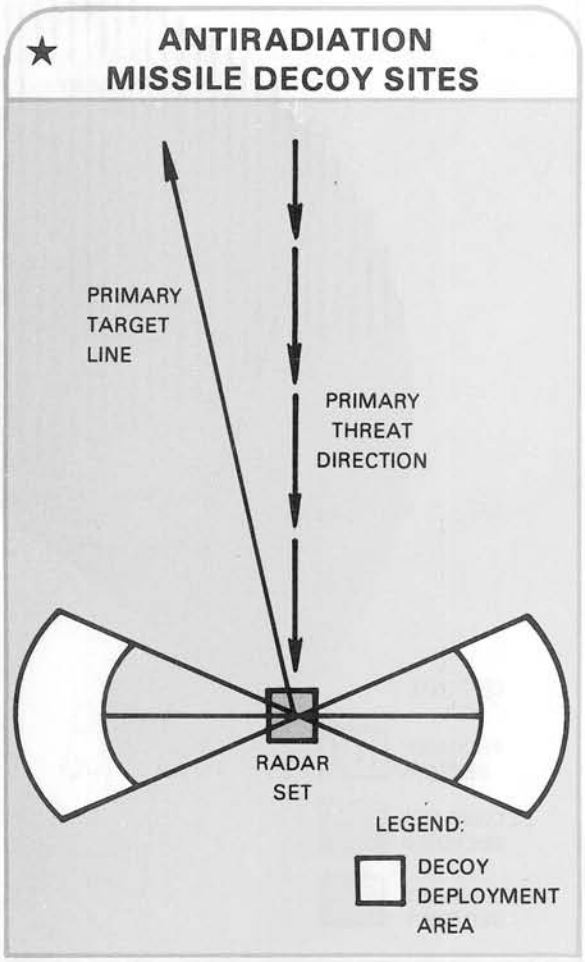
★ The primary consideration in siting the antenna mast group is to provide line-of-sight communications to the battalion FDC and adjacent firing batteries (or to the appropriate relays). As with the engagement control station, the antenna mast group must be to the rear of the radar set, in a concealed area (if possible). The antenna mast group requirement for level terrain is by far the most stringent leveling requirement of all pieces of Patriot equipment. The antenna mast group must be leveled within one half of a degree in both pitch and roll.

Electric Power Plant

★ The electric power plant is sited to the rear of the radar set in a concealed area, if possible.

Antiradiation Missile Decoys

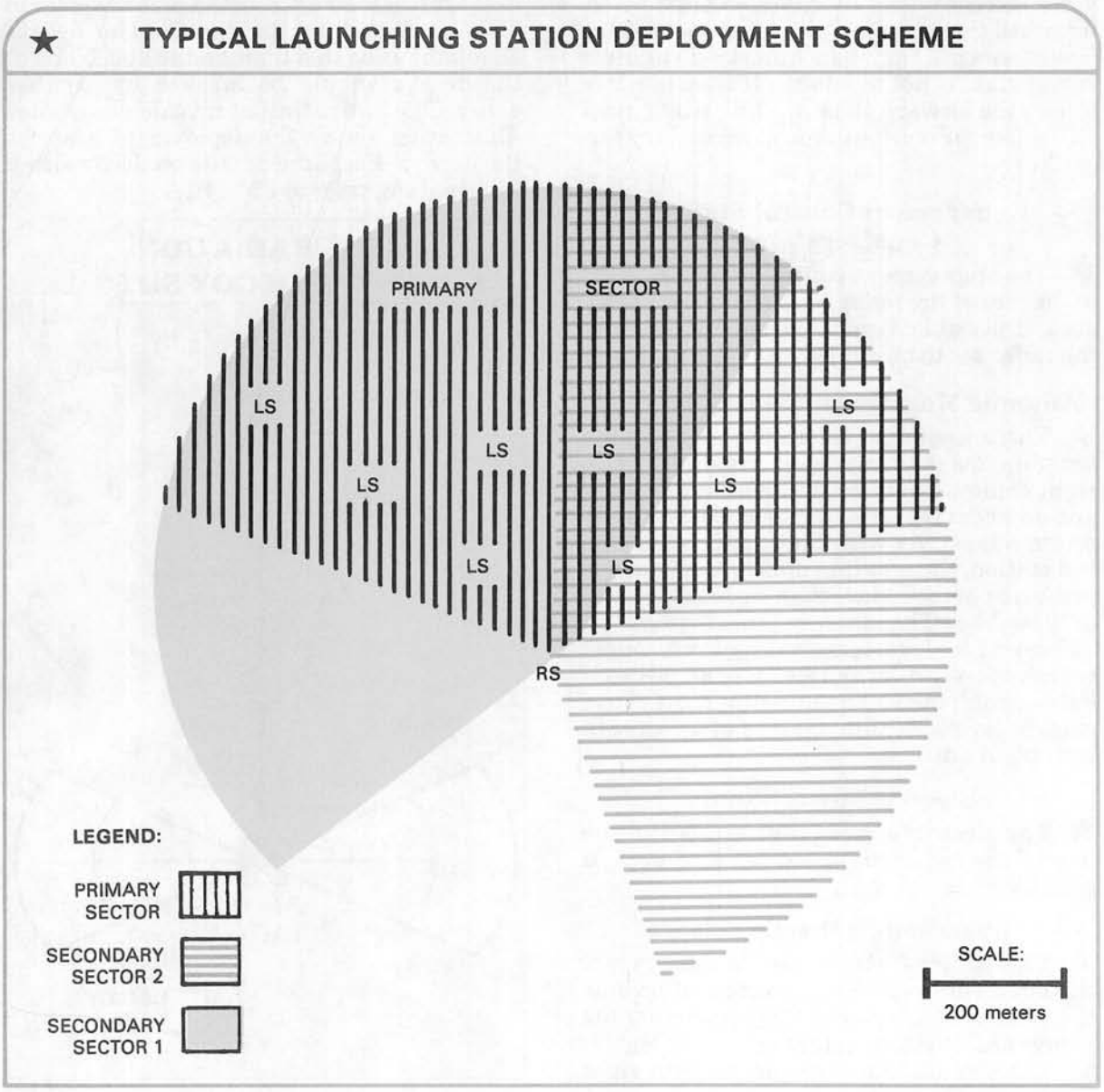
★ The antiradiation missile decoys are sited in an area 400-600 meters on either side of the radar set. It is immaterial whether the decoys are sited to the right or the left. But, in no case should decoys be placed both right and left of the radar set. The emplacement area is further limited in azimuth. The decoys can be emplaced in an azimuth limited sector to either side of a line perpendicular to the primary threat direction. The primary threat direction and the primary target line may not coincide. Each decoy should have clear line of sight in the primary threat direction. The decoy furthest away from the radar set should also be closest to the threat. The decoys should be sited in a diamond shape. None of the decoys should be masked by another decoy. The antiradiation missile decoy sites illustration shows the deployment area for the decoys. For more details on decoy siting information, refer to FM 44-1A.



LAUNCHER PLATOON

★ The typical launching station deployment scheme illustration shows deployment of launching stations relative to the radar set. The doctrine is to deploy so that 100 percent of the launching stations are available in the primary sector and at least 50 percent of the launching stations are available if the radar set is reoriented to cover either of the secondary sectors.

★ TYPICAL LAUNCHING STATION DEPLOYMENT SCHEME



Launching Station Considerations

The launching station site must be accessible. The ground must be able to support the weight of the launching station. Terrain slope must not exceed 10 degrees. A 6-meter by 15-meter clear area is required for the emplacement of the launching station. (If missile reload is conducted or planned at the site, an additional 10 by 15 meters is required to allow a guided missile transporter to park alongside the launching station.) Because of missile backblast, approximately 90 meters behind the launching station must be kept clear of personnel and equipment. The site must be inside a sector which is 20 degrees wider on each side than the radar track sector. Minimum and maximum separation distances between the radar set and launching stations are 120 and 1,000 meters respectively. Minimum distance between launching stations is 90 meters. Grid coordinates and azimuth reference to the radar set for each launching station are determined as time permits. First priority is given to launching stations that have line-of-sight. Second priority is given to launching stations that do not have line-of-sight to the radar set.

The alignment of the Patriot radar set and launching stations must be with respect to true north. This is because system coordinates used by Patriot are in longitude and latitude. Therefore, the north reference for the radar set and launching stations provided by the survey element of the RSOP must be a true north reference.

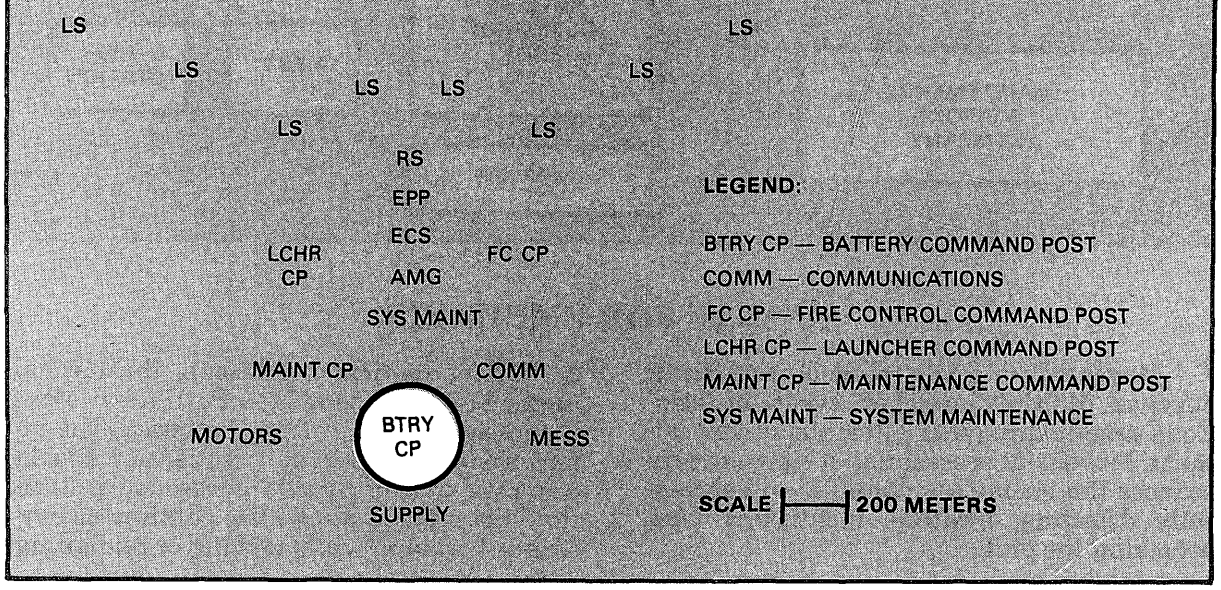
On-Site Missile Reload Considerations

A missile storage area, if required, is also selected. Pre-positioned guided missile transporter or guided missiles would be sited here until needed.

SUPPORT ELEMENTS

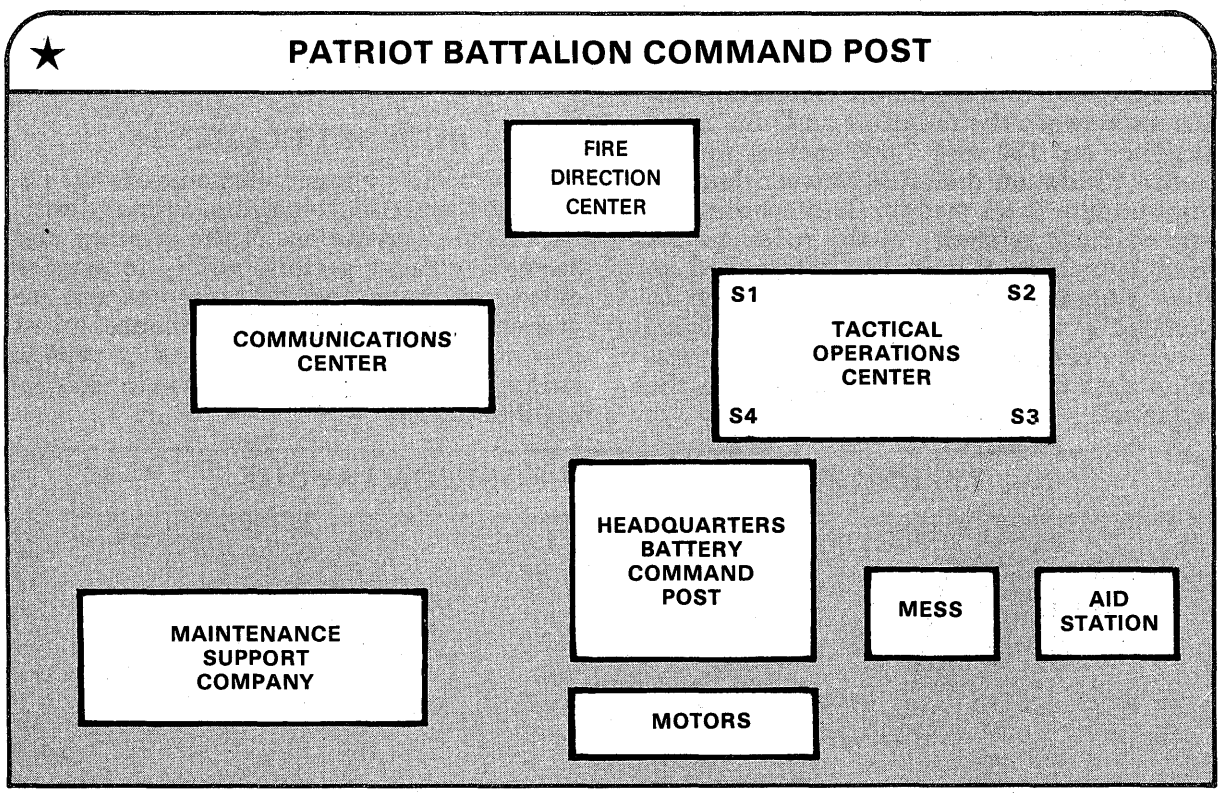
The battery support elements are sited to support the tactical elements. Primary criteria include staying out of the primary and secondary radar sectors, ability to provide effective support, good access routes, and use of areas that provide cover and concealment and enhance camouflage efforts. A typical firing battery position is shown in the following illustration.

TYPICAL FIRING BATTERY POSITION LAYOUT



BATTALION COMMAND POST POSITION REQUIREMENTS

The battalion command post contains the battalion tactical operations center, the fire direction center, and the battalion support elements. The Patriot battalion command post illustration shows a typical deployment of the CP. The primary consideration for positioning the CP is a location from which command and control of the firing batteries can be accomplished. This involves line-of-sight communications directly (or through communications relay groups) with the firing batteries, higher headquarters, and adjacent battalions. As with any other position, access to and within the position, security, cover and concealment, trafficability, and room for support elements are considerations. The battalion CP may be collocated with, or adjacent to, a firing battery to assist in local security and to reduce communications requirements. In some instances it may be advantageous to deploy the battalion support elements to a separate position to facilitate the support forward concept and to decrease the likelihood of detection and attack.



POINTS FOR EMPHASIS

Movement is a key method of insuring survival. Multiple launches reveal unit positions despite any other attempts at concealment. Movement is essential; it significantly reduces the enemy's probability of successfully detecting, locating, identifying, and attacking the unit.

★ Under tactical conditions, the normal method of movement for a Patriot battalion is by leap-frogging firing batteries. The information and coordination central should be moved during periods of lessened air traffic. This method allows the continuous coverage of an area while moving or realigning

the defense. In the extremely fluid environment of the modern battlefield, the RSOP party may be required to move from the occupation of a selected fire unit position immediately into an RSOP for the next fire unit position. This may entail the almost continuous movement of the RSOP party. The ability of the battlion FDC to manage the air battle is dependent upon the accuracy of the siting and alignment information of the batteries' radar sets. The ability to successfully engage aircraft requires accuracy of the launching station and radar set siting and alignment information. Without adequate accuracies, the functions of target correlation, site calibration, triangulation, and even missile acquisition are not assured. The Patriot battalion must maintain proficiency in the survey techniques which give the required accuracies.

The following illustration shows a typical combat day movement schedule. The day is divided into eight 3-hour blocks. Air defense warnings (red, yellow, and white) are shown for each three-hour block. At no time are more than two firing batteries or one firing battery and the ICC conducting movement. During the period of a higher air defense warning only one unit is moving.

As can be seen from the preceding discussion, RSOP with Patriot units may be continuous and complex. It is mandatory that careful planning be accomplished for the execution of the RSOP to be successful. With adequate training, many of the actions of the RSOP become "second nature" and are accomplished routinely. A Patriot unit can perform its mission only when in position and ready to fire. The time required for unit movement is out-of-action time. Units move frequently to accomplish their mission and survive on the battlefield. The Patriot unit must be able to move and regain an operational capability at a new position in the shortest possible time. This can only be accomplished through detailed, practiced RSOP procedures, that cover both day and night operations.

★ TYPICAL COMBAT DAY MOVEMENT SCHEDULE

3-HOUR BLOCK	1	2	3	4	5	6	7	8
AIR DEFENSE WARNING	W	W	W	W	W	Y	Y	R
BATTALION								
HHB	S	S	S	M	S	S	S	S
A	M	S	S	M	S	S	S	S
B	M	S	S	S	M	S	S	S
C	S	M	S	S	M	S	S	S
D	S	M	S	S	S	M	S	S
E	S	S	M	S	S	S	M	S
F	S	S	M	S	S	S	S	S
BATTALION MINUS								
HHB	S	S	S	M	S	S	S	S
A	S	S	M	S	S	S	S	M
B	S	M	S	S	S	S	M	S
C	M	S	S	S	S	M	S	S

LEGEND:
W — WHITE M — MOVEMENT S — STATE OF READINESS/EMISSION CONTROL Y — YELLOW R — RED

☆U.S. GOVERNMENT PRINTING OFFICE 1986 491-885/40063