FM 3-01

U.S. Army Air and Missile Defense Operations

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HEADQUARTERS, DEPARTMENT OF THE ARMY

*FM 3-01

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U.S. Army Air and Missile Defense Operations

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Preface

FM 3-01 is the Army-specific air and missile defense (AMD) publication outlining doctrinal AMD principles and guidelines. It describes how air defense artillery (ADA), the Army's dedicated component for AMD, and its organizations prepare for and conduct operations. It presents the AMD roles in support of joint unified action operations and Army unified land operations, addressing offensive and defensive, stability, and defense support of civil authorities tasks. The strategic, operational, and tactical levels of war are discussed, and AMD operations are defined in terms of their contributions to Army operations, as expressed in FM 3-0, the Army operational concept of unified land operations, and the joint counterair mission as presented in JP 3-01. FM 3-01 provides doctrinal guidance for commanders, staffs, leaders, and trainers at all levels in the operational and institutional forces, and is the basis for curricula development in the U.S. Army Air Defense Artillery School.

The primary target audience for this manual is the ADA community and Army/joint leaders and staff personnel. Other services and joint organizations may use this manual to gain insight into Army AMD operations.

Commanders, staffs, and subordinates must ensure their decisions and actions comply with applicable U.S., international, and, in some cases, host-nation laws and regulations. Commanders at all levels must ensure their Soldiers operate in accordance with the law of war and the rules of engagement (see FM 6-27).

FM 3-01 uses joint terms where applicable. Joint and Army terms and definitions appear in both the glossary and the text. Terms for which FM 3-01 is the proponent publication are marked with an asterisk (*) in the glossary. Definitions for which FM 3-01 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and referenced to the proponent publication number. All ADA-unique acronyms, with the exceptions of ADA and AMD, are spelled out the first time they are used in each of the chapters to enhance readability. Common Army acronyms are spelled out only once, the first time they are used.

FM 3-01 applies to the Active Army, Army National Guard, and United States Army Reserve forces unless otherwise stated.

The proponent for FM 3-01 is the Commandant, U.S. Army Air Defense Artillery School. The preparing agency is the United States Army Fires Center of Excellence, Directorate of Training and Doctrine, Doctrine Division. Send comments and recommendations on Department of the Army (DA) Form 2028 (*Recommended Changes to Publications and Blank Forms)*, to Directorate of Training and Doctrine, 700 McNair Avenue, Suite 128 ATTN: ATSF-DD, Fort Sill, OK 73503; by email to usarmy.sill.fcoe.mbx.dotd-doctrine-inbox@mail.mil; or submit an electronic DA Form 2028.

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Introduction

Department of Defense Directive 5100.01 charges the Army to "conduct air and missile defense to support joint campaigns and assist in achieving air superiority." FM 3-01 describes the contributions of the ADA, the Army's dedicated AMD component, to the planning, coordination, and execution of AMD operations in support of joint and Army forces in large-scale combat operations.

Air and missile defense is the direct (active and passive) defensive actions to destroy, nullify, or reduce the effectiveness of hostile air and ballistic missile threats against friendly forces and assets (JP 3-01). It includes actions that may be taken on the land, in the air, at sea, and in cyberspace and space. AMD is a key element of the defensive counterair construct for defeating air and missile threats. AMD operations are generally integrated with other offensive and defensive counterair missions within the overall counterair framework. While this manual addresses aspects of offensive counterair and passive AMD, it focuses on active AMD tactics and procedures.

FM 3-01 addresses today's operational environment which envisions threats to the Army and joint force that these forces have not faced in twenty-five years. In this environment, ADA units must adapt and prepare for large-scale combat operations in a highly contested air domain. FM 3-01 provides a doctrinal approach for ADA forces to fight future conflicts, explaining how the ADA echelons contribute to the four Army strategic roles: shape operational environments, prevent conflict, conduct large-scale ground combat, and consolidate gains.

This FM 3-01 version is organized in terms of the ADA echelons, unlike previous versions which were presented from the ADA systems' perspectives. It presents the roles, functions, and foundational principles and employment tenets of ADA echelons, from the Army Air and Missile Defense Command (AAMDC) to the air defense airspace management (ADAM) cell. It further depicts the ADA echelons in current or near-term operations, with respect to their AMD force operation and engagement operation actions, and discusses continuing challenges to these operations.

This version introduces and defines new AMD terms. It also defines older terms that are repeatedly used, but never defined, in other doctrinal AMD publications.

FM 3-01 consists of 12 chapters.

- Chapter 1 provides an overview of Army AMD. It introduces a new ADA role statement and identifies five key ADA essential capabilities. It introduces the AMD foundational principles and employment tenets. It summarizes ADA actions in support of joint and unified land operations. Chapter 1 reintroduces short-range air defense (SHORAD), a key contributor to the protection of maneuvering forces. The chapter concludes with a discussion of the training of ADA Soldiers and leaders. Numerous definitions and expanded explanations of terms are presented throughout the chapter to facilitate understanding of AMD actions and language which are applicable to all ADA echelons.
- Chapter 2 discusses the Army operations process from an AMD perspective. AMD force operations generally consist of planning and preparatory actions required to support engagements of air and missile threats. AMD engagement operations consist of all actions to execute and assess the engagements.
- Chapter 3 addresses the operational environment, focusing on air and missile threats, from rockets, artillery, and mortars to intercontinental and submarine-launched ballistic missiles, and their generic capabilities. It also addresses the challenges that U.S. forces may face from space and cyberspace threats.
- Chapter 4 describes mission command and also command and control (C2) as related to Army AMD. It discusses the principles of mission command through the AMD lens. It also presents the applicable authorities and C2 elements resident in the conduct of engagements.

- Chapters 5 through 10 address the application of the AMD operational framework and foundational principles and tenets to ADA echelons, from the AAMDC to ADAM cells in maneuver brigade formations, respectively. Each chapter presents the roles and capabilities, composition, and operations – in terms of C2, force operations, engagement operations, and sustainment operations − for the respective echelon.
- Chapter 11 describes the contributions of non-AMD Army forces to the execution of AMD operations. It summarizes C2, planning and employment, and engagement considerations with respect to air and rocket, artillery, and mortar (RAM) threats. It introduces doctrinal and operational information on the employment of maneuver force Stinger teams.
- Chapter 12 presents an overview of the ADA data and communications architecture and the linkages between Army, joint, and multinational AMD elements.
- Appendices A and B present the Army AMD strategic organizations and systems and the ADA systems (those systems that normally support the operational and tactical levels), respectively.

Based on current doctrinal changes, certain terms for which FM 3-01 is the proponent have been added, modified, or rescinded. A listing of these terms is presented in introduction tables 1 and 2 on page ix. The glossary contains the defined terms.

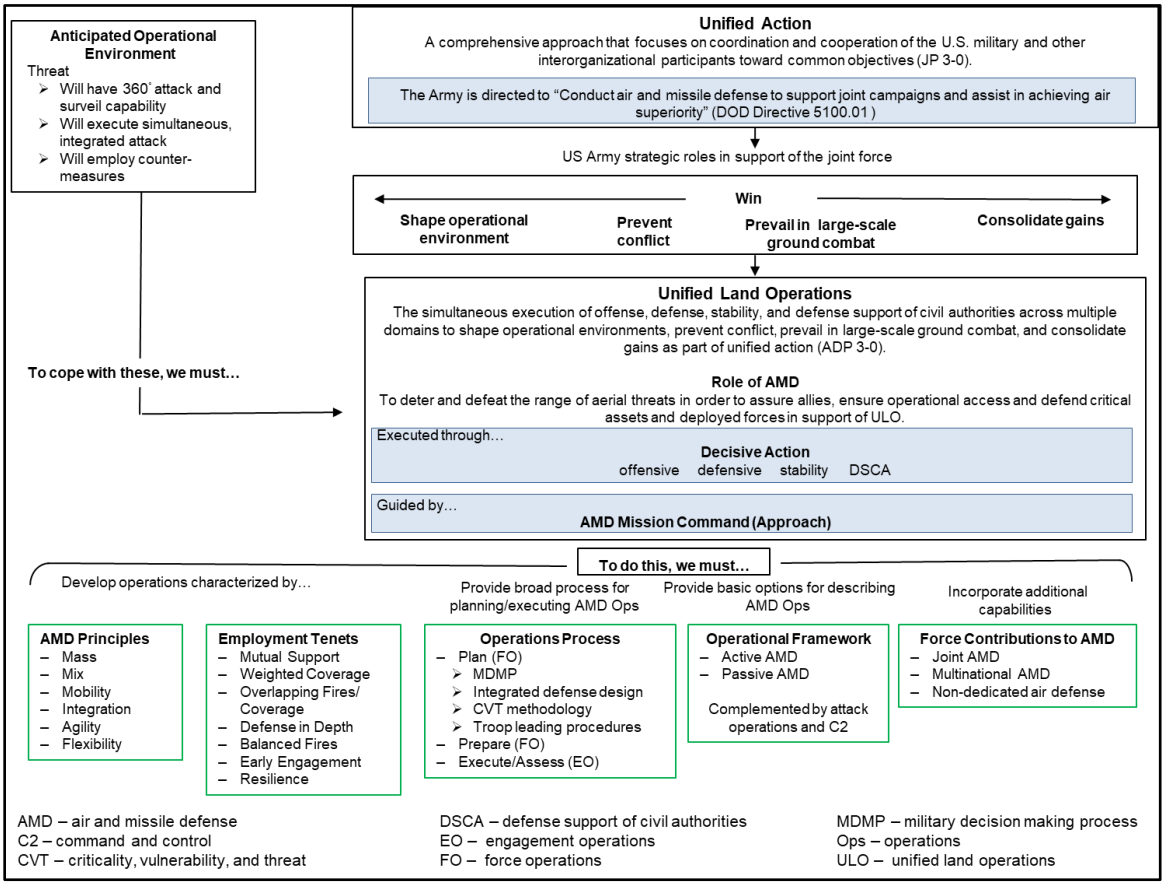
Introduction figure-1 on page x illustrates the logic chart for FM 3-01. Introduction figure-2 on page xi illustrates the ADA Doctrine publications hierarchy.

Introduction table 1. New terms and definitions

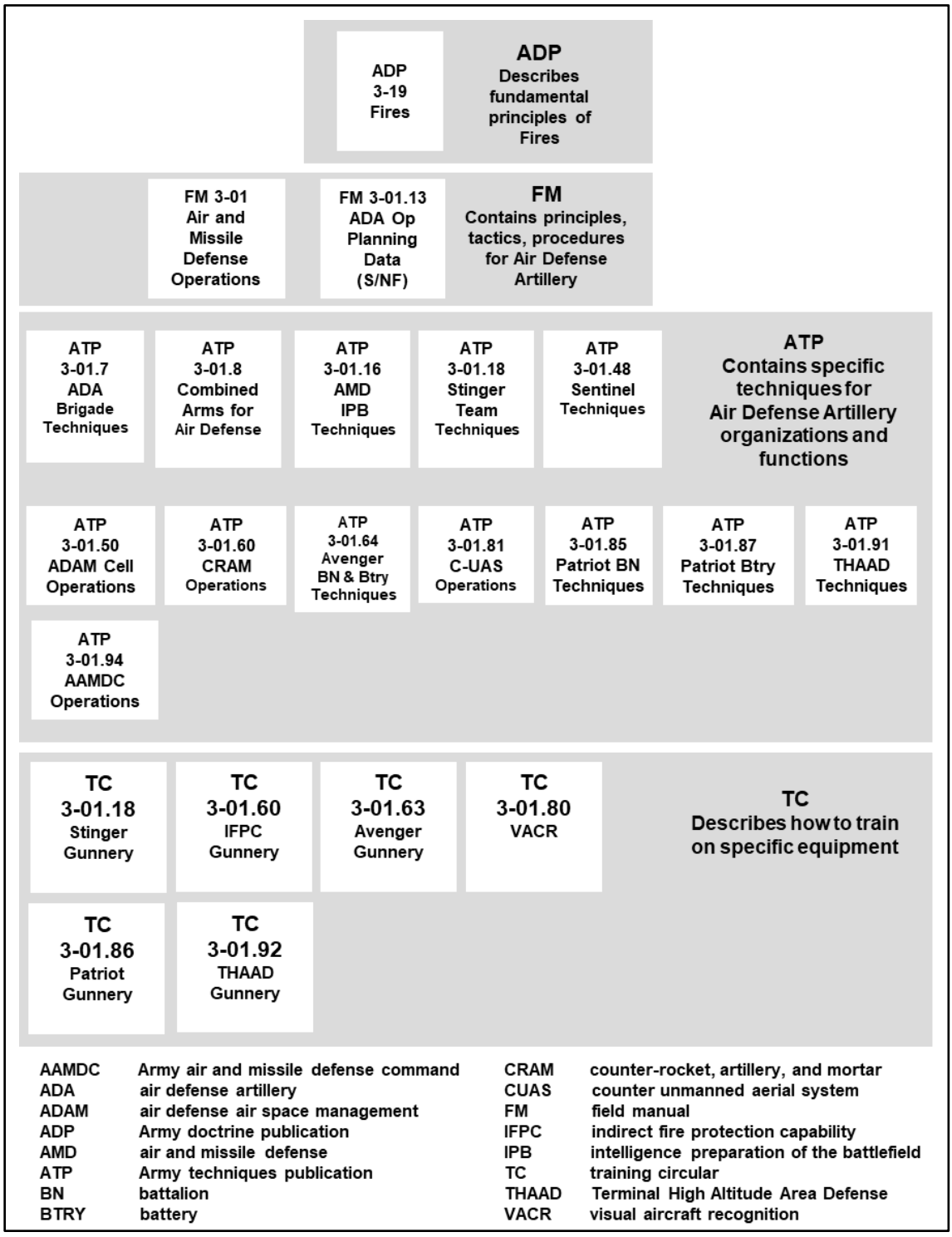
Term	*Reasoning*
Alert state	New term and definition
Assess	New term and definition
Classification	New term and definition
Complex integrated attack	New term and definition
Cover	New term and definition
Discrimination	New term and definition
Engage Hold	New term and definition
Engagement operations	New term and definition
Engagement sequence	New term and definition
Fire control quality data	New term and definition
Firing doctrine	New term and definition
Force operations	New term and definition
Keep-out altitude	New term and definition
Keep-out range	New term and definition
Kill chain	New term and definition
Lower tier	New term and definition
Methods of fire	New term and definition
Out-of-sector	New term and definition
Primary target line	New term and definition
Resilience	New term and definition
Secondary target line	New term and definition
Short-range air defense	New definition
Threat evaluation	New term and definition
Upper tier	New term and definition

Introduction table 2. Modified and rescinded Army and joint terms

Term	Reasoning
Active air defense	Modifies the term per JP 3-01
Attack operations	Adopts the definition in JP 3-01
Defended asset list	Adopts the definition in JP 3-01
Passive air defense	Modifies the definition in JP 3-01
Rules of engagement	Adopts the definition in JP 3-01
Track	Adopts the definition in JP 3-01
Weapons control status	Modifies the definition in JP 3-01
Weapons free	Adopts the definition in JP 3-01



Introduction figure-1. Logic chart for FM 3-01



Introduction figure-2. Hierarchy of ADA Doctrine publications

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Chapter 1
Army Air and Missile Defense

This chapter provides an overview of Army air and missile defense (AMD). It presents the role and capabilities of air defense artillery (ADA) and the AMD foundational principles and tenets. It continues with a brief discussion of ADA contributions to today's unified action (joint) operations and unified land operations and to tomorrow's multi-domain operations. The chapter concludes with a discussion of ADA training.

OVERVIEW

1-1. The Army supports joint unified action by conducting unified land operations. While operating as part of the joint force and working with interorganizational and multinational partners, the Army forces gain, sustain, and exploit control over land to deny its use to an enemy. They do this using combined arms formations and capabilities to defeat an enemy and establish control of areas, resources, and populations (FM 3-0). AMD is one of the Army's critical contributions to these efforts. Confronted by decentralized, networked, and adaptive enemies in dynamic and uncertain environments, the Army must possess a versatile mix of capabilities, formations, and equipment to conduct AMD. The ADA force must deter and defeat air and missile threats in support of joint campaigns and assist in achieving air superiority to assure victory in a complex and uncertain world.

1-2. *Air and missile defense* is the direct (active and passive) defensive actions taken to destroy, nullify, or reduce the effectiveness of hostile air and ballistic missile threats against friendly forces and assets (JP 3-01). AMD is embedded in the defensive counterair portion of the joint counterair operational framework. (See paragraph 1-3) AMD is used consistently throughout this document to refer to defensive counterair actions and to the capabilities of other service and multinational partners involved in the counterair fight (for example, Navy AMD). Though not specifically addressed in the AMD definition, AMD implies an interdependency of capabilities across the services and, often, with multinational forces. *Air defense artillery* is defined as weapons and equipment for actively combating air targets from the ground (JP 3-01); more precisely, ADA is the dedicated Army systems, personnel, and forces that provide active, land-based defense against air and missile attacks. ADA forces execute AMD operations. ADA is used consistently throughout the document as the Army's dedicated AMD force; however, there are occasions where "Army AMD" appears in lieu of ADA, generally when addressed in connection with other service AMD capabilities, such as Navy AMD, or when referring to ADA and other Army elements that conduct AMD operations, such as the Joint Tactical Ground Station (JTAGS).

1-3. The joint counterair operational framework is based on the integration of offensive and defensive counterair operations. *Offensive counterair* are offensive operations to destroy or neutralize enemy aircraft, missile launch platforms, and their supporting structures and systems both before and after launch, and as close to their sources as possible (JP 3-01). Attack operations are the predominant offensive counterair operations mentioned throughout this document. Attack operations include offensive action by any part of the joint force in support of the offensive counterair mission against surface targets which contribute to the enemy's air and missile capabilities (JP 3-01). Offensive actions may be conducted before, during, and after launch and, though focused on surface targets in the above definition, can include attacks against airborne command and control (C2) platforms. *Defensive counterair* are all defensive measures designed to neutralize or destroy enemy forces attempting to penetrate or attack through friendly airspace (JP 3-01). Defensive counterair consists of two operational elements: active AMD and passive AMD.

- Active AMD operations. Direct defensive actions taken to destroy, nullify, or reduce the effectiveness of air and missile threats against friendly forces and assets. Active AMD includes *air defense* (defensive measures designed to destroy attacking aircraft and aerodynamic missiles,

or to nullify or reduce the effectiveness of such attack [JP 3-01]) and ballistic missile defense (defensive measures designed to destroy attacking enemy ballistic missiles, or to nullify or reduce the effectiveness of such attack [JP 3-01]). Though not included in the definition of active AMD operations, counter-rocket, artillery, and mortar (C-RAM) is a fundamental part of active AMD. C-RAM operations are defensive measures to destroy, nullify, or reduce the effectiveness of rocket, artillery, and mortar (RAM) threats. For, simplicity sake, air, ballistic, and RAM threats are generally referred to as "air and missile threats" hereafter.

- Passive AMD operations. All measures, other than active AMD, taken to minimize the effectiveness of hostile air and ballistic missile threats against friendly forces and critical assets These measures include detection, warning, camouflage, concealment, deception, dispersion, hardening, and the use of protective construction (JP 3-01).

Note. Fixed-wing aircraft, rotary-wing aircraft, cruise missiles, and unmanned aircraft systems (UAS) have traditionally been referred to as "air-breathing threats," or more commonly as "ABTs" by ADA Soldiers. The term "air-breathing threat" has evolved over time to "air threat" in joint doctrine. Neither term has been formally defined in joint or service doctrine; they are described simply in terms of the threat set that they both encompass. Air threat is used consistently throughout this document to refer to these collective threats.

1-4. In general, while active AMD is the more prevalent counterair operational element in the early phase of campaigns, attack operations reduce the capacity of the enemy to launch air attacks over time, thus decreasing the demand for active AMD munitions in the later stages of the campaign. C2 systems link the planning and execution activities of the other operational elements.

1-5. All defensive and offensive counterair operations are enabled by joint and Army C2 elements and further facilitated by mission command. *Mission command* is the Army's approach to command and control that empowers subordinate decision making and decentralized execution appropriate to the situation (ADP 6-0).

1-6. While all of the operational elements are mentioned in this document, the focus throughout is active AMD and C2 as executed by ADA organizations primarily at the operational and tactical levels. Some discussion of strategic AMD capabilities is presented in appendix A, but most is deferred to FM 3-27 and JP 3-27. The combination of active AMD, attack operations, and passive AMD optimize the use of AMD capabilities in the protection of Soldiers, equipment, and other military and geopolitical assets.

1-7. "Air defense artillery (ADA) units conduct air and missile defense (AMD) operations in support of both the protection, fires, and movement and maneuver warfighting functions" (ADP 3-19). Commanders must execute and integrate fires, in combination with the other elements of combat power, to create and converge effects and achieve the desired endstate. Fires tasks are those necessary actions that must be conducted to create and converge effects in all domains to meet the commander's objectives. For example, a commander may simultaneously employ offensive cyberspace fires to attack an enemy air defense network, air support to destroy air defense C2 nodes, and land- and sea-based AMD fires to defend against air and missile threats. The converged effects provide reduced risk to allied operational aircraft.

1-8. AMD planners at all echelons from AAMDC (Army theater level) to SHORAD battery (division and below tactical level) dialogue with respective protection cell planners to finalize the echelon's defended asset list. Regular coordination is conducted to ensure that the critical assets are protected from air and missile attack and surveillance. Respective AMD organizations should actively participate in protection working groups and provide all working group personnel advised of pertinent AMD directives, actions, and the overall AMD picture.

ADA ROLE AND CAPABILITIES

1-9. The role of ADA is to deter and defeat the range of aerial threats in order to assure allies, ensure operational access, and defend critical assets and deployed forces in support of unified land operations.

1-10. ADA forces conduct AMD operations to support U.S. forces across the range of military operations, from military deterrence and engagement through large-scale combat operations. The primary ADA capabilities in executing AMD operations are:

- Defeat the full range of enemy air and missile threats encountered in current and future geo-strategic, operational, and tactical fights. The threat spectrum encompasses ballistic missiles, ranging from intercontinental to close-range ballistic missiles; cruise missiles; UASs; RAM; tactical air-to-surface missiles; and fixed- and rotary-wing aircraft. Threat details are provided in chapter 3.
- Integrate with Army, joint, interorganizational, and multinational elements. ADA forces establish and maintain tactical data linkages to other service and multinational forces conducting AMD operations. This includes the ability to integrate across multiple weapon systems, sensors, effectors, and C2 nodes at echelon.
- Provide early warning. ADA forces provide early warning by employing sensors to detect air and missile attacks and disseminating attack warnings to forces and, where appropriate, civilian populations. C2 elements disseminate early warnings (and all clear) only to at-risk forces and, when appropriate, to at-risk populations.
- Enhance situational awareness. ADA sensors provide extended range surveillance of the airspace and detect, acquire, track, classify, discriminate, and identify aerial objects from near-ground level to high altitudes, in difficult terrain and in adverse weather conditions.
- Contribute to airspace management. Army airspace management and control functions involve identifying, coordinating, integrating, deconflicting, and regulating the Army need for and use of joint airspace. Army airspace management ensures that airspace users are synchronized in time, space, and purpose interdependently with joint and multinational forces. Air defense airspace management (ADAM) cells in brigade combat teams (BCT) and AMD sections in divisions and corps work with airspace control elements to support management of the airspace.

1-11. ADA forces consistently operate in a joint environment, maintain forward presence, and preserve joint operational access, protecting critical specified military and geopolitical assets throughout each operation. However, given the limitations in force structure as noted in para 1-16, ADA forces are unable to defend all of the critical assets dispersed throughout the theater.

1-12. AMD is inherently a joint and interdependent endeavor. Each component of the joint force contributes capabilities necessary for mission success. In addition, service capability and force structure development reflect a purposeful reliance on all components to maximize complementary and reinforcing effects while minimizing relative vulnerabilities (JP 3-01).

1-13. An ADA task force is a flexible deterrent option, showing U.S. resolve and commitment to our partner nations. For this reason, ADA forces are often called upon to maintain a forward presence. These ADA forces contain high-to-medium altitude air defense capabilities such as those found in the Patriot, Terminal High Altitude Area Defense (THAAD), and AN/TPY-2 forward-based mode radar systems. Thus, ADA forces project national power and set the conditions within the theater for projection of additional combat power.

1-14. Entry operations are likely to be contested, as the time of greatest vulnerability is in the early phases of deployment. Enemy forces are expected to concentrate on access points with air and artillery munitions to deny U.S. build-up of forces. Forward deployed or early entering ADA forces provide defense of these access points to support U.S. massing of critical combat power to seize the initiative. As the campaign progresses, ADA forces, with supporting joint and multinational AMD elements, continue to protect access points, enabling the flow of combat power, logistics, and sustainment elements.

1-15. ADA forces of appropriate strength are allocated to defend critical high value military and geopolitical assets. AMD principles and employment tenets provide a means of assessing the allocation of ADA forces to provide the right force in the right place to adequately defend these assets.

1-16. The number and dispersal of critical assets will exceed the ability of the ADA force to defend against the air and missile threats. The criticality, vulnerability, and threat methodology is used in the planning process to prioritize the assets on the critical asset list and allocate forces to evolve a defended asset list. The methodology enables an understanding of risk to undefended or under-defended assets, and operation plans can be adjusted in accordance with the risk and the AMD defensive coverage available. See chapter 2 for

additional details. Mitigation of some of the capacity shortfalls can be achieved through contributions by the other services' AMD components. In addition, the Army is standing-up additional ADA SHORAD forces and reintroducing them into maneuver formations. ***Short-range air defense*** **are capabilities that provide air defense against low-altitude air threats.** The ADA force is also introducing the Integrated Air and Missile Defense Battle Command (IBCS) system in the near term. IBCS provides a common C2 capability across all ADA echelons. It will allow for efficient task force tailoring of system components, vice complete systems, and the defense of more assets by the same number of ADA units.

AMD FOUNDATIONAL PRINCIPLES AND TENETS

1-17. Fundamental to the planning and employment of ADA forces and the execution of the tasks cited above for joint and unified land operations are the AMD principles and employment tenets. ADA commanders use these to design AMD defenses. When applying the principles and tenets, planners must consider the tactical and technical capabilities of each weapon and sensor system and the relevant factors of mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC), intelligence preparation of the battlefield (IPB), and AMD priorities.

1-18. The principles provide an underlying rule set. The tenets identify criteria for the positioning of ADA systems.

AMD PRINCIPLES

1-19. Armed with a thorough understanding of the operational environment that is further focused through the lens of current METT-TC conditions, commanders apply AMD principles when planning active AMD operations. A *principle* is a comprehensive and fundamental rule or an assumption of central importance that guides how an organization or function approaches and thinks about the conduct of operations (ADP 1-01).

1-20. The AMD principles are mass, mix, mobility, integration, flexibility, and agility. Mass, mix, mobility, and integration are traditional principles that have stood the test of time. The new principles, flexibility and agility, are inherent considerations for how ADA forces organize and operate on future battlefields.

MASS

1-21. Mass is the concentration of combat power sufficient to achieve the commander's intent. Mass, when applied to AMD, is achieved by assigning enough AMD firepower to successfully defend the force or the asset against aerial attack or surveillance. To mass AMD combat power in one area, commanders may have to accept risks in other areas of the battlefield.

1-22. AMD mass may also be achieved by the launching of more than one missile against a target. In today's system-centric architectures, missile-on-target mass is achieved by assigning the target to an engaging fire unit and that fire unit selecting a method of fire, such as ripple or salvo fire, for assigned launchers to achieve the desired mass. See paragraph 2-32 on page 2-9 for additional discussion of methods of fire.

> ***Note***. A fire unit is the smallest group of personnel and equipment capable of conducting a complete engagement, from detection to destruction. In Patriot and THAAD, a firing battery is a fire unit. In Avenger, an Avenger platform constitutes a fire unit.

MIX

1-23. Mix is the employment of a combination of weapons and sensors to protect the force and assets from the threat. Mix offsets the limitations of one system with the capabilities of another and complicates the situation for the attacker. Joint, interorganizational and multinational AMD capabilities are considered when applying this principle. Proper mix causes the enemy to adjust tactics. Enemy tactics designed to defeat one system may make the enemy vulnerable to another system. Mix is achieved by assigning multiple system-centric architectures within a defense design, with each system controlled by its C2 architecture, and coordinating with other systems in the defense. The principle of mix addresses both threat susceptibilities and vulnerabilities and ADA system limitations. For example, complex integrated attacks by enemy forces

seek to find out-of-sector opportunities to defeat friendly AMD defenses. ***Out-of-sector* is defined as that part of the air and missile defense footprint which cannot be covered by a sensor or defended by a shooter.** Some ADA systems can provide 360-degree coverage but are limited in the altitude which can be covered or defended. Other ADA systems are limited in azimuth (sectored).

MOBILITY

1-24. *Mobility* is a quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission (JP 3-17). ADA units should have mobility that matches that of their supported units or defended assets. Current ADA units cannot match the cross-country mobility of maneuvering forces. However, Avenger systems can move with and maintain defense of the maneuver force's semi-fixed assets, and Patriot and THAAD units have sufficient mobility to move from position to position to continuously extend protection over the supported force on the move. Mobility of ADA units increases their survivability as well as that of their supported assets.

INTEGRATION

1-25. *Integration* is the arrangement of military forces and their actions to create a force that operates by engaging as a whole (JP 1). As an AMD principle, integration constitutes the combination of ADA and other joint counterair forces, systems, functions, processes, and information acquisition and distribution required to efficiently and effectively perform the mission. Integration combines separate systems, capabilities, or functions in such a way that they can operate singly or in concert without adversely affecting other elements. Integration has three sub-elements. Each of these can be applied to the Army architecture or larger joint or multinational AMD architecture.

- Functional integration consists of those activities associated with the allocation, distribution, and synchronization of AMD functions into the Army's theater architecture. These activities are the basis for establishing both the information required and the means to acquire, produce, exchange, and distribute that information for planning, coordination, and execution purposes.
- Operational integration consists of those activities associated with enabling and optimizing the performance and collective effectiveness and efficiency of AMD within the total theater resources.
- Architectural integration consists of those activities associated with establishing, assuring, and enhancing the information interchange within the AMD component elements (organizations, weapons, and communications systems and components) and with the Army theater information architecture (hardware, software, operations, and personnel).

FLEXIBILITY

1-26. *Flexibility is* the employment of a versatile mix of capabilities, formations, and equipment for conducting operations (ADP 3-0). Flexibility enables adaptive forces, facilitates collaborative planning and decentralized execution, and fosters individual initiative (ADP 3-0). The AMD principle of mix (see paragraph 1-23 above) discusses the combination of ADA systems as task force tailored formations. The principle of flexibility is applied in AMD terms primarily within a system's capability to be adapted to different (changing) threat conditions. While ADA systems have a system-centric architecture, each of the architectures enables some flexibility to tailor the defense design to METT-TC conditions. Patriot can defeat ballistic missile threats, cruise missile, and other air threats. The defense can be tailored to primarily defeat a specific threat or to achieve a balance across the full threat set. Balancing across the full threat set may result in less than optimal defense against a specific threat set. Likewise, SHORAD systems can optimize against a specific threat or balance across their full threat set. The C-RAM system can defeat rockets, artillery, and mortars in the air. Optimization against mortars could result in some compromise with its ability to defeat larger caliber rockets. System architectures allow for some ability to task force tailor. Additional launchers can be assigned to a battery or platoon to attain sufficient mass to defeat anticipated heavy attack scenarios. SHORAD systems at battery and platoon can also accept augmentation of sensors. Patriot requires one, and only one, radar per battery. Thus, if one radar is insufficient in accordance with METT-TC, an additional battery must be incorporated into the defense. Unique C2 capabilities and data link architectures within each of the systems limit task force tailoring across systems.

AGILITY

1-27. "Agility is the ability of friendly forces to react faster than the enemy" (ADP 3-90). Automated battle management aids in ADA systems enable operators to execute engagements in a timely manner within the planned defense design and its branches and sequels. Dynamic replanning to respond to unanticipated enemy avenues of ingress, however, is less responsive primarily due to system centric architectures that do not allow cross-leveling of resources across ADA systems.

AMD EMPLOYMENT TENETS

1-28. While commanders should always start AMD employment planning by applying the principles described above, they should also strive to adhere to employment tenets (desirable attributes) when planning and positioning their ADA resources. A tenet is a belief, dogma, or doctrine generally held to be true. The AMD employment tenets are mutual support, overlapping fires and coverage, balanced fires, weighted coverage, early engagement, defense in depth, and resilience.

1-29. The application of a specific tenet or tenets is METT-TC dependent. In some cases, the application of one tenet may only be achieved at the expense of another, as noted below.

MUTUAL SUPPORT

1-30. Weapons are positioned so that the fires of one weapon can engage targets within the dead zone of the adjacent weapon. For guns, this dead zone is usually small. For missiles, the dead zone may be large, and mutual support is a critical element. Mutual support can also cover nonoperational weapons or weapons at lower states of readiness. Mutual support, when applied to sensors has the same connotation; that is, sensors are deployed to cover the dead zone of adjacent sensors. The application of sensor mutual support is challenging due to the need to pair weapons and sensors by system and the scarcity of ADA systems.

OVERLAPPING FIRES AND OVERLAPPING COVERAGE

1-31. Weapons are positioned so that their engagement envelopes overlap. Because of the many altitudes and ranges from which the enemy can attack or conduct surveillance operations, defense planners must apply mutual supporting and overlapping fires vertically and horizontally. Overlapping coverage is the positioning of sensors such that their coverage does not leave any seam in the defense that might be used by ingressing threats. Overlapping fires and overlapping coverage should be planned during defense design. Achieving overlapping coverage against ballistic threats is a challenge because of the need to orient primary target lines toward ballistic launch zones and the system architectures that require system-specific sensors to support system-specific weapons. Overlapping coverage against low altitude non-ballistic threats is challenged by terrain impacts on ground-based sensor visibility and the aforementioned system-specific limitations.

BALANCED FIRES

1-32. Weapons are positioned to deliver an equal volume of fires in all directions. This is necessary for AMD in an area where the terrain does not canalize the threat or when the avenues of approach are unpredictable. Against cruise missiles and other non-ballistic missile threats, balanced fires is a desired characteristic of defense design.

WEIGHTED COVERAGE

1-33. Weapons coverage is combined and concentrated toward the most likely threat air avenues of approach or direction of attack. Based on the tactical situation, a commander may risk leaving one direction of attack unprotected or lightly protected to weight coverage toward another direction. Weighted coverage is generally desirable when designing defenses to defeat ballistic threats. Weighted coverage and balanced fires are not mutually achievable, requiring the defense designer to give up most aspects of one to achieve the other.

EARLY ENGAGEMENT

1-34. Sensors and weapons are positioned so they can engage the threat before ordnance release or friendly target acquisition. Early engagements enable destruction of enemy platforms over enemy forces and unoccupied areas, thereby reducing the possibility of friendly collateral damage and fratricide. As with weighted coverage, early engagement is achieved at the expense of balanced fires.

DEFENSE IN DEPTH

1-35. Sensors and weapons are positioned so that the threat is exposed to a continuously increasing volume of fire as it approaches the friendly protected asset or force. Defense in depth decreases the probability that attacking missiles, aircraft, or RAM will reach the defended asset or force.

RESILIENCE

1-36. ***Resilience*** **is the quality of the defense to maintain continuity of operations regardless of changes in or unanticipated tactics by enemy air or losses of critical air and missile defense components.** ADA planners must understand the capabilities of the system(s) that are being deployed in a defense design, and plan for deployment and employment of components to enable these capabilities to be exploited during mission execution. Resilience is a key determinant when considering which tenet (or tenets) to use in in maintaining the defense.

ADA OPERATIONS

1-37. Unified action (joint) operations entail the participation of the appropriate joint forces operating as a cohesive team. AMD is an inherent function in joint operations, requiring the interdependent capabilities of each service's AMD component.

1-38. The ADA force is the primary land-based contributor to AMD. It executes its role and missions within the context of unified land operations, as discussed below.

ADA IN SUPPORT OF UNIFIED ACTION

1-39. "Threats to U.S. and allied interests throughout the world can sometimes only be countered by U.S. forces able to respond to a wide variety of challenges along a conflict continuum that spans from peace to war" (JP 3-0). Within the conflict continuum, the range of military operations extends from military engagement, security cooperation, and deterrence in times of peace, through crisis response and limited contingency operations, to large-scale combat operations in times of war (see FM 3-0 for discussion of these operations). Joint operations constitute the integrated actions of the U.S. armed forces in all of these.

1-40. ADA forces provide concerted defensive capabilities in the air domain and in the littoral areas of the sea domain in support of Army operations. The following paragraphs discuss ADA actions and activities in support of the four broad categories of Army operations: operations to shape, operations to prevent, large-scale ground combat operations (defense and offense), and operations to consolidate gains, all of which ultimately lead to winning.

1-41. Operations to shape. "Operations to shape consist of various long-term military engagements, security operations and deterrence missions, and actions intended to assure friends, build partner capacity and capability, and promote regional stability" (FM 3-0). Army shape operations, though most prevalent in military engagement and security cooperation activities, are executed continuously throughout all of the joint phases. ADA forces help shape operations by supporting the assurance of friends, building partner capacity and capabilities, and promoting regional stability. Shaping actions are generally planned and coordinated at the AAMDC or ADA brigade levels and executed by ADA battalions. AMD is a key capability our joint forces and allies want on the ground to build partner capacity in advance of hostilities. ADA forces build partner capacity through security cooperation activities such as joint air defense exercises, on-going training, and leader development of multinational AMD forces. Partner capacity and capabilities are further enhanced through their procurement of technologically advanced ADA systems and the enrollment of our partners' AMD Soldiers in ADA schools.

1-42. Operations to prevent. Operations to prevent "include all activities to deter an adversary's undesirable actions. They are typically conducted in response to activities that threaten unified action partners and require the deployment or repositioning of credible forces in a theater to demonstrate the willingness to fight if deterrence fails" (FM 3-0). ADA forces are a preeminent means of deterrence in support of the U.S.'s commitment to preserve the peace by providing assurance of protection for our forces and allies. In that regard, ADA forces frequently serve as flexible deterrent options to demonstrate U.S. resolve. Forward stationed ADA units, such as Patriot battalions, THAAD batteries, and AN/TPY-2 forward-based mode radar batteries, further serve as a deterrent to our enemies by dramatically reducing their expectation of success. The deployed ADA forces are generally tailored as task forces with the right sizes and mix of capabilities to deter or, when required, defeat the projected air and missile threats.

1-43. Presence, profile and posture define and describe the means by which ADA units can shape the security environment through physical and visual actions. Both profile and posture address the manner that units, systems, and Soldiers are present. Profile is the degree of presence, both in terms of quantity and quality. In offensive and defensive operations, ADA units can tailor their profiles in the number of forces or effects. Military deception can play a significant role by allowing commanders to make their force appear larger or more substantial than it is or to keep the profile to a minimum. Posture dictates how units or Soldiers appear to others and how they act towards them and is determined by the operational environment. See FM 3-13 for additional information.

1-44. While prevent as discussed above focuses on an overseas theater, operations to prevent for joint AMD forces begin in the homeland. Prevent in the homeland denies an enemy's ability to successfully attack a geopolitical area or installation. Army ground-based midcourse defense (GMD) systems are deployed in the United States to counter potential long-range ballistic missile threats, such as intercontinental ballistic missiles (ICBMs). ADA systems are emplaced in and around Washington D.C. to protect the National Capital Region against air threats. Navy and Air Force elements add capabilities to protect against air and ballistic missile threats.

1-45. Large-scale ground combat operations. "Large-scale combat operations require the execution of multiple tasks synchronized and converged across multiple domains to create opportunities to destroy, dislocate, disintegrate, and isolate enemy forces" (FM 3-0). Army forces conduct decisive action to seize the initiative and dominate the enemy.

1-46. "Joint force commanders (JFC)s strive to achieve air, maritime, space, and cyberspace superiority early to allow the joint force to conduct land operations without prohibitive enemy interference" (FM 3-0). Conditions preceding large-scale ground combat operations vary depending on the threat. Some adversaries possess significant capabilities to employ anti-access and area denial strategies. ADA has a critical role in countering anti-access/area denial activities and assuring access into a given region. The joint warfighting force's ability to conduct force projection is reliant on ADA's ability to provide force protection. When deployed, ADA units will be integrated with joint and multinational AMD forces to improve and extend surveillance and defend land, air, and sea bases that support operations in an anti-access and area-denial environment.

1-47. ADA is a significant enhancer in the battle to achieve air superiority, or at a minimum, maintain air parity throughout large-scale ground combat operations. Large-scale ground combat operations require the employment of a considerable amount of ADA forces to protect the most critical theater assets, as designated by the JFC. An AAMDC will be positioned in the theater of operations to provide overall command of deployed ADA forces. ADA brigades and battalions may be placed in supporting roles to Army corps and divisions in accordance with mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC) conditions and the JFC's directives. In addition, ADA forces at battery and platoon levels may be deployed with BCTs. See chapters 5 through 10 for further discussion of the roles, capabilities, and AMD operations conducted by the ADA echelons, from the AAMDC to ADA platoon.

1-48. Operations to consolidate gains. *Consolidate gains* are activities to make enduring any temporary operational success and to set the conditions for a sustainable security environment, allowing for a transition of control to other legitimate authorities (ADP 3-0). Consolidation of gains generally signifies a greater focus on security and stability tasks than on combat operations. ADA forces support operations to consolidate gains by maintaining protection of friendly forces and critical assets as areas are secured. ADA formations, in

accordance with the priorities for defense and available assets, may be positioned in corps or division consolidation areas to defend against enemy residual air and missile capabilities. While an enemy may possess few of these capabilities – the majority having been destroyed or disabled during the dominate phase (large-scale ground combat) of an operation, an attack by a single missile may have a catastrophic impact on a maneuver formation, C2 facility, or geopolitical asset.

ADA IN SUPPORT OF UNIFIED LAND OPERATIONS

1-49. Unified land operations apply "landpower as part of unified action to defeat the enemy on land and establish conditions that accomplish the joint force commander's (JFC's) objectives" (ADP 3-0). Within the context of unified land operations, an operational framework is used to describe operations by echelon in time and space for an area of operations and areas of influence or interest. Land force commanders establish close, deep, support, and consolidation areas within their areas of operations to describe the physical arrangement of their forces over time and their forces' respective roles and missions. Figure 1-1 displays ADA organizations overlaid across the areas.

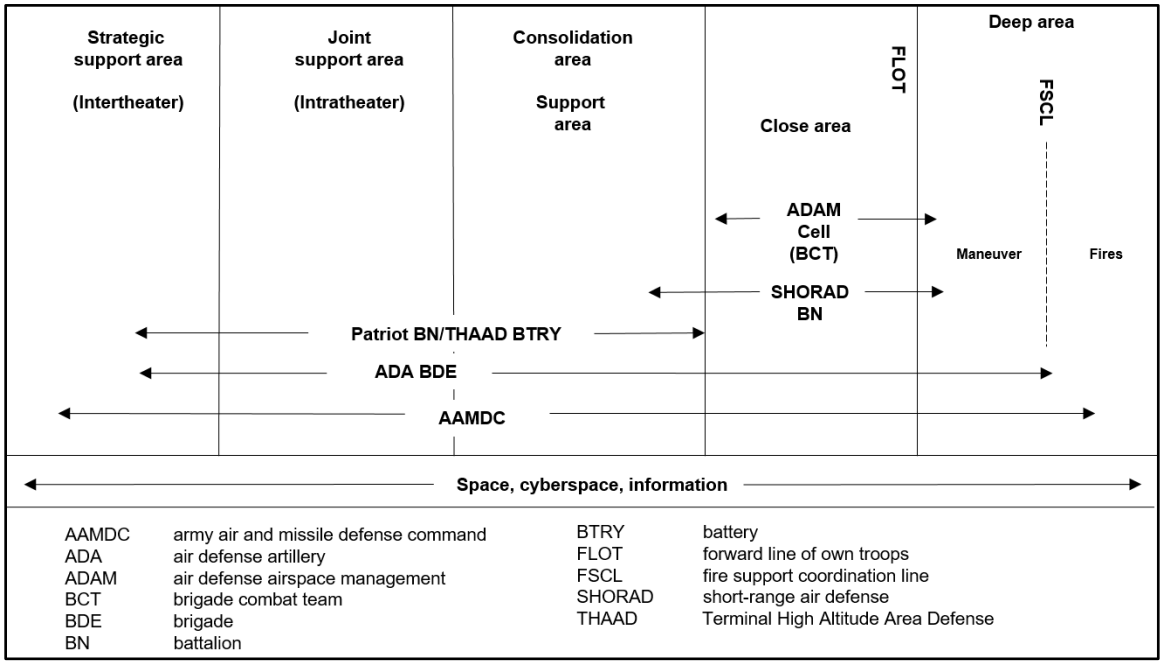

Figure 1-1. ADA echelons in support of a theater of operations

1-50. SHORAD forces are positioned with division or brigade maneuver formations in the close area, where the majority of subordinate maneuver forces conduct close combat. ADAM cell personnel in the BCT plan and coordinate the support of SHORAD or other ADA forces and relay pertinent AMD information and early warning of enemy air activity to maneuver formations. Patriot units may add supplementary protection of the maneuvering forces from their designated locations in the corps or theater areas and/or may be repositioned to sustain coverage. In support of the fight in the corps or theater deep area, the AAMDC or ADA brigade calculate prospective launch areas for ballistic missiles and nominate said areas for subsequent targeting by long-range artillery and aviation assets. The AAMDC and ADA brigade will also assess likely enemy air avenues of approach and missile operating areas from the corps' deep area into the close, support, and consolidation areas and design defenses that are positioned to negate surveillance or attack. ADA forces in the support and consolidation areas provide continuous defense of sustainment facilities and participate in the requisite security and stability tasks. SHORAD forces generally protect assets in the division and brigade areas, while Patriot and THAAD units maintain coverage of assets in the division, corps, and theater areas. See FM 3-0 for additional discussion of the operational framework, its various considerations, and its operational areas.

1-51. The role of ADA forces spans the full range of operations and is a critical enabler in the Army's ability to execute its tasks. ADA forces support Army, joint, and multinational forces in the execution of offensive, defensive, stability, and defense support of civil authorities operations. They facilitate the conduct of decisive and sustainable land operations by Army and other land forces. As with joint operations, the tasks may vary by type of operation and across the strategic, operational, and tactical levels of war. However, irrespective of type operation, ADA forces fundamentally defend friendly forces and other designated critical assets and engage and destroy air and missile threats, ranging from ICBMs to RAM munitions.

1-52. ADA key tasks in support of the defense include:

- Providing AMD coverage of designated critical assets.
- Providing and disseminating early warning to all affected forces.
- Providing situational awareness of the airspace.
- Contributing to engagement information (classification, discrimination, and identification).
- Determining, predicting, and reporting enemy air and missile launch points and impact points.
- Proactively engaging threat air and missile platforms before they attack or surveil.
- Integrating joint and multinational capabilities into the defense design.

1-53. ADA is a key enabler to forces conducting offensive operations. ADA tasks include:

- Providing AMD coverage of maneuver forces and their critical assets, to include denying surveillance by threat air platforms.
- Developing targeting information in support of attack operations.
- Defending forward-based infrastructure, such as lines of communications and command nodes, from air and missile attacks.
- Determining, predicting, and reporting threat air and missile launch points and projected impact points.
- Providing early warning and surveillance.

1-54. ADA key tasks in support of stability operations include:

- Providing forward deployed or forward stationed ADA forces to serve as flexible deterrent options. This is a prelude to unified land operations and serves as an initial condition for shaping operations.
- Supporting security assistance and building partnership capacity efforts through training, education, participation in exercises, and related activities with multinational AMD forces.
- Providing AMD protection for deployed forces and civilian assets and areas from aerial threats, such as RAM attacks.
- Providing or supporting Army-common tasks related to essential governmental services, emergency infrastructure reconstruction, and humanitarian relief efforts.

1-55. ADA key tasks in defense support of civilian authority operations focus on:

- Providing sensor surveillance in support of civilian law enforcement agencies – primarily to U.S. Customs and Border Protection organizations along the U.S. borders. ADA sensors are ideally suited to provide surveillance support to counter-drug operations. Sentinel radars can detect and track low-flying aircraft approaching and penetrating the border.
- Deploying sensors (for example, Sentinel) in support of National security special events and special event assessment rating events, such as the Olympics and Super Bowl.
- Planning for transition to active defense capabilities when properly directed and authorized.

1-56. Fulfilling the ADA role hinges on the ability of ADA forces to conduct effective C2 across both engagement operations and force operations. ***Engagement operations*** **are functions and activities required to execute the air, missile, and counter-surveillance battle.** ***Force operations*** **are actions and functions required to plan, coordinate, prepare for and sustain the total air and missile defense mission.** See paragraphs 2-3 (on page 2-2) through 2-24 (on page 2-6) for additional discussion of force operations and paragraphs 2-25 (on page 2-7) through 2-38 (on page 2-10) for engagement operations.

TRAINING

1-57. The ADA branch requires agile and adaptive Soldiers and Leaders, who are masters of their craft and who are comfortable operating in complex, often ambiguous, environments. Only through an outcome-based training and education system that stresses the development of cognitive skills will this requirement be met.

1-58. The foundation for individual and collective training is the education provided by the Army's institutional education system. Instructors in the various institutional courses introduce, facilitate, or enhance the knowledge of ADA systems, ADA organizations, and AMD operations to resident students. The institutional domain is responsible for providing Soldiers and Leaders with the qualification and preparation for entry into a unit - they teach the ADA competencies.

1-59. Operational force training focuses on collective training conducted at home station, at maneuver combat training centers, during joint exercises, at mobilization centers, and while operationally deployed. Live, virtual, and constructive methods of training are used to attain the desired realism and synchronization of critical tasks across echelons that will facilitate the levels of readiness required to execute wartime missions. ADA Leaders and Soldiers, as individuals and in teams, must be knowledgeable of and capable of executing the actions associated with mission command and C2 – the principles of mission command and the authorizations and directives of Army, joint, and multinational C2 elements, particularly with respect to the AMD kill chain; force operations – planning, coordinating, and sustaining activities for the total AMD mission; and engagement operations – coordinating and executing the engagements of air and missile threats.

1-60. Commanders at all echelons are responsible for ensuring that their units are capable of performing their missions. Commanders cannot delegate this responsibility. Commanders are directly responsible and accountable for all aspects of unit training including the certification/qualification of their individuals, sections, platoons, batteries, and battalions. They understand and employ the principles of unit training and leader development. Through guidance and direction, commanders drive the training management process. They directly observe and participate in the unit's training and leader development to better assess mission readiness and help their subordinates improve. They understand that unit training and leader development are inextricably linked – that good training can develop good leaders, and good leaders are the key to good unit training. They focus the unit's efforts to optimize available time, ensuring their units train the right tasks to meet mission requirements and to support the next higher commander's intent. Each commander determines what essential supporting collective tasks must be trained to attain the required levels of objective training requirements for mission-essential task list proficiency. Commanders look for every opportunity to coach and teach subordinates as they plan, prepare, execute, and assess training, employing the mission command philosophy. They give their subordinate leaders the commander's intent and the resources– including time–to plan, prepare, and conduct the training necessary to develop unit proficiency. Leaders are also trained and educated in the Army Ethic, culture, and character development. They personally create and sustain a positive command climate in their ADA units and organizations. Commander/leader involvement makes a quantitative and qualitative difference in unit training and leader development.

1-61. The proficiencies of individual Soldiers, Leaders, and teams/crews in the operational force are gauged through a certification program. The certification process uses gunnery tables and guidance from higher echelons in the conduct of formal evaluations. In preparation for these periodic formal evaluations, informal assessments are generally conducted by standardization officers at ADA battalions and Leaders at lower echelons. Soldiers and Leaders receive their individual certifications by their units. Teams require certification by the next higher command or a command two levels higher based on the ADA system they use. Re-certification is conducted periodically and is also required if an individual is assigned to a new unit or team, notified of deployment, experiences a major system change to his/her assigned equipment, or as directed by the command. While it is optimal to certify as crews, commanders have the flexibility to retain unit/crew certification as individual crew members rotate in/out, as long as proper evaluation protocols are in place.

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Chapter 2

Air and Missile Defense Operations Process

This chapter addresses the planning, preparing, executing, and assessing phases of the Army's operations process. These are presented in terms of force operations and engagement operations. General aspects and applications of both follow. ADA echelon-specific discussions of force and engagement operations are presented in chapters 5 through 10.

AMD OPERATIONS FRAMEWORK

2-1. The Army's framework for exercising C2 is the operations process - the major C2 activities performed during operations: planning, preparing, executing, and continuously assessing the operation (ADP 5-0). Integral to AMD C2 are force operations and engagement operations. Force operations set the conditions for successful and sustained engagement operations. They include all actions needed to conduct parallel and collaborative planning, coordination, and integration with Army, joint, and multinational forces. Engagement operations constitute the process of engaging air and missile threats. Engagement operations include establishing an air picture, determining the classification and identification of all tracks, evaluating the threat these tracks pose to the defended assets, and exercising engagement control over subordinate units. Categorization as force operations or engagement operations provides a framework to assist in defining/establishing responsibilities and conducting activities. However, not all activities or tasks are clearly distinguishable as force or engagement operations; some may span both categories depending upon the phase of operation or METT-TC considerations.

2-2. Figure 2-1 on page 2-2 depicts the planning and execution focus of the ADA echelons; the two curves represent the traditional activity level of the ADA echelons as they carry-out the AMD fight. Force operations and engagement operations for each ADA echelon are described in greater detail in its respective chapter, beginning with chapter 5.

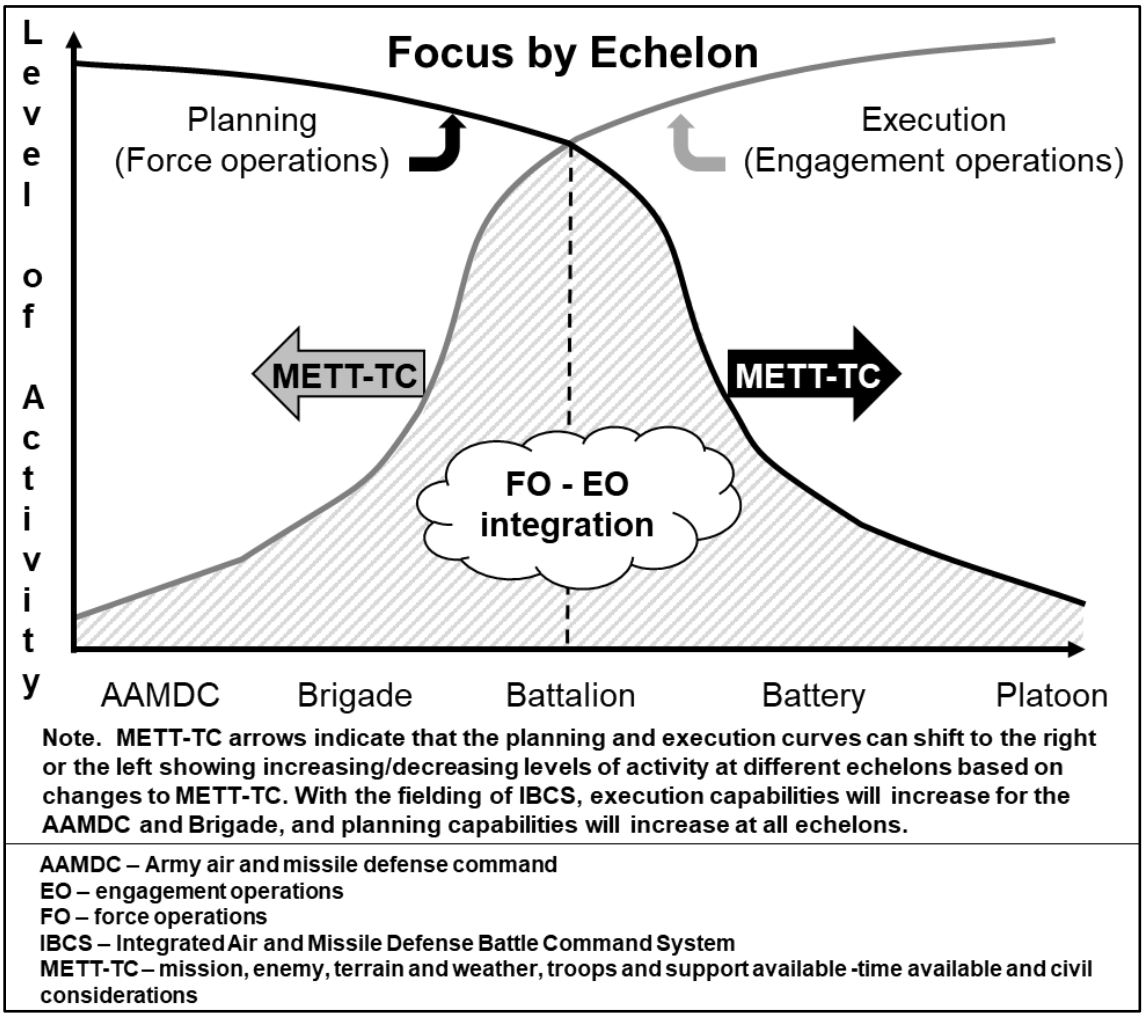

Figure 2-1. ADA echelons-planning versus execution

Note. With the introduction of IBCS, the force and engagement operations curves "flatten" somewhat, though the AAMDC and ADA brigade remain primarily planning headquarters and ADA battalion and below execution organizations. Enhanced engagement operations capabilities are provided to the AAMDC and the ADA brigade. Each may now apply dynamic engagement control over radars and sensors, though generally this control will continue to be exercised at the ADA battalion and below level. The AAMDC and the ADA brigade commanders may also be given engagement authority as METT-TC dictates. (See page 4-9, para 4-53 for more information.) Force operations capabilities are increased at battery and below levels.

FORCE OPERATIONS

2-3. Force operations begin with detailed planning within and between the ADA echelons and synchronization of such plans with other affected Army, joint, and multinational elements. Planning is a continuous process that begins with the receipt of a mission and the commander's guidance and is done as thoroughly as time allows. Successful planning requires an appreciation of the simultaneous nature of operations, awareness of the mission, anticipation of future events, and an understanding of the operational framework.

2-4. Force operations continue, as described below, with such other tasks as designing defenses, task organizing a unit to meet mission requirements, initiating support relationships, moving the unit to the area of operations, establishing communications networks, and sustaining the unit. Each task may be executed before, during, or after the initiation of engagement operations.

AMD PLANNING AND DESIGN PROCESS

AMD Planning and Design Process

- Military Decision Making Process.
- Integrated Defense Design.
- Criticality, Vulnerability, Threat.
- Troop Leading Procedures.

2-5. ADA commanders and staffs develop AMD plans based on the guidance of their higher headquarters and in accordance with their supporting or supported relationships. The military decision making process integrates the activities of the commander, staff, subordinate headquarters, and unified action partners to understand the situation and mission, develop and compare courses of action, decide on a course of action that best accomplishes the mission, and produce an operation plan or order for execution (ADP 5-0).

2-6. Any AMD operation begins with detailed planning in collaboration with joint and multinational AMD partners. Coordinated planning, such as war-gaming, is conducted in anticipation of future operations to identify potential issues or concerns and plan the way ahead. Planning considers all AMD operational elements, as appropriate, across the levels of war. Planning considerations at the operational level may be more extensive than those at the tactical level as a primary threat could be ballistic missiles, and coordination and integration must be conducted with joint and multinational AMD elements. Planning at the tactical level is nevertheless necessary to develop defenses against those aerial platforms that may threaten tactical units. At the operational level, the AAMDC directs ADA planning priorities and focus. The AAMDC identifies the geostrategic picture and provides suitable guidance to deployed ADA forces in concert with directives from the area air defense commander (AADC) to enable operational and tactical level planning. The result of this planning process is an integrated defense design that leverages all available joint AMD capabilities to most effectively defeat aerial threats from ballistic missiles and high-performance aircraft down to UASs and RAM threats at the tactical level. At the tactical (maneuver) level, much of the planning resides with the ADAM cell in BCTs to enable AMD where feasible and to leverage inherent non-dedicated, active AMD capabilities (combined arms fires and maneuver force Stinger teams) for protection of the maneuver forces. The ADA personnel in ADAM cells assist the brigade commanders and their staffs in planning support by ADA forces or general coverage by SHORAD sensors and shooter systems, if such support is allocated.

2-7. AMD planning involves joint, multinational, and Army units including service or functional component commands, AAMDCs, ADA brigades, and ADA battalions. Defense design tools are available in an array of planners, ranging from Command and Control Battle Management and Communications (C2BMC) planner at the strategic level to the air and missile defense workstation (AMDWS). The Patriot tactical planning workstation and THAAD portable planner at the operational and tactical levels provide automated means to develop effective plans and alternative plans and to respond to dynamically changing tactical situations. These design tools are domain specific (C2BMC in ballistic missile defense planning) or system specific (Patriot tactical planning workstation for Patriot AMD planning, AMDWS for general defense planning and specific Avenger planning, and THAAD portable planner for THAAD planning.), thus inducing a strong hierarchical planning structure.

2-8. The criticality, vulnerability, and threat methodology is used to allocate ADA forces to mission requirements. This methodology begins with the combatant commander's nomination of high value assets across all deployed forces and considers political and geographic aspects as well as military assets. These high value assets are incorporated into a *critical asset list* – a prioritized list of assets or areas, normally identified by phase of the operation and approved by the joint force commander, that should be defended against air and missile threats (JP 3-01). After receiving all nominated critical assets, the methodology considers and ranks the importance of these assets based upon:

- Criticality − how critical is the asset to the JFC in the execution of the mission and plan for accomplishing that mission? Criticality can change over the course of a campaign. For example, early entry may place a higher value on a limited number of access points, but, as the theater matures and more access points are opened, the criticality of a particular access point may diminish significantly.

- Vulnerability − how vulnerable is the asset? Vulnerability assesses an asset's susceptibility and recoverability. Susceptibility includes such factors as the asset's or force's hardness and its ability to disperse or displace to another position. Recoverability includes such factors as the time it would take to repair or recover from damage by enemy attack and if the asset can be replicated elsewhere should it be damaged by enemy attack.
- Threat − how likely is the asset to be surveilled and/or attacked by enemy air and missile threats? By what types of threats? In what quantities?

2-9. Missions and threats are analyzed, and forces are sized, matched, and allocated accordingly. The resulting linkage of ADA forces to designated critical assets constitutes the *defended asset list* – a listing of those assets from the critical asset list prioritized by the joint force commander to be defended with the resources available (JP 3-01). The JFC further defines the required level of protection for each asset on the critical asset list based on mission variables. For ballistic missile defense, for instance, the levels range from level 0 (no active defense; accept risk) to level 4 (near leak-proof defense requiring upper and lower tier systems operating in an integrated defense). The AADC implements the JFC-directed protection level for each asset on the defended asset list based on METT-TC.

Note. As formally defined and used hereafter, the critical asset list and defended asset list present formalized lists of prioritized assets at the theater level that require defense against air and missile threats. However, commanders/leaders at all echelons and in all services identify their most critical assets that require protection. These assets are compiled into prioritized lists, which though having different names, are the equivalents of the critical asset and defended asset lists. For instance in the Army corps, the protection cell and work group develop a protection prioritization list and protected asset list. See ADP 3-37 for more information.

2-10. ADA battery commanders and subordinate leaders use troop leading procedures to translate the integrated plan into executable actions to achieve an integrated defense. *Troop leading procedures* are a dynamic process used by small-unit leaders to analyze a mission, develop a plan, and prepare for an operation (ADP 5-0). See ADP 5-0 for process details.

TASK ORGANIZATION

2-11. The METT-TC variables provide the basis for analyzing and selecting the right capabilities to be deployed and employed. Knowing the mission, threat, and operational environment allows commanders to identify and plan for an optimal capability package. Deployment considerations must also factor in the availability of strategic lift – the deployment carriers – and a suitably packaged ADA force to facilitate an operational defense as rapidly as possible. This package may consist of a complete battalion-level task force, a task-organized battery, or sub-sets of a battery. Task organization must consider elimination of exploitable seams in the defense coverage. Seams can be created in azimuth (for example, Patriot sectored coverage), in altitude (ingress below or above a sensor's coverage), and by threat capabilities (for example, use of a threat mixed package that includes platforms with capabilities that exceed those of the sensor or shooter in a defense).

2-12. Current capabilities to task organize enable coordinated but not integrated defenses. Coordinated defenses are fought at the system level; for example, a system such as Patriot or Avenger is selected to engage a threat and other systems in the defense monitor the engaging system's engagement sequence to decide the need for follow-on actions.

SUPPORT RELATIONSHIPS

2-13. Support relationships define specific arrangements and responsibilities between supporting and supported Army units. Though traditionally focused on Army missions, these relationships are also applicable to ADA support of joint and multinational forces. There are four support relationships: direct support, general support, general support-reinforcing, and reinforcing. Commanders specify and change support relationships through task organization. ADP 5-0 provides expanded details on Army support relationships.

2-14. ADA units in a direct support role provide dedicated support to a specific element of the force. Supporting ADA units coordinate their movement and positioning with the supported unit. A SHORAD platoon, for example, may be placed in direct support of a mechanized task force. The platoon will provide dedicated support to the task force, and the platoon leader will position the platoon in accordance with the task force commander's concept of the operation. Additionally, a Patriot battalion can be placed in a direct support mission to the AADC.

2-15. ADA units in a general support role provide support to the force as a whole and not to any particular subordinate echelon unit or element. ADA units in general support commonly protect theater, corps, or division level assets. They are positioned by the ADA commander.

2-16. ADA units with general support-reinforcing missions provide support for the force as a whole and, secondarily, augment the support provided by other ADA units. ADA units must coordinate with the augmented ADA units to reinforce the coverage of assets in the area of operations

2-17. ADA units in reinforcing roles augment the coverage of other ADA units and strengthen AMD capabilities of the force. Reinforcing ADA units are positioned to protect one or more of the reinforced units' priorities as specified by supported ADA unit commanders.

MOVEMENT

2-18. Movement is executed by the most expedient means needed, in accordance with the JFC's requirements for AMD. Strategic lift may be designated to transport sub-sets of ADA batteries or entire ADA units. Due to the large size of many ADA components and systems, and when time is available, transportation by means of self-movement, rail movement, or sea vessels for overseas deployments is likely to be more economical and efficient.

2-19. When such stationing or deployments cannot be achieved within a timely manner, the JFC will rely on Navy AMD assets to protect early entry assets until land-based ADA capabilities can be deployed.

POSITIONING

2-20. ADA units are forward deployed to an area of operations and positioned to best protect the designated assets against the projected air and missile threats in accordance with detailed defense designs. Sensor and launcher placements are selected to maximize surveillance, tracking, and engagements. In designing a defense, sensors are positioned to provide surveillance and fire control tracking capability sufficient to protect assigned assets and prevent gaps in the coverage. Sensors are emplaced on terrain that provides the best longest range line-of-sight in all directions. Shooters are then positioned to optimize the defense of the defended assets, enabling lethal coverage over the assigned assets and extending firepower through as much of the defense coverage area as possible. The AMD employment tenets and latest intelligence reports inform the defense design. Patriot and THAAD forces may use a weighted defense to counter ballistic missile threats from known locations or areas, or a balanced defense when there is a potential for multiple types of threats coming from various approaches. Because of the nature of their target set, SHORAD forces may be able to rely more heavily on the tendency of low flying threats to be canalized by terrain due to their flight level and maneuverability. This may allow SHORAD forces to predict the air avenues of approach for enemy air threats and position forward of the defended asset, weight coverage, and achieve early engagement before the threat is able to reach its ordnance release line. Communications assets interconnect launchers, sensors, and C2 nodes to enable an integrated defense. Tools embedded in C2 capabilities, such as the Patriot tactical planning workstation and AMDWS, enable automated support to defense planning and defense design to both optimize component emplacement and to evaluate defense design alternatives. Software functionality is system specific, requiring manual steps to develop an integrated defense design across a task force containing multiple system capabilities. When planning, positioning, and determining how often ADA units will be required to conduct survivability moves, units take into account the range of enemy indirect fires.

2-21. Positioning ADA units with maneuver forces (generally the case for SHORAD units) or on or near installations (generally for Patriot and THAAD units) allows the units to take advantage of security measures and forces on those installations. ADA units have limited self-defense capabilities and thus must rely on others for that protection. Antiterrorism and force protection considerations are extremely important given the ever present threat of terrorist attacks and the need to protect ADA units at all echelons from becoming

targets of opportunity. Once in place, ADA forces should implement passive defense measures, such as camouflage and protective works, and continuously improve them as long they remain at a location. Deception, camouflage, and concealment should be used as much as possible to deny or limit the ability of enemy surveillance assets to identify sensor, shooter, and C2 components and ultimately target them. Emission control measures should be initiated to reduce the electromagnetic signatures of the sensors and command posts (CP).

DECEPTION

2-22. Deception operations are designed to mislead enemy decision makers by distorting, concealing, and falsifying friendly intentions, capabilities, and dispositions. The objective is to mislead the enemy commander, inducing the enemy to conduct activities that unwittingly serve friendly purposes.

2-23. ADA units plan and conduct deception activities in conjunction with movement, cover, concealment, and other passive defense operations to disguise friendly capabilities and counter enemy capabilities. In the context of tactical deception, ADA units may position weapons systems in locations forward of those typically associated with a point defense. For example, Avengers, employed with Patriot in an integrated defense of a fixed or semi-fixed asset, are generally positioned to deny an enemy low-level access to the asset and to defend the Patriot system. Moving Avengers forward along likely enemy air avenues of approach provides early and unexpected (to the enemy) engagement opportunities. ADA units conduct deception in support of operations security by emission control, "blinking" sensors, and employing counter-countermeasure. Emission control of sensors in the defense limits sensor radiation until the last moment in an engagement sequence, thus reducing or denying enemy targeting. Radiating multiple sensors in a defense at different times and different locations hinders potential lock-on by anti-radiation missiles. Employing counter-countermeasure capabilities mitigates the effects of enemy jamming or other electromagnetic deception. See FM 3-13.4 for additional information on Army military deception operations.

2-24. A summary of the key force operations tasks, with respect to planning and preparing for aerial engagements, is presented in table 2-1. The tasks are representative of those that are conducted across the ADA force, though not necessarily be each of the ADA echelons. See chapters 5 through 9 for additional discussions of force operations by each.

Table 2-1. AMD planning and preparing tasks

AMD Planning and Preparing Tasks	
Plan	• Perform criticality, vulnerability, and threat assessment. • Support development of CAL by phase. • Provide AMD running estimates. • Develop ROE/identification matrix. • Conduct AMD IPB. • Assess availability of AMD assets by conducting a defense laydown. • Determine levels of risk and means to mitigate. • Propose DAL to commander. • Request additional AMD resources if levels of protection cannot be achieved. • Allocate AMD assets. • Establish command and support relationships for subordinate units. • Develop supporting scheme of maneuver. • Develop initial defense design. • Nominate targets for attack operations in support of offensive counter air development. • Support refinement and adjustment of CAL/DAL. • Develop sensor and communication plans. • Plan deception techniques. • Develop AMD plans/AMD appendices to OPLANs. • Plan engagement zones with joint and Army commanders.
Prepare	• Implement identification and engagement authorizations, weapons control statuses, air defense warnings, and ROE. • Coordinate with supported commander. • Position sensors and shooters and implement appropriate deception measures. • Coordinate with joint and multinational AMD forces. • Refine defense design and adjust positions as required. • Establish sensor communications and early warning network. • Conduct ROC drills with supported force. • Implement airspace control order and special instructions. • Conduct surveillance of airspace. • Implement alert states or readiness conditions.
AMD	air and missile defense
CAL	critical asset list
DAL	defended asset list
IPB	intelligence preparation of the battlefield
OPLANs	operation plans
ROC	rehearsal of concept
ROE	rules of engagement

ENGAGEMENT OPERATIONS

2-25. ADA systems generally do not fight as independent AMD fire units. They are employed in integrated defenses with other ADA systems, such as Patriot and Avenger, or with the AMD systems of other services or multinational partners (for example, THAAD and the Navy's Aegis). While SHORAD systems can fight as independent fire units, their capabilities are greatly improved by fighting as integrated formations with Patriot and THAAD forces or joint and multinational partners.

2-26. Defenses are designed to provide the greatest degree of protection of designated assets against probable air and missile threats. Ideally, defenses have the requisite capabilities to overmatch threat capabilities and deny an enemy's expectation of successful air and missile operations. Integrated defenses are developed for the JFC or Army commander's designated assets and planned to ensure the required amount and types of

protection. Integrated active AMD measures are established and executed concurrently with attack operations and passive defenses.

EXECUTION

2-27. Ground-based or aerial sensors, or combinations of both when available, are employed to perform surveillance of the airspace and provide focused early warning to at-risk forces. The sensors provide engagement authorities the time to make engagement decisions that deny threat platforms the ability to see or impact the defended assets.

2-28. These engagement authorities function as a vertically and horizontally integrated kill chain. **The *kill chain* is the successive linkage of commanders who can authorize engagements of air and missile threats.** Engagement decisions are made by the designated engagement authority in the kill chain, providing operational control of and, ultimately, directions to the shooter. Integrated sensors, shooters, and C2 networks will allow for greatly increased engagement options. As such, engagement authorization must be delegated to the lowest level possible.

2-29. Proactive engagements are conducted in accordance with theater-level rules of engagement (ROE) and complementary directives. Engagements are conducted by the best shooter, that weapon system that can best deliver the appropriate effects to achieve maximum attrition at the right time and place, and as far forward as possible, to ensure keep-out ranges and keep-out altitudes. ***Keep-out range* is the horizontal distance from a defended asset at which a successful engagement denies an adversary's desired weapons effects against the defended asset.** A keep-out range is a key defense design consideration for cruise missiles. It also allows AMD systems to counter enemy aerial surveillance and reconnaissance platforms beyond the range at which they can surveil an asset and beyond the engagement capability of a defending AMD system, contributing to the overall ability of friendly forces to see first. ***Keep-out altitude* is the vertical distance above a defended asset at which a successful engagement denies an adversary's desired weapons effects against the defended asset.** A keep-out altitude is a major design consideration for ballistic missiles. Shooters may use shoot-new target-shoot, shoot-look-shoot, salvo, or ripple methods of fire, depending upon the type of system. The method of fire may be stipulated in operation plans, directed by the kill chain, or influenced by the situation. Coordination is effected by the AMD C2 elements to ensure the threats are overmatched by the AMD weapons, facilitating their destruction while simultaneously mitigating the potential for fratricide of friendly and neutral aircraft.

2-30. Combined arms for air defense constitutes another element of Army AMD that can provide vital protection from air threats and contribute to the freedom of maneuver for friendly forces. (See chapter 11 for a fuller discussion of combined arms contributions to AMD). Maneuver forces can effectively engage hovering or slow-moving helicopters within their weapon systems' ranges. Stinger teams organic to maneuver formations further enhance this capability. The ADAM cell (see chapter 10) in the maneuver brigade links the maneuver forces to the kill chain to implement appropriate ROEs. Intelligence enables cyber and electronic warfare elements to electronically attack air targets. Intelligence elements can also provide or assist in the surveillance, identification, and classification of air targets, facilitating early warning.

ENGAGEMENT SEQUENCE

2-31. **The *engagement sequence* is the successive actions taken by all of the services' air and missile defense systems in the engagement of aerial threats**. Terms in the sequence differ by service but capture similar actions. The ADA engagement sequence terms are surveil, detect, track/identify, threat evaluation and weapons assignment, engage, and assess.

- Surveil. Surveil is the systematic observation of airspace by electronic, visual, or other means, primarily for the purpose of identifying and determining the movements of friendly and enemy aircraft and missiles in the airspace.
- Detect. Detect in tactical operations is the perception of an object of possible military interest but unconfirmed by recognition. For ADA units, detect is the acquisition of an aerial object of possible military interest by sensor systems.
- Track/identify. Track is the process of displaying or recording the successive positions of a moving object. *Identification* is the process of determining the friendly or hostile character of an unknown

detected contact (JP 3-01). Identify attains an accurate characterization of detected objects with high confidence so that timely application of weapons can occur. Embedded within the overall process of identification are distinct tasks dealing with classification and discrimination.

- ***Classification*** **is the process of characterizing a detected object by its type, model, variant, nationality, and any other distinguishing feature or attribute.** Classification, for instance, would establish a track as a cruise missile.
- ***Discrimination*** **is the process to distinguish real objects of interest from other objects or phenomenon and military objects from those that are not**. For example, discrimination would differentiate between an enemy air platform and a decoy.

- Threat evaluation and weapons assignment. ***Threat evaluation*** **is the process of determining the intended target of the threat, the threat's predicted impact point upon the defended asset, and the timing of the threat's arrival**. Weapons assignment provides the right unit, launcher, or missile to engage the threat paired to an appropriate sensor, if needed, to support the engagement. Weapons assignment can be based on the location of the unit or ADA system, preferred area where an engagement should be conducted, or ADA system's capability. Sensors may be able to support multiple types of weapons (for example, Sentinel can support Avenger and C-RAM detection and acquisition) or may be designed to specifically support engagements of one weapon system, such as the Patriot. Weapons may need in-air engagement support from a sensor, such as the Patriot radar or may be "fire and forget", such as the Stinger missile, meaning that once the missile is launched it uses on-board guidance and homing capabilities to close with and intercept the air and missile threat.
- Engage. *Engage* is defined as "In air and missile defense, a fire control order used to direct or authorize units and/or weapon systems to attack a designated target (JP 3-01)". Engage commences with the initiation of missile launch or trigger pull of a gun and concludes with the impact of a missile or bullets (hit-to-kill) or impact of fragments from a detonating warhead (arming and fusing of the kill mechanism, explosion of the warhead, dispersal and travel of warhead fragments, and impact of fragments). It can also encompass the use of non-dedicated AMD assets to commit resources to disrupt or destroy air and missile threats.
- Assess. ***Assess*** **in the air and missile defense engagement sequence, the analysis of the effectiveness of the engagement and of the potential for reengagements.**

METHODS OF FIRE

2-32. The operational environment, level of protection required, and time considerations determine the method of fire used by ADA units during engagements. ***Methods of fire*** **are the firing options for air defense artillery interceptors employed against aerial threats.** There are four methods of fire: shoot-new target-shoot, shoot-look-shoot, ripple, and salvo. The method of fire selected provides the statistical probability of achieving the defense design goals, such as achieving less than 10-percent leakage.

- Shoot-new target-shoot. A shot (missile launched or volley of gun rounds fired) is taken against one threat, and the shooter immediately is assigned to a different target without consideration of the effect of the preceding shot. This method of fire primarily applies to fire-and-forget weapons (such as Stinger) in heavy saturating attacks or when the engagement timeline does not permit a re-engagement of the threat just engaged.
- Shoot-look-shoot. After the first shot has been fired, the operator/gunner/system evaluates the engagement. If the target is not destroyed and the operational environment and time permits, another shot is fired.
- Ripple. Two or more missiles or volleys of gun rounds are fired in predetermined intervals from the same or multiple launchers or guns based upon the threat. This method of fire is used to achieve a desired probability of engagement effectiveness or to negate threat tactics (for example, one shot fired against a ballistic missile at relatively high altitudes before aerodynamic maneuvers are likely and one fired at medium altitudes after aerodynamic maneuvers have likely been completed).
- Salvo. Two missiles or volleys of gun rounds are fired near-simultaneously from different launchers or guns. This method is used if there is insufficient time for a shoot-look-shoot or ripple

engagement and when multiple engagements are necessary to achieve the desired probability of engagement effectiveness.

FIRING DOCTRINE

2-33. ***Firing doctrine*** **is the application of the methods of fire to achieve the required level of engagement effectiveness**. It is implemented in accordance with the priority of the defended assets and the number of available interceptors relative to the number of attackers. It may have situational variations from the method of fire selected.

2-34. Patriot, for example, may select ripple fire against a ballistic missile that is part of a massed raid. The first shot of the ripple will occur in accordance with the selected method of fire. The second shot may be preempted by the need to shoot higher priority threats. THAAD may use a shoot-look-shoot, but may conduct the first or the last shot as a ripple fire or salvo fire depending upon engagement timelines and supporting ballistic missile defense fires.

SECTORS OF FIRE AND PRIMARY/SECONDARY TARGET LINES

2-35. A *sector of fire* is that area assigned to a unit, a crew-served weapon, or an individual weapon within which it will engage targets as they appear in accordance with established engagement priorities (FM 3-90-1). Sectors of fire are specified by left and right limits in azimuth and are normally designated at ADA battalion level for Patriot and THAAD units and platoon level for SHORAD units. Sectors of fire are a part of a comprehensive sensor and shooter plan that provides optimum radar coverage of the defined area and effective use of available ADA weapons.

2-36. **A *primary target line* is an azimuth assigned to a weapon system or unit along which the system fire control personnel and or gunners focus their attention.** Primary target lines are established along the centerline of the assigned sector of fire to assist in the distribution of AMD fires.

2-37. **A *secondary target line* is a pre-planned alternative target line used to shift the orientation of fires to assure all likely threat avenues of ingress are adequately defended.** Secondary target lines are designated to supplement the effects of an ADA unit to defend adjoining areas on both sides of the primary target line. These sectors of fire are clearly defined by right and left boundaries. The assignment of primary and secondary target lines for Patriot, which has a sectored radar, is critical to mission success. However, THAAD, which also has a sectored radar, does not plan for or assign secondary target lines. Other sensors, such as Sentinel, provide 360-degree coverage; assignment of secondary target lines are less critical but do enable operators to concentrate attention within assigned sectors based upon likely enemy air avenues of approach.

2-38. A summary of the key engagement operations tasks is presented in table 2-2. The tasks are representative (not inclusive) of those that are conducted by Patriot, THAAD, and SHORAD fire units. See the echelon chapters for additional discussions of engagement operations.

Table 2-2. AMD engagement tasks

AMD Engagement Tasks	
Execute	• Detect aerial objects. • Classify/discriminate/identify aerial objects. • Determine appropriate weapon system to conduct the engagement. • Determine impact area. • Clear the target area. • Order the engagement. • Conduct the engagement in accordance with the control measures.
Assess	• Monitor and assess the engagement. • Reengage as necessary. • Update air and missile defense tactical orders and reports as necessary.
AMD air and missile defense	

Chapter 3
Threat

This chapter summarizes the operational environment, presents existing and emerging threat aerial tactics, and identifies the air and missile threats facing the Army and joint warfighting forces. The air and missile threats, the focus of this chapter, are addressed in terms of generic capability descriptions. The air and missile threats to be countered by ADA systems are ballistic missiles, large-caliber rockets, cruise missiles, air-to-surface missiles, hypersonic weapons, UASs, manned fixed- and rotary-wing aircraft, and rockets, artillery, and mortars. Electronic warfare and, cyber, and threats from space are also addressed.

OPERATIONAL ENVIRONMENT

3-1. An *operational environment* is a composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander (JP 3-0). The operational environment encompasses the five domains of air, land, maritime, space, and cyberspace. Space and cyberspace are relatively "new" domains that individually impact all other domains. Space technologies are proliferating throughout the world. "Adversaries have developed their own systems, while commercially available systems allow almost universal access to some level of space-enabled capability with military applications. Army forces must be prepared to operate in a denied, degraded and disrupted space operational environment" (FM 3-14). Cyberspace supports, enables, and integrates operations for Army and joint forces. Cyberspace includes and considers friendly, enemy, adversary, and host nation networks, communications systems, computers, cellular phone systems, social media web sites, and technical infrastructures. While cyberspace enables friendly communications capabilities, it also creates critical vulnerabilities which adversaries and enemies can attack or exploit. "Cyberspace and the electromagnetic spectrum will grow increasingly congested, contested, and critical to successful operations. Army forces must be able to effectively operate in cyberspace and the EMS [electromagnetic spectrum], while controlling the ability of others to operate there" (FM 3-0).

3-2. Army forces must also be able to operate in degraded conditions in the other domains. The worldwide availability of advanced military and commercial technologies and information may allow adversaries opportunities to acquire, develop, and employ chemical, biological, radiological, and nuclear (CBRN) weapons. Such situations could also expose U.S. forces to CBRN threats and hazards. CBRN threats and hazards have the potential to cause personal injury, illness, or death, equipment or property damage or loss; or mission degradation. CBRN threats include the intentional employment of, or intent to employ, weapons or improvised devices to produce CBRN hazards (FM 3-11). CBRN hazards are those elements that could cause an adverse effect through accidental or deliberate release, dissemination, or impacts (FM 3-11). CBRN hazards present physical and psychological effects well beyond the immediate target area. See FM 3-11 and JP 3-11 for more information.

3-3. As noted in FM 3-0, the operational environment is in a constant state of flux for each commander in their respective operational area, when, at any time, friendly or enemy operations are initiated or curtailed. What is more of a given, regardless of the turmoil inherent in these environments, is that the United States will face a peer threat. In the past, U.S. forces have enjoyed relative advantages over their adversaries with superior capabilities in each of the domains. However, adversaries of the past have become peer threats, capable of challenging U.S. operations in all domains. Peer threats generate tactical, operational, and strategic challenges that are an order of magnitude more challenging militarily than other adversaries.

3-4. Potential adversaries are investing in anti-access strategies and area-denial capabilities to counter the U.S. ability to project military force into an operational area with sufficient freedom of action to accomplish assigned missions. The concept of anti-access/area denial is to control the access into and movement within a region. Preclusion, the combination of anti-access and area denial methods, seeks to influence the ability of an enemy, outside the region, to introduce forces into the theater and sustain combat power. Many countries are pursuing weapon systems, such as ballistic or cruise missiles, which enable anti-access/area denial. To deter current and potential adversaries from achieving these objectives, the United States must maintain its ability to project power in areas where access and freedom to operate are challenged.

3-5. From a pure ADA perspective, operational environment considerations are focused on the air domain, while maintaining an awareness and understanding of the potential impacts of actions within the other domains on AMD operations. The air domain challenges to Army operations include:

- Increased threats from traditional ballistic missile capabilities. The ballistic missile threat has increased both quantitatively and qualitatively, and is likely to continue to do so over the foreseeable future. Our known and potential adversaries will continue to challenge both the proficiency and sufficiency of U.S. ballistic missile defenses due to the resulting improvement in ballistic missile technical sophistication, increase in inventories, advancement of countermeasures, and growing proliferation.
- Expanding spectrum of air and missile threats. Within the last decade, the air and missile arsenal of today's adversaries has become more robust, diverse, and complex. Not only do our adversaries have access to the increasingly sophisticated ballistic missiles, but they also have a growing array of cruise missiles, UASs, and easily attainable and lethal RAM. All of these air and missile threats must be addressed by Army and joint AMD forces within the context of anti-access/area denial operations and of defeating increasingly sophisticated countermeasures, electronic attack, and cyber efforts.

THREAT TACTICS AND OBJECTIVES

3-6. The threat will attempt to develop an overmatch in an area to mitigate the capabilities of the U.S. force. Traditional tactics of massing fires to overwhelm a defense and surveilling or attacking from any direction and altitude will continue to be employed. In massing fires, for instance, the threat will launch more missiles against a defense than the defending Army or joint AMD force can engage. Cruise missiles, UASs, and fixed- and rotary-wing aircraft have freedom of maneuver through 360 degrees in support of both attack and intelligence, reconnaissance, and surveillance operations. Threats will prioritize AMD forces and control elements as high priority targets.

3-7. Advanced electronic attack, in which a threat system jams or spoofs across the electromagnetic spectrum in an attempt to hamper an ADA system's ability to detect or engage a threat system or missile, will also be employed. And, as the ADA force becomes more network centric, a sophisticated cyber-attack could potentially hamper the AMD network's ability to support the detection, identification, or engagement of a target.

3-8. The threat will continue to exploit the use of countermeasures tailored to the attacking platform and the AMD capabilities being countered. Ballistic missiles may employ decoys, in-atmosphere maneuver (which may also aid accuracy of delivery), and electronic jamming pods. Air threats may employ electronic jamming and spoofing, flares, chaff, and other penetration aids. Penetration aids are devices carried on air and missile objects and/or tactics used to counter AMDs. ADA forces must be knowledgeable of the various types of countermeasures that could be employed and prepared to defeat them.

3-9. An emerging tactic is a complex integrated attack which is designed to overwhelm defense of a site by the employment of different capabilities. Simple attacks that send one threat type at a time against a defense are more easily defeated in detail, as a defense can concentrate its capabilities against the specific operational characteristics of that type of threat. For example, when ballistic threats attack within a sector of the defense's coverage, the defense is able to concentrate surveillance and firepower into that sector. However, when out-of-sector cruise missiles are integrated with ballistic missile attacks, the defense must counter the combined effects of the total attacking force. A complex integrated attack is a synchronized attack of a friendly asset by a mix of air and missile threats arriving near-simultaneously from different directions, altitudes, and

ranges. This mix may include any and all air and missile threats, from ballistic missiles to RAM. The defending force's surveillance and firepower must be capable of defending throughout the entire 360 degrees; if focused on only one threat or sector (for example, the ballistic sector of attack), the complex integrated attack will destroy or significantly damage the defended asset. Complex integrated attacks will likely be supported by enemy activities in other domains, such as jamming efforts in the cyberspace domain and special operations forces' attacks in the land domain.

THEATER AIR AND MISSILE THREATS

3-10. The emerging air and missile threats encompass a wide range of missiles, rockets, projectiles, and air platforms. The number of countries developing weapons of mass destruction is unconstrained, and delivery systems with increasing range and accuracy are being sought and developed. Compounding these threats is the potential for or initiation of electronic and cyber-attacks.

3-11. Air and missile threats encompass ballistic missiles, air threats, and rockets, artillery, and mortars. A *ballistic missile* is any missile that does not rely on aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated (JP 3-01). Air threats include manned fixed- and rotary-wing aircraft, UASs, and aerodynamic missiles. Rockets, artillery, and mortars comprise the indirect fire threat.

BALLISTIC MISSILES

3-12. Ballistic missiles are a means to project power in regional and strategic contexts, and they provide a capability to launch an attack from a distance. Ballistic missile proliferation continues and countries are acquiring a greater number of ballistic missiles, increasing their range, incorporating ballistic missile defense countermeasures, and making them more complex, survivable, reliable, and accurate. Ballistic missiles can be used as anti-access weapons by potential regional adversaries. These weapons can be used to reduce military options for combatant commanders and threaten the survivability of regional military assets. There is an increasing threat of the technologies falling into the hands of other countries and hostile non-state groups.

3-13. Ballistic missiles include close-range ballistic missiles with ranges up to 300 kilometers, short-range ballistic missiles with ranges up to 1,000 kilometers, medium-range ballistic missiles with ranges from 1,000 to 3,000 kilometers, and intermediate-range ballistic missiles that range from 3,000 to 5,500 kilometers. These are surface-launched missiles with ballistic trajectories. Ballistic missiles, often launched from highly mobile, difficult-to-detect transporter erector launchers, can carry nuclear, biological, and chemical weapons. Most are single-stage missiles with an estimated circular error probable accuracy of one-tenth of one percent of the range. State-of-the-art guidance technologies, such as the Global Positioning System, can increase this accuracy to less than 50 meters. The most proliferated of these missiles are the close- and short-range ballistic missiles which are available to more than 30 states and non-state actors worldwide. Ballistic missiles are inherently difficult to defend against. Characteristics that increase their survivability include a small radar cross section, high terminal velocity, short notification time for defending forces, a variety of difficult-to-kill warheads, and an all-weather launch capability. With the introduction of penetrations aids such as decoys, chaff, and maneuvering warheads, ballistic missiles have become increasingly sophisticated, accurate, and more difficult to defeat.

3-14. Iran has steadily increased its ballistic missile force, deploying next-generation short- and medium-range missiles with increasing accuracy and new submunition payloads. It is continuing to develop new missiles and working to enhance lethality and effectiveness of existing systems with improvements in accuracy and warhead designs, to include maneuvering reentry vehicles and submunition payloads.

3-15. North Korea has expanded the size and sophistication of its ballistic missile forces - from close-range to intercontinental variants - and has conducted an unprecedented level of nuclear tests and ballistic missile launches since 2016, including its short-range, medium-range, intermediate-range, long-range, and submarine-launched ballistic missile (SLBM) launches. In February 2016, Pyongyang launched a satellite launch vehicle. The technology involved in a satellite launch would be applicable to North Korea's other long-range missile programs. In 2016 and 2017, North Korea conducted an aggressive testing campaign, launching multiple intermediate-range ballistic missiles, with a range greater than 3,000 kilometers. Today,

North Korea fields hundreds of Scud and No Dong missiles that can reach U.S. forces forward deployed in the Republic of Korea and Japan.

LARGE-CALIBER ROCKETS

3-16. Large-caliber rockets, classified as those of 200 millimeters and greater, are unguided, surface launched, indirect fire rockets with ranges greater than 40 kilometers. They can be fired from single or multiple launch platforms. In the past 20 years, large-caliber rockets have increased in range (some as much as 300+ kilometers) and now, with enhanced guidance packages, are morphing into close- and short-range ballistic missiles.

3-17. Rockets can deliver high rates of fire and a variety of warheads, making them ideal weapon systems for fire support missions. The highly mobile launchers can rapidly move around the battlefield. This mobility, coupled with the rockets' short burn time, gives maneuver forces little warning. Their short range and salvo capability complicate engagement by current AMD systems.

3-18. Like ballistic missiles, large-caliber rockets are found in many countries. They are inexpensive and have been used against United States forces in Iraq and against Israel forces and its general population. North Korea has a 300-mm multiple launch rocket systems that can easily range Seoul and many U.S. forces stationed in South Korea, including those at Osan Air Base.

AERODYNAMIC MISSILES

3-19. Aerodynamic missiles use lateral surfaces to maintain their flight path. Aerodynamic missiles include cruise missiles and tactical air-to-surface missiles.

3-20. Cruise missiles are unmanned, self-guided vehicles that maintain sustained flight at one or more pre-determined constant (cruise) altitudes and have ranges from 30 to 3,000 kilometers. Tactical air-to-surface missiles are similar to air-launched cruise missiles, but are smaller, have shorter ranges, lack the wings and aerodynamic lifts associated with cruise missiles, and are launched by tactical fighter-bomber aircraft. Though regarded as distinctly separate threats, the application of new technologies has given cruise missiles and tactical air to-surface missiles virtually identical capabilities.

CRUISE MISSILES

3-21. Modern cruise missiles can travel at low-to-supersonic or high subsonic speeds, are self-navigating, and can fly non-ballistic trajectories at very low to very high atmospheric altitudes. Cruise missiles can be found in two general categories: land attack and anti-ship. Cruise missiles are generally very expensive and have complicated navigation devices, two considerations which minimized their proliferation; regardless, many nations have shown an increased interest in obtaining the ability to produce these missiles after seeing the U.S. success in employing the land attack variants. Cruise missiles are the hardest air target to detect and intercept which makes them particularly well suited against static ADA systems.

3-22. Cruise missiles are reliable, accurate, survivable, and lethal. They can be launched from the land, air, or sea. They are difficult to detect, can fly indirect routes at low altitudes to avoid heavily defended areas, and can attack from any direction. Today's cruise missile can hit a target with remarkable accuracy; tomorrow's smarter, maneuverable, more accurate missile will pose a far greater threat. Cruise missiles are ideal for striking high-value targets in highly defended areas, since aircraft and aircrews are not put at risk.

3-23. The use of air-breathing turbojet and turbofan engines has given cruise missiles a longer range and the capability to fly at high, subsonic speeds and altitudes lower than 50 meters above ground level. Their flight paths can be programmed using sophisticated guidance systems, such as the Global Positioning System, inertial navigation systems, and terrain contour matching. Their guidance systems contribute to overall accuracy, optimize surprise, and help avoid air defenses. A terminal guidance seeker increases accuracy to less than 10 meters. A wide array of conventional warheads, including individually targetable submunitions, allows targeting of both soft and hard targets. In addition, cruise missiles may carry weapons of mass destruction warheads.

3-24. Many countries have cruise missiles in their arsenal. Some countries have nuclear-capable cruise missiles.

3-25. Technological advances are now making hypersonic glide vehicles and missiles flying non-ballistic trajectories practicable. Hypersonic glide vehicles are a new class of weapon propelled to hypersonic velocity by ballistic missile boosters. After launch, they are essentially unpowered cruise missiles.

TACTICAL AIR-TO-SURFACE MISSILES

3-26. These missiles are air-launched, precision-guided munitions designed to strike ground targets. They are ideal against targets such as bridges that are difficult to destroy with conventional dumb bombs. Tactical air-to-surface missiles are an extremely lethal threat because of their versatility and pinpoint accuracy.

3-27. Most variants employ radio-command, laser, anti-radiation homing, or electro-optical guidance systems. Missiles that employ anti-radiation homing systems are referred to as anti-radiation missiles; they represent the greatest threat to radars such as those employed by ADA forces. An aircraft firing an anti-radiation missile will usually launch from outside the lethal envelope of the ADA system defending the asset. Laser-guided systems provide the least standoff range, generally less than 10 kilometers. Electro-optical or video-guided systems and anti-radiation missiles offer the greatest standoff range and aircraft survivability. Some electro-optical systems have ranges of approximately 100 kilometers.

HYPERSONIC WEAPONS

3-28. Technological advances are now making hypersonic weapons practicable. There are two main types of hypersonic weapons: hypersonic cruise missiles and hypersonic glide vehicles. Hypersonic cruise missiles, which are powered by scramjet, are restricted below 100,000 feet; hypersonic glide vehicles can travel higher. Hypersonic weapons, by definition, travel five or more times the speed of sound.

3-29. Some weapon systems have characteristics of both ballistic and cruise missiles. For example, ballistic missile-launched hypersonic glide vehicles are essentially unpowered cruise missiles. Future supersonic/hypersonic powered cruise missiles may be launched by large rocket boosters that have traditionally been associated with ballistic missiles.

3-30. Hypersonic glide vehicles are being developed as a new type of ballistic missile payload. They are maneuverable vehicles that travel at hypersonic (greater than Mach 5) speed and spend most of their flight at much lower altitudes than a typical ballistic missile. The combination of high speed, maneuverability, and relatively low altitude makes them challenging targets for missile defense systems.

UNMANNED AIRCRAFT SYSTEMS

3-31. An *unmanned aircraft system* is that system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft (JP 3-30). Threat UASs are categorized in groups (see table 3-1 on page 3-6), typically based on weight, operating altitude, and speed. Groups 1 through 3 are further categorized as low, slow, small systems.

Table 3-1. UAS Groups

	Speed / Altitude	*Characteristics*	
Group 1 Micro / Mini UAS	Normally operates below 1,200 feet AGL at speeds less than 100 knots	• Generally hand-launched. • Real time video and control. • Small payloads; focus on reconnaissance, surveillance, and intelligence gathering.	• Operates within LOS of user (limited range).
Group 2 Small Tactical	Normally operates below 3,500 feet AGL at speeds less than 250 knots	• Launched in unimproved areas by a small number of personnel. • Medium range and endurance. • Payload focus: reconnaissance, surveillance, and intelligence gathering; may add weapons. • Requires LOS to ground control station.	
Group 3 Tactical	Normally operates below 18,000 feet MSL at speeds less than 250 knots	• Launched in unimproved areas by a small number of personnel. • Range and endurance vary significantly. • Payload focus: reconnaissance, surveillance, and intelligence gathering; may add weapons. • Requires larger logistics footprint than Groups 1 and 2.	
Group 4 Persistent	Normally operates below 18,000 feet MSL at any speed	• Can be used both strategically and tactically. • Requires a runway for launch and recovery. • Extended range and endurance. • Payloads: reconnaissance, surveillance, intelligence, gathering, and ASM weapons. • Operates at medium-to-high altitudes.	
Group 5 Penetrating	Normally operates higher than 18,000 feet MSL at any speed	• Strategic-level asset. • Requires an improved runway for launch and recovery. • Greatest range, endurance, and airspeed. • Payloads: suite of optics for targeting and weaponry for engagements. • Operates at medium-to-high altitudes. • Logistical footprint similar to that of a manned aircraft.	

AGL above ground level
ASM air-to-surface munition
LOS line-of-sight
MSL mean sea level
UAS unmanned aircraft system

3-32. UASs include drones, characterized by preprogrammed flight paths and patterns, and remotely piloted vehicles controlled by ground-based operators. Some UASs may implement both drone and remotely piloted flight control types. Each can perform a variety of missions, ranging from reconnaissance and battlefield surveillance to attack and electronic warfare. UASs have extensive commercial applications and, as a result, are readily available and arguably the most developed system in many armies around the world. Due to the prolific use of unmanned systems, commercial off-the-shelf UASs are readily available and can be weaponized with relative ease. There are over 1,000 current and developing UAS programs worldwide. UASs are typically comprised of a control element, communication systems, support elements, an unmanned aircraft, a payload or pod, and a human element.

- The control element typically consists of UAS operators and leaders providing aircraft control, payload control, weapons control, and communications supporting the commander's and staff's planning/execution requirements. It also includes the control station itself from which the unmanned aircraft receives its commands. The control station can be mounted on tactical vehicles, in stationary and static structures, on civilian vehicles such as vans or trucks, and on ships; it could even be placed in orbit around the Earth.
- Communication within an UAS is normally conducted via line-of-sight communications or satellite control; it is often encrypted to increase information protection and survivability. UASs

also make effective platforms for communications relay stations due to their potentially high mission endurance and ability to avoid (over-fly) terrain that ground-based vehicles with relay components would be unable to navigate.

- The support element includes all logistical systems required to deploy, transport, recover, enable, and generally sustain the UAS.
- The unmanned aircraft can manifest itself in a variety of types to include fixed-wing, rotary-wing, aerospace, and even balloons. Typically, the larger the aircraft the higher its endurance and the higher the altitude in which it can operate. Low, slow, and small UAS are particularly dangerous due to the challenges which they present to friendly sensor systems for detection and identification and for weapon systems to consistently defeat them given their low/slow kinematic profile. UASs are also easily obtained commercially and inexpensive, making them even more of a threat.

3-33. UASs serve as intelligence, surveillance, and reconnaissance platforms for target detection, identification, and location; weapon targeting; target designation; and battle damage assessment. UASs can assist commanders with early warning to develop friendly courses of actions. State-of-the-art sensors and data links provide real-time targeting for fire support systems, maneuver forces, and aircraft. UASs equipped with laser designators provide immediate targeting assistance and terminal guidance of munitions. UAS platforms also can serve as a means for weapons delivery or may themselves serve as the weapon, and have been used extensively to attack high payoff targets without endangering pilots. Threat actors consider UASs expendable.

3-34. UASs have relatively low radar cross sections, low speed, and low thermal signatures, thus making them difficult to detect, track, and engage. Mission-dictated flight profiles take full advantage of terrain, increasing system survivability and optimizing coverage. Flight altitudes for UASs vary by their size and mission and can range from meters to thousands of kilometers. UASs conducting intelligence, surveillance, and reconnaissance missions operate at altitudes consistent with their sensor systems. They normally fly at altitudes safe from small arms fire and can stand off and detect from up to 25 kilometers.

3-35. UAS optical payloads consist of daylight television, infrared video, and recording cameras (for reconnaissance missions). Other major payload categories include electronic warfare (jammers), electronic intelligence, radar, communications relay and attack warheads. Several nations are developing and fielding anti-radiation homing UAS capabilities with the primary mission of attacking battlefield radio frequency emitters (radars and communications). These platforms have a variety of launch options and are usually fire-and-forget systems.

MANNED ROTARY-WING AIRCRAFT

3-36. Most countries maintain helicopter fleets to support military operations. While the majority of helicopters can be armed to perform a variety of roles, the attack helicopter poses the greatest threat to maneuver forces. The versatility of helicopters make them ideal for use in most combat areas.

3-37. Threat ground force commanders rely primarily on helicopters to fulfill direct air support requirements. Helicopters can perform a variety of missions. Hovering and low-flying helicopters, taking full advantage of terrain masking, are difficult to acquire and target. An especially challenging ingress technique is nap-of-the-earth flying, in which a helicopter hovers at a masked point, dashes to the next mask point, and hovers again. This technique is challenging because of short exposure times and varying between near-zero Doppler and moderate Doppler velocities. Improvements in fire control and weapon capabilities enable helicopters to search, acquire, and fire at ground targets from longer standoff ranges, thus increasing their survivability and effectiveness.

MANNED FIXED-WING AIRCRAFT

3-38. Manned fixed-wing aircraft remain essential to virtually every type of military operation and despite the emergence of ballistic missiles and cruise missiles, it will continue to play a role in future conflicts. There are more than 40,000 operational military aircraft today; of these, some 10,000, many produced during the Cold War era, are in third world inventories. Over 50 countries have an aviation industry of some kind, and over 20 countries design their own aircraft.

3-39. Manned fixed-wing combat aircraft are highly flexible and can perform a variety of missions in offensive and defensive operations: air interdiction, strategic attack, suppression of enemy air defense, and close air support. Fixed-wing aircraft can employ a variety of munitions, including bombs, guns, rockets, cruise missiles, and tactical air-to-surface missiles. Integrated navigation/bombing computers and related mission equipment provide new combat aircraft with a precision-strike capability, day or night and in bad weather.

3-40. New aircraft incorporate such features as radar warning receivers, on-board jammers, chaff, flares, and a lower radar cross section to improve survivability and mission success rate. In addition, the proliferation of fixed-wing aircraft throughout the world increases the probability that opposing forces may employ the same type of aircraft in a conflict; this exacerbates the already challenging problem of identification.

ROCKETS, ARTILLERY, AND MORTARS

3-41. RAM are traditional indirect fire threats to ground forces. These systems vary in size and effect. Rockets and artillery are usually fired from towed or self-propelled platforms while mortars are frequently transported by dismounted crews.

3-42. Rockets are unguided projectiles with a short boost phase and unpowered flight, and fly ballistic trajectories. The most common type of warhead is high explosive with a point detonating fuse. Rockets are commonly fired from self-propelled platforms known as multiple rocket launchers. Multiple rocket launchers may fire large volleys of rockets (20 to 40) with multiple launchers being used in a volley. Rockets come in many calibers such as 57-millimeter, 68-millimeter, 80-millimeter, 81-millimeter, 107-millimeter, 120-millimeter, 122-millimeter, and 127-millimeter. Their high rate of fire and volume of fire make them a stressing threat. Hybrid and irregular forces have used rockets as harassing fire, with improvised firing methods and delays to limit counterfire effects. Large caliber rockets, 200-millimeter and greater, were addressed earlier.

3-43. Artillery and mortar rounds are also unpowered and traditionally fly ballistic trajectories. All armies throughout the world have some form of artillery. The most common artillery calibers are 122-millimeter, 152-millimeter, and 155-millimeter. Unless using rocket assisted projectiles, artillery systems are generally limited to 20 to 30 kilometers. The most common mortar calibers range are 60 to 120-millimeter, but include many variants, such as 81-millimeter, 82-millimeter, 100-millimeter, and 160-millimeter.

ELECTRONIC WARFARE AND CYBER

3-44. Electronic warfare and cyber threats are continuously present throughout the tactical, operational, and strategic realms. Electronic warfare involves the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Electronic warfare includes electronic attack, electronic protection, and electronic warfare support. A threat will attempt to deny, degrade, disrupt, or destroy friendly emitters (radar and communications) and other electromagnetic spectrum dependent devices. Sensors to locate emitters or to listen for information and/or intelligence can be mounted on ground or air platforms. Cyberspace attacks will target technical networks, systems, and data. For more information see FM 3-12.

3-45. The most common form of tactical electronic attack is electromagnetic jamming. Jamming consists of an emitter radiating electromagnetic energy to prevent a radar receiver from discerning the expected return from the background noise or a radio from receiving voice or data. Advanced jamming techniques allow the threat to project false location, speed, and altitude, creating confusion for radar operators.

3-46. The use of an electromagnetic pulse, normally envisioned as produced by a high altitude nuclear explosion, is a threat to friendly electronic systems. Our increasing dependence on advanced electronics systems results in the potential for an increased electromagnetic pulse vulnerability of our forces, and if unaddressed makes electromagnetic pulse employment by an adversary an attractive asymmetric option (Electromagnetic Pulse Commission Report). In addition, several countries are experimenting with generating an electromagnetic pulse from non-nuclear explosives.

3-47. ADA organizations, from the tactical to the strategic level, face multiple types of sophisticated cyber threats, whether in garrison or operating in the field. Regional powers, peer states, and transnational terrorist organizations have personnel with capabilities to conduct cyber-attacks on installations and sites. Cyber-

attacks are expected against C2 nodes; theater and tactical data and voice networks, information systems, radars and their tracking and targeting systems, and missile guidance packages. The threat is expected to use cyber attacks in conjunction with physical attacks as part of a larger campaign. Cyber threats can prevent target detection, tracking, and engagement of threat munitions and platforms. The threat is likely to also expand attempts to penetrate networks for data collection and exploitation with a growing sophistication to conduct cyber attacks. Strategic organizations, with "on-line" missions, face multiple types of cyber threats on a continual basis.

STRATEGIC MISSILE THREATS THAT MAY IMPACT THE THEATER

3-48. Despite the end of the Cold War, the threat of accidental, unauthorized, or limited strategic strikes against the United States continues to exist. ICBMs and SLBMs are a threat to the United States. They carry nuclear warheads and employ a variety of penetration aids.

3-49. ICBMs and SLBMs pose significant challenges to active defense and attack operations forces. Some ICBMs are road mobile, reducing the time that they can be targeted, while others are designed with countermeasures to ballistic missile defense systems. Some SLBMs may be launched from surfaced and submerged submarines from various launch locations.

INTERCONTINENTAL BALLISTIC MISSILES

3-50. An ICBM is a ballistic missile with a range greater than 5,500 kilometers and typically designed to deliver one or more nuclear warheads. Most modern designs support multiple independently targetable reentry vehicles, allowing a single missile to carry several warheads, each of which can strike a different target.

3-51. Although current ICBM-producing countries are limited, several countries are developing production capabilities. Thus, the threat to the United States continues to grow. Other countries developing ballistic missiles are also likely to build various responses to U.S. defenses. Developing countries would probably rely on available countermeasure technologies such as separating reentry vehicles, spin stabilizing reentry vehicles, radar absorbing material, low-power jammers, and simple decoys such as balloons.

3-52. Rudimentary technologies from earlier versions of missiles are more readily available and are adequate for use by nations not overly concerned with missile accuracy, reliability, or safety. The increased availability of technical assistance from other nations and of classified information related to ballistic missiles and weapons of mass destruction will short-cut development programs. Once launched, ICBMs are difficult to defeat. Their targets may be strategic or political, civilian or military. ICBMs will most likely use nuclear warheads, and many will carry multiple reentry vehicles. Projected ICBM improvements include mobile basing, improved reliability, increased accuracy, and improved penetration aids.

3-53. Iran's progress on space launch vehicles - along with its desire to deter the United States and its allies - provides Tehran with the means and motivation to develop longer-range missiles, including ICBMs. In April 2016 Iran launched a space launch vehicle, which could be capable of ICBM ranges if configured as such. Iran may be able to deploy an operational ICBM by 2020 if the regime chooses to do so.

3-54. North Korea is developing and has paraded two road-mobile ICBMs which, if successfully developed, would likely be capable of reaching much of the continental United States. North Korea launched several ICBMs in 2017 and claims to be capable of ranging most of the continental United States with its ICBMs.

SUBMARINE-LAUNCHED BALLISTIC MISSILES

3-55. Submarine mobility provides launch location options unavailable to ICBM forces and makes detection difficult. SLBMs provide ICBM capabilities with the added advantages of better hiding, shorter flight times, and depressed reentry angles. Targets will generally be identical to those of ICBMs. Projected improvements include more sophisticated payloads and guidance systems, improved reliability, increased range, and improved penetration aids.

3-56. North Korea conducted multiple flight tests of a developmental SLBM. North Korea tested a new SLBM capability in 2015 and again in 2016. In February 2017, North Korea publicized the launch of a new solid-propellant missile that appeared to be a land-based variant of its SLBM. The missile was launched from a canister carried on a previously unseen tracked launcher.

SPACE

3-57. Space is the new high ground for operations. It is becoming an increasingly congested, competitive, and contested environment. Space systems are critical to the tactical, operational, and strategic levels of warfighting. The quantity and quality of foreign satellites on orbit is rapidly increasing, and foreign countries are developing counters to the U.S. space advantage, including methods to disrupt or deny access to communications; position, navigation, and timing; and intelligence, surveillance, and reconnaissance satellites. Employment of these threat space-based capabilities can have a significant impact on U.S. systems and their ability to execute missions.

3-58. Peer competitors are pursuing space efforts for military, economic, and political objectives. They recognize the strategic value of space and view U.S. dependency on space for projection of military power as a vulnerability. They operate satellites for communications, navigation, earth resources, weather, intelligence, surveillance, and reconnaissance purposes, in addition to conducting manned space and space exploration missions.

3-59. Over the next 10 years, hundreds of commercial or government-sponsored imaging satellites are projected to be launched. The sheer number of these new satellites, and the fact that most are foreign or consortia owned, diminishes the ability of the United States to impose political constraints on the use of satellite imagery products. These new commercial imaging capabilities will allow an adversary to challenge the U.S. force's ability to achieve strategic and tactical surprise and to gain and sustain information superiority.

SUMMARY

3-60. Ballistic, cruise missiles and hypersonic weapons are and will continue to be offensive weapons of choice for many nations. These threats, as standalone systems or complemented with UAS, electronic warfare and cyber, and other capabilities described above, create formidable challenges for Army, joint, and multinational AMD forces. Table 3-2 provides a summary of the air and missile threats, their primary targets, and their capabilities and trends.

Table 3-2. Air, missile, and electronic warfare/cyber threats to surface targets

System Category	*Targets*	*Capabilities*	*Trends*
Ballistic Missiles	• Geopolitical/population centers. • Airports and seaports. • Logistical areas. • Troop concentrations.	• To 5,500 kilometers range. • Low radar signature. • Warheads – conventional, weapons of mass destruction, submunitions. • Launch from mobile platforms. • Penetration aids, decoys, chaff, maneuvering warheads.	• Increased range – solid fuel, multi-stage. • Improved accuracy – terminal guidance, global positioning system. • Increased survivability – decoys, signature reductions.
Large Caliber Rockets	• Assembly areas. • ADA/field artillery locations. • Defensive positions. • Chokepoints/routes of advance.	• High rates of fire, rapid reload and highly mobile. • Extended Range–300+ kilometers. • Low signature and flat trajectory. • Warheads – conventional, weapons of mass destruction, submunitions.	• Course corrected munitions. • Increased ranges blurring line with close- and short-range ballistic missiles. • Increased accuracies with global positioning system guidance.
Cruise Missiles	• High-value military/industrial complexes. • Airports and seaports. • Logistical areas. • C2 centers. • Maneuver force concentrations.	• 30-3,000 kilometer range. • 360-degree threat; very low radar signature. • Air, sea, or ground launched. • Warheads – conventional, weapons of mass destruction, submunitions.	• Increased number of land attack variants. • Reduced radar signatures. • Improved accuracy and increased range.
Tactical Air-to-Surface Missiles	• Armored vehicles. • Radars. • Bridges or other point targets. • ADA sites.	• >100 kilometer range. • Supersonic speeds (Mach 3). • Extremely accurate. • Radio-command, laser, anti-radiation, or electro-optical guidance.	• Improved accuracy and lethality. • Lock-on-after-launch or loitering. • Dual/tri mode seekers – increased reliability and all weather capability.
Unmanned Aircraft Systems	• Assembly areas, logistical areas, C2 centers (seeing). • Troop movements (seeing). • C2 centers (jamming). • Maneuver formations/systems (attacking).	• Multi-mission – reconnaissance, surveillance, and target acquisition; electronic warfare; attack. • Range to 1,900 kilometers; altitude near-ground to 17+ kilometers. • Standoff/detection to 25 kilometers. • Payloads – daylight television, cameras, missiles, laser designators, retransmitters.	• More missions – decoy, suppression of enemy air defenses, and electronic attack. • Standoff range in excess of 25 kilometers. • Detection to 40 kilometers; all weather, day/night. • Perch and stare ability. • Low radar signature. • Low thermal signature.

Table 3-2. Air, missile, and electronic warfare/cyber threats to surface targets (continued)

System Category	*Targets*	*Capabilities*	*Trends*
Unmanned Aircraft Systems	• Assembly areas, logistical areas, C2 centers (seeing). • Troop movements (seeing). • C2 centers (jamming). • Maneuver formations/systems (attacking).	• Multi-mission – reconnaissance, surveillance, and target acquisition; electronic warfare; attack. • Range to 1,900 kilometers; altitude near-ground to 17+ kilometers. • Standoff/detection to 25 kilometers. • Payloads – daylight television, cameras, missiles, laser designators, retransmitters.	• More missions – decoy, suppression of enemy air defenses, and electronic attack. • Standoff range in excess of 25 kilometers. • Detection to 40 kilometers; all weather, day/night. • Perch and stare ability. • Low radar signature. • Low thermal signature.
Rotary-Wing Aircraft	• Troops/armored vehicles. • Convoys. • C2 centers.	• Multi-role – attack; reconnaissance, surveillance, and target acquisition; electronic warfare. • Combat diameters out to 460 kilometers; terrain masking/hovering. • Payloads – daylight TV, cameras, missiles, laser designators, retransmitters.	• Modular upgrades to airframes. • Expanded night/adverse weather capability. • Improved fire control systems/engagement capability – at greater ranges. • Improved countermeasures.
Fixed-Wing Aircraft	• Ports. • Assembly/logistical areas. • C2 centers. • Geo-political/ population centers. • Maneuver force vehicles/ formations.	• Multi-role – close air support; reconnaissance, surveillance, and target acquisition; electronic attack; interdiction; strategic attack; suppression of enemy air defenses. • Precision strike. • Equipment – missiles, rockets, bombs, submunitions, guns.	• Multi- versus single- mission aircraft. • Greater use of standoff and precision. • Reduced radar and infrared signatures. • Integrated electronic attack. • Proliferation increases identification challenges.
Rockets, Artillery, and Mortars	• Troops/armored vehicles. • Fixed/semi-fixed sites.	• Variable payload. • Saturation of airspace. • Mass fires. • Easily moved/relocated.	• Extended ranges. • Improved accuracy. • Greater lethality.

Table 3-2. Air, missile, and electronic warfare/cyber threats to surface targets (continued)

System Category	*Targets*	*Capabilities*	*Trends*
Electronic Warfare and Cyber	• C2 nodes. • Tactical data and voice information, networks, and systems. • Theater data and voice information, networks, and systems. • ADA radars. • ADA tracking and targeting systems. • Missile and UAS guidance systems.	• Disrupt data and voice communications. • Locate C2 nodes for targeting. • Disrupt targeting and guidance systems. • Electronic warfare techniques, such as interception and spoofing, to gain information on planning and operations. • Radar jamming. • Electromagnetic pulse to incapacitate electronic systems.	• Cyber-attacks in conjunction with physical attacks. • Expanded attempts to penetrate networks for data collection and exploitation. • Growing sophistication of threats. • Increased exposure of tactical systems to cyber threats as office systems are combined with tactical systems.
Inter-continental Ballistic Missiles	• Large fixed military installations. • Capitals and other population centers. • Major industrial sites/regions. • Intercontinental ballistic missile sites.	• Mobile launchers. • Multiple warheads – nuclear. • Penetration aids.	• Mobile basing. • Improved reliability and accuracy. • Improved penetration aids.
Submarine-launched Ballistic Missile	• Large fixed military installations. • Capitals and other population centers. • Major Industrial areas/sites. • Intercontinental ballistic missile sites.	• Mobile. • Hide/wait/launch from anywhere. • Worldwide targeting. • Multiple warheads – nuclear. • Penetration aids.	• More sophisticated payloads and guidance systems. • Increased range and accuracy. • Improved reliability and penetration aids.
Space Systems	• Lodgment areas. • Massed troops. • Ships. • Missile launch sites.	• Functions: communications/ navigation support, weather prediction, surveillance, reconnaissance, intelligence collection, and counter-space operations. • Payloads: synthetic aperture radar, electro-optical, imaging infrared. • Disrupting communications.	• Easy access to improved commercial sources. • Remote sensing resolution to one meter. • Advanced data processing/ storage.

ADA air defense artillery C2 command and control UAS unmanned aircraft system

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Chapter 4

Command and Control of ADA Forces

This chapter describes the elements of mission command, the elements of command and of control, and the authorities exercised through C2. It discusses how ADA forces execute AMD C2 and the C2 relationships exercised across joint elements and ADA echelons in a theater of operations.

MISSION COMMAND

4-1. *Mission command* is the Army's approach to command and control that empowers subordinate decision making and decentralized execution appropriate to the situation (ADP 6-0). To effectively exercise authority and provide direction, a commander must fully understand the problem, envision the desired end state, and grasp the nature and design of operations that will lead to it. The criticality of understanding cannot be overstated. It is vital to making effective decisions, managing associated risks, and considering subsequent effects.

4-2. A fundamental aspect of Army AMD operations is that AMD fires are defensive in nature. The enemy chooses when to initiate offensive action by air surveillance and attack, and, thus, the enemy commander holds the initiative as friendly ADA forces react to the method, tempo, and volume of air attack. However, ADA commanders, who are skilled in translating mission command into executable plans and effective AMD fires, render enemy air attacks and surveillance ineffective. In so doing, they wrestle the initiative from the enemy commander and translate it into operational and strategic advantages for the Army and JFC. Further, successful countering of enemy air attacks sets the conditions for joint and Army commanders to seize or retake the initiative through offensive action, forcing the enemy commander to react to our actions.

4-3. C2 systems provide the ability to receive and disseminate orders, immediately view friendly activity and supply movement, plan operations, receive situation and intelligence reports, view the airspace, and receive automatically disseminated weather observations, forecasts, and analysis. C2 capabilities ensure commonality across Army operations and standardize planning and execution functions across all echelons. A unique aspect of the ADA force is the degree of integration that exists between the art of command and the science of control. ADA C2 systems, as well as a comprehensive understanding of mission command, are critical enablers for ADA commanders as they determine how, when, and at what level they should impact the tactical engagement sequence.

4-4. AMD operations are complex and require commanders who, through mastery and application of mission command,

- Understand the air and missile threat,
- Know how to design air and missile defenses,
- Can develop cohesive teams,
- Can employ ADA forces to maximize weapon systems capabilities with joint and multinational AMD partners.

4-5. The Army's principles of mission command enable ADA commanders at all echelons to effectively conduct operations. These principles − competence, mutual trust, shared understanding, commander's intent, mission orders, disciplined initiative, and risk acceptance − allow commanders to cut through the "fog of war" and make timely and effective decisions despite operating in an environment that is both uncertain and often ambiguous.

4-6. Competence. ADA leaders and Soldiers at all echelons must be tactically and technically competent in executing AMD operations – masters of their craft – as individuals and in teams. Competence is achieved

through institutional training and education focusing on the individual, operational force training emphasizing team building, and self-development enhancing knowledge. Competence is reinforced through a continuous series of focused and progressively stressing drills and exercises and challenging certifications.

4-7. Mutual trust. Central to creating a functional mission command climate is the need to build cohesive teams. Demonstrated competencies, dedicated leadership, and commitment to mission accomplishment are the cornerstones to building mutual trust. ADA commanders have a unique opportunity to build cohesive teams with joint and multinational partners. Commanders must have a fundamental understanding and appreciation for the unique community cultures of these partners to build cohesive multicultural AMD teams.

4-8. Shared understanding. AMD C2 capabilities at the operational and tactical levels (Patriot C2, Air and Missiles Defense Planning and Control Systems (AMDPCS), forward area air defense (FAAD) C2/C-RAM C2, THAAD C2, AMDWS, and air defense systems integrator) provide information exchanges, automated processing aids, and warfighter/machine interfaces to achieve awareness. Lack of commonality and unique system interfaces complicate the achievement of this objective across all echelons of the ADA force. As such, a greater premium is placed on human cognition when it comes to transforming awareness and sometimes conflicting or ambiguous information into understanding.

4-9. Commander's intent. The ADA commander regularly synchronizes several warfighting functions across multiple joint, multinational, and Army organizations. It is impossible for the commander to specify the task, purpose, and end state for every possible contingency. It is with this backdrop that the commander must issue a clear intent that provides the necessary framework for subordinate and adjacent leaders to execute their short notice warfighting tasks and mission – maximum attrition as far forward as possible.

4-10. Disciplined initiative. AMD functions, by their very nature, are complex. A thinking enemy with a wide range of capabilities, combined with a saturated joint or multinational operating environment, creates the conditions for demonstrated disciplined initiative. The key to operating in this environment is for subordinates to demonstrate understanding of the mission, the commander's intent and end state, the AMD concept of operations (to include ROE), and the tasks and purposes of each subordinate unit within that concept of operations. This understanding arms subordinates with the ability to exercise disciplined initiative.

4-11. Mission orders. The AMD environment is fast paced and always evolving. Effective use of mission orders to provide direction and guidance enables commanders to achieve mission accomplishment over a wide ranging, rapidly evolving, and three-dimensional operational environment. Properly constructed and disciplined orders allow commanders to direct change to the concept of the operation, when necessary.

4-12. Risk acceptance. ADA commanders must know where they are facing risk and ensure these risks are understood at all echelons. Commanders, staffs, and subordinate leaders use the risk management process in developing plans and preparing for operations (see ATP 5-19 for more information). The risk management process allows commanders to determine the level of risk, supports their decisions as to how much risk to accept (prudent risk), and facilitates the identification of means to minimize the effects of the risk. It is most important to provide leadership with accurate risk information and for all to understand at what level the responsibility to accept risk resides.

COMMAND OF ADA FORCES

4-13. *Command* is the authority that a commander in the armed forces lawfully exercises over subordinates by virtue of rank or assignment (JP 1). Command includes the authority and responsibility for effectively using available resources and for planning the employment, organization, coordination, and control of forces for the accomplishment of missions. Direct leadership within a command decreases as the level of command increases.

4-14. Command is more art than science. The art of command is the creative and skillful exercise of authority through timely decision making and leadership. As an art, command requires exercising judgment.

COMMMAND RELATIONSHIPS

4-15. Army command relationships define superior and subordinate relationships between unit commanders and identify the degree of control of the gaining commander. There are five types of command relationship: organic, assigned, attached, operational control, and tactical control (ADP 5-0).

Note. The joint community identifies four command relationships: combatant command, operational control, tactical control, and support. Operational and tactical control are discussed below. Support Relationships is discussed on page 2-4, paragraphs 2-13 through 2-17. *Combatant command* (COCOM) is the nontransferable command authority, which cannot be delegated, of a combatant commander to perform those functions of command over assigned forces involving organizing and employing commands and forces; assigning tasks; designating objectives; and giving authoritative direction over all aspects of military operations, joint training, and logistics necessary to accomplish the missions assigned to the command (JP 1).

4-16. *Organic* are those assigned to and forming an essential part of a military organization as listed in the table of organization for the Army, Air Force, and Marine Corps, and are assigned to the operating forces for the Navy (JP 1). An ADA battalion, for instance, is organized with a specified number of ADA batteries based on its table of organization and equipment. Organic ADA forces have command relationships with all other organic forces organized with the headquarters. Organic ADA forces are positioned by its organic headquarters and have their priorities established by that headquarters.

4-17. *Assign* is to place units or personnel in an organization where such placement is relatively permanent and/or where such organization controls and administers the units or personnel for the primary function, or greater portion of the functions, of the unit or personnel (JP 3-0). Assigned ADA forces have command relationships with the gaining unit, are assigned positions by that unit's commander, and have priorities established by that commander or by a subordinate commander if so delegated.

4-18. *Attach* is the placement of units or personnel in an organization where such placement is relatively temporary (JP 3-0). Attached ADA forces have command relationships with the gaining ADA unit and are assigned positions and have priorities established by that unit's commander.

4-19. *Operational control* is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission (JP 1). Command relationships, positions, and priorities are established by the gaining ADA unit. See paragraph 4-51, on page 4-8 for additional discussion.

4-20. *Tactical control* is the command authority over assigned or attached forces, or military capability of forces made available for tasking, that is limited to the detailed direction and control of movements or maneuvers within the operational area necessary to accomplish missions or tasks assigned (JP 1). Command relationships, positions, and priorities are established by the gaining ADA unit. See paragraphs 4-58 and 4-59 on page 4-10 for additional discussion.

ELEMENTS OF COMMAND

4-21. The elements of command are authority, responsibility, decision making, and leadership. Commanders exercise their authority by making decisions and leading their command in the implementation of those decisions (ADP 6-0).

4-22. Command requires providing leadership. *Leadership* is the process of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization (ADP 6-22). Collaboration and dialogue are essential to this process, and effective commanders employ their C2 systems to promote these in order to support decision making.

AUTHORITY

4-23. Authority is the right and power to judge, act, or command. Commanders exercise authority by virtue of their positions; they sustain authority, in many cases, by their competence and leadership abilities and by the trust and respect with which they are held by superiors and subordinates. Command authority permeates all force and engagement operations. This authority may be, and often is, delegated to subordinates. Commanders must determine how much authority is delegated and when. These determinations are made based on the commander's confidence and trust in subordinates and METT-TC. For example, when significant air threats are imminent or an air battle intensifies, engagement authority for air threats may be delegated to Avenger team leaders. Authority with respect to command and to control is more fully discussed in Authorities: Command and Control, beginning on page 4-6.

RESPONSIBILITY

4-24. With authority comes responsibility. Though commanders may delegate authority, they cannot delegate responsibility. Commanders are legally and ethically responsible and accountable for their own actions and decisions and for those of their subordinates. Responsibility entails fulfilling the assigned task; accountability is about "answerability." Commanders are responsible and accountable for mission accomplishment; the health, welfare, morale, and discipline of Soldiers; and the use and maintenance of resources. Commanders are always accountable to their superiors for what happens or fails to happen in their command. AMD command responsibility and accountability are inherent in all force and engagement operations irrespective of phase of operation, time, allocation of ADA resources, or aerial threats.

DECISION MAKING

4-25. Given the nature of the AMD operational environment (compressed detection-to-engagement timelines, congested airspace, and ambiguous air pictures), ADA commanders and their staffs must be equipped and trained to make decisions that are both timely and effective. While our AMD capabilities include a variety of automated decision aids, the volume and variety of information presented to commanders and operators require those making decisions to process and understand it quickly enough to allow for the most appropriate response/action. To facilitate this, ADA commanders must train subordinates to realistic standards, organize available assets, establish procedures, and demand focus in order to streamline the information flow and expedite the decision-making process.

LEADERSHIP

4-26. A key ingredient to successful command is the exercise of effective leadership in the inherently stressful, ambiguous, and often chaotic conditions of combat operations. *Leadership* is the activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization (ADP 6-22). Collaboration and dialogue are essential to this process, and effective commanders employ their C2 system to promote these in order to support decision making.

4-27. Effective leadership requires commanders to establish their presence at the critical place and time in battle. Commanders' presence at subordinate elements allows them to personally check for an understanding of plans and intent. Their presence also allows them to better understand the operational concerns and challenges of their subordinate commanders and factor those into their decision making. Finally, their presence allows them to assess the overall unit climate, readiness, and morale.

4-28. Commanders at all echelons must exploit opportunities for greater leadership presence and use those opportunities to instill confidence in their Soldiers and cultivate a positive leadership climate. The typically wide dispersion of subordinate units in an AMD defense design makes this extremely challenging. As such, commanders must be deliberate about prioritizing the time spent "on the ground" with their staffs and subordinate units. The face-to-face interaction with subordinate leaders and Soldiers helps to improve the flow of information, both up and down, contributing to a common and shared situational understanding across echelons. Ultimately, this time spent "on the ground" is time well spent; it facilitates building and maintaining trust and confidence, which will result in significant operational dividends during those times when command presence is not possible.

CONTROL AND COORDINATION OF ADA FORCES

4-29. *Control* is the regulation of forces and warfighting functions to accomplish the mission in accordance with the commander's intent (ADP 6-0). Control extends over the entire force and is executed in the different domains by various authorities. In the air domain, the JFC designates the AADC to execute AMD operations and the airspace control authority to coordinate the use of the airspace. See paragraph 4-51 on page 4-8 for more information.

4-30. Limited AMD resources, the potentially catastrophic consequences of failed engagements, and the ever present risk of fratricide make effective control of AMD fires a top priority of all personnel involved in engagement operations. The structure and degree of this control varies based upon situational factors, which include span of control, degree of airspace traffic density, operational context (phase of operations), and geo-political considerations and sensitivities.

ELEMENTS OF CONTROL

4-31. Commanders use control to direct and coordinate the actions of subordinate forces. However, control is not a one-way process – it entails the reciprocal flow of information from subordinate elements as well as from higher and lateral sources. There are four elements of control: direction, feedback, information, and communications.

DIRECTION

4-32. Directions are generally transmitted through plans and orders. These may contain amplifying control and coordination measures. AMD documents, such as the area air defense plan, airspace control plan, and airspace control order, may, for instance, identify air routes through the area of operations, specify who is delegated engagement and/or identification authority, activate/deactivate missile engagement zones, and establish the weapons control status.

4-33. Automated C2 tools can enhance the ADA commander's ability to exercise control to account for changing circumstances and direct adjustments within the defense design and ROE to address the new situation. These tools facilitate shortened response times to achieve and implement critical C2 decisions and directives.

FEEDBACK

4-34. Feedback may come from higher headquarters or adjacent, subordinate, or supporting forces, and it may occur before, during, or after operations. Feedback conveys concurrence/approval of existing plans or activities, or it may recommend/direct changes. Feedback promotes common situational understanding.

INFORMATION

4-35. The ability to gather and process information from multiple sources (for example, sensor data, situation reports, and unit movement reports) allows commanders and their staffs to see and understand the air battle. While this holds true for all phases of the fight, it is particularly critical as maneuver forces look to seize the initiative and execute decisive action against the enemy. Given the pace of these operations, this information must be timely and unambiguous. While this has proven to be a challenge across all domains, the ability to gather and process this information as it pertains to the airspace has been particularly daunting. The lack of a real-time air picture at BCTs and functional brigades forces these commanders to accept what amounts to incalculable risk when factoring in the enemy's ability to influence (interdict, delay, or disrupt) their schemes of maneuver to achieve decisive action. ADAM cells must establish communications and information exchange procedures with ADA units and other AMD assets, within their assigned brigades' areas of operations, in order to leverage the capabilities those assets provide. Even if they do not have all the assets to defeat the potential air threat, identifying and understanding it allows brigade commanders to assess the risk and implement measures to mitigate it.

COMMUNICATION

4-36. Effective communication is essential when operating in the complex and ever evolving AMD operational environment. The information being transmitted must be timely, relevant, and, most importantly, must equal the information being received. Due to these requirements, every effort must be made to ensure voice and data communication networks are established and maintained through all phases of operations. Outages to networks must be addressed immediately. When outages do occur, established degraded communication procedures must be followed to ensure safe and effective continuity of operations until networks are restored.

4-37. One way to deal with degraded communications is through primary, alternate, contingency, and emergency (also known as PACE) communication planning. PACE plan establishes the methods of communications, typically from higher echelons to lower echelons. A good plan establishes redundancy so that communications are always available, while ensuring that an alternate or contingency method of communications does not rely on the primary.

COORDINATION

4-38. Inherent in command and control relationships is coordination of efforts. Coordination is a continuous process extending from initial planning for AMD operations through their execution. Coordination of functions and actions is effected by ADA officers in organizations and elements at the various Army, joint, and multinational levels. The primary AMD coordinators are the AAMDC commander; AAMDC and ADA brigade air defense artillery fire control officer (ADAFCO); AMD section chiefs in the theater, corps, and division headquarters; and the ADAM cell ADA officers in BCTs and other specified brigades. However, all ADA officers down to platoon level execute coordination tasks with their supported and supporting commanders.

4-39. AMD coordinators ensure that ADA plans and operations are synchronized with and integrated into the plans and operations across the land, sea, and air domains. Key coordination tasks (echelon dependent) include:

- Advise commanders and their staffs of the AMD capabilities, unit locations and statuses.
- Assess air and missile threats and supported commanders' priorities in order to optimize defense planning.
- Inform protection cells in corps and below of current operations and future AMD plans.
- Assist the fire support coordinator in integrating attack operations priorities into the forces targeting process.
- Request and disseminate AMD information to include airspace control measures or restrictions.
- Develop the AMD appendix in the operations plan.
- Assist in facilitating force protection and sustainment support for ADA units.

4-40. Additional discussion of the specific responsibilities of individual AMD coordinators are contained in section IV, below, and in chapters 4 through 9.

AUTHORITIES: COMMAND AND CONTROL

4-41. *Command and control* is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission (JP 1). Command of AMD forces and the control of AMD fires are derived from separate authorities. Army commanders exercise legal authority and responsibility for the ADA formations assigned to them or otherwise placed under their operational control. However, because AMD fires occur in the airspace, they are controlled by the AADC. The *area air defense commander* is the component commander with the preponderance of air defense capability and the required command, control, and communications capabilities who is assigned by the joint force commander to plan and execute integrated air defense operations (JP 3-01). The AADC establishes the AMD ROE for the theater of operations. The separation of command responsibility from the authority to control AMD fires presents unique challenges for ADA commanders. They must command their ADA forces in the planning, preparation, and execution of the AMD mission, but at the same time, they engage air threats

according to specified authorities and controls promulgated by the AADC. This complex environment results in the following set of conditions, which characterize nearly all AMD operations:

- AMD operations are inherently joint and interdependent.
- Army AMD operations require an integrated and networked C2 system.
- Command of ADA forces is exercised by Army commanders.
- Control of Army AMD fires is exercised in accordance with JFC directives and by delegated authorities.

AIR AND MISSILE DEFENSE OPERATIONS ARE INHERENTLY JOINT AND INTERDEPENDENT

4-42. The JFC counters air and missile threats to ensure freedom of action, provide protection, and deny enemy freedom of action (JP 3-01). The service component commands of the joint force normally are tasked to conduct operations in support of the counterair mission to maximize the complementary and reinforcing capabilities that each service brings to joint warfighting while minimizing relative vulnerabilities.

4-43. The U.S. Army provides the primary land-based AMD to the joint force. The JFC depends on the Army to execute AMD of critical assets from the land within the context of a larger joint counterair mission, which includes offensive and defensive operations. As the land AMD force to the larger joint defensive counterair effort, ADA forces depend on other service capabilities to provide space-, air-, and land-based intelligence, surveillance and reconnaissance to detect, track, provide early warning of air and missile threats, and cue ADA weapon systems to effectively counter these threats. The combination of Army AMD capabilities brought to the joint counterair effort, coupled with the support required of other services, make AMD operations inherently joint and interdependent.

4-44. ADA commanders must build a cohesive Army team that understands joint doctrine, tactics, techniques and procedures, and that is trusted by other members of the joint force. Further, through joint training and exercises, collaboration, and regular interaction, ADA commanders and those of other service components foster shared understanding that is critical to the execution of the joint counterair mission.

ARMY AIR AND MISSILE DEFENSE OPERATIONS REQUIRE AN INTEGRATED AND NETWORKED COMMAND AND CONTROL SYSTEM

4-45. ADA forces dependence on other service capabilities, as well as on each other, requires that all contributing systems (or sensor and shooter components) be networked and integrated to the greatest extent possible to facilitate a shared understanding of the operational environment for the air domain. Current capabilities are somewhat limited in the extent to which they are able to network and integrate due to their unique system interfaces. These capabilities rely on joint tactical data links to share track data and coordinate engagements. The Army has established an interface control officer position in the AAMDC, ADA brigades, corps, and divisions to focus on the planning and integration of the many Army and joint systems, networks, and information exchange capabilities. The Army interface control officer works with the designated joint interface control officer who is normally located at the joint air operations center (JAOC). The joint interface control officer is responsible for planning and managing the links over which critical force operations and engagement operations data is passed between joint AMD capabilities. See chapter 12 for more information on the networks and the Army's interface control officer.

4-46. To overcome the inherent system-centric limitations to integration, the Army is developing the Integrated Air and Missile Defense Battle Command (IBCS) system, a comprehensive and common networked C2 capability package that will leverage all relevant external data links for full joint integration; integrate all Army AMD sensor, shooter, and C2 platforms; employ an integrated defense design planning capability; provide a robust tool set to manage both force and engagement operations; and, allow for dynamic task organization of previously stove-piped ADA systems and major components into tailored force packages. By employing these capabilities, ADA forces will be able to overcome many of the inherent

challenges associated with the complexities and ambiguities that characterize the wide range of air and missile threats they must defeat.

COMMAND OF AIR DEFENSE ARTILLERY FORCES IS EXERCISED BY ARMY COMMANDERS

4-47. Although AMD operations are inherently joint and interdependent, the command of ADA forces is always retained by Army commanders and cannot be delegated. Similarly, while the control of AMD fires is usually retained by the designated AADC, that control does not lessen the fundamental responsibility of ADA commanders for mission accomplishment and leading their formations.

4-48. Army command policy and mission command/C2 doctrine apply to all commanders regardless of unit type. Command of ADA forces includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling forces for the accomplishment of assigned missions. The ADA commander issues the commander's intent which expresses the purpose of the operation and the desired military end state, provides focus to the staff, and helps subordinate and supporting commanders act to achieve the commander's desired results.

4-49. Operational control is inherent in command authority and may be delegated within the command. Operational control, as previously defined in paragraph 4-19 on page 4-3, includes the authoritative direction over all aspects of military operations and joint training. Operational control normally provides full authority to employ those forces as the commander in operational control considers necessary. However, operational control does not give the commander in operational control the implied authority to direct logistics or administration, discipline, internal organization, or unit training. These authorities reside with the commander pursuant to service directives. ADA forces may receive operational control of subordinate organizations, and may also be placed under the operational control of higher level Army organizations or another service component in support of a joint force or component commander.

4-50. The Army's overarching framework for exercising C2 is the operations process. The operations process drives AMD mission planning and the execution of AMD operations in accordance with a unit's command structure (for example, ADA brigade to battalion) and collaboration with joint and multinational partners. Within the operations process, the analysis process continuously collects and evaluates all available information on friendly and enemy forces to support decisions made by the commander. Throughout the operations process, ADA commanders apply leadership to translate decisions into actions and operations. This process culminates when operations orders are published, thereby initiating the execution activity.

4-51. ADA commanders make decisions and direct assigned ADA forces or those placed under their operational control. The planning, preparation, execution, and sustainment of the total AMD mission (force operations) is conducted before, during, and after commencement of combat operations. Guided by the principles of mission command, ADA commanders, assisted by their staffs, direct the operations of subordinate forces. The net results of force operations are units ready to perform the AMD mission and ADA capabilities integrated with, and under the control of, the designated engagement authority to execute AMD engagement operations.

CONTROL OF ARMY AMD FIRES IS EXERCISED IN ACCORDANCE WITH JOINT FORCE COMMANDER DIRECTIVES AND BY DELEGATED AUTHORITIES

4-52. Control of Army AMD fires is exercised according to JFC directives and delegated authorities. The separation of command responsibility from the control of AMD fires can appear problematic given that ADA commanders can only direct the engagement of air threats under their command authority in compliance with the promulgated ROE and designated engagement authority; yet, they possess the mission to defend critical assets. This challenge is overcome by the joint common operating precept of unity of effort in the accomplishment of the JFC's objectives.

4-53. Control of AMD engagements is executed through various personnel and agencies that collectively constitute the engagement authorities in the kill chain (see figure 4-1). An *engagement authority* is an

authority vested with a joint force commander that may be delegated to a subordinate commander that permits an engagement decision (JP 3-01). Figure 4-1 depicts both positions (for example, regional air defense commander [RADC]) and organizations (for example, Army corps), and thus does not necessarily imply the physical locations of ADA organizations nor parallelism between ADA organizations in the center of the figure and the Army maneuver echelons shown on the right.

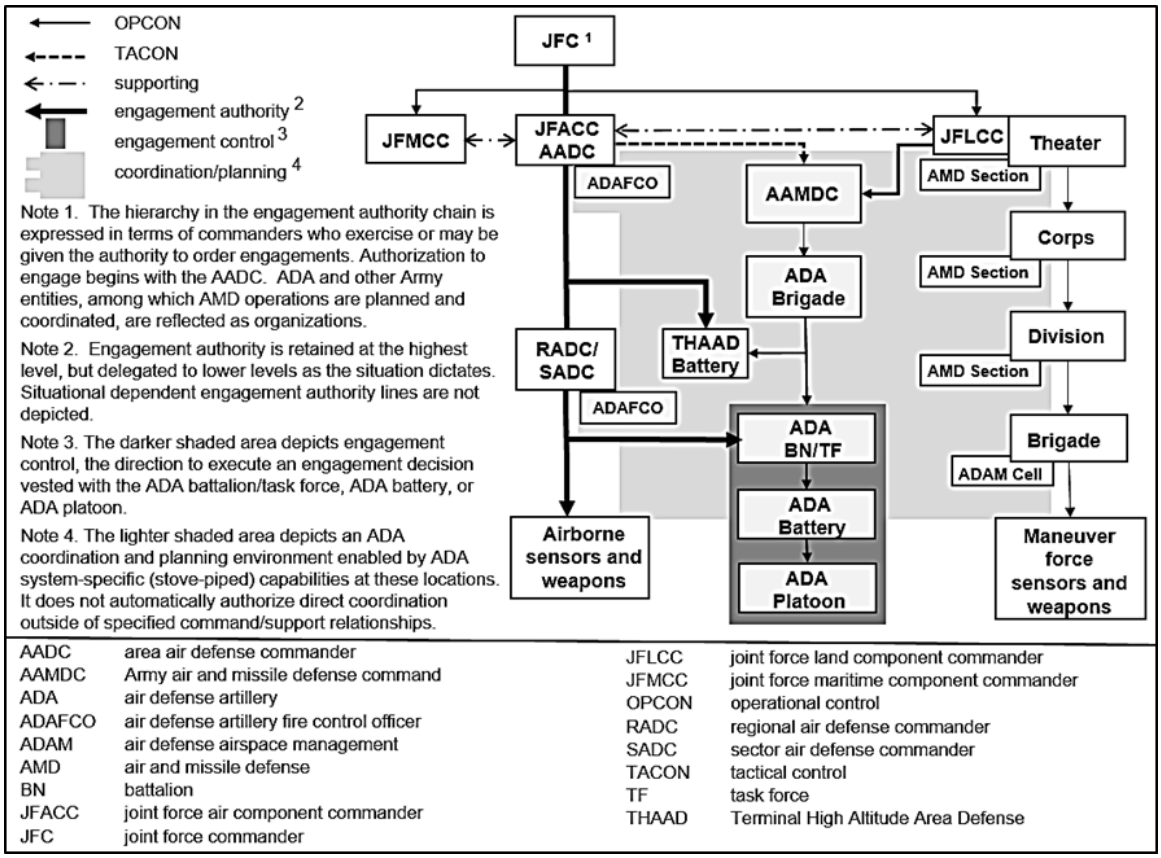

Figure 4-1. Theater AMD control relationships

4-54. The JFC appoints a *joint force air component commander* − The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for recommending the proper employment of assigned, attached, and/or made available for tasking air forces; planning and coordinating air operations; or accomplishing such operational missions as may be assigned. (JP 3-0). The joint force air component commander (JFACC) normally has operational control of their Service's component forces and tactical control or direct support of the other forces made available for tasking. The JFACC, or the joint force maritime component commander in some circumstances, also typically serves as the airspace control authority and AADC, though these functions may be assigned to different individuals. As the airspace control authority, the JFACC coordinates use of the airspace through the airspace control plan and synchronizes/deconflicts all airspace user requirements through the airspace control order (see JP 3-52 for more information). As the AADC, the JFACC plans, coordinates, and integrates the joint force's defensive counterair operations. The AADC's responsibilities include developing and implementing identification procedures and authorities, developing and implementing engagement procedures, developing and executing plans for joint AMD operations, developing and transmitting AMD weapon control procedures and measures, and establishing air defense regions or sectors to enhance decentralized execution of defensive counterair missions. RADCs and subordinate sector air defense commanders (SADC)s may be appointed within large theaters of operations and are delegated responsibilities and decision-making authority for defensive counterair operations within their region or sector (JP 3-01). The AAMDC commander, as discussed in chapter 4, has responsibilities at the AADC level (for example, deputy AADC for AMD) and frequently is collocated with the AADC. The AAMDC headquarters may be collocated with the AADC at

the JAOC, with the joint force land component commander (JFLCC) headquarters, or as shown in figure 4-1 on page 4-9, separately in accordance with METT-TC.

4-55. The ADAFCO coordinates/integrates Army AMD fires within the joint AMD architecture. An ADAFCO team consists of a fire control officer, a control assistant, and an operations assistant. ADAFCO personnel must have proper clearances for the specified operation and duty location. They conduct continuous 24-hour operations and ensure effective control of AMD fires. Typically, ADAFCO requirements are identified by the responsible ADA headquarters staff during the mission analysis step of the military decision making process with consideration for the joint air operations plan, the area air defense plan, and the supported commander's requirements. The ADAFCO must be collocated with the commander possessing engagement authorization for air and missile threats. As depicted in figure 4-1 on page 4-9, the AAMDC ADAFCO is positioned with the JFAAC/AADC and the ADA brigade ADAFCO with the RADC/SADC. Once embedded within that commander's organization, the ADAFCO provides for the rapid engagement of airborne targets/platforms, coordinates and controls AMD engagements, and assists the controlling authority with friendly protect functions and fratricide prevention. When AAMDC and brigade ADAFCOs are deployed, it is essential that they have access to a display of the integrated air picture at the hosting unit (for example, JAOC, Aegis, or Airborne Warning and Control System [AWACS]), voice and data communications with subordinate ADA battalions and separate batteries, and access to the senior weapons officer at the hosting unit, such as the senior air defense officer at the joint AOC or senior director on AWACS.

4-56. Under the precept of unity of effort, both ADA commanders and the AADC are unified in their efforts to execute joint AMD operations in support of the JFC's objectives. The practical application of unity of effort is the delineation of operational control authorities, described above, and the tactical control of ADA fires.

4-57. In the context of joint AMD operations, the designated component commander, usually the JFACC/AADC, is supported by ADA forces. The designated component commander is granted the necessary authority (in this case tactical control) for controlling and directing ADA fires. Because ADA forces are not typically assigned or attached to a commander of a different service, tactical control provides sufficient authority for controlling and directing the application of force or tactical use of ADA assets within the assigned mission or task.

4-58. Tactical control and the near-real-time exercise of the kill chain, as depicted and described above, generally do not apply to Army Avenger and C-RAM units. Avenger and C-RAM engagements of threats, such as low, slow, small tactical UASs (groups 2 and 3) and rockets, are very time sensitive and cannot wait for authorizations through the various elements comprising the kill chain. Their engagements are delegated to the lowest level as established by the ROE, fire control orders, and weapons control status (see procedural control discussion in paragraphs 4-59 through 4-60, on pages 4-10 through 4-11). The employment of Avenger and C-RAM must fully exploit the capabilities of early warning systems in conjunction with a functional airspace control plan to reduce risk to friendly aircraft while facilitating successful engagements. To ensure success, units must conduct in-depth planning and integration of the area air defense plan nested with the standing airspace control plan at the appropriate echelon. The *airspace control plan* is the document approved by the joint force commander that provides specific planning guidance and procedures for the airspace control system for the joint force operational area (JP 3-52).

POSITIVE AND PROCEDURAL MEASURES OF CONTROL

4-59. AMD fires may be controlled through positive and procedural means and measures. *Positive control* is a method of airspace control that relies on positive identification, tracking, and detection of aircraft within an airspace, conducted with electronic means, by an agency having the authority and responsibility therein (JP 3-52). Positive control is enabled by a common air picture that synthesizes data from multi-service intelligence and AMD sensors, correlates air tracks, and identifies them based on an integrated airspace control plan and established identification criteria. Positive control is exercised through fire control orders. *Procedural control* is a method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures (JP 3-52). Procedural controls include air defense warnings, ROE, published identification criteria, and weapons control status.

4-60. Regardless of the echelon, positive and procedural control are exercised through the fire control element (FCE), which is a subset of the current operations section in ADA units; it is responsible for air battle management, airspace C2, and engagement operations. The composition of an FCE is echelon and METT-TC dependent. The FCE manning crew accomplishes five functions. A single manned position may execute more than one function when the pace of combat operations permits. Conversely, some functions may require distribution across more than a single manning position or possibly across multiple C2 nodes. The five FCE functions are:

- Fire control function encompasses the overall management of the air battle and engagement decisions.
- Surveillance function provides for clarity in the air picture.
- Identification function focuses on proper combat identification. The identification and fire control functional positions may be combined into a single manned position during light to moderate levels of combat operations.
- Weapons control function addresses actions from receipt of an engagement decision from the fire control officer to execution of that engagement. Depending upon span of control and pace of combat operations, more than a single weapons control functional position may need to be manned. Allocation between multiple weapons control positions may be based on threat type (for example, one position for the ballistic missile fight and one for the air fight), a geographical division (for example, one controlling all engagements occurring in the northern sector of the defense and one controlling those occurring in the southern sector), or along system type lines (for example, one controlling Patriot fires and one controlling Avenger fires).
- Information control function addresses the maintenance of networks and information flow across the task force and with higher, adjacent, and supported units.

Note. The term "fire control element (FCE)" is used generically throughout the ensuing chapters to address those elements, sections, and centers (such as fire direction centers in Patriot battalions, air battle management operations centers in Avenger battalions, and fire control elements in THAAD batteries) that manage or control AMD engagements.

ALERT STATES

4-61. **An *alert state* is a condition that prescribes the amount of resources required to achieve ready to fire and desired radar emissions, and which specifies manning requirements and equipment configurations**. Alert states are METT-TC dependent and are determined by the senior ADA commander, in coordination with the AADC and RADC/SADC.

4-62. The AAMDC governs subordinate units' readiness levels through the use of alert states. In addition, alert states provide maintenance and training opportunities for subordinate units.

AIR DEFENSE WARNING CONDITIONS

4-63. An *air defense warning condition* is an air defense warning given in the form of a color code corresponding to the degree of air raid probability with yellow standing for when an attack by hostile aircraft or missiles is probable; red for when an attack by hostile aircraft or missiles is imminent or is in progress; and white for when an attack by hostile aircraft or missiles is improbable (JP 3-01).

4-64. Warnings conditions are a procedural control used to "posture" units based on the assessed threat. The AADC will establish the baseline air defense warning condition for the joint force during the planning stage. A condition may be different for an air threat and a missile threat. Subordinate air defense commanders may issue higher, but not lower, conditions for their region or sector. Air defense warning conditions are disseminated though C2 channels to all AMD elements, ADA fire units, and supported assets.

RULES OF ENGAGEMENT

4-65. *Rules of engagement* are directives issued by competent military authority that delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered (JP 3-84). The JFC approves the theater rules. These established rules enable the AADC to retain control of the air battle by prescribing the exact conditions under which engagements may take place. ROE apply to all warfare participants in the theater and are disseminated to all echelons of air, land, and sea forces. There are six AMD ROE categories: right of self-defense, identification criteria, fire control orders, weapons control status, levels of control, and modes of control.

4-66. Right of self-defense. Commanders at all echelons must take whatever action is necessary to protect their forces and equipment against air or missile attack. When under attack, the right of self-defense is inherent to all ROE and weapons control procedures (JP 3-01).

4-67. Identification criteria. The employment of ADA weapon systems requires early identification of friendly, neutral, or hostile aircraft and missiles to maximize extended-range engagement and avoid fratricide. The problem of distinguishing friendly, neutral, and hostile air objects, while employing various weapon systems against the enemy, is a highly complex task; the same type of aircraft may be flown by friendly and enemy countries. However, since ballistic missiles have a distinct flight profile, ROE for this threat should be based on the trajectory profile. The AADC and the airspace control authority establish measures and procedures within the airspace control system to positively identify all airborne assets and permit the execution of AMD operations. These measures and procedures reduce delays in operations and prevent fratricide. Positive identification of tracks is normally the preferred method of operation. *Positive identification* is an identification derived from observation and an analysis of target characteristics including visual recognition, electronic support systems, non-cooperative target recognition techniques, identification friend or foe systems, or other physics-based identification techniques (JP 3-01). In the absence of positive identification, procedural identification is used; procedural identification employs previously established and promulgated airspace coordinating measures and rules. Procedural identification separates airspace users by geography, altitude, heading, time, and/or maneuver. Generally, some combination of positive and procedural identification is used.

- Hostile criteria are a description of conditions under which aerial platforms or missiles may be identified as hostile for engagement purposes. For AMD units, they are basic rules that assist in distinguishing between friendly and enemy aerial objects. For example, air platforms such as fixed-wing and rotary-wing aircraft may be declared hostile if they begin to attack an asset, appear to be in an attack posture, or are not providing an appropriate friendly identification code; UASs may be declared hostile if they are surveilling a friendly asset or force; and ballistic missiles and large-caliber rockets are generally considered hostile, allowing for engagement based on the current ROE.
- Commanders having identification authority use hostile criteria to determine the identification of detected air targets. Identification authority is the authority to assign an identity classification to an unknown contact, if possible (JP 3-01). The highest echelon capable of managing engagement operations normally retains identification authority. Upon target detection, fire units with near-real-time data transmission capability assist the engagement authority by forwarding target information. The engagement authority makes final targeting decisions based on identification (for example, classification and kinematic evaluation) and may delegate the authority to engage. Delegation of engagement and identification authorization to lower echelons is normal for SHORAD units.

4-68. Fire control orders. Fire control orders are commands that are used to exercise positive control over engagements on a case-by-case basis and can be transmitted electronically or verbally. They are given to direct or inhibit firing by surface-to-air weapons units based on the ROE and rapidly changing tactical situation (JP 3-01). However, not all of the fire control orders, presented below, can or will be used by every type of ADA unit.

- *Engage* is a fire control order used to direct or authorize units and/or weapon systems to attack a designated target (JP 3-01).

- Hold fire is an emergency fire control order used to stop firing. If technically possible, missiles already in flight must be prevented from intercepting (JP 3-01). Hold fire is primarily used to effect friendly protection or avoid intercepts on neutral tracks.
- Cease engagement or cease fire directs units to stop the firing sequence against a designated target; however, units may continue to track, and missiles already in flight are permitted to continue to intercept (JP 3-01). Cease fire is normally issued to preclude engagement of the same track by two or more weapon systems.
- ***Engage hold* is a fire control order which prevents automatic engagement of the specified target by the system when the system is operating in the automatic mode.** Missiles in flight are allowed to continue to intercept. This order is applicable to Patriot and THAAD systems only. Engage hold is primarily used to prevent initiation of a redundant engagement during the time period when an engagement has been initiated until its completion.
- ***Cover* is, in air and missile defense, a fire control order that instructs a unit to assume a posture that will allow engagement of a target**. This order can be used for targets that are presently being engaged by another fire unit or for targets that have yet to become significant threats; to execute this command, the unit must report tracking and ready to fire to higher echelons.

4-69. Weapons control status. A *weapon control status* is an air and missile defense control measure declared for a particular area and time by an area air defense commander, or delegated subordinate commander, based on the ROE, that establish conditions under which fighters and surface air defense weapons are permitted to engage threats (JP 3-01). Weapon control statuses (weapons hold, weapons tight, and weapons free) may be applied to weapon systems, volumes of airspace, or types of air platforms. They prescribe the relative control of AMD fires. The degree or extent of control varies depending on the tactical situation (JP 3-01).

- Weapons hold: the most restrictive status. Units may only fire in self-defense or when ordered by proper higher authority (JP 3-01).
- Weapons tight: the normal status. Units may only fire on targets identified as hostile in accordance with current ROE (JP 3-01).
- Weapons free: the least restrictive status: used to indicate when any target not positively identified as friendly in accordance with current ROE may be engaged (JP 3-01).

4-70. Levels of control. Levels of control describe the AMD commander/echelon permitted to authorize engagement of an air or missile threat (JP 3-01). This can be the AADC, RADC, SADC, ADA battalion, ADA battery, ADA platoon, or ADA team. Different levels of control may be established for ballistic missiles, UASs, fixed-wing aircraft, and rotary-wing aircraft.

4-71. Modes of control. There are three modes of control: centralized, decentralized, and autonomous. The mode of control selected will depend upon the capabilities of the C2 system and weapons employed and both the friendly and enemy air situations.

- Centralized control mode. In this mode, a higher echelon must authorize target engagements by fire units. The executing element seeks permission to engage targets by requesting authorization from that higher authority. Centralized control is used to minimize the likelihood of engaging friendly aircraft while permitting engagements of hostile aircraft and missiles only when specific orders are issued to initiate those engagements.
- Decentralized control mode. In this mode, a higher echelon monitors unit actions, making direct target assignments on a management by exception basis, to ensure proper fire distribution, prevent engagement of friendly air platforms, and prevent simultaneous engagements of hostile air targets. Decentralized control is used to increase the likelihood that a hostile aircraft or missile is engaged as soon as it comes within range of an ADA weapon system.
- Autonomous operations. Autonomous operations are initiated when a firing unit has lost all communications (voice, data link, and tactical chat) to higher tactical headquarters. The fire unit commander assumes full responsibility for control of weapons and engagement of hostile targets in accordance with existing ROE, weapons control status, and previously received directives. In this mode, the unit commander bears the full weight and responsibility of the unit's actions or inactions with regard to fire control.

4-72. ADA units will normally be governed by a mix of positive and procedural controls that will vary by weapon system. For example, aircraft engagements by Patriot are typically positively controlled by engagement orders passed through voice and data links from the engagement authority, while those by Avenger may be positively controlled, but are, more commonly, procedurally controlled – initiated at the fire unit based on established identification criteria (visual identification) and weapons control status.

Chapter 5

Army Air and Missile Defense Command

This chapter describes AAMDC operations and how this level of command deploys, employs, and supports ADA organizations. The guidance in this chapter is applicable to the role of an AAMDC in all areas of AMD operations and ADA fires supporting the preservation of land and air combat power.

ROLES AND CAPABILITIES

5-1. The role of the AAMDC is to perform AMD planning, coordination, integration, and execution in support of the JFC priorities. One AAMDC is normally assigned to a theater. If not already forward stationed or deployed, an early entry element of the AAMDC initially deploys followed by the remainder of the headquarters. The AAMDC can operate either with the entire force in theater or using split operations. The AAMDC is the primary ADA command organization and lead for Army Theater AMD. The AAMDC strategically deploys combat ready ADA forces. In performing this role, the AAMDC ensures the Army's contribution to the joint AMD fight is architecturally and seamlessly integrated, coordinated, and synchronized with other Army, joint, and multinational units, and supports the JFC's intent.

5-2. In wartime, the AAMDC operates in theater in support of the Army force commander or, if designated, the JFLCC and JFACC. Normally the AAMDC is under the operational control of the JFLCC and in direct support of the area air defense commander (AADC) (JP 3-01).

5-3. The AAMDC commanding general has three primary roles: senior AMD commander, theater Army AMD coordinator, and, if appointed, deputy AADC for AMD. The AAMDC commander is the Army proponent for the AMD combat function and has total responsibility for active AMD planning within Army forces and, when assigned, for the entire land force. As the theater Army AMD coordinator, the commander ensures organic, assigned, and supporting ADA units' contributions to accomplish AMD objectives in support of the Army force commander's, JFLCC's (if appointed), and JFC's concept of operations are properly planned, coordinated, and synchronized. These responsibilities include recommending AMD missions for the other members of the joint combined arms team. The AAMDC commander, as the deputy AADC for AMD, ensures that Army AMD operations are properly coordinated and integrated with those of joint and multinational forces. In addition, as the deputy AADC, the commander may chair the theater AMD coordination board which recommends changes to AMD priorities on the defended asset list, adjustments to planned defense designs, and actions across all the operational elements based on threat activities and/or friendly operations.

5-4. While the capabilities of the AAMDC and the ADA brigade have significant overlap, their roles and responsibilities are distinct, as highlighted in table 5-1 on page 5-2. Discussions of each of these roles and responsibilities are provided in subsequent sections addressing command and control, force operations, engagement operations, and sustainment. Additional details are provided in ATP 3-01.94.

Table 5-1. Distinctive responsibilities of the AAMDC and ADA brigade

Responsibility	*AAMDC*	*ADA Brigade*
Planning	• Plans future operations and adjusts existing plans as dictated by METT-TC.	• Plans current operations and makes required plan adjustments and modifications.
Current Operations	• Supports joint air operations center.	• Supports regional/sector air defense center. • Provides administrative, operational, and sustainment support of deployed forces.
Joint/Multinational Air and Missile Defense Integration	• Plans for and coordinates integrated operations.	• Executes integrated operations.
Sustainment	• Plans and coordinates joint, Army, and multinational requirements.	• Executes AMD requirements.
Force Provision	• Develops requirements for forces needed. • Certifies brigades for deployment. • Ensures brigades are trained.	• Provides forces to achieve needs. • Certifies battalions/batteries/ force packages for deployment. • Ensures battalions and batteries are trained.
Air Battle Management	• Primarily performs upper tier ballistic missile, defense coordination and execution. • Can link subordinate task forces to the kill chain via the ADAFCO.	• Highest organizational echelon equipped, trained and staffed to operationally integrate multinational land-based AMD forces. • Primary organization linking subordinate task forces to the kill chain via the ADAFCO.
Force Protection	• Coordinates support for protection from the ground threat with the joint force land component commander.	• Coordinates for support for protection from the ground threat with the local supported commander.

AAMDC Army Air and Missile Defense Command
ADA air defense artillery
ADAFCO air defense artillery fire control officer
AMD air and missile defense
METT-TC mission, enemy, terrain and weather, troops and support available, time available, civil considerations

AAMDC COMPOSITION

5-5. The AAMDC is staffed for its primary role to plan for U.S. and multinational land-based AMD forces and integrate these forces and their defenses into the AADC's overall AMD plan. The AAMDC is an organization of either wholly active or reserve component ADA, fire support, aviation, intelligence, CBRN, signal, and sustainment personnel melded into an effective AMD team. All AAMDCs are constructed based on a core table of organization and equipment but are staffed somewhat differently to meet unique regional challenges in performing their missions. The organizational structure of the AAMDC consists of a command section and twelve subordinate sections: the chief of staff, G-1 (Personnel), G-2 (Intelligence), G-3 (Operations), G-4 (Logistics), G-6 (Communications/Electronics), inspector general, public affairs, staff judge advocate, unit ministry team, battery headquarters, and motor maintenance. Strategic planning and resource management functions (G-5/G-8) are performed by designated personnel from within the existing staff structure. An example of a typical AAMDC organizational structure is shown in figure 5-1.

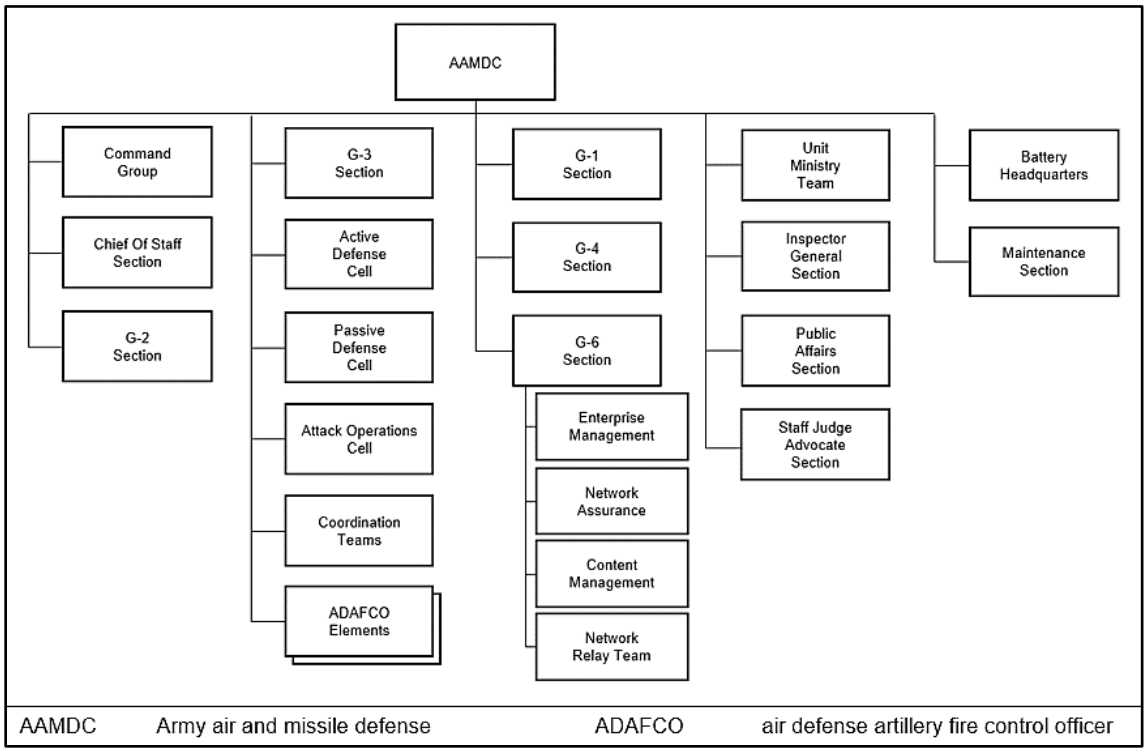

Figure 5-1. AAMDC organization

5-6. AAMDCs are regionally aligned, mission tailored organizations. ADA formations are typically task organized to the AAMDC to conduct AMD operations.

COMMAND AND CONTROL

5-7. The AAMDC serves as an operational command supporting the Army force commander, or JFLCC, and JFACC. In exercising C2, the AAMDC is guided by the seven principles of mission command in training, equipping, supporting, deploying, and fighting relevant ADA formations from brigade (in most operations) to crew level (generally in early entry or small scale deployment operations). See the discussion of the mission command principles in paragraphs 4-5 through 4-12 on pages 4-1 through 4-2.

5-8. Nominal AAMDC control relationships are depicted in figure 5-2 on page 5-4. As noted in paragraph 4-55 on page 4-9, the positions depicted for the ADA organizations do not necessarily imply their physical locations nor parallelism between ADA organizations and the Army maneuver echelons.

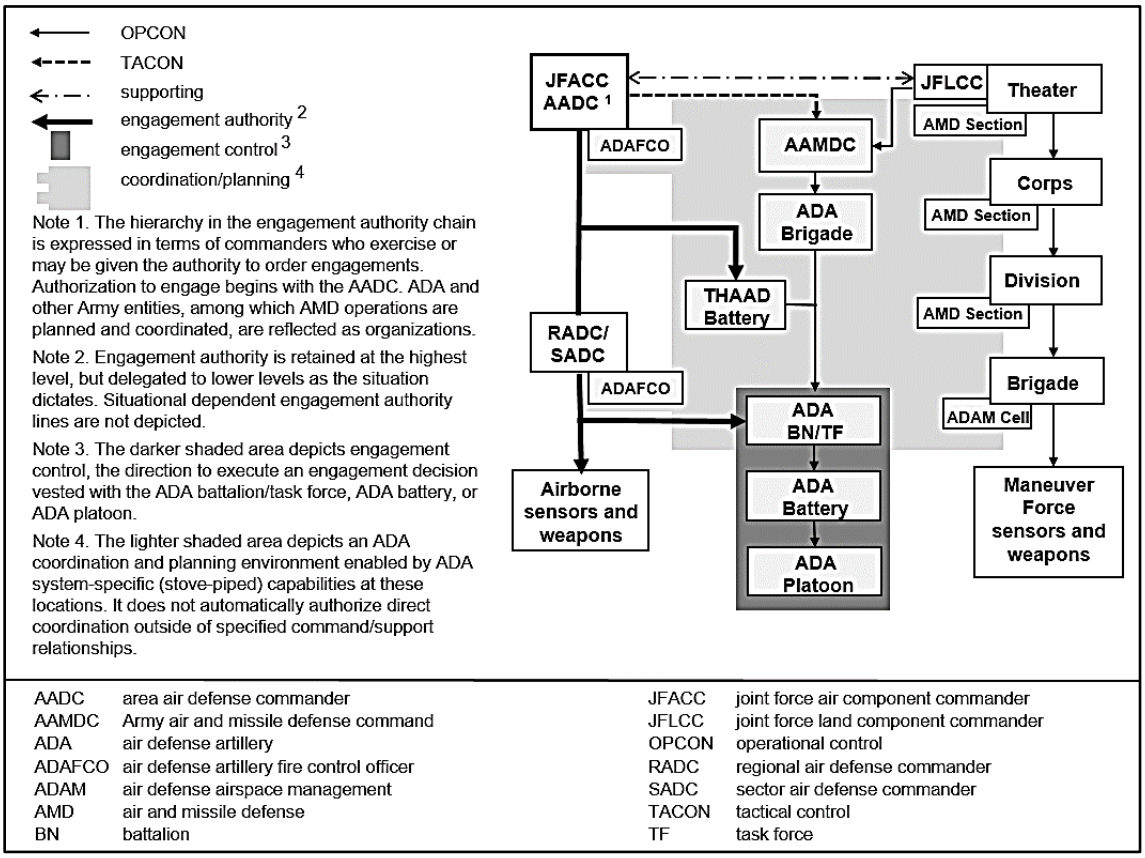

Figure 5-2. AAMDC AMD control relationships

5-9. The AAMDC C2 node links active defense, passive defense, and attack operations functions and provides timely assessment of the threat. It enables rapid dissemination of data fusion, tactical warning, mission assignment, cueing, targeting data, and post-strike assessment to the appropriate AMD element. AAMDCs are equipped with AMDPCS and a Terminal High Altitude Area Defense (THAAD) portable planner. The AMDPCS is capable of exercising C2 functionality for force and engagement operations. The portable planner enables the AAMDC to plan and evaluate THAAD defenses. The AAMDC focuses on force operations across the theater for deployed ADA forces. The AAMDC participates in engagement operations through its ADAFCO. As noted in chapter 4, the ADAFCO team is collocated with the designated engagement authority for air and missile threats.

5-10. The AAMDC assists in coordinating upper and lower tier engagements across the theater and region. This involves coordination between the Navy's Aegis, Patriot, and THAAD weapon systems, all of which may be employed in the homeland defense mission as well as in theaters. This responsibility is primarily executed through the ADAFCO who serves as the Army's upper and lower tier coordination officer. The ADAFCO is deployed at the joint air operations center (JAOC) or other appropriate joint controlling headquarters, in conjunction with the naval ballistic missile defense liaison officer; the ADAFCO uses equipment provided by the joint controlling headquarters and organic voice communications.

FORCE OPERATIONS

5-11. The AAMDC projects its ADA forces to theater to support the JFC priorities based on METT-TC. This includes all aspects of mobilization and pre-deployment operations, deployment and entry operations, employment and sustainment, and redeployment, as well as the responsibility for training and certifying its task organized forces.

5-12. Historically, the AAMDC conducts strategic and operational level efforts, coordinating the administrative, operational, logistical, and special staff requirements for subordinate units, typically brigades. The AAMDC plans future operations and supports current operations by monitoring the execution of its subordinate ADA brigades and conducting appropriate replanning to maintain viability of land-based air and missile defenses as the tactical and operational situations change.

5-13. AAMDC operations focus on coordinating, integrating, and synchronizing the operational elements, C2 nodes, sensors, attack systems, and active/passive defense to effectively counter the air and missile threat and weapons of mass destruction. AAMDC force operations include the following core tasks:

- AMD planning and coordination with and between supported and supporting headquarters.
- Coordination of AMD related tasks and liaison with multinational forces.
- AMD resource allocation.
- Support of critical and defended asset list development and management.
- Airspace control measures planning and coordination.
- AMD aspects of the IPB – referred to as AMD IPB in further discussions.
- AMD reporting.
- Coordination of force protection requirements.
- Dissemination of early warning.
- Support offensive counterair (attack operations) during target development and time sensitive targeting.
- Sustainment operations.

5-14. The AAMDC performs AMD planning and coordination with and between supported and supporting headquarters. The AAMDC functions as a theater Army AMD coordinator, coordinating and planning centralized air battle management of tactical through strategic levels of command, as part of the supported commanders' objectives and concepts of operations. The AAMDC coordinates with the JFLCC to define the critical assets requiring defense and further coordinates the ground locations where ADA units will be positioned to execute that defense. The AAMDC also coordinates and integrates AMD plans and operations to enable synchronized efforts within designated areas of operation. It supports theater-strategic current operations by providing the AADC up-to-date information on the operational and sustainment status of land-based AMD forces. It supports future operations by participating in air operations planning, gathering intelligence data to predict future threat air activities, and evaluating the JFC's schemes of operations and maneuver. Operation plans and requirements are coordinated with the AAMDC by ADA officers in the corps/division functional cells, air defense airspace management (ADAM) elements within the BCTs, and subordinate ADA brigades. The coordination of plans allows for the assessment, prioritization, and apportionment of resources and further dissemination of orders.

5-15. The supported Army or joint headquarters develops and issues a base plan or order. From the base order, all supporting or subordinate Army echelons prepare estimates and begin planning; this may generate requirements to update the base plan due to modifications received. Based on the final order, AAMDC or ADA brigade representatives assist the corps/division AMD elements in developing the AMD appendix of the fires annex to the operations order. The AMD section coordinates with all supporting echelons, including the AAMDC and supporting ADA brigades and subordinate units, allowing force tailoring of AMD capabilities to satisfy mission requirements. The AMD appendix directs task organization, coordination, integration, and synchronization tasks; informs subordinate units of their specific missions; and allocates resources required to sustain operations.

5-16. The AAMDC coordinates AMD related tasks with joint, interorganizational, and multinational organizations. Additionally, planning and integration requires coordination to economize forces and capabilities and create unity of effort. Optimizing the AMD capabilities of regional partners to contribute to plans also requires synchronization with the overarching theater engagement plans.

5-17. The AAMDC performs AMD resource allocation. As a theater level command supporting the combatant commander's AMD requirements, the AAMDC allocates AMD forces in a manner consistent with priorities established by area air defense plans and commensurate with unified command protection plans in support of national objectives. The AAMDC staff participates in all stages of joint planning while developing

the AAMDC commander's recommended AMD force allocation to the JFC, JFACC/AADC, and JFLCC. The AAMDC also recommends the allocation of elements to strengthen/establish passive defenses for assets, facilitating the economy of ADA forces.

5-18. The AAMDC supports the development of the critical and defended asset lists. The AAMDC staff works with the JFACC/AADC and JFLCC staffs in developing and managing the critical asset list and defended asset list within a joint operations area. The AAMDC staff receives the nominated critical assets from subordinate Army, joint, and multinational elements, consolidates them into a list, and contributes to the prioritization of this critical asset list. The joint and AAMDC staffs then identify the most critical assets that must be defended, given the amount and availability of AMD forces. Defended assets change throughout an operation, as METT-TC changes. This ongoing integrated process – nomination and prioritization of critical assets, AMD force resourcing, and identification of defended assets – facilitates the efficient allocation or reallocation of AMD forces to provide the degree of protection desired or risk accepted by the JFC for the most critical assets in theater.

5-19. The AAMDC performs airspace control measure planning and coordination. Airspace control spans joint and multinational activities and can include intergovernmental aspects as well. The AAMDC identifies the most suitable airspace control measures for AMD ground forces and advises the AADC of these. AAMDC personnel then coordinate the measures with the AADC staff, or the joint force maritime component commander's staff as appropriate, to ensure the most effective measures are in place in the area of operations. Coordination is continuous as the requirements for and use of various control measures may change throughout an operation depending on METT-TC.

5-20. The AAMDC performs an AMD IPB. The AMD IPB is an analysis process to continuously assess air and missile threats to the area of operations. AAMDC intelligence personnel and other staff members systematically evaluate the effects of significant characteristics of the operational environment and the anticipated threat characteristics and project the quantities and capabilities of the air and missile forces that may be used against friendly assets. These projections allow the AAMDC commander and staff to identify the degree of protection for designated critical assets and to allocate AMD elements accordingly, facilitating designs of the most capable defenses for the assets. AAMDC intelligence personnel also provide or assist their joint or Army force counterparts in the development of theater-specific threat information. This information assists ADA officers and staff planners, in supported corps or division headquarters, in the development of AMD plans and orders. For additional information on the AMD IPB, see ATP 3-01.16.

5-21. The AAMDC performs AMD reporting. The reporting requirements begin as soon as deployment alerts are received. The reports comprise all aspects of force operations, to include preparation, readiness, certifications, personnel, training, deployments, planning, headquarters and unit locations, communications, weapons statuses, and future planning. Some reporting is formal, and some is more coordination oriented to assure synchronization with supported forces. Some reports are AMD specific and reflect the posture of ADA forces and their capability to defend designated assets in the joint operations area.

5-22. The AAMDC coordinates force protection requirements for ADA forces. ADA forces are not sufficiently manned to provide 24-hour protection from air and missile threats and concurrently force protection against ground threats. The AAMDC coordinates with the JFLCC or other commanders, as appropriate, for forces to provide protection against the ground threat.

5-23. The AAMDC disseminates early warning. The AAMDC, as well as other members of the joint force, develop early warning architectures to detect air and missile threats and warn supported Army, joint, and multinational units, and, when requested, civilian authorities in the operations area. The AAMDC plans, coordinates, and integrates AMD and other external sensor capabilities to maintain situational awareness of the airspace. It generates and disseminates timely early warning and alert of impending attacks for units or areas at risk.

5-24. The AAMDC attack operations section supports the JFLCC and JFACC in the development of targets specifically against the air and missile threat. The section integrates with JFLCC and JFACC targeting teams to address AMD objectives in the JFC targeting strategy, and coordinates through JFLCC or JFACC targeting personnel to implement a coherent joint theater AMD attack plan. The section enables the deputy AADC to support the JFACC by helping to synchronize the targeting efforts against the air and missile threat, and providing AMD focus to Army deep operations and within the JFLCC's operating environment.

5-25. The AAMDC performs sustainment operations. The AAMDC plans and coordinates sustainment operations as described in paragraph 5-31 on page 5-7.

5-26. Based on METT-TC, AAMDC elements are forward deployed into an area of operations prior to hostilities. During contingency missions and wartime, the AAMDCs plan/recommend force requirements and task organize the forces again based on METT-TC. The AAMDC may mobilize along with some or all of its subordinate ADA organizations or as a separate AMD C2 capability. Dedicated AAMDC liaison sections or teams deploy to selected major joint operational areas and with Army forces/JFLCC elements to assist in the execution of the mission.

5-27. The AAMDC has the flexibility to organize and employ itself in a variety of ways to successfully support and execute higher headquarters' AMD guidance, intent, and concept of operations. Locations of the CPs, as well as the AAMDC commander, are based on METT-TC. The AAMDC may collocate its entire CP or an operations and intelligence-heavy main CP with the JAOC. It may also collocate an administrative/logistics heavy CP or element in the proximity of the Army force/JFLCC headquarters. The AAMDC commander has the flexibility with its modular CP to tailor it to meet mission unique requirements. The placement of headquarters elements requires extensive coordination and determination of force protection support available in that location. Force protection can usually be attained by collocating with supported elements; this must be deliberately addressed during the planning process. Coordination with the supported unit must include a complete understanding of the specific ADA assets that require force protection.

5-28. To plan operations, the AAMDC uses the embedded planning tools within the AMDPCS. The primary planning tool is the air and missile defense workstation (AMDWS), which allows the staff to develop defense design options using algorithms based upon broad system capabilities. To assist in force operations planning, it retrieves situational awareness information from joint headquarters, the Army Battle Command System network, subordinate ADA units, national intelligence assets, all source centers, and tactical and strategic sensors. The AAMDC also uses the THAAD portable planner to plan and evaluate THAAD defenses. Additionally, the AAMDC uses the C2BMC system (see Appendix A) as a means of integrating its assigned theater AMD assets with the United States Strategic Command's global missile defense plan/architecture. C2BMC assists the AAMDC as it works to deconflict competing priorities across the operational and strategic levels, enabling the most effective allocation of AMD resources.

ENGAGEMENT OPERATIONS

5-29. The AAMDC provides a joint air picture and connectivity with the controlling identification and engagement authorities in accordance with the area air defense plan, special instructions, and AAMDC tactical supplement. This connectivity is conducted through the ADAFCO.

5-30. The ADAFCO serves as the Army point of contact between the ADA FCEs and the controlling authority. The AAMDC ADAFCO provides Army AMD operational expertise and monitors, coordinates, and synchronizes surveillance and engagement activities of ADA assets with joint and multinational AMD units. The ADAFCO is also responsible for the coordination and deconfliction of upper-tier engagements by joint and multinational systems in conjunction with the naval liaison officer. The ADAFCO maintains communications with the ADA brigade ADAFCOs at other controlling authorities, sharing tactical air pictures and situational awareness and coordinating for the engagement of upper-tier leakers. The ADAFCO additionally serves as the conduit for the issuing of fire control or engagement orders from the controlling authority to ADA units.

SUSTAINMENT OPERATIONS

5-31. The AAMDC plans and coordinates joint, Army, and multinational sustainment for land-based air and missile defenses and supervises execution of sustainment through its subordinate ADA brigades. Often ADA units or elements are located with supported forces and require sustainment support from them. Required support includes religious, health, financial management, and personnel services, as well as maintenance support by the support maintenance company and signal support by the expeditionary signal battalion. Sustainment support must be coordinated in detail and in advance as much as possible. The AAMDC

examines sustainment needs to position land-based air and missile defenses in sufficient time and quantities to meet the JFC's needs in seizing and maintaining the initiative to defeat the enemy.

5-32. The AAMDC must provide a sustainable force that enables supported commanders to optimize their operations while minimizing adverse impacts from possible air and missile attack. The AAMDC's organic primary and special staffs provide specialized operational, administrative, and logistical support for its task-organized ADA forces. This includes all types of support unique to the theater, from force protection to supply chain management, communications and network operations, and diplomatic and host nation coordination.

5-33. The AAMDC analyzes the operational environment to account for ground and air threats that may impact friendly infrastructure and the availability of resources, ensuring that adequate support is planned and available for sustainment, resupply, and reconstitution activities throughout all phases of an operation.

5-34. Sustainment activities focus on how, when, and where to accomplish the functions of manning, arming, fueling, fixing, and moving. Ensuring the adequacy of personnel services, health services, field services, quality of life, and general supply support is also a priority of sustainment activities.

5-35. The AAMDC commander may establish priority supporting efforts by phase of the operation or change priorities during operations to ensure that operational and force sustainment is provided in accordance with their relative importance to accomplishing the mission. Changes by phase to the defended asset list, or reprioritization of critical assets on the list, will normally affect support priorities and require continual assessment by the staff.

5-36. Reconstitution activities, including regeneration and reorganization, are conducted to restore the AAMDC and/or its supporting forces to a desired level of combat effectiveness commensurate with mission requirements and available resources. They are implemented when combat effectiveness has been degraded as a result of enemy activity, battlefield damage, or other environmental factors and hazards. Regeneration involves rebuilding the unit through large-scale replacement of personnel, equipment, and supplies, including the reestablishment or replacement of essential C2 personnel and equipment and the conduct of mission-essential training. Reorganization involves the shifting of internal resources within the unit to increase its level of combat effectiveness.

Chapter 6
ADA Brigade

This chapter discusses the ADA brigade headquarters and the AMD capabilities it provides in support of the joint force commander (JFC) and unified land operations. Like all ADA headquarters units, the brigade headquarters is task organized to support the mission based on METT-TC.

ROLES AND RESPONSIBILITIES

6-1. The role of ADA brigades is to command and coordinate the operations of subordinate ADA battalions and other assigned and attached units in the theater army. Normally one brigade is assigned per theater. If not already forward stationed or deployed, an early entry element of the ADA brigade initially deploys as a part of an AAMDC, followed by the remainder of the headquarters. ADA brigades are structured to perform several functions supporting the AAMDCs and those designated geographic command organizations which support AMD integration and operations. ADA brigade functions include C2, integration, planning, and liaison with joint and higher echelon units and subordinate battalions. See table 5-1 on page 5-2 for the brigade responsibilities as compared with the AAMDC responsibilities. The brigade responsibilities are further defined in this chapter. ADA brigades provide forces for the AAMDCs to meet the commanders' AMD objectives. ADA brigades, in both the active and reserve components, can integrate a mix of active, reserve and multinational forces. The ADA brigades are aligned under the AAMDCs and exercise C2 of subordinate units in support of unified land operations.

6-2. The ADA brigade focuses on the execution of current operations, while supporting planning through collaboration with the AAMDC. The ADA brigade executes C2 functions in support of force and engagement operations. Consistent with the AAMDC, the ADA brigade's level of effort remains more heavily focused on planning and force operations than on engagement operations.

6-3. The ADA brigade provides ground-based AMD command across a large area of operations. It generally commands several ADA battalions/task forces and reports directly to the AAMDC. Like the other ADA echelons, the ADA brigade is normally under the operational control of the AAMDC and in direct support of the AADC for the execution of operational and geostrategic missions. The ADA brigade generally exercises this direct support role through an AADC's subordinate commander, such as a RADC or sector air defense commander (SADC). METT-TC considerations may allow for them to be placed under operational or tactical control of a corps, as has been the case in past conflicts. Support relationships, such as direct and general support, may also be used to provide AMD fires in support of maneuver echelons.

6-4. The ADA brigade commander can serve as the senior AMD commander for land forces in the absence of the AAMDC. In these situations, the brigade may be augmented with capabilities organic to the AAMDC.

6-5. The ADA brigade integrates into the kill chain by attaching the brigade's ADAFCO to the designated AADC engagement authority. This authority is usually the RADC or SADC.

6-6. The ADA brigade assists the AAMDC in providing the requisite C2 to specific organizations or geographical areas where multiple joint and multinational AMD forces operate. The brigade is the highest echelon that is properly resourced with the skills, equipment, and staff to integrate multiple ground-based ADA capabilities into the joint and multinational AMD fight and in support of Army maneuver forces.

6-7. Generally, the integration of U.S. and multinational land-based AMD forces occurs with the oversight of the ADA brigade headquarters. The operational, tactical and support relationships in these situations are METT-TC dependent and often support specific bi-lateral agreements between nations.

BRIGADE COMPOSITION

6-8. Each brigade consists of a headquarters, a brigade staff, and its subordinate battalions and batteries. A brigade headquarters can effectively provide C2 of several subordinate units. ADA brigades differ in their composition, which are driven by METT-TC, and the manner in which their battalions are task organized. The typical brigade can expect to have between two and seven battalions.

6-9. The brigade is comprised of active and/or reserve component personnel. The range of personnel working in the brigade includes intelligence, chemical, air defense, signal, logistic, and special staff personnel.

6-10. The brigade staff consists of a command section and multiple subordinate sections: S-1 (personnel), S-2 (intelligence), S-3 (plans, operations, training, and fire control), S-4 (motor maintenance, and support operations), S-6 (information technology and voice/data communications), public affairs, surgeon, chaplain, and brigade judge advocate.

- The brigade staff is led by the brigade deputy commander. The deputy commander is responsible for all coordination within the brigade staff and with higher, adjacent, and subordinate staffs.
- The S-1section provides personnel and administrative support and limited postal services to the battalions and separate batteries. The S-1 manages personnel strengths and actions for all subordinate units, including personnel readiness. The S-1 also performs adjutant duties, including protocol.
- The S-2 section processes battlefield information and coordinates intelligence requirements within the battalions and separate batteries and with the supported units, higher headquarters, and military intelligence assets. The S-2 section leads the staff in the IPB process, identifies threat characteristics, and coordinates with adjacent intelligence assets to provide the commander with a full spectrum threat assessment. The brigade S-2 also performs other functions such as support to Army information and personnel security programs.
- The S-3 section is the focal point for task organization, planning, operations, fire control, and training. The S-3 section conducts current and future planning, operations, and ADA-specific training certifications. As in all headquarters staffs, the S-3 is the central staff that drives the requirements and is supported by the other staff sections. Specific staff sections under the S-3 include the current and future operations cells, CBRN cell, brigade FCE, and ADAFCO element. The current operations cell executes force operations and maintains an accurate awareness of the current situation for the commander. The future operations cell plans and coordinates future brigade operations. The CBRN cell monitors the CBRN environment and integrates passive defensive measures taken to minimize or negate the vulnerability to, and effects of, CBRN attacks. The FCE and ADAFCO elements are addressed in paragraph 6-15 on page 6-4 and paragraphs 6-21 and 6-22 on page 6-5 and 6-6. The S-3, in coordination with the deputy commander, oversees the brigade's controlled substitution plan to ensure it remains deliberately managed and supports the AAMDC commander's specific guidance.
- The S-4 section provides supervision and coordination of logistics; coordination of food services field feeding, and sanitation; coordination of supply and resupply; and coordination of transportation and maintenance support. It operates the admin/log network control station and transports S-1 and S-4 personnel and equipment. The S-4 section provides the full range of logistics support from property accountability, maintenance and readiness, to budget management. The S-4 oversees the brigade's property book and the brigade's equipment readiness to include coordinating with external logistics support agencies for repairs, upgrades, and modifications. Specific staff sections under the control of the S-4 include the support operations section and the motor maintenance section.
- The S-6 section provides staff planning and supervision of communications for the brigade. It provides for the installation, operation, and maintenance of internal signal communications and electronic equipment in the brigade headquarters. It coordinates frequency allocation and assignments. The section performs field maintenance, internal and external planning, and 24 hour communications and courier services. It conducts network operations to establish, operate, manage, protect, and defend communications networks and information services. The S-6 section manages organic communications capabilities and computers, and coordinates for the use of

external communications capabilities based on METT-TC. The S-6 oversees the brigade's communications security accounts and equipment.

- The special staff section provides the command with the necessary subject matter expertise to ensure medical, legal, public affairs, and spiritual unit readiness. The brigade surgeon provides medical treatment for the brigade. The brigade judge advocate section provides legal expertise pertaining to military, domestic, and international law. It provides advice on laws of armed conflict, interprets ROE, determines the legality of targets and plans, supervises the administration of military justice, and monitors treatment of captured and detained persons and refugees. The public affairs office section assists in conducting briefings for the media on brigade operations and ground rules for media coverage of those operations, reviews material scheduled for release to the media for operational security limitations or requirements, and provides guidance to new media personnel concerning field censorship procedures and guidelines. The unit ministry team provides religious support to all assigned, attached, or authorized personnel, to include ministry for mass casualties and hospitalized members. The team advises the commander on religious, ethical, morals, morale, and soldier welfare issues, and liaises with higher and adjacent unit ministry teams.
- The battery headquarters, while not a staff section, provides C2, administrative, and logistical support for headquarters battery personnel.

COMMAND AND CONTROL

6-11. ADA brigades have the primary mission of linking subordinate ADA echelons to the kill chain. The brigade ADAFCO deploys to the appropriate joint C2 facility at which the RADC or SADC operates, and provides voice connectivity with subordinate ADA echelons for engagement operations. The brigade maintains operational control of its organic subordinate ADA units and any attached forces. It also maintains constant communications and coordination with the AMD element at corps and, when required by METT-TC, with the AMD element at division. The brigade C2 capabilities are provided by the AMDPCS, Patriot tactical planner, and THAAD portable planner. The AMDPCS gives the ADA brigade a limited capability to operate a FCE to direct subordinate C2 nodes. The AMDPCS provides the means to select and direct a subordinate C2 node to conduct an engagement, but cannot directly execute the engagement. The Patriot tactical planner provides a capability to create and test defense designs of Patriot forces. The THAAD portable planner provides the capability to design and evaluate THAAD defenses.

6-12. Figure 6-1 on page 6-4 presents the nominal brigade control relationships. See ATP 3-01.7 for additional discussions of brigade C2.

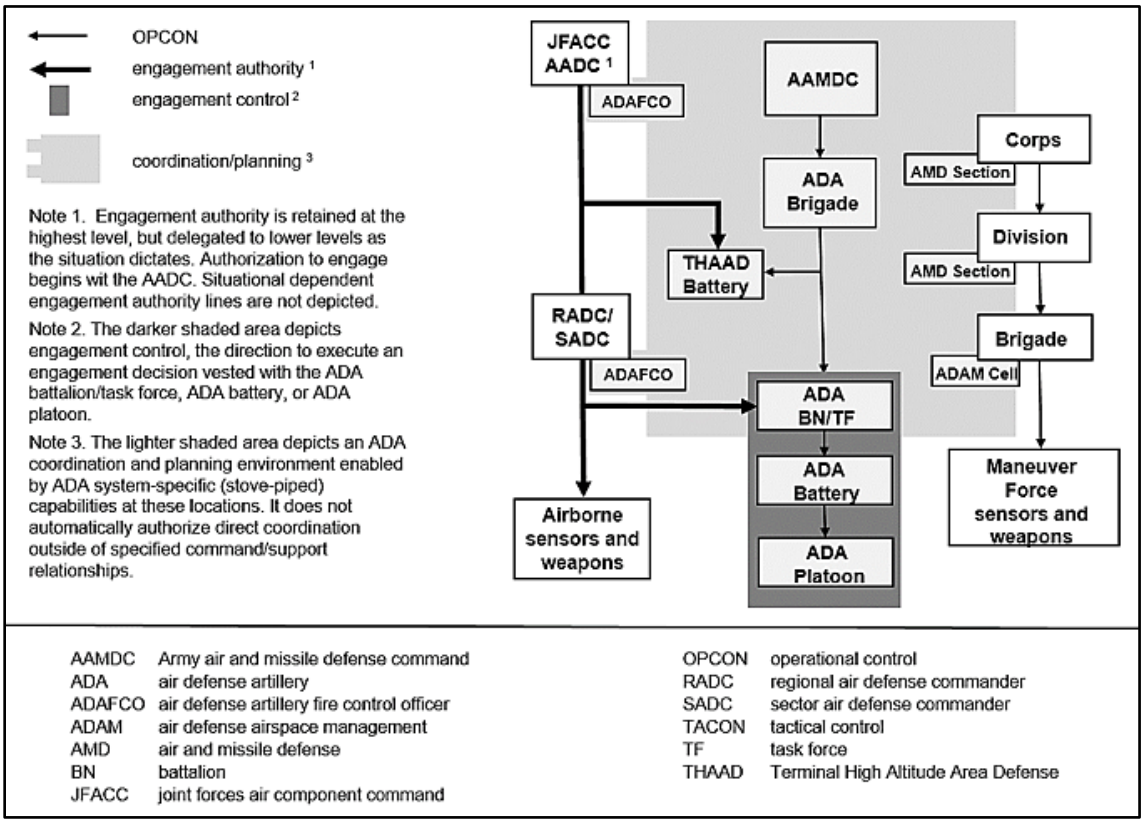

Figure 6-1. ADA brigade AMD control relationships

6-13. As a part of exercising C2 over subordinate ADA organizations, the ADA brigade also focuses on building, and potentially controlling, cohesive joint and multinational teams responsible for executing the AMD mission in a given area of operations. The ability of the ADA brigade to operate in the joint and multinational environment, with ever changing METT-TC factors that influence this environment, is critically important. In situations where an AAMDC is not present, the brigade can expect to coordinate with and support multiple joint, multinational and Army headquarters, including the joint air operations center (JAOC), regional and sector air defense command centers, multinational AMD headquarters, Army division, corps, or numbered Army headquarters, and, in some circumstances, host nation airspace control elements.

6-14. The ADA brigade, through its AMDPCS and via tactical data links, provides the necessary situational awareness to joint and multinational partners which enhances the timely and required decision making to support unified land operations. The AMDPCS provides the ADA brigade with some flexible capability: support to current operations and sustainment, and support to future operations or a capability to support forward operations − a jump capability.

6-15. An ADA brigade can provide C2 of subordinate units, to include a multinational task force. Engagement operations are controlled through the ADA brigade ADAFCO deployed with the SADC, for instance. Control of subordinate forces is exercised through tactical data links and voice communications. The brigade may operate an FCE to battle manage engagement operations of subordinate battalions, generally in a management by exception role. The normal mode of operations is for the ADAFCO supporting the SADC to provide engagement authority directly to the battalion/separate battery capable of executing the engagement.

FORCE OPERATIONS

6-16. Historically, the brigade focuses on training and certifying subordinate units to execute their AMD mission while providing and/or coordinating all the administrative, operational, logistical, and special staff

requirements for subordinate units. The ADA brigade focuses on dynamic adjustments to current plans during execution to maintain the viability of the defense. It also conducts hierarchical planning with the AAMDC and with subordinate ADA echelons. Brigade force operations mirror those of the AAMDC and consist of the following core tasks: AMD planning and coordination with and between supported and supporting headquarters, AMD resource allocation, critical and defended asset list development and management support, airspace control measures planning and coordination, AMD reporting, AMD IPB, force protection, early warning dissemination, sustainment, and multinational AMD related tasks. Generally, the brigade focuses more on C2 capabilities that enhance force operations and planning than those associated with engagement operations. An exception to this general rule may occur if there is an unacceptable risk to engagement operations within the brigade footprint.

6-17. The ADA brigade assists the AAMDC in projecting its AMD forces to theater to support the JFC's priorities. This includes all aspects of mobilization and pre-deployment operations, deployment and entry operations, employment and sustainment, and redeployment. The brigade oversees subordinate units' rear detachment operations, including the effective execution of family readiness groups. Forward ADA brigades participate in portions of the reception, staging, onward movement, and integration process in theater. Following the reception, staging, onward movement, and integration principle of unity of command, a theater sustainment command typically controls the first three stages. The gaining ADA brigades can influence the onward movement stage by recommending tactical assembly areas. Integration is complete when the gaining ADA brigade establishes positive command over the arriving unit, and determines that the unit is combat ready and capable of performing its assigned mission.

6-18. The ADA brigade headquarters can mobilize along with some or all of its subordinate ADA organizations or as a separate AMD capability. Brigade headquarters generally deploy in theater to areas that facilitate joint/multinational coordination and provide the best geographical opportunities to execute C2 of current and future AMD capabilities. It is common, but not necessary, for ADA brigades to collocate with a subordinate unit to benefit from mutually supporting force operations considerations like logistics and force protection. Key to employing an ADA brigade headquarters is a comprehensive understanding of the AMD operation across all phases. Special consideration is given when a brigade's C2 responsibilities will significantly change in scope or magnitude while transitioning from one phase of the operation to the next. In this scenario, the brigade should employ in a way that minimizes disruptions to the AMD operation while transitioning across phases.

6-19. ADA forces lack a sufficient physical security capability to protect themselves, so deployment considerations for the ADA brigade includes the support relationships, sustainment operations, and physical security needs. It is frequently advisable for the ADA brigade to collocate with the supported unit, such as the regional or sector air defense command, or with other Army organizations that can supplement the ADA brigade's capabilities.

6-20. The ADA brigade is under the operational control of the AAMDC. Additionally, the brigade regularly conducts direct coordination with supporting joint and multinational base commands for mission and Soldier support.

ENGAGEMENT OPERATIONS

6-21. Brigades exercise engagement operations through the C2 systems of subordinate units. ADA brigades also assist in integrating and controlling joint fires by positioning an ADAFCO team with the kill chain controlling headquarters. A brigade ADAFCO normally deploys to a control and reporting center, AWACS, Aegis combat system, JAOC, or combined air operations center, per the regional and/or sector layout.

6-22. ADA brigade ADAFCO functions include:

- Controlling ADA engagements and providing assistance for rapid engagement of airborne targets or platforms by maintaining a continuous communications link with the AAMDC ADAFCO, engagement authority, subordinate FCEs, and THAAD fire control officers, as appropriate.
- Tracking deconflictions between AMD and other joint sensors via the regional/sector air defense command's mission crew to assist in resolving identification and correlation issues.
- Disseminating and complying with air defense warnings, airspace control orders, special instructions, early warning data, real-time intelligence, and air tasking orders.

- Issuing surface-to-air missile tactical orders which direct ADA fire unit readiness based on the Army headquarters or AAMDC, and AADC, RADC, or SADC guidance.
- Monitoring ADA unit information such as status and engagement reports, to include C-RAM.

6-23. Brigade-level control of sensors generally revolves around coordinated emission control procedures and alert states. The procedures and alert states provide subordinate units predictable maintenance opportunities, emission authorization to achieve the directed alert state, and the opportunity to train with sensors outside of a full radiation condition.

SUSTAINMENT OPERATIONS

6-24. As discussed in the unit composition section, the ADA brigade is resourced to provide all staff functions, including the special staff sections of the chaplain, judge advocate, and surgeon. However, the brigade is dependent upon appropriate elements of the theater for financial management support, force health protection, personnel and administrative services, and supplemental transportation; the expeditionary signal battalion for signal support; support maintenance company for maintenance support beyond organic means; and field feeding company for field feeding support.

6-25. The ADA brigade headquarters generally oversees two sustainment related responsibilities. First, the brigade assesses all the sustainment requirements across subordinate units and direct specific sustainment responsibilities to subordinate headquarters based on METT-TC. It is quite possible that a subordinate battalion will be directed to assume sustainment responsibilities such as logistics support and force protection, for non-organic subordinate batteries. Second, the ADA brigade coordinates sustainment support for joint/multinational AMD forces within the brigade's area of operations. The combination of these two responsibilities ensure that all sustainment functions are properly provided for subordinate AMD units. In cases where a particular sustainment function is inadequate for a subordinate unit, the brigade will seek the assistance of the AAMDC to secure the appropriate resources.

Chapter 7
ADA Battalion

This chapter describes the ADA battalion, task organized to form an ADA task force, and its capabilities, firepower, and tactics. The guidance in this chapter is applicable to the role of an ADA battalion in all phases of operations and to ADA fires supporting the preservation of land and air combat power. This chapter is written to a METT-TC tailored task force consisting of multiple sensor and shooter types, providing a coordinated capability to defend against enemy forces employing complex integrated attack tactics. This chapter is also applicable if the task force consists of a single type of sensor and shooter.

ROLES AND RESPONSIBILITIES

7-1. The role of the ADA task force is to protect forces and selected geopolitical assets within a specified geographical area from air attack, missile attack, and surveillance. The ADA task force consists of a mix of sensors and shooters to provide low-to-high altitude, short- to long-range AMD protection of combat land forces and other critical assets. The ADA task force components can defeat the following threats, after launch, in accordance with the METT-TC considerations in which it is being deployed:

- Ballistic missiles.
- Cruise missiles.
- UASs.
- Tactical air-to-surface missiles, to include anti-radiation missiles.
- Large-caliber rockets.
- Hypersonic weapons.
- Fixed-wing aircraft.
- Rotary-wing aircraft.
- RAM.

7-2. An ADA task force is frequently used as a flexible deterrent option, showing U.S. resolve and commitment to our partner nations. It is often forward deployed or stationed. For example, currently more than 45 percent of the Patriot force is deployed in overseas locations.

7-3. An ADA task force provides the terminal defense for multi-tier joint AMD systems supporting the combatant commander's needs. Its missile defense capabilities (Patriot and/or the THAAD) comprise an element of the Ballistic Missile Defense System (BMDS). When THAAD and Patriot are combined in a task force, a layered (upper and lower tier) ballistic missile defense is achieved. While able to operate as an independent entity consisting of a single system's capabilities, such as Patriot, the task force is optimized when organized with multiple ADA sensors and shooters, such as those organic to Patriot and Avenger units. ADA task forces help to defend the lodgment during entry operations. The ADA task force provides robust defense against ballistic missiles and air threats, and can be augmented with C-RAM capabilities to defeat RAM threats after launch. As the theater develops and entering forces expand into forward positions, ADA task forces support shaping activities and enable decisive action. ADA task forces provide AMD for maneuver forces, their sustainment assets, and resupply routes using overlapping movement and positioning schemes to maintain supportive coverage. This protection provides maneuver force commanders the ability to conduct aggressive, as well as sustained, offensive and defensive tasks.

7-4. ADA task force resources may remain in theater to continue providing AMD of critical assets as a conflict is resolved, preventing residual enemy forces from successfully affecting assets or friendly forces

that are redeploying. ADA units also promote stability within a country or region by protecting civilians and geopolitical assets from state and non-state actors who may seek to exploit periods of transition.

7-5. ADA task force capabilities can be tailored to counter diverse or specific air and missile threats based on JFC requirements and METT-TC. The nominal task force is generally deployed to counter both air threats and lower tier missile threats.

SUPPORT TO JOINT AIR AND MISSILE DEFENSE

7-6. An ADA task force provides defense of designated joint force command assets at the strategic and operational levels. These include senior CPs, logistic facilities, operating bases, aerial and sea ports of debarkation, and geopolitical assets. The maneuver commander's key assets are also addressed during the planning process. These assets are recommended by the commander's organic AMD section or ADAM cells for inclusion in the critical asset listing from which defended assets are derived.

7-7. The task force's persistent presence facilitates long-term protection of assets against all-altitude air and missile threats. Augmentation with C-RAM sensors and shooters is required for the task force to defend against RAM threats.

7-8. The task force also contributes to aerial surveillance and situational awareness. Its nominal configuration includes sensors capable of detecting low-flying air threats to ballistic missile threats, and publishing track data across Army and joint links to alert the force to impending attacks. Augmented with C-RAM sensors, the task force can also provide detection, alerting, and focused warning of RAM threats.

SUPPORT TO UNIFIED LAND OPERATIONS

7-9. The ADA task force counters a wide variety of potential air and missile threats that target assets identified by the joint force land component commander (JFLCC) and selected for the JFC's defended asset list. The main threats that the ADA task force must be prepared to counter are:

- Ballistic missiles.
- Cruise missiles and anti-radiation missiles.
- UASs, both attack and surveillance.
- Hypersonic weapons.
- Fixed- and rotary-wing aircraft, jammers and aerial surveillance platforms that penetrate defensive counterair into the task force's defended area (commonly called leakers).

7-10. The ADA task force's support of ground-based elements varies in accordance with the type of operation, projected threats, amount of deployed maneuver and ADA forces, and other METT-TC considerations. Most ADA task forces are deployed to defend strategic and operational high value assets. ADA task forces may be assigned general support missions or, in rare occasions, placed in direct support of maneuver elements. In a direct support role, the task force commander coordinates with the supported unit commander and the ADAM cell to select the asset(s) to be defended. Direct support assignments are more typically made at the ADA battery or platoon echelons than at ADA task force levels.

7-11. The ADA task force in a general support role within a corps or, more likely, a division is assigned to defend such key Army assets as corps or division headquarters, fuel and ammunition points, counterfire radars, and forward arming and refueling points. The points to be defended are designated by the supported commander. Offensive tasks and defensive tasks requiring rapid mobility are supported by bounding overwatch, as ADA elements, other than Avenger, lack shoot-on-the-move capability. Bounding overwatch to support offensive tasks places ADA elements behind the maneuver force, as the terrain must be secured prior to its occupation by ADA elements. In retrogrades, ADA elements precede the withdrawal of maneuver units to vacate terrain being surrendered by the retrograde.

7-12. An ADA task force provides warning of impending air and missile attacks. Detections by Patriot and Sentinel radars or other sensors are broadcast to affected units or installations. UAS detections, particularly of low, slow, and small variants, can trigger self-defense actions taken by non-ADA units.

7-13. When providing support to maneuver forces, commanders should bear in mind that even though ADA task forces are mobile, they are extremely vulnerable. They require a security contingent and are unable to provide AMD coverage while on the move.

ADA TASK FORCE COMPOSITION

7-14. In peacetime, there are multiple types of ADA battalions, organized according to system types. A peacetime battalion serves as the baseline for an ADA task force, providing the resources from which ADA task forces are tailored and deployed in wartime. A peacetime battalion without further tailoring, once deployed, may be designated as a task force if METT-TC indicates that it is the right size capability to accomplish the mission. However, the battalion will more likely be tailored, adding or deleting similar type capabilities, or adding capabilities from two or more peacetime organizations to deny threats a preferred attack strategy. There are four types of peacetime ADA battalions:

- Patriot battalions are fielded in the active component. A Patriot battalion consists of a headquarters and headquarters battery, four Patriot firing batteries, and a field maintenance company.
- Composite Patriot/Avenger battalions, also in the active component, have the same Patriot force as a Patriot battalion and one organic Avenger battery. The maintenance company is adjusted to include system-peculiar maintenance for the Avenger component of the battalion. This battalion composition constitutes an integrated battalion consisting of Patriot and Sentinel radars, the Patriot family of missiles, and Stinger missiles.
- Composite Indirect Fire Protection Capability (IFPC)/Avenger battalions are fielded in the active component. They consist of a headquarters and headquarters battery, one battery of Avenger missioned primarily to defeat the cruise missile and UAS threats (groups 2 and 3), two batteries of C-RAM with their Land-Based Phalanx Weapon System (LPWS) missioned primarily to defeat the RAM threat, and a maintenance company.
- Avenger battalions are fielded in the Army National Guard and in the active component force. Avenger battalions consist of a headquarters and headquarters battery, three firing batteries with two firing platoons each, and a maintenance detachment.

Note. A fifth type of peacetime battalion, a composite Patriot/THAAD battalion, is being explored.

7-15. Task force composition can be varied. Three factors impact the size of an ADA task force: mission requirements (METT-TC), human span of control, and geographical span of control.

- Mission requirements, based on METT-TC, determine the desirable size of the task force. These requirements may indicate that a force smaller than an equivalent peacetime battalion is adequate. If the requirement is fewer than the equivalent of two peacetime ADA batteries, the task organized element is called an ADA task-organized battery (see chapter 8). Mission requirements greater than the equivalent of six peacetime ADA firing batteries is equivalent to an ADA brigade (-) operation, which is covered in chapter 6.
- Human span of control encompasses both the command and the control functions. While human span of control varies based on the abilities and experiences of the leaders involved, effectiveness diminishes as the number of elements and dispersion of these elements increases. For example, Patriot commanders, commanding the original battalion configuration of six firing batteries, were somewhat overwhelmed by the human span required to cover these six batteries (mainly impacting command functions) and the technical challenges of adequately controlling the AMD operations of the batteries. The Patriot battalion configuration was ultimately reduced to four firing batteries per battalion based on organizational studies and other factors. While human span of control must be considered, it should not dictate task force sizing. If METT-TC requires a greater human span of control, the risks associated with it should be addressed and mitigated by augmenting elements within the task force that facilitate C2.
- Geographic span of control is a combination of two factors: firepower reach and communications and networking. The firepower reach of the task force determines the span in which effective defense can be achieved. Communications and networking design features of ADA systems impact physical separation distances between elements of the defense in order to achieve time

crucial air battle information exchange. AMD networks are sized to provide assured delivery across a set geographic span of control, within latency constraints, that enable full defense effectiveness. Patriot multi-routes critical ADA data by sending the information across multiple point-to-point links, thus requiring each node to have multiple paired nodes. Each node uses a terrestrial line-of-sight radio, limiting the distance between them. Large geographic spans of control would result in one or more points of failure, thus reducing the probability of successful message transfer between the task force C2 node and the executing firing battery. Avenger fire units have more limited data and communications ranges. Therefore, an Avenger platoon is limited in its geographical dispersal of fire units in order to maintain effective mission control. Patriot and Avenger share information to achieve a coordinated defense across joint air defense linkages, with each system then distributing the shared information to its firing components via their own data interfaces. The terrestrial reach of the radios within each system are a limiting factor in task force composition without significant augmentation from unique ADA communications resources. Standard Army communications can augment non-critical air battle data distribution, but lack compatible interfaces to effect battle management.

7-16. Task force sensors may be of one type, such as the Patriot radar, but normally have at least two types (for example, Patriot and Sentinel radars). Likewise, shooters may be of one type (for example, Patriot), but normally have at least two types (for example, Patriot and Avenger). In addition, the task force has a field maintenance company or detachment.

7-17. Avenger and C-RAM share a C2 framework that allows for full integration across sensors and weapons. C-RAM C2 is a modification of forward area air defense (FAAD) C2 that maintains full backward compatibility across the systems. An ADA task force, composed of Avenger and C-RAM weapons and Sentinel radars, can provide short-range, low-altitude defense against air threats (fixed- and rotary-wing aircraft, UASs, cruise missiles) and incoming RAM. Avenger provides defense against the air threat while C-RAM counters the RAM threat. FAAD C2/C-RAM C2 integrates the defense across the weapons. In such a task force, human and geographic spans of control are the primary limiting factors in ADA task force composition.

7-18. ADA task forces using Patriot as the base capability with augmentation from Avenger or C-RAM forces present greater integration challenges. Each system has a unique C2 capability that does not provide air battle control over the other system. Patriot C2 effects air battle management over Patriot forces and integrates with higher echelons via joint data linkages. Patriot shares air battle management decisions and data with Avenger or C-RAM via these joint linkages, but cannot direct engagements over these linkages. Likewise, FAAD C2/C-RAM C2 cannot plan or execute Patriot engagements. Thus, this type of ADA task force fights a coordinated but not fully integrated air battle. Primary considerations in ADA task force sizing for this type of ADA task force are human and geographic spans of control. This has two implications to task force composition:

- Maximum task force composition is always limited by human span of control, that is, task force size should not exceed six firing batteries. For example, two Avenger batteries, or one Avenger battery and one C-RAM battery, may be attached to a Patriot battalion to form a six firing battery task force.
- Avenger and C-RAM components are directly controlled by their organic FAAD C2/C-RAM C2 node and fight a coordinated, but not holistic, fight through C2-to-C2 interfaces.
- The dual communications architectures require separate network planning, one for Patriot's interconnectivity and one for Avenger's/C-RAM's interconnectivity. Patriot fire units may disperse over a wider area than that which can be spanned by FAAD/C-RAM C2 in connecting firing elements. The Patriot battery communications architecture is incapable of transmitting into joint data linkages; these interconnectivities come directly from the Patriot battalion. Network planning for Avenger units may require that each Avenger platoon individually enter into the joint data networks rather than relying upon the battery to be the point of interface, distributing the data down to the platoon level.

7-19. THAAD batteries may be independently deployed, commanded by their parent ADA brigade and controlled by the AAMDC ADAFCO collocated with the AADC controlling headquarters, such as the JAOC. THAAD interoperates with the ADA task force through its tactical fire control and communications

equipment. Interface to the ADA task force is achieved through link 16. A THAAD battery may also be attached to an ADA task force. THAAD operates, whether independently deployed or attached to an ADA task force, as a part of BMDS, and it interfaces with other Army ADA forces via joint linkages. Patriot has the capability to exchange information, to include engagement orders, with the THAAD battery. Neither the Avenger nor C-RAM C2 node has the necessary software to direct THAAD fires. When THAAD is attached to a non-Patriot based ADA task force, tactical control of THAAD fires remains under the authority of the AAMDC ADAFCO, with the ADA task force commander exercising operational control.

7-20. Ten types of ADA task forces may be formed by METT-TC tailoring of peacetime organizations:

- Patriot ADA task forces may consist of two to six Patriot firing batteries capable of providing short-to-medium range lower tier ballistic missile defense and low-to-high altitude air defense against air threats. Additionally, Patriot can provide defense against large caliber rockets, but not other elements of the RAM threat.
- Patriot/THAAD ADA task forces may be composed of two to five Patriot batteries and one THAAD battery. THAAD provides upper tier missile defense and Patriot provides lower tier missile defense and air defense.
- Patriot/THAAD/Avenger/C-RAM ADA task forces may be composed with up to four Patriot batteries, a THAAD battery, and an Avenger or C-RAM battery. This composition enables the defeat of the broadest spectrum of air and missile threats.
- Patriot/Avenger or Patriot/Avenger/C-RAM ADA task forces composed from elements of peacetime composite Patriot/Avenger battalion(s) may consist of up to five Patriot batteries and one Avenger battery, four Patriot batteries and two Avenger batteries, or four Patriot batteries, one Avenger battery, and one C-RAM battery. Patriot provides the ballistic missile defense capability and the most robust air defense capability, with Avenger supplementing Patriot with very low-altitude, short-range air defense. Composite battalions are equipped with an AMDPCS subset called the air battle management operations center with specific modifications to hardwire to the Patriot C2 node, thus enabling a composite FCE with both Patriot and Avenger (but not C-RAM) weapons control capability. The air battle management operations center can provide higher echelon integration of C-RAM into the ADA task force, but direct control of C-RAM fires is through the C-RAM C2 node.
- Patriot/Avenger or Patriot/Avenger/C-RAM ADA task forces composed from elements of peacetime Patriot battalions and peacetime Avenger or C-RAM battalions or batteries. As above, the ADA task force may consist of up to five Patriot batteries and one Avenger battery, four Patriot batteries and two Avenger batteries, or four Patriot batteries, one Avenger battery, and one C-RAM battery. The primary difference in these two forms of ADA task forces is that the hardwired air battle management operations center is not available in non-composite battalions. Thus, the Avenger or C-RAM battery C2 node interfaces via joint linkages to the Patriot C2 node, enabling a coordinated but not integrated fight.
- Patriot/C-RAM ADA task forces may consist of up to five Patriot batteries and one C-RAM battery or up to four Patriot batteries and two C-RAM batteries. Patriot provides ballistic missile and air defense capabilities, and C-RAM provides capabilities to defeat the RAM threats.
- Avenger ADA task forces may consist of up to six Avenger batteries. This task force has only very low- to low-altitude, short-range air defense capabilities.
- Avenger/C-RAM ADA task forces may consist of any combination of Avenger batteries and C-RAM batteries up to a maximum of six. This type of task force can defend against low-altitude, short-range air and RAM threats.
- Avenger/THAAD ADA task forces may consist of up to five batteries of Avenger and one THAAD battery. THAAD provides ballistic missile defense and Avenger provides short range air defense.
- Avenger/C-RAM/THAAD task forces may consist of up to four batteries of Avenger, one C-RAM battery, and one THAAD battery. THAAD provides ballistic missile defense, Avenger short range air defense, and C-RAM defeats the RAM threat within the task force.

7-21. Sensing functions, such as detection, acquisition, and tracking, are provided by networked sensors. These sensors include Patriot, Sentinel, or AN/TPY-2 (operating in the THAAD or forward-based mode).

Patriot has a robust capability for developing an internal air picture in which the ADA task force C2 node receives and processes data from all Patriot radars in the task force tracking the object. Other sensors in the ADA task force use a track reporting schema that has rules for selecting the best sensor track for reporting across the network. Additional sensors, such as the Army's Lightweight Counter-Mortar Radar (LCMR) and Firefinder, Navy's Aegis SPY radar, and the Air Force's AWACS radar, may supplement networked sensors by reporting tracks across standard Army or joint linkages. Track reports are received at the ADA task force C2 node, which further distributes the data to subordinate fire units. The THAAD radar reports tracks across joint linkages through the THAAD fire control and communications equipment.

7-22. Engagements are conducted by mixes of missiles carried on Patriot and Avenger launchers or by C-RAM guns. Patriot employs three missile variants: PAC-3, missile segment enhancement, and guidance enhanced missile. PAC-3 and missile segment enhancement missiles use inertial midcourse with ground-based target vector updates and radar terminal homing to defeat air and ballistic missile threats from low-to-high altitudes. Missile segment enhancement missiles are an upgraded version of PAC-3 missiles with greater kinematics to achieve higher altitude and longer range intercepts. Both of these missiles are optimized against ballistic threats but have significant capability against air threats. Guidance enhanced missiles are retrofitted older versions of Patriot missiles that retain midcourse command guidance and track-via-missile terminal homing. Guidance enhanced missiles are optimized against air threats, especially cruise missiles, while retaining good capability against close-range ballistic missiles. Patriot missiles require the support of a "local" Patriot radar (a radar located in a geometric missile capture and guidance relationship with the launcher) for the entire engagement sequence. The shooting function may be augmented by the attachment of Avenger with Stinger missiles and .50 caliber machinegun or LPWS guns. THAAD launchers carrying THAAD missiles may also augment the task force.

7-23. Voice and data communications capabilities enable task force integration with external data and targeting networks supporting Army and joint advanced warning and engagement operations. ADA task force communications operate within the tactical data link networks (for example, link 16 and LandWarNet) for battlefield integration. The ADA task force can operate independent of other U.S. AMD forces, but will normally be employed as a part of a larger joint AMD capability.

COMMAND AND CONTROL

7-24. ADA task forces are normally employed with other ADA assets and organized under the ADA brigade and the AAMDC to support JFC priorities. On rare occasions, an ADA task force may be employed with minimal or no supporting ADA resources and be required to directly integrate with the AADC for control. An ADA task force may also be required to integrate with the JFLCC for command. ADA task forces perform AMD functions as specified by the JFC. The deployed ADA task force performs lower-tier missile defense and air defense in support of joint unified action and Army unified land operations. Figure 7-1 depicts the nominal control relationships for a deployed ADA task force. The figure omits echelons above the ADA brigade level to focus on the ADA task force. Engagement authority is exercised through an ADA brigade ADAFCO, deployed with a joint higher echelon commander, presented as a regional air defense commander (RADC)/SADC in the figure. Engagement authority may be delegated in accordance with METT-TC and promulgated through a surface-to-air missile tactical order or a short-range air defense tactical order; the engagement authority may change dynamically as the battle proceeds. Patriot engagements are planned and managed by the task force C2 node, unless engagement authority is decentralized and executed at the battery, which has direct control of its assigned Patriot radar and launchers. Avenger and C-RAM normally deploy and fight at the platoon level, which has direct control of assigned weapons. Avenger sensors are under the control of the battery C2 node, but may be attached to a platoon and controlled by the platoon C2 node. C-RAM sensors are controlled by the platoon. Supported units may vary in accordance with METT-TC. The ADA task force coordinates with the supported unit to pass high quality air picture information and to collaborate on defense design to protect the maneuver element's high value assets.

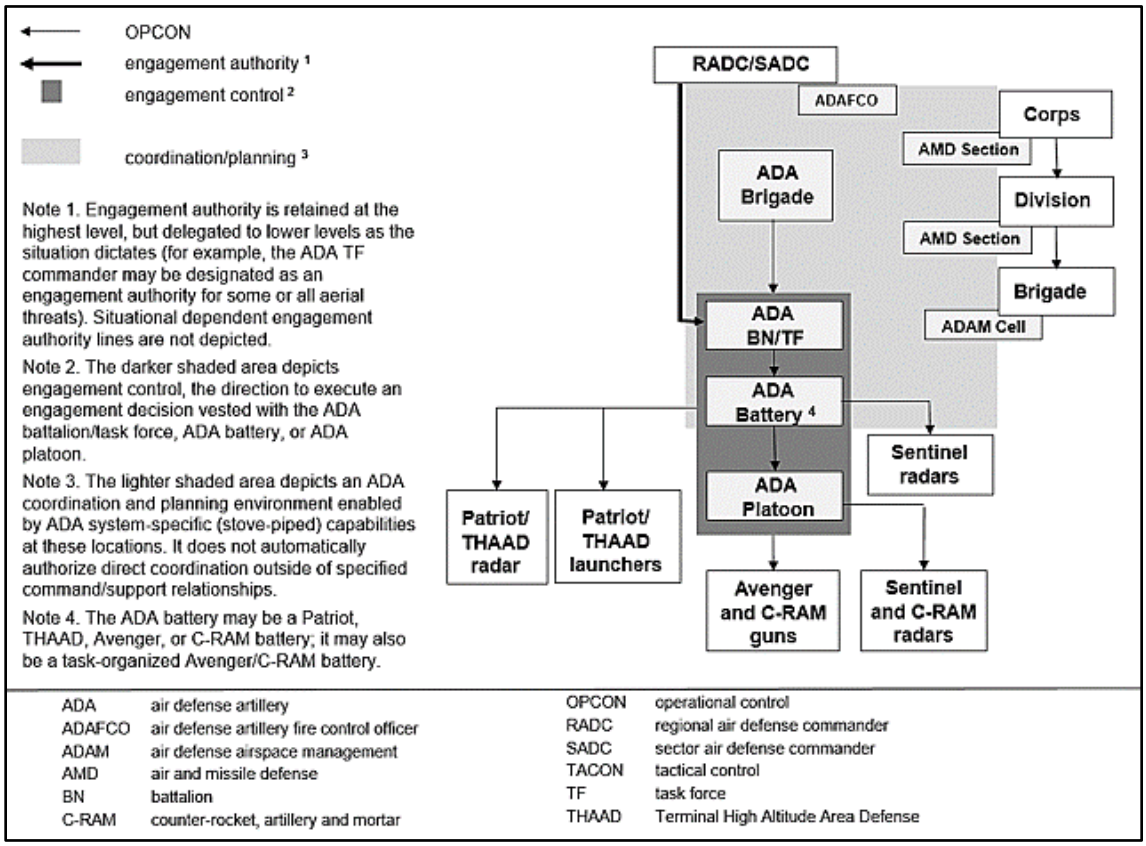

Figure 7-1. ADA task force AMD control relationships

7-25. Each firing echelon in the ADA task force operates a FCE during combat operations. Manning for each echelon varies according to the allocation of C2 functions across the ADA task force and METT-TC. The ADA task force FCE generally mans all five functional positions: fire control, surveillance, identification, weapons control, and information control, with one operator for each position. Under heavy loads, more than one person per function may be required. For example, two or more weapons control operators may be needed when control is decentralized to the ADA task force and the air threat is heavy.

7-26. FCEs in Patriot and THAAD batteries within the ADA task force require a minimum manning of three Soldiers: fire control officer (who also executes identification functions), weapons control operator (who also does surveillance functions), and information control officer. Medium to heavy air threats may require manning the weapons control/surveillance functions with two Soldiers. These positions allow for continuity of operations upon loss of linkage through the higher echelon FCE, while also assuring that communications within the FCE continue to provide requisite performance to maintain data linkages.

7-27. The ADA task force C2 node plans, deploys, operates, manages air battle operations, and sustains combat operations across the task force. When a single type of system is deployed in an ADA task force, C2 components of that type are sufficient. However, when the ADA task force consists of multiple types of systems, its C2 node must contain components of each type to effect coordinated battle management. The following discussion considers an ADA task force consisting of Patriot batteries augmented by an Avenger battery. The same principles hold if the ADA task force is a Patriot battalion augmented by a C-RAM battery:

- Patriot C2 provides for battlefield integration with the joint AMD authority and with the supported land combat component. Planning is coordinated using the combined capabilities of Patriot C2 and FAAD C2/C-RAM C2.
- Each C2 node plans its engagements in accordance with higher echelon control and ROE. The nodes share air picture data and engagement decisions via link 16. Engagement decisions of one capability, such as Patriot, place an engagement hold on the companion capability, such as

Avenger, until the planned engagement has been completed. This frees the companion system to use resources to engage another threatening track.

7-28. The dismounted Patriot information and coordination central (DPICC) affords Patriot-based ADA task forces flexibility in deployment while retaining full employment functionality. Potential usages of the dismounted capability include:

- Initial deployment. Early entry operations typically see initial ADA task force deployments by batteries. A Patriot battery, with joint data network receive only capability, has no means to directly inject data into the kill chain, necessitating early deployment of the Patriot battalion's information and coordination central (ICC). This requires the dedication of precious strategic transport to deploy the large truck-mounted ICC van. However, the fly-away DPICC can be deployed with the battery within the battery's strategic transport requirements, thus enabling a greater tooth-to-tail ratio in the critical early entry periods.
- Sustained operations in a location. The DPICC can be located inside permanent or semi-permanent facilities, enabling greater efficiency and troop protection in operations of the ADA battalion task force FCE along with better coordination across the headquarters staff.
- Mobile operations. The ICC provides functionality not available in a battery engagement control system. When the ADA battalion task force is conducting mobile operations, the DPICC can serve as a base or jump capability while the ICC is relocating, thus retaining full C2 functionality during times of movement.
- Independent battery deployment. A Patriot battery can receive data across link 16, but can only transmit its air picture across the Patriot digital information link (PADIL) network. Thus, when deployed outside the communications range of the ICC, the battery is unable to uplink its internal air picture across the kill chain. By deploying the independent battery with an attached DPICC, full data connectivity with the kill chain is realized. This topic is more fully explored in chapter 7.

FORCE OPERATIONS

7-29. ADA forces are deployable via air, rail, and sea. Due to the size and weight of ADA equipment, the most economical means of transporting into a theater of operations is via sea; however, this requires long lead times. If an AMD capability is required as part of a rapid deployment package, an ADA task force can be deployed via C-17 and C-5 to support the mission or a strategic response.

7-30. An ADA task force's standard to prepare all equipment for movement is a minimum of one hour and another hour once on site to emplace and initialize the unit for tactical operations, except for C-RAM and THAAD. (C-RAM is transportable, but not mobile. C-RAM emplacement is generally into sites that may take weeks to prepare, and actual emplacement requires days. THAAD standards are two hours to prepare for movement and four hours to emplace and initialize.) This standard will vary based upon conditions (for example, day, night, weather conditions, and mission oriented protective posture) and composition of the ADA task force (for example, Patriot timelines are longer than Avenger timelines). Although the ADA task force is fully mobile with all tactical equipment mounted on wheeled trailers or vehicles, much of ADA equipment is both oversized and heavy. When deploying systems in theater, planners must consider route and site suitability. Road surfaces, bridges, and terrain to be negotiated may limit the route taken. Thus, route and site (if possible) reconnaissance are essential prior to movement. Once the initial emplacement is completed, adjustments to the defense can be obtained by moving individual pieces of equipment with minimal disruption of combat operations.

7-31. At the operational level, the AAMDC or ADA brigade determines force allocation, task organization when needed, and ADA areas of operations in defending the JFCs' critical assets. At the tactical level, the ADA task force plans and executes defense designs to maximize inherent capabilities against the threat. Planning includes initial and follow-on positions, determining primary and secondary target lines, allocating resources to the designated critical assets, and planning the necessary communications networking. For more information on Patriot technical and system details of defense design refer to ATP 3-01.85 and ATP 3-01.87.

7-32. The ADA task force staff utilizes the tools embedded in its C2 node to assist in the planning process. These tools include the Patriot tactical planning workstation and the AMDWS in the FAAD C2 and C-RAM C2 systems.

7-33. The ADA task force commander must translate a defense plan into a defense design. The plan provides information on the mission, critical assets to be defended and their priority, resources allocated to the ADA task force, and other critical METT-TC considerations. Defense design begins by determining optimal sensor positions. Locations for the most capable sensors are selected first; less capable sensors are then positioned to complement the coverage of the more capable sensors. In most ADA task forces, Patriot radars are the most capable sensors and the only sensors currently able to provide fire control quality data against ballistic missile threats (assuming no AN/TPY-2). ***Fire control quality data*** **is usable guidance updates to a weapon in flight that allows a seeker to acquire the target.** Patriot radars available to the ADA task force are allocated to provide for ballistic missile defense as the first priority in accordance with mission orders and the presence of a creditable ballistic missile threat. Secondarily, Patriot radars are sited to provide as much low-altitude coverage as is feasible within the limitations of achieving necessary ballistic missile defense coverage. Once the Patriot radars are sited and their coverage determined, Sentinel radars are positioned to complement Patriot coverage, with a concentration primarily on low-altitude avenues of ingress and, secondarily, on weighted coverage or early engagement.

7-34. Patriot is most effective when it fights as an ADA task force, but it deploys by batteries because of strong system site configuration requirements. The battery fire control section, consisting of the battery engagement control station, battery command post, radar set, electric power plant, and antenna mast group, are physically cabled together and require approximately 500 square meters of moderately level ground. All equipment, other than the antenna mast group, can be emplaced on up to a 10-percent slope. The antenna mast group cannot be emplaced on greater than a 0.5-degree slope. Patriot launchers have limitations on where they can be placed with respect to the radar in order to be available for the air battle. Launchers can be dispersed within these limitations to best provide for effective fires over the defended assets. Patriot missiles must be captured by a Patriot radar. Missile capture is highly dependent upon physical separation distance between the capturing radar and the launcher. The launcher must be in the capturing radar's field of view, and that field of view varies between a "local" capture (separation distance less than one kilometer) and remote launch phases 1 and 3.

7-35. Avenger typically fights as a platoon within an ADA task force. The Sentinel radar is positioned to best complement Patriot radars in the task force, as discussed above, while also providing track data to support Avenger fires. Avenger platforms can deploy independently, with no site configuration requirements. The primary factor impacting Avenger platform dispersal is communications connectivity to the controlling FAAD C2 node. An Avenger platform is capable of completing an engagement using visual detection and identification, but is more effective and efficient when alerting data and higher echelon identification data are fed to it through its controlling FAAD C2 node.

7-36. C-RAM typically fights as a platoon within an ADA task force. C-RAM requires extensive site preparation for deployment of its guns. Its effectiveness is optimal when pairs of guns have mutual support and each pair of guns have overlapping fires with an adjacent pair. As a minimum, overlapping fires between guns must be achieved. Site surveys are normally done to optimize C-RAM fires against RAM well in advance of actual deployment. The C-RAM system includes two LCMRs per platoon. These sensors provide C-RAM with detection and alerting of RAM threats. They are positioned to best achieve the C-RAM mission, irrespective of where other sensors in the ADA task force are positioned.

7-37. When an ADA task force includes a THAAD battery, the THAAD radar forms the base piece for sensor emplacement planning, followed by Patriot radars and then Sentinel radars. The THAAD radar provides extended range surveillance and tracking of ballistic missiles. Patriot may have to augment THAAD assets to provide sufficient firepower to counter ballistic missile threats as well as sufficient protection against threats not in THAAD's capabilities set. This is a consideration in selecting locations and primary target lines for Patriot radars when THAAD coverage is available to support the task force.

7-38. During the planning of the radar locations and primary target lines, planners must take into account threat air avenues of approach and named areas of interest (formerly called, in AMD applications, ballistic missile operating areas). Many technical aspects are involved with the positioning of the Patriot radar and launchers to ensure the radar can control missiles in flight. The sensor's primary target lines are determined based on mission requirements, number of defended assets, and the Patriot unit's location in relation to the assets. Because Patriot is a sectored system, radar orientation is critical. Sentinel radars rotate to provide 360-

degree surveillance and track-while-scan capabilities; they may be stopped to stare at fixed sectors. THAAD also provides sectored radar coverage against ballistic threats.

7-39. Patriot radars may be assigned secondary target lines to counter alternate air avenues of approach or to provide mutual support/overlapping coverage for an adjacent radar. Secondary target lines must be planned in advance to allow the proper siting of launchers to accommodate both primary and secondary target line requirements.

7-40. Patriot launchers can be rotated in azimuth via tabular inputs from the engagement control station, but such rotation is done prior to the conduct of an engagement. During the engagement process, Patriot launchers fire at a fixed elevation and azimuth. Patriot missiles must be acquired by a Patriot radar so that in-flight updates can be provided to enable target intercept. Thus, launcher locations must be carefully selected to meet technical requirements and to ensure proper lethality at intercept. Patriot launchers are emplaced within the Patriot radar coverage, or, if secondary target lines are assigned, in such a position as to support fires in this secondary sector. Launchers emplaced to support secondary sectors may not be available in the primary sector, and launchers available in the primary sector may not be available to support secondary sectors. Algorithms in the engagement control station automatically calculate which launchers can support a sector and command appropriate slew actions to enable that support. The first principle in emplacing launchers is that of mass to ensure proper lethality against the anticipated attacks on defended assets. Patriot launchers are emplaced, dependent upon missile load, with sufficient mass to defeat the anticipated ballistic missile threat and support wider area cruise missile defense. Missile load-out is task force tailorable as is the composition of the task force itself. In consideration of defeating the ballistic missile threat, preference is given at emplacement to launchers carrying missile segment enhancement missiles first and then to PAC-3 missiles second, as the hit-to-kill characteristics of these missiles provides greater lethality against ballistic threats. Launchers carrying guidance enhanced missiles should be placed in positions primarily to optimize cruise missile defense and secondarily to support the ballistic missile fight. While other factors are considered in the engagement, decision, and assignment process, missile selection is critical.

7-41. Patriot launchers can be distributed across the area of operations, subject to constraints on the technical requirements of missile capture and uplinks and the need to achieve sufficient mass. Patriot launchers are connected to the network via data link terminals, which are embedded in engagement control stations and communication relay groups. Launchers are directly connected to their controlling engagement control station by data link terminals (local and phase 1 remote) or by launcher data link terminal to a data link terminal in a communications relay group (phase 3 remote), which then connects the launcher to its controlling engagement control station. (When providing control of remote launchers, a communications group is also called a launcher control station.) Fiber optic cable connections can replace the data link terminal connections when time permits site improvements. Since only four communication relay groups are available in a nominal task force, launchers should be grouped either locally with the radar or in distributed remote launch farms such that the demand for relay terminals to place launchers on the net is minimized consistent with achieving desired lethality to protect assets. Patriot launchers located in the vicinity of a defended asset provide for better lethality and shorter time of flight. However, sustainment and security of remote launch farms must be considered when selecting locations for the deployment of launchers.

7-42. Avengers, with a nominal load of eight Stinger missiles, are emplaced to support engagements of the anticipated cruise missile threat through 360 degrees, though Stinger's operational range is limited. Avengers rotate in azimuth to point Stinger missiles in the optimal direction. Since Patriot radars, and thus Patriot engagements, are sectored, the emplacement of Avenger considers the out-of-sector attack potential of air threats in a complex integrated attack scenario; Avengers are positioned to deny any ingress routes not already covered by Patriot. Once these routes are defended, any additional Avengers can be positioned to thicken the defense and provide for earlier engagement of very low altitude threats.

7-43. C-RAM deploys and fights as a platoon. When C-RAM is attached to an ADA task force, C-RAM deployment and employment continues to be in accordance with C-RAM doctrine.

7-44. ADA units are high value assets with limited organic security capabilities. ADA task force equipment is vulnerable to both direct and indirect fire and enemy special operations forces. When the mission permits, ADA forces are typically emplaced as part of larger operations bases; however, when a mission requires that ADA components deploy outside of these installations, additional force protection assets, such as engineers and infantry, are required to prepare and secure the new site.

7-45. Force protection is an important planning function for distributed elements of the ADA task force. Selection of sites for distributed components, such as communications relay groups and remote launch farms, must consider the availability of other military organizations in the vicinity of the dispersed element to provide force protection and site security.

ENGAGEMENT OPERATIONS

7-46. The ADA task force does not fight the AMD battle alone. Fires are typically controlled by joint C2 authorities, such as the RADC or the SADC, as part of the kill chain. These commanders have a more complete understanding of the air domain as they execute the airspace control plan and offensive/defensive counterair operations on behalf of the JFACC/AADC. While the ADA task force possesses significant functionality to perform active and passive identification of air tracks, these capabilities often fall short of achieving true combat identification for the full spectrum of airspace users. Operating under the centralized control of the kill chain via joint tactical data links ensures that the ADA task force receives a joint air picture and achieves connectivity with the controlling identification authority and engagement authority. ADA task force engagement operations are governed by several documents specific to each theater, such as the area air defense plan, special instructions, and AAMDC tactical supplement.

7-47. Identification authority and engagement authority reside with the AADC; however, these authorities may be delegated to the echelon level that has the greatest amount of situational understanding and the resources to make decisions timely enough to affect an action. For ADA task force aerial engagements, less ballistic missiles and RAM, this authority typically remains with the RADC or SADC. For certain types of threats, such as ballistic missiles and small UASs, identification authority and engagement authorization are commonly delegated to ADA task force level (or below). Against RAM threats, engagement authorization typically resides at the base defense operations center, if operating on an installation, or at firing platoon level if operating in off-base locations. Decentralizing identification and engagement authorization to the task force commander enables more responsive land-based AMD fires; it also allows for greater defense effectiveness as the threat volume increases. However, this decentralization may increase the risk of fratricide to friendly air platforms.

7-48. ADA task force mission readiness is governed through the use of alert states. Alert states, as mentioned previously, prescribe the amount of resources directed to achieve battle stations (ready to fire) and specify manning requirements and equipment configuration. Alert states are METT-TC dependent. Alert states are generally promulgated by the ADAFCOs via the surface-to-air missile tactical order. Utilizing alert states allows for maximum flexibility to conduct training or maintenance while meeting mission requirements.

7-49. The ADA task force fights from stationary locations; therefore, tactics are a matter of the proper positioning, orientation and system configuration of subordinate components with respect to the defended assets and threat, rather than a function of maneuver. Tactics for threat engagements will vary based on the specific threat platforms, such as ballistic missiles, cruise missiles, or fixed-wing aircraft.

7-50. At the ADA task force level, Patriot C2 node is capable of controlling engagements against ballistic missiles within the Patriot and THAAD system. Ballistic missile engagement planning and execution are accomplished at the battery C2 node in both Patriot and THAAD. The ADA task force C2 node performs a threat assessment to the defended assets which are threatened by an in-flight missile and assigns the best battery to conduct the engagement. The engaging battery (Patriot or THAAD) C2 nodes then determines when, where, and how (launcher, missile type) to execute the engagement. Missile engagements are conducted manually or automatically; even in the automatic mode, an operator must validate engagements and may prevent the engagement or, if required, destroy the missile after launch. If a designated defended asset is threatened and the threat is engageable, the system will initiate an engagement when in the automatic mode; however, an operator must initiate engagement in the manual mode.

7-51. When a THAAD battery is attached to a non-Patriot ADA task force, the THAAD battery C2 node provides the capability of planning and executing engagements against ballistic missiles in its threat set. While operational control resides in the ADA task force C2 node, tactical control is exercised through the AAMDC AADFCO, as neither FAAD C2 nor C-RAM C2 has the requisite software to provide adequate fire control orders to THAAD. See ATP 3-01.91 for further discussions of THAAD battery operations.

7-52. Anti-radiation missiles present an urgent self-defense threat to task force sensors. Depending on the type and launch point, anti-radiation missile trajectories may emulate those of a ballistic missile or a fixed-wing aircraft. Patriot's C2 node employs special logic to classify a track as an anti-radiation missile. Other system C2 nodes lack the software to specifically declare a threat as an anti-radiation missile. In Patriot, some classification parameters are operator defined and should be a product of the planning process. Like ballistic missiles, anti-radiation missiles may be engaged automatically or manually. System configuration will be METT-TC dependent. For further information see ATP 3-01.85.

7-53. Cruise missiles, UASs, and fixed- and rotary-wing aircraft are capable of flying similar trajectories. Because of the inherent difficulties in distinguishing between these types of platforms, identification and engagement authorities are typically held at the RADC/SADC and will always be engaged manually.

- Patriot battalion-level C2 node conducts a threat evaluation, assesses engagement options, and assigns an appropriate battery C2 node to execute engagements. In heavy threat scenarios, the battalion-level node may decentralize to allow each battery to plan and execute engagements.
- Avenger fights primarily at the platoon level, with higher echelon C2 nodes providing battlefield coordination, linkage to the joint air picture, and authorization to engage. Avenger engagements occur at the Avenger platform level. See ATP 3-01.64 for further discussion of Avenger battalion and battery techniques.

7-54. ADA task forces integrate with other Army, joint and multinational network systems at ADA task force headquarters level. ADA task force communications capabilities allow for exchange of track messaging over tactical data links via radio frequency transmissions, secure local area networks, or commercial telephone, to include secure and non-secure internet protocol-based applications and C2 networks to send and receive voice, video, and data-related items. The ADA task force's communication capability allows for critical track data to be exchanged among a wide variety of service platforms, such as AWACS, Aegis ships, control and reporting center, and JTAGS.

SUSTAINMENT OPERATIONS

7-55. A maintenance company or detachment is organic to each ADA battalion. The company or detachment has repair personnel for the types of equipment within the battalion and, thus, has a different composition for each type of ADA formation.

7-56. ADA task force tailoring must include pulling the appropriate level of sustainment support from the peacetime organizations of battalions for the composition of the ADA task force. This support includes system-specific maintenance parts and maintainers, as appropriate, for the mix of ADA sensors and weapons in the task force.

7-57. Planning for sustainment of dispersed elements of the ADA task force considers the availability of support from the supported unit. Most supported units can provide some level of common Army support, but do not have the capability of providing system-specific support. For example, a supported unit, with proper planning, coordination and collaboration, can provide fuel support to a distributed Patriot launch farm.

Chapter 8
ADA Battery

This chapter discusses the capabilities, linkages, and tactics and procedures of a generic ADA battery employed as a task-organized battery. An ADA battery is a subordinate element in every ADA battalion; an ADA task-organized battery is a tailored organization based on METT-TC that fights subordinate to an ADA task force or as an independent entity. An ADA task-organized battery consists of sensors, shooters, and command and control (C2) elements; sensors and shooters may be of one type or of multiple types. The guidance in this chapter is applicable to the role of an ADA task-organized battery in all areas of operations and in support of unified land operations.

ROLES AND CAPABILITIES

8-1. An ADA task-organized battery defends forces and selected assets against air and missile attacks and from the effects of enemy surveillance. To accomplish this, the battery employs sensors and shooters to provide AMD protection within the altitude and range capabilities of its organic and attached weapon systems.

8-2. An ADA task-organized battery may be comprised of a peacetime battery organization with an additional platoon of the same system for instance, but is more effective against complex integrated attacks when augmented with complementary sensors and shooters from another type of organization. For example, a task-organized battery, consisting of a Patriot battery augmented with an Avenger platoon, provides sectored ballistic missile defense and 360-degree defense against air threats such as cruise missiles and UASs. A task-organized battery may initially deploy a minimum element consisting of at least two launchers with ready missiles, a sensor, a C2 node, and a tailored set of support equipment.

8-3. The ADA task-organized battery's roles and responsibilities generally remain the same irrespective of type of operational tasks – offensive, defensive, or stability. It may be deployed in tactical to strategic roles, depending on the capability of the team, priority of its defended assets, and commander's intent.

8-4. ADA task-organized batteries promote stability within a country or region by protecting civilians and geopolitical assets. Their presence discourages enemy factions and supports the resident government in essential services and humanitarian efforts. ADA task-organized batteries may remain in theater to continue providing AMD of critical assets as a conflict is resolved, preventing residual enemy forces from successfully affecting assets or friendly forces that are redeploying and supporting the transition to civil authorities.

SUPPORT TO JOINT AIR AND MISSILE DEFENSE

8-5. An ADA task-organized battery provides defense of designated JFACC and joint force land component commander (JFLCC) assets at strategic, operational and tactical levels. These assets include aerial and sea ports of debarkation, senior CPs, logistical facilities, assembly areas, forward operating bases, and geopolitical assets. The battery affords continuous protection of assets against threats within its METT-TC tailored capabilities.

8-6. Defense of these assets requires capabilities, such as those provided by a Terminal High Altitude Area Defense (THAAD) or Patriot battery, to defeat the most likely threats – longer range, lethal ballistic and cruise missiles. THAAD, as part of the BMDS, may be tasked to engage ballistic missiles within or across the boundaries of a combatant commander's area of responsibility. An Avenger platoon, added to either battery, supports engagements of other threats, such as fixed-wing aircraft. Engagements are generally controlled and directed by the designated engagement authority.

SUPPORT TO UNIFIED LAND OPERATIONS

8-7. The ADA task-organized battery is integral to the execution of offensive, defensive, and stability tasks by maneuver formations and other Army elements. Battery participation in each of these facets of unified land operations is METT-TC dependent. Deployment and employment considerations are similar in each.

8-8. An ADA task-organized battery can also be placed in support of a maneuver element or other designated critical asset. The battery may be employed as part of an ADA task force and placed in a general support role within a corps or division, or it may be employed independently, attached to a maneuver unit (most likely no higher than a brigade) and placed in a direct support role. Support relationships are METT-TC dependent. In its general support role, it may be assigned to defend such key Army assets as a corps headquarters, major sustainment points, assembly areas, and forward operating bases. When in a direct support role, the battery commander coordinates with the supported unit commander and the air defense airspace management (ADAM) cell to optimize defense of the asset(s) selected to be defended. There may also be circumstances where a reinforcing or general support-reinforcing role may be most suitable.

BATTERY COMPOSITION

8-9. The peacetime ADA battery structure is consistent with that of a traditional Army company-size unit. The battery generally contains some 70-90 Soldiers and is equipped with interceptors, launchers, sensors, C2 elements, and such general Army materiel as vehicles and generators. Peacetime battery organizations vary by type of system:

- The THAAD system is organized in the active component and deployed as a battery. Major organic components of the battery are the AN/TPY-2 radar, six launchers with up to eight missiles per launcher, C2 elements, communications, and a battery support center. THAAD C2 is achieved by the THAAD tactical fire control and communications equipment for engagement operations and components of the Air and Missile Planning and Control System (AMDPCS) for force operations. The THAAD tactical fire control and communications equipment and THAAD portable planner also perform defense design and evaluation.
- Patriot batteries are in the active component and organized as part of Patriot battalions. They generally deploy as part of the battalion or in an ADA task force; when deploying as separate batteries, Patriot C2 assets from the parent battalion are normally attached to the battery to enhance integration with higher echelon units, joint and multinational forces, and the host nation. Organic components of a battery include C2 elements, a radar, six launching stations containing from 4 to 16 missiles per launcher (dependent on the type of Patriot missile), and support equipment.
- Avenger batteries are organized as part of active component and National Guard Avenger battalions or separate batteries in active component composite battalions; they generally deploy with the battalion or as separate batteries and are employed as batteries or platoons. An Avenger battery has two Avenger platoons and appropriate support equipment. The battery in the active component and National Guard battalions contains 12 Avengers and two Sentinel radars; the battery in the active component composite battalions has 24 Avengers and four Sentinels. Each Avenger has eight uploaded Stinger missiles, M3P .50-caliber machine gun, and sensor package, and identification, friend or foe capability. C2 is provided by the FAAD C2 system.
- C-RAM batteries are organized in the active component in IFPC/Avenger battalions, deployed as batteries and employed as platoons. A C-RAM battery has three C-RAM platoons and appropriate support equipment. The battery contains 12 Land-Based Phalanx Weapon Systems (LPWS) – 20-millimeter gun systems, three Sentinel radars, six LCMR, and three platoon engagement operations sections. C2 is provided by the C-RAM C2 System.

8-10. Peacetime organizations are METT-TC tailored to wartime configurations by attaching or detaching launchers, sensors, and C2 systems. Task-organized Patriot batteries require a Patriot radar, and a task-organized THAAD battery requires an AN/TPY-2 radar. The Patriot radar can provide sectored alert and cueing support to other weapon systems, but 360-degree coverage against air threats requires the addition of a Sentinel. The AN/TPY-2 radar can provide extended surveillance against ballistic threats and can cue other systems and sensors to the threat. Defense against rocket, artillery, and mortar (RAM) threats requires a Sentinel radar, modified to detect, acquire, and track RAM threats, or a LCMR.

8-11. The maximum composition of an ADA task-organized battery is a "base" battery plus up to two platoons. Anything larger is, by definition, an ADA battalion task force (see chapter 7). Patriot and THAAD forces have no mission organizational structure smaller than a battery. Possible compositions of task-organized batteries are driven by the C2 capabilities available in the formation.

- THAAD and Patriot have unique C2 capabilities. When either is used as the base battery, engagement coordination with the supporting platoon(s) is achieved through link 16. Neither THAAD nor Patriot C2 nodes can issue engagement orders to dissimilar systems over link 16, so each system makes its engagement decisions and informs the other to prevent redundant engagements. Planning and force operations is accomplished through Army standard voice and data communications (LandWarNet). THAAD provides ballistic missile defense and the supporting platoon(s) provide Avenger/C-RAM fires. Patriot provides ballistic and cruise missile defense and the supporting platoons augment with Avenger/C-RAM fires. Note that a THAAD/Patriot combination requires the equivalent of two batteries, and is thus by definition an ADA task force.
- FAAD/C-RAM C2 allows task force tailoring of Avenger and C-RAM components, but FAAD/ C-RAM C2 cannot control THAAD or Patriot components. Thus, a base Avenger battery could be augmented with up to two platoons of any combination of Avenger and C-RAM. Although possible to form a task-organized battery with a base battery of C-RAM and additional C-RAM or Avenger platoons, doing so is unlikely since C-RAM fights as a platoon in most operational scenarios.

COMMAND AND CONTROL

8-12. An ADA task-organized battery is under the command of its parent ADA battalion and generally placed under the operational or tactical control of an ADA task force. The ADA task-organized battery exercises traditional command responsibilities, to include planning, resource allocation, and sustainment. Operational linkages for engagement and sustainment operations are established and maintained with the ADA task force, supported unit or asset, and the ADAFCO in the kill chain, as required. The battery commander is responsible for coordinating the support relationship, engagement considerations, and sustainment plans with the supported asset. The battery's data and voice capabilities vary in accordance with its C2 elements.

- Patriot interconnects battery components via its internal communications architecture, a combination of hardwire and radio frequency devices, using voice and the PADIL for data. The battery can receive link 16 but is not authorized to transmit on link 16. Thus, it requires a PADIL connection to its parent battalion or an attached dismounted Patriot information and coordination central (DPICC) to uplink engagement operations data. The parent battalion ICC or DPICC then inserts battery engagement operations data into link 16 in accordance with approved protocols. The battery communications architecture is supplemented by LandWarNet, primarily for communications external to the battery. FAAD/C-RAM C2 data and voice services include FAAD data link and LandWarNet. Sensor networks use the radar enabling subsystem, and weapons use the analog weapons enabling subsystem over the FAAD data link.
- The DPICC may interconnect in one of two ways as illustrated in figure 8-1 on page 8-4. A direct linkage via a copper cable is used when the DPICC is collocated with the Patriot battery. The DPICC can also connect to the Patriot battery across Army communication services or host nation infrastructure through a point of presence package deployed with the Patriot battery. The latter option enables a single DPICC to interconnect up to three independently deployed Patriot task-organized batteries into the kill chain.
- THAAD interconnects battery components via its internal communications architecture, a link 16 derivative, and uses link 16 to report to other AMD elements. LandWarNet provides additional critical data and voice services.

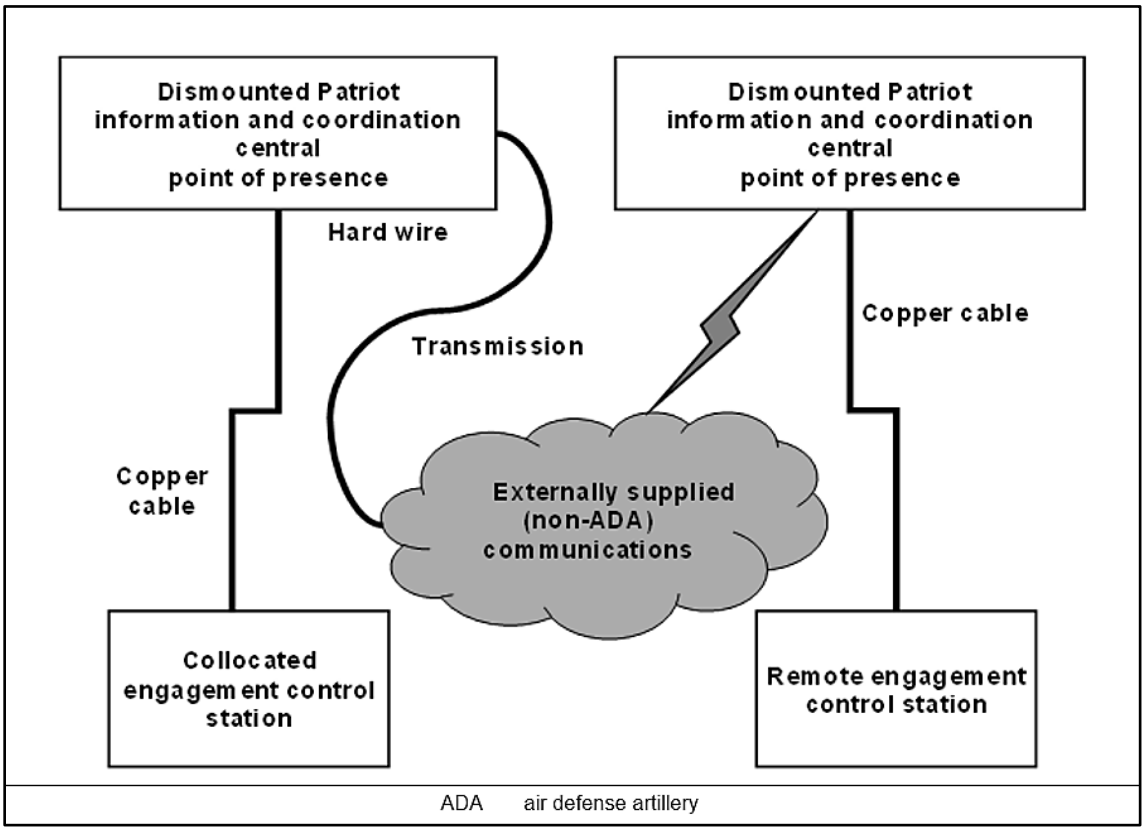

Figure 8-1. DPICC at the task-organized battery

8-13. Figure 8-2 focuses on lines of engagement and planning and coordination for the ADA task-organized battery in the joint and Army C2 architectures, when the battery is deployed as a part of a larger ADA task force or is independently deployed. Accordingly, connectivity lines to all higher echelons that are resident in these architectures (for example, JFACC and AAMDC), but not directly connected to the battery, have been omitted. While engagement authorization for most of the air threat is likely initially centralized above the ADA task force, the engagement control in the figure begins with the ADA task force. When the battery operates within an ADA task force, it takes direction from the ADA task force, irrespective of the centralized level of control in effect. When the battery is independently deployed, it enters a link 16 net or connects to a higher echelon network that provides C2 data. When engagement authority is centralized above an independently deployed battery, the ADAFCO provides control orders to the battery. When engagement authority is decentralized to the battery, the base battery C2 node is responsible for target identification (using joint data links and internal battery capabilities) and engagement decisions in accordance with promulgated ROE. Since neither THAAD nor Patriot C2 nodes can issue engagement orders via link 16 to dissimilar systems, voice communications are used to provide engagement control over fires of the supporting platoon(s).

8-14. Sensors and shooters are hierarchically controlled. Patriot and THAAD C2 nodes directly control Patriot and THAAD sensors and shooters. When Avenger deploys as the base battery of an ADA task-organized battery, the battery C2 node controls Sentinel radars and platoon C2 nodes; the platoon C2 node controls the Avenger platforms. When THAAD or Patriot provides the base battery, the battery C2 node, in addition to directly controlling its organic radar and shooters, controls the attached platoon C2 node. While METT-TC may enable the augmentation of an Avenger platoon to a THAAD or Patriot battery without a Sentinel radar, most situations are likely to see the Avenger platoon augmented with a Sentinel radar from its parent battery. The C-RAM platoon C2 node directly controls its organic and attached sensors and shooters.

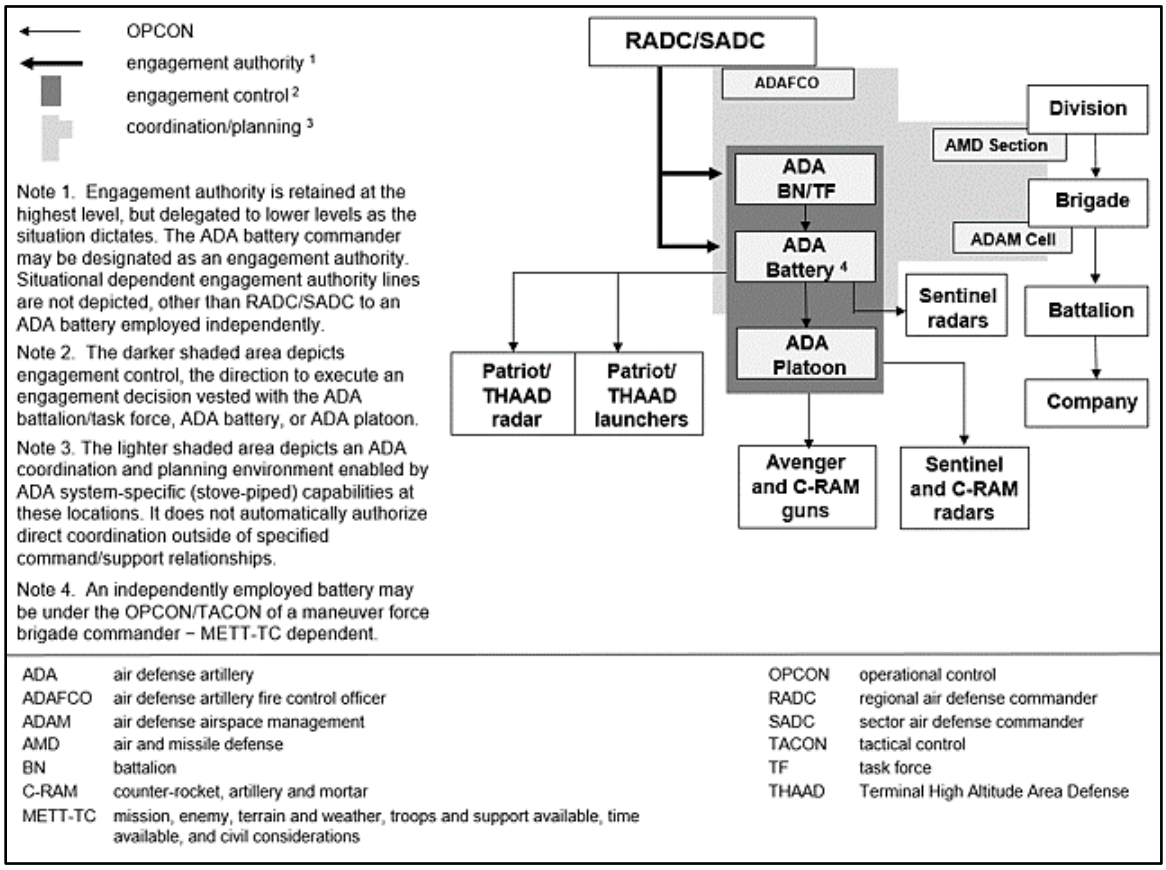

Figure 8-2. ADA task-organized battery AMD control relationships

8-15. Engagement and identification authority in a low intensity air threat environment is generally centralized at the AADC designated level, with the RADC or SADC, and engagement orders are transmitted to ADA units through the ADAFCO. The ADAFCO transmits the engagement orders directly to the ADA task force or ADA task-organized battery, if deployed independently of its parent battalion or task force.

8-16. In a high intensity air threat environment, with significant, simultaneous, and coordinated manned air, cruise missile, and ballistic missile attacks, the AADC may, for instance, decentralize engagement/ identification authority for cruise missiles and manned aircraft in a specified area to an ADA task force or independent ADA task-organized battery.

8-17. The task-organized ADA battery is at the end of the kill chain. The battery executes engagement operations under positive controls – positive identification and tracking of airborne objects and control of fires by a designated engagement authority.

FORCE OPERATIONS

8-18. Operation plans are usually prepared by the parent battalion prior to mission initiation. If deployed independently of the parent battalion, the battery commander develops the plan and subsequent changes, as required, in accordance with METT-TC. If operating as part of an ADA task force, the battery commander builds the plan in synchronization with that of the task force. If operating in support of a maneuver unit or other critical asset, the battery commander coordinates the plan with the supported commander.

8-19. An ADA task-organized battery normally defends one primary asset. It may have secondary assets within its area of operations, dependent upon METT-TC factors, such as the criticality of the asset, anticipated threat types and quantities, and available ADA forces. The battery commander uses the Patriot tactical planner workstation, THAAD portable planner, and/or the AMDWS to develop positional options for the

defense. These planning tools are system specific, so the battery commander must coordinate with dissimilar system platoon leaders and exercise manual integration of options to develop a desired defense design. Patriot and THAAD planning tools provide automated capabilities for determining the "best" defense design, and information can be directly linked into the initiation of these systems. AMDWS provides for the transfer of planning factors and acceptance or rejection of higher echelon mission orders, but requires a manual determination of "better" defense design options. The commander synchronizes the detailed positioning plans with the overall defense design being developed by the parent battalion and supported force's air defense element/ADAM cell, if assigned a direct or other support mission to a maneuver element.

8-20. Once the initial emplacement is completed for ADA task-organized batteries, adjustments to the defense can be executed by moving individual pieces of equipment. Patriot and THAAD C2 tools provide automated assistance in the adjustment of defense designs and can adjust parameters of the design that do not require physical relocation of equipment, with only minor disruptions in combat operations. This includes adjustment of primary target lines, rotation to secondary target lines (for Patriot), and a change in radar search parameters. Patriot, THAAD, and FAAD/C-RAM C2 require manual processes to adjust the defense as components depart and enter the network. Task-organized Patriot and THAAD batteries, with Patriot or THAAD unique C2 equipment, must deploy and redeploy as a battery, with the exception that individual launchers can be redeployed within the defense. Complementary Avenger or C-RAM platoons, forming a part of a task-organized Patriot or THAAD battery, can deploy and redeploy independently of the base battery by individual element.

8-21. ADA task-organized batteries are high value assets with limited organic security capabilities. When the mission permits, they are emplaced on large operating bases, similar to ADA task forces. When a mission requires that they deploy outside of these installations, additional force protection assets may be required to prepare and secure the new sites. IPB and analysis of METT-TC factors determine the force protection requirements. However, batteries must be prepared to implement their own site defenses regardless of other force protection assets.

8-22. The ADA task-organized battery's deployment of its sensors and weapons varies based on the threat and the defended asset. When integrated with its parent battalion, sensor and weapon positioning are determined as a part of the integrated ADA task force defense design. When deployed independent of its parent battalion, a greater responsibility rests upon the battery commander to select the positions. Sensor positioning is generally the first consideration in establishing a defense. The most capable sensor (for example, THAAD or Patriot) is deployed first. Other sensors are then deployed to complement the coverage of the base sensor. Sensors are distributed in the ADA task-organized battery's area of operations to best take advantage of their sensing function. Patriot and THAAD radars are site-configured such that the radar has direct linkage to its controlling C2 node. Sentinel radars have a sensor C2 node that links them into the FAAD C2 data network, allowing greater freedom in their deployment. Identification metrics are supplied by AMD sensors and can be supplemented by data from networked sensors accessed via the battery C2 node. The node correlates track data from multiple air defense sensors into a composite air picture. Sensor data is reported via the standard joint reporting responsibility schema on link 16 to form a common air picture.

8-23. The battery commander uses the ADA employment tenets to position launchers in accordance with METT-TC. THAAD and Patriot launchers are weighted towards ballistic missile defense. A secondary consideration for Patriot launchers is early coverage along potential cruise missile avenues of ingress within the Patriot radar's sectored coverage. Avenger and C-RAM weapons are positioned to achieve mutual support and/or overlapping fires (see paragraph 9-34 on page 9-5).

8-24. Sensors and launchers are assigned primary and secondary target lines. When integrated into an ADA task force defense, these lines are established as a part of the task force defense design. When operating independently, the battery commander selects them based on mission requirements and defended assets. Patriot should have secondary target lines to enable rapid reaction to attacks from other than the primary sector. Secondary target lines require careful planning. They must be sufficiently broad to cover all likely avenues of attack. However, launchers must be positioned to support them. Launchers positioned to protect in secondary sectors may not be available to support the primary sector, depending upon system limitations on missile capture by the guiding radar after launch. Avenger and Sentinel use primary and secondary target lines as a means of prioritizing operations in mass attack scenarios.

ENGAGEMENT OPERATIONS

8-25. When operating as a part of an integrated ADA task force, the ADA task-organized battery C2 node operates under the direct supervision of the ADA task force C2 node. The ADA task-organized battery C2 node directly controls weapons and sensors (THAAD, Patriot, and in some cases Sentinel radars). It supervises the operations of the Avenger and C-RAM platoon C2 nodes which directly control their sensors (unless under battery control) and shooters.

8-26. When operating as a part of an ADA task force, the fire control element (FCE) of the task-organized battery requires accomplishment of four functions: fire control, which has overall responsibility for battery engagement operations, to include identification; surveillance, which is maintenance of the air picture; weapons control, which monitors or controls battery component operations; and information control, which assures continuous information flow between battery components and the task force C2 node. Manning to accomplish these four functions is operational load and operator skill set dependent. Medium to heavy operational loads require four Soldiers. Minimum manning is three Soldiers, with one Soldier executing the surveillance and weapons control functions.

8-27. When operating independent of the task force, the battery executes full C2 through its C2 node. Patriot batteries, with Patriot-unique C2 nodes, cannot transmit to the kill chain (receive only), unless augmented with a DPICC, thus limiting operations to procedural implementation of the ROE and increasing risk of fratricide. All other batteries, pure or task-organized, must establish digital and voice connectivity with the kill chain and fully integrate operations with joint AMD units.

- The ADA task-organized battery C2 node either directly controls sensors and shooters or supervises platoon C2 nodes, as noted in paragraph 8-13 on page 8-4.
- The ADA task-organized battery operates a full FCE which requires five functions to be manned: fire control, surveillance, identification, weapons control, and information control. Multiple functions may be accomplished by a single crew member if the operational load permits. Minimum crew size is three Soldiers, combining fire control and identification into a single position, and surveillance and weapons control into a single position. Medium to heavy operational loads require one Soldier per function. An ADA task-organized battery is not resourced to man a fully staffed FCE in which each of the functions is accomplished by a single Soldier. Thus, when heavy operational loads are expected, the ADA task-organized battery may require augmentation from its parent battalion to operate independent of the ADA task force.

8-28. Battery engagement operations may be conducted in the manual or automatic mode. The manual mode requires the operator to confirm engagement recommendations provided by the automated battle management aids or to manually select targets for engagement. Air threats, such as fixed- and rotary-wing aircraft, UASs, and cruise missiles, can only be engaged in manual mode to reduce the risk of fratricide. For ballistic missiles and anti-radiation missiles, the operator has a choice of engaging in the automatic or manual mode. The automatic mode uses automated battle management aids to evaluate the missile threat, determine engagement eligibility, prioritize the engagement, optimize the engagement timeline, and conduct and monitor execution of the engagement (subject to operator override). Due to the shortened engagement timeline and necessity to optimize the engagement for increased probability of kill, ballistic missile and anti-radiation missile engagements are typically conducted in the automatic mode.

8-29. When a THAAD battery is the base for an ADA task-organized battery, tactical control of fires is more complex. THAAD C2 lacks the software to manage non-ballistic missile components of the air battle; an attached platoon(s) lacks ballistic missile defense software. The THAAD battery assumes operational control of the attached platoon or platoons. THAAD fires are controlled through the AAMDC ADAFCO and managed internal to the THAAD battery. The attached platoon, or platoons, is placed under the tactical control of the SADC or RADC through linkages to the kill chain.

SUSTAINMENT OPERATIONS

8-30. The sustainment concept for an ADA task-organized battery embodies the principles of responsiveness, flexibility, and initiative. Force-projection operations require that the task-organized battery anticipates needs and not wait to react. This is accomplished through constant coordination and detailed planning between the battery and organizations from which it will draw support.

8-31. An ADA task-organized battery deploys with the ability to sustain itself for 72 hours; after that, it requires external support from higher headquarters or other support systems in general. The ADA task-organized battery employs the Army's two-level maintenance system, consisting of field maintenance and sustainment maintenance. Field maintenance is characterized by on-system maintenance − repair and return to user − while sustainment maintenance is off-system maintenance – repair and return to supply.

8-32. The ADA task-organized battery commander should be familiar with the diagnostic mandatory parts list, as the Department of the Army's approved supply support method for ADA systems. Its purpose is to maintain the highest possible state of readiness through diagnosis and repair of faults in non-mission capable equipment and to ensure availability of combat/mission essential assets at or near the firing battery to preclude extended downtime for lack of repair parts. The basic objective is to authorize stock of essential diagnostic and repair/replacement parts that may not otherwise be authorized based on demands. If the end item is found to be non-mission capable, the diagnostic mandatory parts list item will be used to repair the piece of equipment and a replacement part for the list will be put on order. Parts carried on the list will be used as required in peacetime operations. Replenishment will be on an as-used basis. Some ADA repair parts are classified and require the appropriate level of security for transport and storage.

8-33. The ADA task-organized battery commander is responsible for all administrative and logistical functions within the ADA task-organized battery, supported by the executive officer, supply NCOs, system and conventional technicians, and, in most cases, system-specific or conventional maintenance warrant officers. The executive officer is responsible for supply, maintenance, services, and transportation of unit personnel and equipment and should organize and take advantage of all assets available. The executive officer is typically charged with bridging unit sustainment and logistics with the commander's intent. Some materiel readiness functions that the executive officer must coordinate are:

- Apprising the commander of materiel readiness.
- Providing assistance to the platoon leaders on materiel readiness problems.
- Providing liaison with higher headquarters and outside agencies regarding materiel readiness.
- Forecasting logistical requirements and support requests during combat. The executive officer concentrates on seven classes of supply: classes I, II, III, IV, V, VII, and IX. The executive officer and supply NCO coordinate the requisition, receipt, preparation, and delivery of classes I, III, and V.

8-34. The executive officer works with the system warrant officer, NCOs, and Soldiers to ensure unit sustainment supports the unit mission. In a typical ADA battery, the warrant officer is responsible for ensuring system sustainment requirements for the unit are met. The warrant officer accomplishes this through expertise in Army logistics and sustainment, through assigned NCOs and Soldiers, and by ensuring that officers in the unit are fully advised of the employment capability of the weapon system. The warrant officer and maintenance NCOs also coordinate with other units and higher headquarters to ensure ADA unique parts and supplies are available to maintain the best possible mission-capable posture.

8-35. The ADA task-organized battery commander is responsible for the operator/crew maintenance functions in the unit. The commander leverages the senior maintainers' technical expertise on all aspects of the maintenance mission, including diagnostics and troubleshooting to isolate faults and expedite the repair and return of systems to operation.

8-36. The battery commander can ensure flexibility by tailoring methods of sustainment and should not allow the organization to be bound by traditional support methods. The commander must know the logistical requirements of the battery and the details of operation plans, and devise innovative ways to support the plans and reduce risks. The ADA task-organized battery must be flexible enough to obtain support from any base arrangement and accomplish its mission.

Chapter 9
ADA Platoon

This chapter discusses the capabilities, linkages, and tactics and procedures of a generic ADA platoon. While the platoon is a subordinate element in every ADA system organization (for example, Patriot battalion/battery and C-RAM battery), the focus of this chapter is an ADA platoon that has traditionally been referred to as SHORAD and currently encompasses Avenger and C-RAM capabilities. Neither THAAD nor Patriot platoons are deployable and employable at the platoon level; they fight as part of the larger battery. The generic ADA platoon, henceforth referred to as a SHORAD platoon, embraces the common capabilities of these systems. When required, the unique capabilities of Avenger or C-RAM are identified.

ROLES AND CAPABILITIES

9-1. Within the context of the overarching ADA role, a SHORAD platoon detects, engages, and defeats short-range, low-altitude air threats to defend designated forces and other critical assets. Low-altitude air threats consist of UASs, fixed- and rotary-wing aircraft, cruise missiles, and RAM.

9-2. Detection is provided by the Sentinel radar in Avenger and C-RAM units, LCMR in C-RAM units, and other Army sensors whose data is available through the FAAD C2 or C-RAM C2 nodes. Engagements of the different threats are dependent upon the platoon's unique weapons. An Avenger platoon, with Stinger missiles, predominantly engages fixed- and rotary-wing aircraft and UASs (groups 2 and 3); a C-RAM platoon, with 20-millimeter guns, engages RAM targets.

9-3. SHORAD platoon sensors also provide supported or affiliated units (for example, a task force) situational awareness of the airspace and timely, localized warning of impending attacks. The sensors can classify and aid in the identification of air objects, facilitating situational awareness in proximity to a defended area and reducing the potential of fratricide incidents. In addition, the LCMR, supplemented with data extracted from other Army sensors, determines predicted points of impact for RAM munitions, enabling in-time warnings to at-risk forces and areas through the RAM warn system.

9-4. Though normally employed as an organic element of an Avenger battery, an Avenger platoon may also be employed as an independent organization, as METT-TC dictates. C-RAM normally deploys as a battery and is employed as a platoon. The platoon's roles and responsibilities generally remain the same, irrespective of the operational tasks – offensive, defensive, or stability.

9-5. SHORAD platoon roles and capabilities are improved in the near term with the fielding of the Maneuver-SHORAD capability and IFPC. The Maneuver-SHORAD capability, mounting a mix of selectable weapons (guns and missiles), will provide protection of Stryker and Armor BCT maneuvering forces against rotary- and fixed-wing aircraft and group 3 UASs. The IFPC system will provide enhanced firepower and extended range protection of critical, more stationary fixed assets (for example, an air base) and semi-fixed assets (transient structures or locations, such as assembly areas) against cruise missiles and UASs, with a residual capability against fixed- and rotary-wing aircraft.

SUPPORT TO JOINT AIR AND MISSILE DEFENSE

9-6. A SHORAD platoon, as either a subordinate element of an ADA task force/task-organized battery or an independent organization, provides defense of designated JFACC and JFLCC assets at strategic, operational, and tactical levels. These may include such key AMD equipment as U.S. Air Force and Marine Corps long-range surveillance radars and THAAD systems – low density, operationally critical equipment

for the AMD fight. The platoon's presence facilitates long-term protection of assets against low-altitude threats.

9-7. The SHORAD platoon also provides warning of impending air attacks. Its sensors can detect low-flying threats, such as RAM and "pop-up" rotary-wing aircraft, which may be below the coverage of other AMD sensors, and report their locations. This information can then be furnished via applicable data links for situational awareness and broadcast to at-risk forces, facilities, or populations for appropriate passive defense actions.

SUPPORT TO UNIFIED LAND OPERATIONS

9-8. ADA forces, to platoon level, support Army maneuver forces and their subordinate elements in the conduct of unified land operations. The SHORAD platoon's support varies in accordance with the type of operation, projected threats, amount of deployed maneuver and ADA forces, and other METT-TC variables.

9-9. The SHORAD platoon may be employed as part of an ADA task force/task-organized battery, or as an independent platoon placed in support of a maneuver unit (most likely no higher than a brigade), for defense of assets designated by the supported commander. Support relationships are dependent upon the operational environment and METT-TC. Avenger platoons are preferred in offensive operations and those defensive operations that require some movement, against UASs and rotary- and fixed-wing aircraft threats. C-RAM platoons are preferred when there is a preponderance of RAM threats, and defenses are limited to static sites, with no movement required.

9-10. The SHORAD platoon leader, when placed in direct support of a maneuver unit, coordinates with the supported unit commander and the resident ADAM cell to select the asset(s) to be defended. Defense of maneuvering forces against UASs is particularly critical during movements to contact and other offensive operations in the close area. Surveillance by unmanned aircraft system (UAS) platforms may be followed by volleys of RAM or air-to-surface munitions, potentially rendering a maneuver force incapable of fulfilling mission requirements. Avenger platoons may be positioned along routes of march, pre-positioned at potential geographical choke points, or otherwise move with the support elements of maneuver formations.

9-11. Similar to its role in joint AMD operations, a SHORAD platoon supports unified land operations by providing warning of threat actions, most notably RAM attacks and UAS surveillance, to Army elements. Detections by Sentinel radars or other sensors are broadcast to affected units or installations. Passive defense measures can be executed to mitigate RAM attacks. UAS detections, particularly of small variants (group 2), can trigger self-defense actions by non-ADA elements in Army units (combined arms for air defense).

PLATOON COMPOSITION

9-12. A platoon is the smallest echelon that can execute an independent operation for a limited period of time. It requires sustainment support from its parent organization or the supported unit or asset during operations.

9-13. The SHORAD platoon structure replicates that of a "traditional" Army platoon. It contains some 20-30 Soldiers and is equipped, in general, with multiple shooters (launchers or gun platforms), one or more sensors, a C2 node, and ancillary mission support equipment.

9-14. The Avenger platoon has six Avengers and FAAD C2, which is embedded in the platoon headquarters. The platoon receives sensor support from the Sentinel radars in the battery headquarters. Each Avenger has eight ready-to-fire Stinger missiles in two turret-mounted standard vehicle missile launchers, an M3P .50-caliber machine gun, a sensor package with forward-looking infrared sensor, a laser range finder, and an identification, friend or foe capability. Avenger crews have the additional ability to remove Stinger missiles from the Avenger and attach a gripstock to form a man-portable air defense system. (See ATP 3-01.64 for additional discussion of Avenger capabilities.) The C-RAM platoon has four Land-Based Phalanx Weapon Systems (LPWSs), each with a 20-millimeter, multi-barrel gun and an on-board fire control radar; C-RAM C2 in the platoon headquarters; two LCMRs; RAM Warn; and one Sentinel radar. The LPWS automatically executes search, detection, threat evaluation, tracking, engagement, and kill assessment functions. (See ATP 3-01.60 for additional discussion of C-RAM operations.)

9-15. SHORAD platoons are deployed and employed as pure units, containing only one type of weapon system. A limited number of launchers and sensors may be added or removed from the platoon, while still maintaining the platoon's integrity and ability to exercise C2.

COMMAND AND CONTROL

9-16. A SHORAD platoon is under the command of its parent ADA battery and may be placed under the operational or tactical control of an ADA task force or pure/task-organized battery and further employed with a maneuver brigade or battalion. The battery exercises traditional command responsibilities, to include planning, resource allocation, and sustainment. When placed under the operational or tactical control of an ADA task force or task-organized battery, the platoon is attached to that unit; when employed with a maneuver brigade or battalion, the platoon is generally placed in direct support of that formation.

9-17. The platoon headquarters establishes and maintains operational links for engagement and sustainment purposes with its parent battery or task-organized battery, and with the supported unit/asset generally through the ADAM cell, supported unit CP, or base defense operations center. The platoon leader is responsible for coordinating the support relationship, engagement conditions, and sustainment plans with the supported asset.

9-18. Planning and coordination is continuous between ADA echelons and with the supported maneuver force and/or defended installation. When employed in defense of an installation, a SHORAD platoon is generally linked to the installation's base defense operations center. The base defense operations center participates in planning Avenger or C-RAM positions on the installation, identifying installation-unique ROE and establishing sustainment relationships.

9-19. The platoon's data and voice capabilities include Enhanced Position Location Reporting System (also known as EPLRS), Single-Channel Ground and Airborne Radio System (SINCGARS), LandWarNet, and the FAAD/C-RAM C2 data link. Connectivity between the platoon headquarters and its organic sensors and weapons and with higher echelon units is achieved through the FAAD/C-RAM C2 data link.

9-20. Figure 9-1 on page 9-4 focuses on lines of engagement and planning and coordination for the SHORAD platoon in the joint and Army C2 architectures. Connectivity lines to all higher echelons that are resident in these architectures (for example, JAOC and AAMDC), but not directly connected to the platoon, have been omitted. The engagement authority lines in the figure begin with a higher echelon unit commander, the RADC or SADC, who controls engagements per direction of the area air defense commander (AADC). The ADAFCO, collocated with the RADC or SADC, transmits engagement commands to the ADA battalion/task force and ADA battery. An Avenger platoon is generally not a participant in this kill chain; Avenger fire units conduct engagements in accordance with established procedural control rules vice the positive control exerted by the kill chain. However, the Avenger platoon is connected to and receives AMD operational information from its parent battery/task-organized battery, an ADA task force, or the ADAM cell if operating in support of a maneuver force. The C-RAM platoon is also not a part of the kill chain; it receives its engagement commands from the base defense operations center.

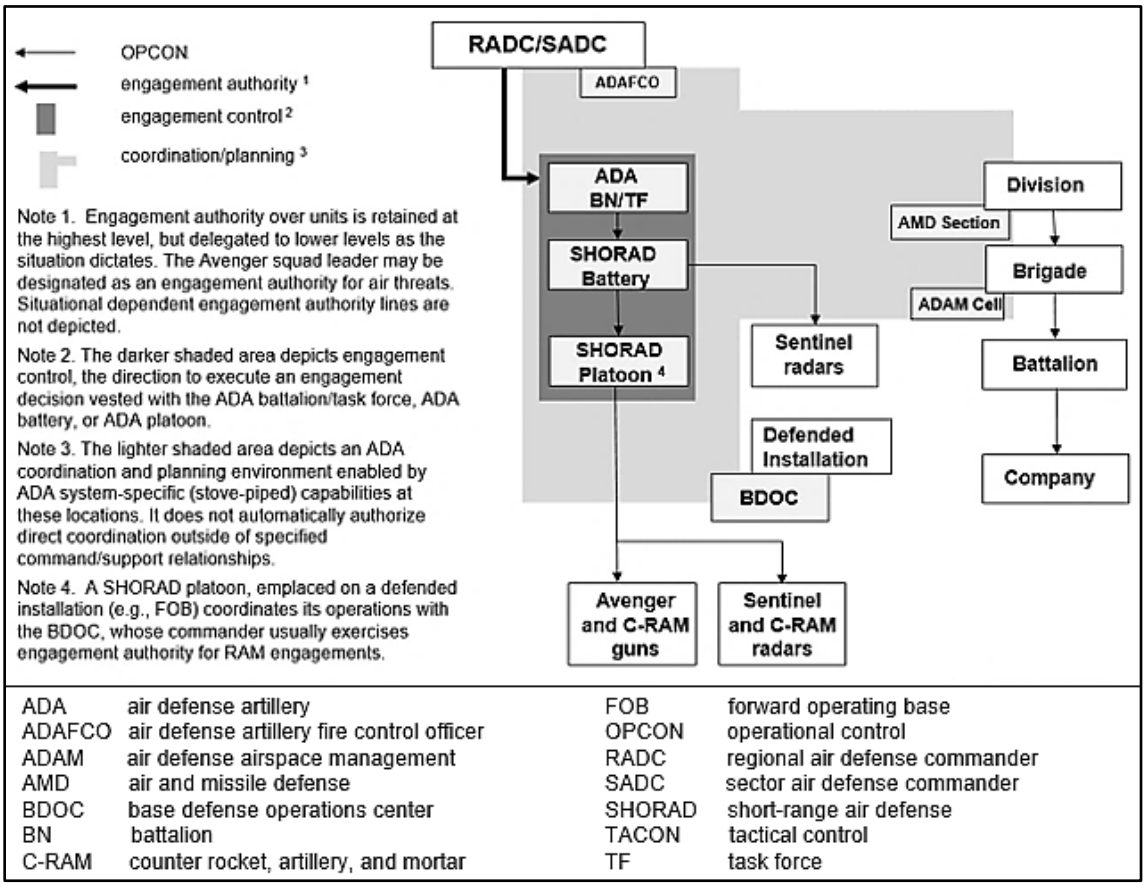

Figure 9-1. Platoon AMD control relationships

9-21. Engagement and identification authority, except for rotary-wing aircraft, smaller class UAS, and RAM threats, is normally maintained by the AADC's designated commander (for example, the RADC or SADC). Avenger team leaders serve as engagement and identification authorities for rotary-wing aircraft and the smaller class of UASs. The ground commander is generally given the responsibility to execute C-RAM operations (JP 3-01). Authority for RAM engagements is decentralized to and exercised by the commander of an installation or base on which C-RAM assets are employed. The C-RAM platoon leader conducts the tactical engagements for the installation/base commander in compliance with the ROE and other AMD control measures forwarded by an ADAFCO, ADAM cell, or another ADA unit.

9-22. In a low intensity air threat environment that may exist prior to or after ground combat operations, engagement/identification authority for fixed-wing aircraft is generally centralized at the RADC/SADC level. Engagement orders are transmitted by the ADAFCO to ADA task force level, or, in some cases, to battery level.

9-23. When there are projections of high intensity air and missile threats with significant simultaneous and coordinated ballistic missile attacks (the expected norm in large-scale combat operations), the AADC may decentralize engagement/identification authority for all air threats. Authority may initially be delegated to an ADA task force, or, if no task force is present in the vicinity and some centralized control above weapon level is required, to an ADA pure/task-organized battery. Once attacks are imminent, authority will likely be decentralized directly to the Avenger team leaders. All Avenger leaders must be cognizant of and prepared to assume requisite authority when so delegated.

9-24. Equipment status reports are provided by the platoon to the ADA task force or task-organized battery, when operating in these formations, or to an ADAM cell when directly supporting a BCT or its subordinate

forces. These reports identify the operational status and availability of the platoon's major items of equipment, with a focus on those items required to conduct engagements.

FORCE OPERATIONS

9-25. Operation plans are usually prepared by the parent battery prior to mission initiation. Once employed, the platoon leader may be responsible for developing changes, METT-TC dependent (for example, an Avenger platoon assigned a new mission of defending a river crossing site).

9-26. One platoon is generally allocated in defense of an asset. More may be allocated dependent upon METT-TC factors, such as the size, dispersion, and criticality of the asset; anticipated threat types and quantities; and available ADA forces.

9-27. The SHORAD platoon deploys as part of an ADA task force or with its parent battery. The platoon fights as part of an ADA task force/task-organized battery or as a separate organization.

9-28. When placed in support of a maneuver unit, the Avenger platoon leader coordinates the operation plan with the supported unit commander. If assigned to an ADA task force or ADA task-organized battery, the platoon leader builds the plan in synchronization with that of the task force or battery.

9-29. When deployed to a base or semi-fixed location, the SHORAD platoon is integrated into that location's overall security plan. The platoon provides its own defense with augmentation by security elements to protect against ground assaults. When supporting a maneuver element, the platoon must rely on that force for security while moving and in static positions.

9-30. Since C-RAM units are most likely positioned on a fixed base or installation due to the limited mobility of the LPWS, C-RAM platoon operation plans and orders are developed by its parent battery and controlling AMD element on that asset in coordination with the base or installation commander. The C-RAM platoon leader advises the AMD element and the base/installation commander of the best positions for the guns given the projected threat.

9-31. The method of employment for a SHORAD platoon varies based on the threat and the defended asset. Placement of the sensors and launchers must maximize coverage of the designated asset. The AMDWSs in Avenger and C-RAM units, with automated battle management aids, provide platoon leaders the best positional options for the defense.

9-32. Sensors must be carefully placed to ensure optimal surveillance of the area. Their positioning is generally the first consideration in establishing a defense. Sentinels have a 360-degree capability to detect and classify aerial threats. LCMRs provide 360-degree detection of RAM threats. They aid in the identification of targets with small radar cross sections and small electronic signatures, traveling at low speeds and altitudes. Identification can be supplemented by data from networked sensors accessed via FAAD/C-RAM C2. The FAAD/C-RAM C2 architecture allows fire control operators to correlate track data from multiple AMD sensors into a composite air picture provided by the track report correlation technique. The supplementary data provided by other AMD sensors is especially useful to SHORAD platoons during potential rotary- and fixed-wing aircraft engagements as it serves to further mitigate the risk of fratricide.

9-33. Sentinel may be employed as a separate component in the area of operations, providing low-altitude coverage of areas that may be masked to other AMD sensors. When so employed, it requires site protection. When developing the sensor plan, leaders must take into account the threat's ability to detect radar emissions and build survivability moves and emplacement locations beyond artillery engagement ranges when possible. Security of these assets must be balanced with the ability to provide early warning to the force.

9-34. In defense of static assets, the SHORAD platoon leader uses the ADA employment tenets to position launchers in accordance with METT-TC. The Avenger platoon leader stresses mutual support, or overlapping coverage when possible, to enhance engagement opportunities. If fixed-wing aircraft are considered to be a major threat, the platoon may weight coverage to the most likely air avenue(s) of approach. The C-RAM platoon leader positions the LPWS launchers in pairs with mutual support if possible, or overlapping fires between pairs as a minimum, for RAM engagements given the relatively short range of the LPWS.

9-35. During deployments with maneuver units, Avenger platoons are generally positioned forward and to the flanks. Avenger can launch a missile or fire its .50-caliber machine gun on the move. Defenses are

optimized at static locations (for example, refuel points or bridge crossings)—where missiles and sensors are in place and positioned along the most likely directions of attack (again using the employment tenets)—and minimized when units are on the move. The platoons employ an overwatch technique to ensure continuous coverage of units on the move. For example, a team of two Avengers, with the associated C2 node and sensors, is positioned in a static location to provide defense over the maneuvering forces. As the supported force moves, a second team maneuvers into position to provide the follow-on defense. Once the second team is in place, it assumes the defense while the first team maneuvers. Overwatch may require additional sensors and launchers. While platoon assets may be positioned at critical points along a route of advance, there is no intent for the platoon weapons or sensors to maintain pace with the maneuvering elements.

9-36. Avenger and C-RAM launchers are assigned primary and secondary target lines. Primary target lines are determined based on mission requirements and defended assets. They assist in the distribution of fires when defending against multiple targets that are attacking from different directions. Secondary target lines allow mutual support and overlapping coverage. Secondary target lines are planned in advance to allow the proper positioning of equipment to accommodate both primary and secondary target line requirements.

ENGAGEMENT OPERATIONS

9-37. The platoon conducts engagement operations from its C2 node. Each platoon's C2 node includes a FCE. The platoon leader serves as the fire control officer and ADA Soldiers fulfill surveillance and identification functions. Engagement operations can be conducted 24 hours per day, requiring constant manning. Battle management aids, embedded in FAAD/C-RAM C2, assist operators in executing their missions.

9-38. Virtually all rotary-wing, smaller class UAS, and RAM engagement authorizations are decentralized to platoon level, without further direction or guidance from higher engagement authorities. Engagements of these threats are time sensitive; there is insufficient time for higher echelons to exert positive control. However, a higher echelon – a task force C2 node for Avenger or base defense operations center for C-RAM, for example – may impose control prior to an engagement when a SHORAD weapons system will fire into a no-fire or controlled airspace zone.

9-39. SHORAD platoon leaders, in their capacity as fire control officers, must consider the "where" of engagements, identifying those locations that allow for minimum collateral damage to friendly forces and defended assets. However, when defended assets are in urban areas and there is significant potential for civilian casualties, ROE and the platoon leader's judgment may result in non-engagements, except for those engagements required for self-defense.

9-40. UAS and RAM engagements are conducted by Avenger and C-RAM systems using procedural controls and are guided by fire direction orders, as required, from the platoon headquarters. The common air picture, facilitated by FAAD/C-RAM C2, enhances the platoon's ability to identify and engage the right target. See ATP 3-01.81 and ATP 3-01.60, respectively, for further discussions of counter-UAS techniques and C-RAM operations.

9-41. SHORAD weapons are placed in the manual or automatic engagement mode. The manual mode is the preferred mode for the Avenger; in this mode, the Avenger gunner conducts the engagement. The automated mode is preferred for C-RAM weapons; in this mode, the gunner conducts the engagement while sitting in a unique LPWS control station and connected to the C-RAM C2 system.

9-42. C-RAM units "clear" airspace before engagements through dynamic "do-not-engage sectors". The sector puts an "uncertainty bubble" around aircraft based on local radar track quality and sends that information to the LPWS. The LPWS then does not initiate an engagement of a RAM threat – or continue an engagement if one has been initiated – if its rounds will pass through this uncertainty volume. The system continues to track the threat and, once clear of the do-not-engage sector, continues the engagement if possible.

9-43. While FAAD/C-RAM C2 facilitates more permissive engagement controls, given the ability to support and display a common air picture with positive identification, Avenger platoons may still be required to visually identify targets as hostile before engaging.

9-44. Engagement, sustainment, and other operational reports are forwarded to parent battery/task-organized battery, ADA task force, and/or ADAM cell. The platoon advises these echelons, for example, of its

engagement results, equipment status (to include battle damage to major components and the need for additional missiles/ammunition), and future maneuver force plans.

SUSTAINMENT OPERATIONS

9-45. The SHORAD platoon is not self-sustaining. It requires administrative and logistical support from its parent unit, the ADA task force or task-organized battery to which it is assigned, or the supported force. When operating independently, the platoon may require an attached maintenance element consisting of select system maintainers and repair parts. Unique items, especially Class V, require careful planning as they cannot be resourced from supported units in many cases, and the parent organization may not have the distribution capability to transport bulky loads across the width and depth of the area of operations. The distributed nature of SHORAD operations also requires consideration of medical support, as medical personnel assigned to a platoon's parent unit will have difficulty covering the area as well.

9-46. Maintenance relies on the Army's two-level maintenance concept: field maintenance and sustainment maintenance. Class IX repair parts are ordered through the Global Combat Support System-Army. A robust prescribed load list will be established to maximize the operational status of sensors and shooters to meet mission requirements and limit maintenance downtime.

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Chapter 10
ADAM Cell

This chapter describes the roles, responsibilities, and functions of the air defense airspace management (ADAM) cell in the corps, division, and brigade. ADAM cells in the corps and division, per the tables of organization and equipment, are titled AMD sections; however, they perform many of the functions of the brigade-level ADAM cell. Therefore, for purposes of simplicity, they are referred to as ADAM cells throughout this chapter. While the following addresses tactics and procedures of the ADAM cell in the corps, division, and brigade, emphasis is placed on ADAM cells in brigade combat team (BCT).

ROLES AND CAPABILITIES

10-1. ADAM cells plan, coordinate, and distribute tactical information necessary to execute AMD operations and to support airspace management at all required Army echelons. They also provide a near-real-time, common operational air picture to facilitate situational awareness. ADAM cells at corps, division, and brigade levels primarily perform planning and liaison functions for force operations, though they also provide some engagement operations support. ADAM cells also ensure that AMD and aviation plans are considered in corps, division, and brigade planning and preparations for operations.

10-2. The ADAM/brigade aviation element cell at brigade level, under the direction of the S-3, is the executive agent for integrating the use of airspace for the brigade commander. The cell resolves immediate airspace conflicts affecting targeting missions and contributes to the air-ground integration process.

10-3. The ADAM cell in the BCT is linked to and coordinates operations with the division ADAM cell, ADAFCO positioned at a regional or sector air defense center, and any supporting ADA units. Through constant coordination, the ADAM cell facilitates the BCT's awareness of the air environment and current and projected AMD operations within and around the BCT's area of operations.

10-4. Major functions and capabilities of the ADAM cell include:

- Coordinate the airspace with aviation, field artillery, and other prime airspace user representatives.
- Advise the commander and staff of air and missile threats and supporting or in-vicinity ADA force capabilities, locations, and activities.
- Plan and coordinate AMD operations with supporting ADA units.
- Receive, stage, and integrate supporting ADA forces/positions into the brigade's area of operations.
- Coordinate early warning of air activity and complementary defense coverage with other Army, joint, and multinational AMD units.
- Clear the airspace, with airspace authorities and other users, for AMD engagements.
- Relay early warning of enemy air and missile attacks to maneuver and supporting forces.
- Broadcast air defense warnings, ROE, and other pertinent AMD information to maneuver elements to support their AMD actions.
- Write the AMD appendix in accordance with the commander's guidance.
- Continuously assess requirements for AMD augmentation.

SUPPORT TO JOINT AIR AND MISSILE DEFENSE

10-5. ADAM cell personnel in BCTs serve as the conduit for AMD information transmitted by the AAMDC ADAFCO or, more likely, the ADA brigade ADAFCO. ADAM cell personnel support the conduct of AMD operations in the brigade's area of operations, primarily with respect to UASs (groups 2 and 3) and rotary-wing aircraft.

10-6. ADAM cell personnel monitor engagements and advise the ADAFCO of air activity in the BCT's area. They also report the locations and actions of a supporting ADA unit as required. In addition, the ADAFCO relies on the ADAM cell for information on the BCT's operating environment when the BCT area of operations encompasses the ADAFCO's region or sector, or portions thereof.

SUPPORT TO UNIFIED LAND OPERATIONS

10-7. ADAM cell personnel at division and corps levels coordinate and assist in the planning of AMD operations when ADA forces are placed in support of, or operate within, the areas of operations of those organizations. The ADA officer is the resident AMD coordinator at each echelon.

- ADAM cell personnel at the corps, or division when a corps headquarters is not present, are linked to the AAMDC in theater and ADAFCO at the JAOC or regional/sector centers for planning and coordination. The AAMDC advises ADAM cell personnel of the overall AMD plan for the area of operations, the projected locations of ADA units within the corps' or division's area of operations, and the allocation of ADA units to support land forces. ADAM cell personnel advise the AAMDC of their commander's intent, the designated critical assets, and the proposed positions of the supporting ADA units.
- ADAM cell personnel ensure that AMD operations are supportive of the corps/division commander's intent, while simultaneously synchronized with the overall AMD plan.
- ADAM cell personnel also coordinate with the supporting ADA brigade, task force, or task-organized battery to ensure common understanding of AMD capabilities and mission requirements.

10-8. ADA personnel in the BCT ADAM cells advise the brigade commander of RAM and UAS engagements, coordinate with a supporting ADA task force or task-organized battery for defense of critical assets, and assist in the coordination of the airspace to facilitate rapid, unimpeded engagements.

- ADA personnel synchronize AMD operations with the commander's scheme of maneuver.
- They contribute to the commander's aerial situational awareness by connecting to appropriate joint and multinational elements and providing a common air picture at the unit level.
- They transmit airspace data to maneuver elements at the tactical edge of the close area to enable awareness of the air picture, initiation of passive defense measures, and execution of appropriate self-defense actions.

10-9. Planning and coordination between the corps-, division-, and brigade-level ADAM cells, and with supporting ADA forces, are continuous. Plans and operations are reviewed and adjusted in accordance with changes to commanders' priorities, increases or decreases in threat activity, and friendly force situations.

ADAM CELL COMPOSITION

10-10. ADAM cells are organic to corps, divisions, BCTs, field artillery brigades, maneuver enhancement brigades, and theater/combat aviation brigades. They provide resident AMD expertise, coordination, and integration with other Army airspace and joint AMD and airspace authorities.

10-11. In corps and divisions, the cells consist of ADA Soldiers who provide AMD planning expertise to the commander and staff. At brigade level, the cells contain ADA and aviation Soldiers, in a combined ADAM/brigade aviation element, whose duties focus on airspace management. While the aviation personnel are integral to ADAM cell operations, they will only be discussed minimally in this chapter, primarily with respect to airspace management. Refer to ATP 3-01.50 for a more detailed discussion.

10-12. ADAM cells have 4 to 12 ADA Soldiers, depending upon echelon. A headquarters battery in a maneuver enhancement brigade, for instance, contains 4 ADA Soldiers, while the corps, with ADAM cells in the main CP and tactical CP, requires 12 ADA Soldiers.

10-13. As staff elements, ADAM cells do not have assigned sensors or shooters. Their major items of equipment are C2 related. Current ADAM cells contain FAAD C2 and AMDWS hardware and software as well as communications equipment to enable integration with the supported force and into the joint data net. ADAM cells contain a suite of communications equipment, to include the Multifunction Information Distribution System, Joint Tactical Terminal, Enhanced Position Location Reporting System (also known as EPLRS), and SINCGARS. This equipment collectively provides access to the joint community via link 16, affording the ability to transmit and receive near-real-time tactical intelligence, targeting, position location, and identification information.

10-14. Equipment is mounted on two HMMWVs and powered by a 10-kilowatt generator. In the future, the high mobility multipurpose wheeled vehicles are projected to be replaced by medium tactical vehicles.

COMMAND AND CONTROL

10-15. C2 is facilitated through FAAD C2 and AMDWS. ADAM cells use LandWarNet and tactical data links to transport data to effect C2. LandWarNet is leveraged to provide planning and sustainment support and to distribute airspace management and control data to corps, division, and brigade elements. The tactical network enables AMD force operations and engagement operations at the maneuver element.

10-16. Figure 10-1 on page 10-4 reflects the ADAM cell's C2 relationships at the joint regional/sector and Army division and below levels. As depicted in the figure and described in previous chapters, engagement authority lines emanate from the RADC or SADC and engagement control from the ADA battalion/task force, ADA battery, or SHORAD platoon. The ADAM cell participates in the planning and coordination of AMD operations with joint and Army elements; it is not involved in the engagement authorization or engagement control chains.

- A BCT ADAM cell is most likely linked to the ADAFCO in a sector air defense command center and generally monitors engagements by a supporting ADA unit.
- Planning and coordination is conducted between the ADAM cells at the corps, division, and brigade levels; ADAM cells and ADA units, from the AAMDC to platoon level; ADAM cell and non-ADA elements in a BCT conducting air defense operations (combined arms for air defense); and an ADAM cell and base defense operations center when the ADAM cell is deployed on an installation.
- An ADAM cell forwards air defense data to the non-ADA elements in the BCT to allow them to conduct air engagements in self-defense per the ROE.

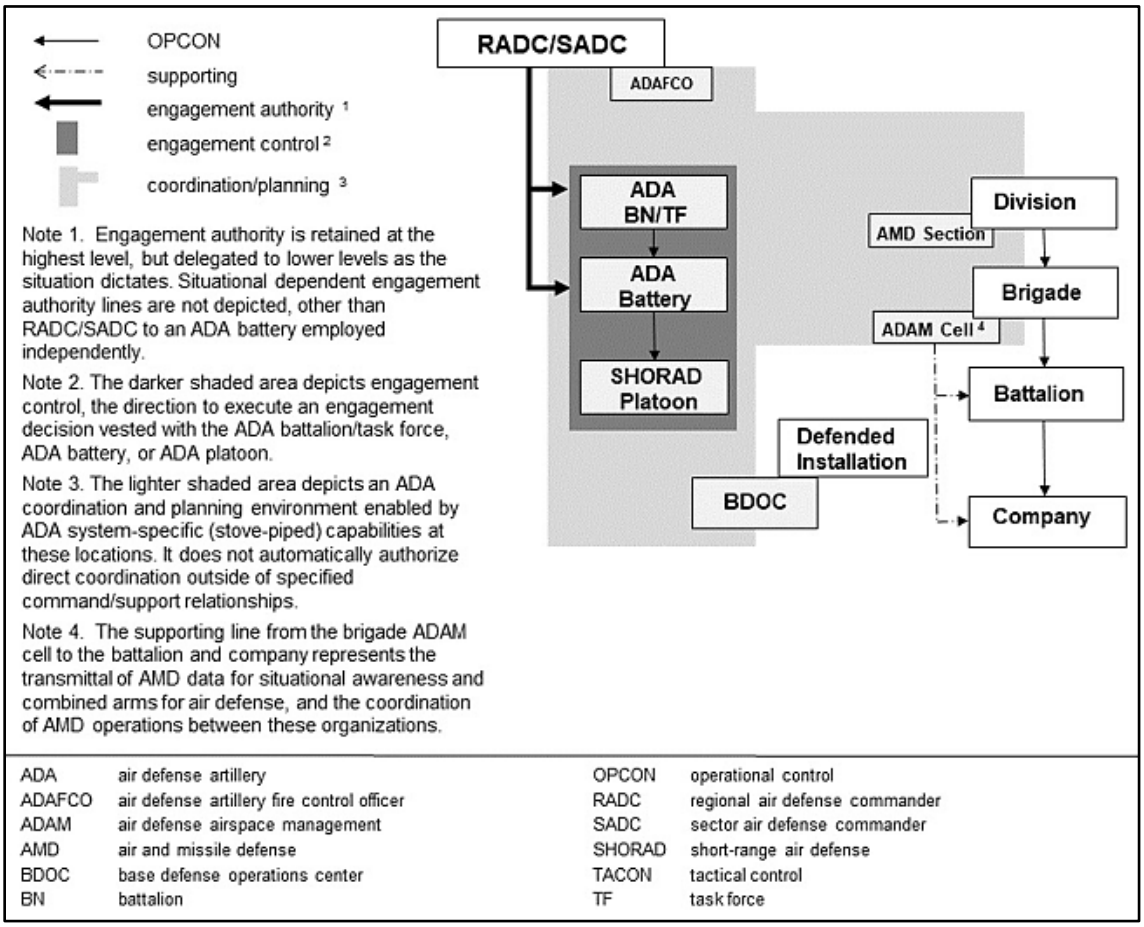

Figure 10-1. ADAM cell AMD relationships

10-17. The ADAM cell assists in the coordination of defenses when shooters are attached to or placed in support of the BCT. The ADAM cell becomes the singular point of contact within the brigade for the augmenting ADA force. ADAM cell personnel maintain constant, complete, and timely pictures of supporting ADA force engagements, equipment status, and positional moves in the BCT area. However, coordination and execution of AMD operations remains a primary function of the commander of the augmenting force.

10-18. ADAM cell personnel transmit brigade-unique ROE to the supporting ADA force. The ADAM cell ensures that the supporting ADA force understands if, where, and when more restrictive rules are imposed in the brigade area.

FORCE OPERATIONS

10-19. An ADAM cell is deployed and employed with its parent headquarters. ADAM personnel are positioned in the fires cell in a BCT, in the protection cells at corps and division, and in the current operations staffs or as stand-alone cells in the field artillery, maneuver enhancement and theater/combat aviation brigades.

DEFENSE PLANNING AND EMPLOYMENT CONSIDERATIONS

10-20. ADAM cell personnel at the corps, division, and brigade levels develop the AMD appendix for their respective echelons. The appendix includes the AMD IPB, priorities for defense, and recommended allocation of ADA forces. The recommended allocation is vetted with other land and air component

commander priorities, and a force allocation decision is made. The ADA personnel assist the BCT commander and staff in planning for support by ADA forces or general coverage by AMD sensors and missile systems, when support is allocated. They also recommend how to integrate designated AMD capabilities into the maneuver plan.

10-21. Current ADAM cells achieve visibility of and input to AMD planning through their embedded AMDWS capability. ADAM cells leverage ADA capabilities through AMDWS functionality, allowing their commanders to shape the defended asset plans. Data is transported across LandWarNet.

10-22. ADAM cells plan and coordinate the emplacement of low-level sensors (for example, Sentinel radars), as applicable, to support AMD operations. They may coordinate with the target acquisition platoon, within the brigade's organic field artillery battalion, for Sentinel placement. Adjustments in position locations and trade-offs in allocation of resources may be required as the field artillery battalion may desire Sentinels for support of RAM Warn and counterfires, while the ADAM cell may need Sentinels to support the counter-UAS fight.

10-23. ADAM cell personnel monitor and advise the fires cells of the operational status of the ADA shooters and their available munitions. They assist in the coordination of adjustments to launcher position when shooters are out of action and advise when missile and ammunition resupplies are required.

10-24. ADAM cell personnel coordinate force protection requirements for ADA forces supporting the brigade or operating within its area. ADA echelons do not have organic personnel that can provide adequate protection against ground threats. Some force protection requirements may be met by locating the ADA force with other brigade assets at a base; however, this is only suitable if the ADA force can execute its mission from that base. When positioned at a separate location and METT-TC dependent, the ADA force may need an attachment of Soldiers from the brigade for protection.

10-25. ADAM cell personnel also assist in AMD planning in maneuver battalions and companies. They advise battalion and company commanders of the supporting ADA assets or units, their capabilities and limitations, and their employment considerations. In addition, they plan for and monitor active and passive AMD measures to be executed by BCT elements. They coordinate force protection of supporting ADA elements with supported battalion and company commanders.

AIRSPACE COORDINATION AND MANAGEMENT

10-26. The ADAM cell is part of an airspace coordination team, consisting of ADA, field artillery, aviation, and other service representatives at corps, division, and brigade levels that facilitate airspace deconfliction and clearance of fires. The ADAM cell responsibilities for airspace management vary dependent upon echelon. The corps ADAM cell, for instance, is more involved with planning airspace usage and coordinating that usage with joint air planners. The BCT ADAM cell is focused on the execution of airspace usage, such as deconfliction and clearance of fires.

Note. At the division level, the ADAM cell's ADA officer is a participant in the joint air ground integration center. The joint air ground integration center is designed to fully support and enable division-level current operations through the rapid execution and clearance of fires and airspace. It is a modular and scalable center designed to integrate and synchronize fires and airspace control in the division's area of operations. See ATP 3-91.1 for additional details.

10-27. Planning considers the identification of potential airspace users and the airspace needs of these users. The ADAM cell personnel determine the most appropriate airspace control measures that provide the least restrictions to airspace users while maximizing their use and combat effectiveness. The ADAM cell may establish restricted operations zones within the brigade's airspace to support management and deconfliction of airspace users. A *restricted operations zone* is an airspace reserved for specific activities in which operations of one or more airspace users is restricted (JP 3-52). ADAM cell personnel also monitor the restricted zones that are created by other airspace management and control authorities.

10-28. The ADAM cell manages the airspace over the BCT's area of operations. The brigade aviation officer coordinates the actions of the ADAM cell and ensures that airspace management activities are

integrated with the brigade staff sections and higher echelons. The ADAM cell maintains a relationship with higher airspace control elements and with supporting air traffic services elements.

10-29. The ADAM cell provides oversight of brigade UAS operations. ADAM/brigade aviation element personnel may assist in mission planning, though planning is generally conducted at maneuver battalion or UAS platoon level. ADAM cell personnel must maintain continuous awareness of UAS operations as UASs at division and brigade levels tend to be used for multiple missions and need to be able to maneuver over the battlefield with relatively few restrictions.

10-30. Airspace deconfliction is conducted by ADA, field artillery, and aviation Soldiers to mitigate potential fratricide of aircraft and other friendly air users and minimize the interruption of ongoing operations. Such operations include aircraft transiting the area, ADA forces conducting engagements of air or missile threats, or field artillery units executing fire support missions. The ADA, field artillery, and aviation Soldiers, enabled by the common air picture, maintain situational awareness. They are cognizant of the locations, plans, and activities of other users to enable the greatest use of the airspace with minimal conflicts. Where potential conflicts might exist, the ADAM cell facilitates the commander's priority efforts.

10-31. Airspace must be cleared to allow uncontested operations by the multitude of airspace users, avoiding time and space conflicts. ADAM cell personnel contact various airspace control agencies for clearance. These agencies include the Air Force control and reporting center, radar approach control, and air traffic control agencies. Responsibilities of these agencies are generally defined by the established coordinating altitude; a *coordinating altitude* is an airspace coordinating measure that uses altitude to separate users and as the transition between different airspace control elements (JP 3-52). The majority of all fires exceeds the coordinating altitude and therefore must be cleared by the control and reporting center and radar approach control. Clearance must be obtained from the control and reporting center because it controls tactical military aircraft, and from the radar approach control because it has control of commercial and non-tactical military aircraft. Air traffic control agencies control their defined airspace below the coordinating altitude. Once each agency clears its airspace, the ADAM cell can acknowledge that the airspace is cleared for the designated operation.

ENGAGEMENT OPERATIONS

10-32. The ADAM cell has limited engagement operations responsibilities, as it is not in the kill chain and does not exercise battle management of ADA units or combined arms for air defense elements. Its primary functions in engagement operations are to disseminate AMD data to maneuver forces, transmit early warning and general air threat information provided by supporting sensors, and to inform the ADAFCO and higher Army echelons of air threats operating in the BCT's area and subsequent engagement results, as appropriate.

10-33. ADAM cell personnel interface with the ADAFCO at a regional and/or sector air defense command center for the positional information on projected air threats and to provide the status of engagements. The ADAM cell may also link to an ADA task force or task-organized battery if one is located in or near the BCT's area of operations for positional information.

10-34. ADAM cell personnel provide the linkage between the AMD authorities and maneuver forces conducting AMD engagements, generally in self-defense. ADAM cell personnel transmit air defense warnings, ROE, weapons control status, and other air defense procedural control measures to aviation elements and fire support officers at battalion and company levels for further transmission to Soldiers at those levels. These procedural controls allow Soldiers, to include maneuver Stinger teams, to conduct engagements of air threats without further authorization.

10-35. ADAM cells at the BCT and higher levels are involved in the deliberate targeting process through participation in the targeting working groups, targeting board, and assessment working groups. The ADAM cell supports the collection of information to confirm or deny potential named areas of interest through the use of ADA sensors and to nominate targets for attack operations. The ADAM cell may also support attack operations (counterfire) in the brigade area by transmitting sensor back plot information (information that identifies the point of origin of incoming fires). Sensor data is forwarded to fire support officers for execution of immediate fires.

SUSTAINMENT OPERATIONS

10-36. ADAM cell personnel plan for and coordinate sustainment requirements for ADA elements supporting the brigade or one of its subordinate units. ADAM personnel work with the brigade S-4 to identify and program the resupply of required rations, ammunition (less ADA unique), and petroleum products; maintenance of common Army equipment (ADA-specific maintenance needs are furnished by the ADA unit's next higher headquarters); and, as available, supplementary transportation. Coordination may entail the delivery of rations, ammunition, and petroleum products to an ADA site, instead of the ADA element picking up such items at a brigade logistical location. If some or all sustainment needs cannot be met, ADAM personnel may contact and request support from an ADA force operating in the brigade's area, or, with the supporting ADA element's commander, contact the next higher ADA headquarters for assistance. Sustainment planning continues throughout an operation and is modified, as appropriate, in accordance with METT-TC.

10-37. ADAM cell personnel perform operator-level maintenance on their equipment. Additional maintenance requirements for common Army equipment can be met by the corps, division, or brigade maintenance unit. Maintenance of ADA equipment beyond the scope and capabilities of the ADAM cell ADA Soldiers is coordinated with the supporting ADA force.

10-38. ADAM cell sustainment needs are provided by the echelon headquarters to which the ADAM cell is assigned. Administrative support is provided by its parent unit.

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Chapter 11

Combined Arms for Air Defense

This chapter addresses the contributions that Army non-AMD forces provide in the execution of AMD operations, commonly referred to as combined arms for air defense. All forces may be involved in AMD operations, either through direct engagement or indirect support actions. The capabilities and considerations presented throughout this chapter are of those non-AMD forces that complement the capabilities of dedicated Army, joint, and multinational AMD forces. The capabilities may include small arms, crew-served weapons, or missiles. In most cases, the discussion addresses situations where there are no ADA forces present. The focus of this chapter, unless otherwise indicated, is the BCT and low-flying threats.

GENERAL

11-1. Since the advent of air power, Army forces have been observed, challenged, threatened, and attacked by enemy air and have had to learn, train, and execute their missions under the premise of air attack. To help counter this air threat the Army developed AMD capabilities, ranging from missile defense to C-RAM systems. The AMD capabilities are prioritized and allocated to protect the most critical force assets throughout an operation. However, the amount of dedicated ADA resources available within the Army has always been insufficient to protect all of the force components. Therefore, non-ADA forces must contribute to defense against air threats, relying on their own protection capabilities to supplement any dedicated ADA forces allocated to them.

11-2. The primary air threats to the maneuver force are RAM, UASs (groups 1 and 2), fixed- and rotary-wing aircraft, and cruise missiles. It is likely all of these threats, in various quantities and with various capabilities, are present in a BCT's area of operations and can threaten the commander's ability to maneuver freely and execute mission requirements. The most prevalent air threat generally varies by theater and by time during an operation. RAM and surveillance UASs, capable of cueing fires against friendly assets, are likely always present. The low, slow, and small l UASs (groups 1 and 2) are prominent threats, given their small size and signature and ability to report friendly force locations in near-real time. UASs may also be employed in coordinated groups and, in the future, swarms, further complicating engagements by friendly forces. And, as discussed in previous chapters, the threat has added the capability to execute complex integrated attacks, using a combination of different platforms with different capabilities to conduct a synchronized attack in near-real time.

11-3. Actions taken by Army forces in support of AMD may be either active or passive.

- Active measures are offensive and defensive actions taken to defeat the air threat before, during, and after they attack friendly assets. These actions can be taken by Army systems that have not been optimized or adapted with a capability against the air threats or by Army systems with enhanced AMD capabilities. The non-optimized systems engage an air threat, without making changes to the system's primary mission, role, or capabilities. For instance, crew-served weapons shoot at an air target using manual super elevation and lead angle (Kentucky windage). Enhancements may add such capabilities as air track targeting information in C2 systems, airborne platform attack mode in electronic attack systems, and new software in BCT sensors to enable detection, tracking, and reporting of airborne platforms. Active measures may be taken against all air threats cited above in the air or on the ground, with the exception of RAM. Only ADA units and some self-protection systems have the capability to actively engage RAM threats in the air.
- Passive measures are actions taken to reduce the enemy's ability to detect, locate, target the force, and minimize the effects of the attack. Passive measures include camouflage, cover, concealment,

air guards, convoy procedures, signals intelligence, and operational security. These measures help mitigate the enemy's ability to use air power to affect Army operations. Passive measures may be taken against all threats.

11-4. As previously mentioned, all Army forces participate in and support AMD operations. Sustainment forces in general, for instance, provide the standard Army class I-IX support, maintenance, and transportation support. Maneuver support forces, such as chemical sections, military police forces, and engineer components may advise ADA elements on CBRN, support the security requirements of ADA units, and enhance the survivability of ADA systems with protective works, respectively. The forces most actively and directly engaged in AMD operations are maneuver, aviation, special operations, field artillery, and intelligence.

- Maneuver. Maneuver forces support both surveillance and attack operations against threat air capabilities. Maneuver forces can conduct and support the engagement of UASs (groups 1 and 2). The addition of Stinger teams in maneuver formations provides an enhanced capability to engage enemy UASs, fixed- and rotary-wing aircraft, and some low-altitude cruise missiles.
- Aviation. Aviation forces may attack an enemy's ground-based theater launch assets in the deep area. Army aviation forces are not equipped for air-to-air combat. However, they may attempt to engage air threats as targets of opportunity or in self-defense.
- Special operations. Special operations forces are adept at deep strikes on C2 facilities and launch sites, as part of attack operations.
- Field artillery. Field artillery is one of the Army's primary means for attack operations. Field artillery forces provide scalable capabilities, a range of nonlethal to lethal actions, against enemy C2 stations and launch sites (suppression of enemy air defenses), as well as in the counterfire fight. These capabilities provide the required effects, while considering collateral damage. Artillery sensors also provide data inputs to the air picture. When C-RAM is deployed in the maneuver area, artillery sensors are directly linked to it to provide cueing against RAM threats in the air.
- Intelligence. Intelligence elements perform the analysis of enemy aerial capabilities, the foundation of the IPB for ADA units. They assist in collecting and analyzing such data as threat air activity, technical characteristics, ingress tactics, and potential warheads and/or payloads. In addition, they provide strategic early and accurate warning and targeting information for attack operations.

11-5. Maneuver, special operations, and field artillery forces generally contribute to AMD operations before and after launch. Aviation and intelligence forces contribute before, during, and after launch.

COMMAND AND CONTROL

11-6. AMD operations are further enhanced by electronic warfare actions, specifically electronic attack and electronic protection. Electronic attacks, for instance, can deceive or confuse operators in C2 nodes at the tactical through strategic levels; they can also adversely impact an enemy's ability to surveil using UASs (see paragraphs 11-16 on page 11-3 and 11-21 on page 11-4). Electronic protect involves actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy use of the electromagnetic spectrum that degrade, neutralize, or destroy friendly combat capability. This may include limiting the electromagnetic signatures of radars to reduce an enemy's ability to locate these systems. For further information on cyberspace and electronic warfare operations, see FM 3-12.

11-7. Engagements of air threats are executed in accordance with AMD directives issued by the AADC. Directives such as ROE, weapons control status, and air defense warnings establish the conditions for what can be engaged and, to a degree, when an engagement can be conducted (for example, in self-defense). AMD information is initially incorporated into the BCT's operation plan.

11-8. ADAM cells transmit the AMD directives to BCT forces through LandWarNet. The information constitutes the initial air defense conditions and changes as they are enacted. Information can be transmitted by voice or data. LandWarNet is also used to provide sensor detections, situational awareness of the BCT's airspace and airspace in the immediate vicinity of the BCT, and early warning.

PLANNING AND EMPLOYMENT CONSIDERATIONS

11-9. ADAM cell personnel develop the AMD appendix for the BCT. The appendix addresses the organic capabilities of the BCT, for both active and passive defense, and capabilities of an ADA unit placed in support of the BCT or of ADA units operating in its vicinity. It identifies AMD missions for the BCT's organic and supporting units. Intelligence units, for instance, may assist in identifying the air threat to be countered and analyze potential enemy courses of action.

11-10. The brigade commander establishes the priority of assets to be defended and influences the positioning of any supporting ADA unit. The ADAM cell facilitates the commander's understanding of the airspace and the capabilities, locations, and missions of ADA units in or near the BCT area.

11-11. The BCT's battalion-size elements can get assistance from the ADAM cell or supporting ADA unit, if one is assigned, in incorporating AMD into their plans. The ADAM cell or ADA unit can provide the current data on projected air threats, special guidance on ROE, UAS and aviation locations and transit routes through the brigade's area, and any engagement directives from the designated engagement authority. This enables aerial situational understanding for BCT units and mitigates fratricide.

11-12. Defenses for virtually all Army elements are focused on the potential or projected ground threat. Units and their weapons are positioned to deny or mitigate this threat. However, with the increasing proliferation of UASs and potential for complex integrated attacks of any friendly concentration of forces, commanders must be cognizant of, plan, and allocate resources to defend against air threats. Thus, defenses of installations, such as operating bases, or areas where brigade elements may concentrate should consider the most likely air ingress routes, surveillance orbits, and suspected areas from which UASs and rotary- and fixed-wing aircraft can be launched.

11-13. BCT units must incorporate passive defense measures into their AMD planning. In addition to camouflage and movement control, units can plan for and institute electromagnetic hardening, electronic masking, and emission control by such measures as shielding sensitive equipment components, controlling signatures to protect against threat signal intelligence operations, and selecting and controlling the use of sensors and C2 emitters, respectively (FM 3-12). Units on installations should continually harden their locations and incorporate all means to lessen the potential for threat observation and mitigate the effects of air attacks. For more information on passive AMD measures, see ATP 3-01.8.

11-14. ADAM cells are cognizant of friendly UAS launch times and projected operating areas. ADAM Soldiers, in coordination with brigade S-3 and the maneuver force UAS units, may establish restricted operations zones that encompass UAS operating areas and affect the AMD actions initiated by maneuver force Soldiers.

ENGAGEMENT CONSIDERATIONS

11-15. Engagements can be lethal or non-lethal, and they can be executed against air and missile threats on the ground or those that are airborne. Engagements are conducted by the best available system or systems positioned and capable of negating an enemy's capabilities. All of the maneuver forces' organic weapons can be used in self-defense. Key to the engagements is the detection of the threat in sufficient time and with sufficient accuracy to allow friendly forces to execute necessary responses. For more information on active AMD measures, see ATP 3-01.8.

11-16. The best defense against air and missile threats is to destroy them on the ground before launch or disrupt/destroy their control stations. Intelligence analysis and collection efforts are continuous and support preplanned and dynamic targeting. Using potential launch site and C2 location information identified by intelligence elements, field artillery, aviation, and special operating forces employ lethal means to target these threat assets at extended ranges. Electromagnetic jamming directed against a UAS control station can disrupt its electronic signals, thus reducing the controlled UAS's ability to surveil the right area and transmit targeting data.

11-17. Once the threat is airborne and enters the brigade's defended areas, brigade units use all means to destroy these threats. Engagements are procedurally controlled. A different weapons control status (weapons hold, weapons tight, and weapons free) may be applied simultaneously to different weapon systems, different

threat types, and in different airspace areas (JP 3-01). The more restrictive status (weapons hold) is generally in effect in low threat environments or when there are numerous friendly aircraft operating in the brigade airspace. A more liberal status (weapons tight or free) may potentially be declared in a high threat environment or when there is certainty that no friendly or neutral air platforms are in the area. The right of and rules for self-defense are also established; the right of self-defense is never denied.

11-18. Engagement authority for most air threats in the brigade area flying below the coordinating altitude is likely vested with the BCT commander. The sole exception may be fixed-wing aircraft; the AADC or his designated representative (for example, the RADC) may retain engagement authority for these threats, irrespective of whether they are flying above or below the coordinating altitude.

11-19. Maneuver forces on the tactical edge of the battlefield use their organic weapons to engage surveilling or attacking rotary- or fixed-wing aircraft and UASs. All such efforts are considered self-defense actions. Crew-served weapons are more capable against fixed-wing aircraft and helicopters, while small arms are generally better against the group 1 UASs. Threat systems that transit a unit's location, but are not attacking that unit, may also be engaged; however, they are more likely allowed to continue transiting given the relative short ranges and limited AMD effectiveness of maneuver force weapons.

11-20. The reintroduction of Stinger to the maneuver force provides an additional capability for the defense of critical assets in BCTs and their subordinate units. Brigade or battalion commanders may task organize Stinger teams at their respective locations for protection of CPs or logistical elements, or each team may remain with its parent company (one Stinger team is currently projected per maneuver company). Regardless of organization, a team is generally positioned in proximity to the defended asset. The team weights its coverage to the most likely air avenue of approach. The team receives positional information of friendly, hostile, or neutral air activity in its vicinity from the ADAM cell, or a supporting ADA unit, through its unit's communications nets. Early warning cues the Stinger Soldier as to where to look for the aerial object. Once the object has been detected, the team uses the ROE, weapons control status, and identification criteria to determine whether to engage or not. Primary targets are rotary-wing aircraft and UASs, especially the low, slow, and small ones. As noted previously, different weapon control statuses may be in effect for different air types. It is likely that weapons tight may be directed for rotary-wing aircraft and weapons free for the low, slow, and small UASs. See ATP 3-01.18 for additional discussion of Stinger team techniques.

11-21. Army forces can use electronic attack measures against airborne UASs to disrupt signals. Electromagnetic deception and intrusion devices and activities are designed to mislead or deceive the threat (FM 3-12). These devices can deny, defeat, or exploit the link between the UAS and its ground control station. Deny activities are executed through jamming with little to no operator interaction; defeat is the deliberate measure to render the link ineffective and requires man-in-the-loop interaction; and exploit is the deliberate effort to employ deception measures and is exercised by an operator. See FM 3-12 for additional discussion of cyberspace capabilities.

11-22. Aviation forces do not have a dedicated air-to-air weapon system. Army helicopters and UASs may engage enemy air threats as targets of opportunity or in self-defense. Air crews must give careful consideration to collateral damage. No current aviation weapon system has a self-destruct capability, and firing air-to-ground systems at enemy aircraft creates a significant collateral damage hazard in the sector of fire.

11-23. Offensive actions by the aviation, field artillery, and special operating forces continue during the air battles and after the threat platforms have exited the brigade area. Combined fires continue to target enemy air capabilities − platforms on the ground and control stations – to reduce further air activities.

11-24. A summary of the actions which the different forces, cited in paragraph 11-4 on page 11-2, can take against air threats is presented in table 11-1. Engagement actions are typically conducted in self-defense. For more information, see ATP 3-01.8.

Table 11-1. Summary of actions against air and missile threats

Threat to be Countered	*Actions Initiated By:*				
	Maneuver Forces	***Aviation Forces***	***Special Operating Forces***	***Field Artillery Forces***	***Intelligence Forces***
Unmanned Aircraft System	• Passive defense. • Engage in the air with organic small arms and crew-served. Weapons. • Engage in the air with Stinger.	• Passive defense. • Engage as targets of opportunity or in self-defense. • Attack launch/ airfield facilities and ground C2 station.	• Passive defense. • Attack ground C2 station. • Attack launch sites.	• Passive defense. • Target C2 stations and launch sites. • Support the air picture with data from artillery sensors. • Engage in the air with small arms and crew-served weapons.	• Passive defense. • Collect and analyze data re threat capabilities. • Provide early warning. • Provide targeting data for attack operations.
Rotary-Wing Aircraft	• Passive defense. • Engage with small arms and crew-served weapons. • Engage in the air with Stinger.	• Passive defense. • Engage as targets of opportunity or in self-defense. • Attack launch sites, C2 stations, and forward arming and refueling points.	• Passive defense. • Attack C2 facilities. • Engage with organic weapons, to include Stinger. • Attack launch sites, C2 stations, and forward arming and refueling points.	• Passive defense. • Engage in the air with all organic weapons. • Support the air picture with data from artillery sensors.	• Passive defense. • Collect and analyze data re threat capabilities. • Provide early warning.
Fixed-Wing Aircraft	• Passive defense. • Engage with small arms and crew-served weapons. • Engage in the air with Stinger.	• Passive defense. • Engage as targets of opportunity or in self-defense.	• Passive defense. • Attack ground C2 station. • Attack operating bases. • Engage in the air with organic weapons, to include Stinger.	• Passive defense. • Engage in the air with all organic weapons.	• Passive defense. • Collect and analyze data re threat capabilities. • Provide early warning.

Table 11-1. Summary of actions against air and missile threats (continued)

Threat to be Countered	*Actions Initiated By:*				
	Maneuver Forces	***Aviation Forces***	***Special Operating Forces***	***Field Artillery Forces***	***Intelligence Forces***
Rocket, artillery, and mortar	• Passive defense.	• Passive defense. • Attack launch site.	• Passive defense. • Attack launch site.	• Passive defense. • Counter-battery. • Attack launch site.	• Passive defense. • Collect and analyze data re threat capabilities. • Provide early warning.
Cruise Missile	• Passive defense.	• Passive defense. • Attack ground C2 station. • Attack launch sites.	• Passive defense. • Attack ground C2 station. • Attack launch sites.	• Passive defense. • Target C2 stations. • Target launch sites.	• Passive defense. • Collect and analyze data re threat capabilities. • Provide early warning.

C2 command and control

Chapter 12

ADA Data and Communications Architecture

This chapter discusses the ADA data and communications architecture and how it connects with the joint AMD organizations. It includes information on connectivity specified for the joint, interorganizational, multinational AMD elements, and ADA organizations, echelons, and systems capable of connecting directly to the major AMD networks. The intent is to show the connectivity that supports the doctrinal linkages discussed in the previous chapters.

MAJOR NETWORKS

12-1. The major networks addressed are the AMD supporting networks for the joint, interorganizational, and multinational elements, link 16, and LandWarNet. LandWarNet is discussed in terms of its radio frequency connections and internet protocol connections.

12-2. Networks that span ADA echelons and joint, interorganizational, and multinational links using multiple types of interfaces require special skills to plan, coordinate, install, operate, and maintain. Personnel who perform this mission have extensive experience and detailed technical training. To support the AMD operational networks, an interface control officer is positioned at the corps, division, AAMDC, and ADA brigade levels. The interface control officer is responsible for planning data links for early warning dissemination within the area of operations. The Army interface control officer, in the G-6 staff, coordinates with ADA units, the Army AMD network design facility, and the joint interface control officer to plan the network design with the information exchange requirements that have been provided by subordinate units and the command. The interface control officer manages and coordinates the entire multi-link interface for supporting units and works with the joint interface control officer for connectivity into the larger joint, interorganizational, and multinational networks. The G6, normally from the AAMDC, deploys an interface control officer, as necessary, to the joint interface control officer's location to integrate Army AMD assets into the tactical data link architecture.

AMD SUPPORTING NETWORKS

12-3. The AMD supporting networks includes the many tactical data links and unique connections throughout the joint, interorganizational, and multinational community. Link 16, though not included below, is also an AMD supporting networks; it is discussed and shown separately due to its significance. The AMD networks support development of the air picture with situational understanding, intelligence activities, planning, operations, and engagement operations with threat position information and firing guidance. Some of the networks are legacy networks for U.S. joint forces but are still in use with multinational forces. However, some joint forces currently retain the capability to enter or monitor the legacy networks to maintain connectivity with joint, interorganizational, and multinational organizations and elements.

12-4. Examples of legacy AMD supporting networks still in use on some platforms are link 11 (also known as tactical data link-A), link 11B (also known as tactical data link-B), PADIL, forward area air defense data link (FDL), and the Army tactical data link 1. The Command and Control Battle Management and Communications (C2BMC) network is used to integrate the BMDS. The cooperative engagement capability (CEC) network is a newer network used by the U.S. Navy. These networks are discussed briefly below.

12-5. Link 11 is a secure, half-duplex, netted digital link that provides a network for exchanging tactical data between subscribers at either 1,364 or 2,250 bits per second. It is normally operated in a roll call or polling mode, using either high frequency or ultra-high frequency communications. It is controlled by a net control

station to exchange information between airborne, land-based, and shipboard systems. The system uses the M-series messages.

12-6. Link 11B is a secure, full duplex, point-to-point digital data link using serial transmission frame characteristics and standard message formats at either 600, 1,200, or 2,400 bits per second. The system uses M-series messages, which can be exchanged using ultra-high frequency or landline communications.

12-7. PADIL is a Patriot system internal data link. It has a high capacity, full-duplex, and line-of-sight/point-to-point radio system. Its normal routing is between fire units and the ICC, although it can also link to another battalion's ICC. The radio system interfaces up to 11 bit rates up to almost 9000 kilobits per second. Digital traffic includes high quality digital voice equipment with a data service channel. Analog voice for circuit installation and maintenance is available for additional communications between operators using a handset directly attached to the radio set.

12-8. FDL is used with the FAAD C2 system and passes information, including targeting information, between the Sentinel radar C2 node, Avenger battery and platoons, Avenger platforms (squads), and C-RAM battery and platoon. FAAD C2 includes an AMDWS and an air defense system integrator (also known as ADSI). A variant of FAAD C2, C-RAM C2, is used to support C-RAM systems.

12-9. ATDL-1 is a legacy secure, full duplex, point-to-point digital data link using serial transmission frame characteristics and standard message formats at a basic speed of 1200 bits per second. It is used to interconnect tactical air control systems and Army or Marine Corps tactical AMD systems. ATDL-1 can be exchanged using ultra-high frequency, very high frequency, or landline communications. The capability to link with ATDL-1 systems provides a means to exchange air and missile data with some multinational partners using this data link.

12-10. C2BMC is a vital operational system that provides the U.S. President and Secretary of Defense a common operating picture. It also enables combatant commanders at strategic, regional, and operational levels to systematically plan missile defense operations, collectively see the battle develop, and dynamically direct designated networked sensors and weapons systems to achieve global and regional mission objectives. The worldwide distributed and regional combatant command C2BMC architecture provides operational flexibility to engage both strategic- and theater-level ballistic missile threats and affords each command the flexibility to tailor system behavior and data sharing to satisfy unique mission objectives.

12-11. CEC is a real-time, sensor-netting system that enables high-quality situational awareness and an integrated fire control capability. It is used on selected Aegis cruisers and destroyers, amphibious ships, aircraft carriers, and selected Hawkeye aircraft. Its two major hardware pieces are the cooperative engagement processor, which collects and fuses sensor data, and the data distribution system, which exchanges data between participating CEC units. CEC increases Naval AMD capabilities by integrating sensors and weapon assets into a single real-time network that enhances situational awareness, increases depth-of-fire, enables longer intercept ranges, and improves decision and reaction times. Targeting data from CEC can be passed onto link 16.

LINK 16

12-12. Link 16, also known as tactical data link-J, is the Department of Defense's primary tactical data link for command, control, and intelligence, providing critical joint interoperability and situational understanding information and supporting AMD engagements. It is used by the joint services, some nations of the North Atlantic Treaty Organization, and Japan.

12-13. Link 16 is a relatively high-speed link. It has a capability to transfer data of over 50 kilobits per second. It uses an L-band transceiver and has its own frequency hopping algorithm and internal encryption. It provides technical and operational improvements to older capabilities, including spread spectrum frequency hopping over 51 discrete frequencies, increased data rate, data volume and granularity, hardware size and weight reduction, digital secure voice capability, relative navigation, improved security, jam-resistance, seamless network entry and exit, precise position and location information, and increased numbers of participants.

12-14. Link 16 uses the Joint Tactical Information Distribution System radio or the Multifunctional Information Distribution System radio. Both radios operate in a line-of-sight frequency band. Other radios

are available that can interface with the link 16 waveform. It is a time division multiple access link where time slots are allocated to users by the network controller. Link 16 has its own protocol and uses the J-Series messages. It requires network preplanning.

12-15. Link 16 has an enhancement to increase its range. The Joint Range Extension addresses the requirement to pass secure/anti-jam data and voice via common means in a timely manner, beyond line-of-sight, without the use of a dedicated airborne relay. Joint Range Extension is a gateway between existing link 16-capable systems and satellite terminals, and can be used with other beyond line-of-sight media, such as landline-based networks. There are two major employment applications of the gateway: in-theater reachback and inter-zone connectivity. In-theater reachback is used to transmit the air surveillance and ballistic missile information from a forward area of a theater to a remote command center located beyond-line-of-sight of the forward link 16 elements. Inter-zone connectivity is used to transfer air surveillance and ballistic missile information between localized areas of a theater operation.

LANDWARNET

12-16. LandWarNet is the Army's contribution to the global information grid. It consists of all globally interconnected, end-to-end Army information capabilities, associated processes, and personnel for collecting, processing, storing, disseminating, and managing information on demand supporting warfighters, policy makers, and support personnel. It includes all U.S. Army owned and leased and leveraged Department of Defense/joint communications and computing systems and services, software (including applications), data security services, and other associated services. LandWarNet exists to enable the war fight through C2. As the Army's enterprise system of systems, LandWarNet moves information through a seamless network that facilitates information-enabled joint warfighting and supporting operations from the operational base to the individual Soldier. LandWarNet provides the Army's enterprise networking capabilities that enable Soldiers, leaders, and units today and in the future to operate anytime, anywhere, and at every echelon as part of the joint force. However, the LandWarNet is in a state of continual improvement with capabilities being refined yearly.

12-17. LandWarNet provides the construct for the Army's transition to the future. LandWarNet enables voice, data, and video to the edge of tactical formations, ultimately pushing these capabilities to the Army's modular brigades, battalions, and Soldiers. LandWarNet is the means to provide linkages between sensors, shooters, and leaders; seamless and secure interoperability; network services; and end-to-end connectivity throughout the enterprise.

12-18. ADA units rely on supported organizations or Expeditionary Signal Brigades to provide connectivity to the Army backbone network for establishment and maintenance of common user networks, Department of Defense information network services, and integration of network transport and cyberspace support activities. In this chapter LandWarNet is addressed through two modes, radio frequency and internet protocol:

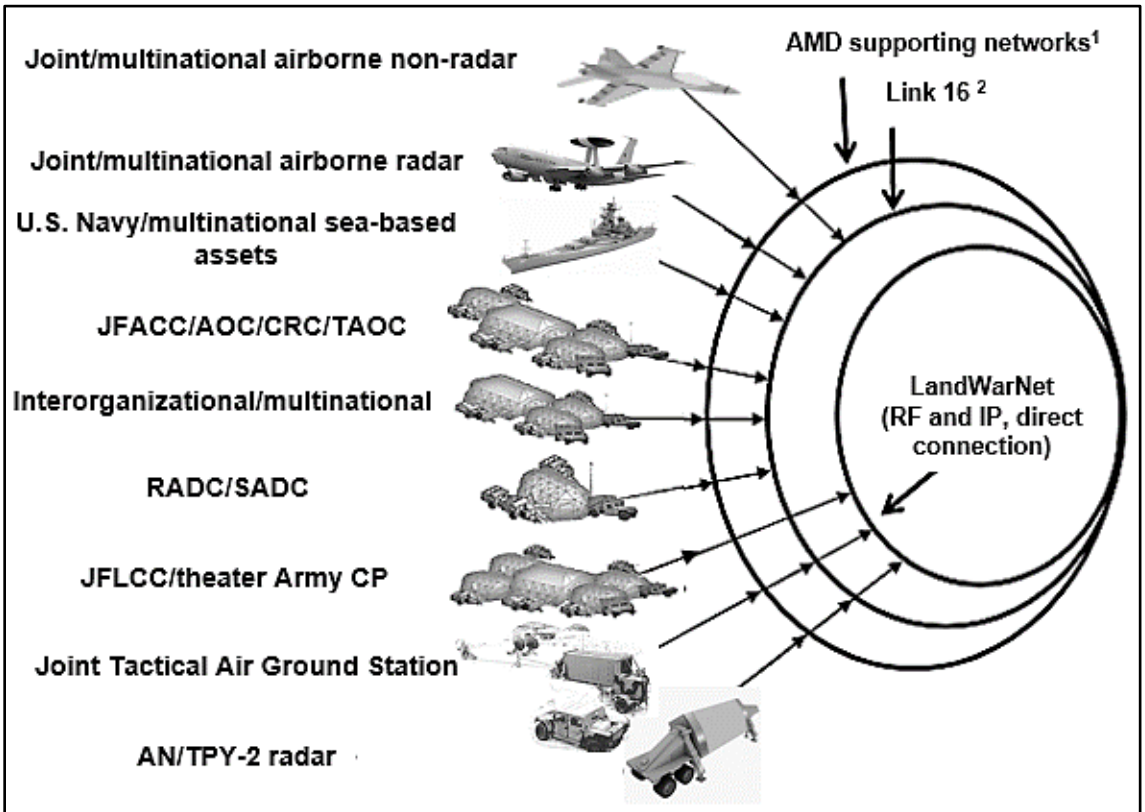
- The radio frequency system most used in the tactical forces is SINCGARS. Almost every vehicle whose senior occupant is involved in engagement operations or directly supporting engagement operations has a SINCGARS radio. In many cases in the SHORAD mission, SINCGARS is the primary means of voice communications and also a means of data communications. SINCGARS operates in the very high frequency spectrum. Other radios used in ADA include the AN/PRC-117, Enhanced Position Location Reporting System (also known as EPLRS), the high frequency AN/VRC-104, as well as radios capable of linking through satellites.
- LandWarNet supports an internet protocol-based system and, therefore, is able to send messages from anyone on the internet protocol network to anyone else on that network using routing conventions like those on the internet. The tactical implementation of this concept is more difficult than in the civilian world with its permanent supportive infrastructure. Internet protocol connectivity "to the edge" is a stated goal of LandWarNet.

COMMUNICATIONS AND DATA ARCHITECTURE CONNECTIVITIES

12-19. Figures 12-1 (on page 12-4) and 12-2 (on page 12-5) present the data and communications networks supporting ADA forces. Figure 12-1 primarily depicts joint and multinational elements, while figure 12-2 is

ADA focused. Listed on the left side of each figure are the organizations, echelons, systems, and key command/operations positions that can connect directly into the cited networks. In some cases, such as the "Joint/multinational airborne radar" in figure 12-1, broad terms are used as there can be several types of airborne radars connecting to the network, depending on which country or service is present and which airborne platform is used. Next to the listing are icons – visual cues – of each organization, echelon, or system in the networks. On the right of the figure are concentric ovals, one for each network or type of network discussed. PADIL and FDL are shown separately in figure 12-2, as each touches only a few systems. There are lines drawn from icons to selected ovals or networks. An arrowhead (→) from an icon that touches an oval indicates that the organization, echelon, or system has direct connectivity with the network that is identified by the oval label.

12-20. The depicted architecture is projected to change in the future with the introduction of a common C2 capability and the integrated fire control network. ADA system components, such as radars and launchers, will be able to be controlled by non-homogeneous ADA C2 systems.



AN/TYP-2	Army Navy Transportable Radar Surveillance and Control Model 2
AOC	air operation center
CP	command post
CRC	control and reporting center
IP	internet protocol
JFACC	joint force air component commander
JFLCC	joint force land component commander
RADC	regional air defense commander
RF	radio frequency
SADC	sector air defense commander
TADC	tactical air operations center

Figure 12-1. Communications and data architecture supporting AMD forces

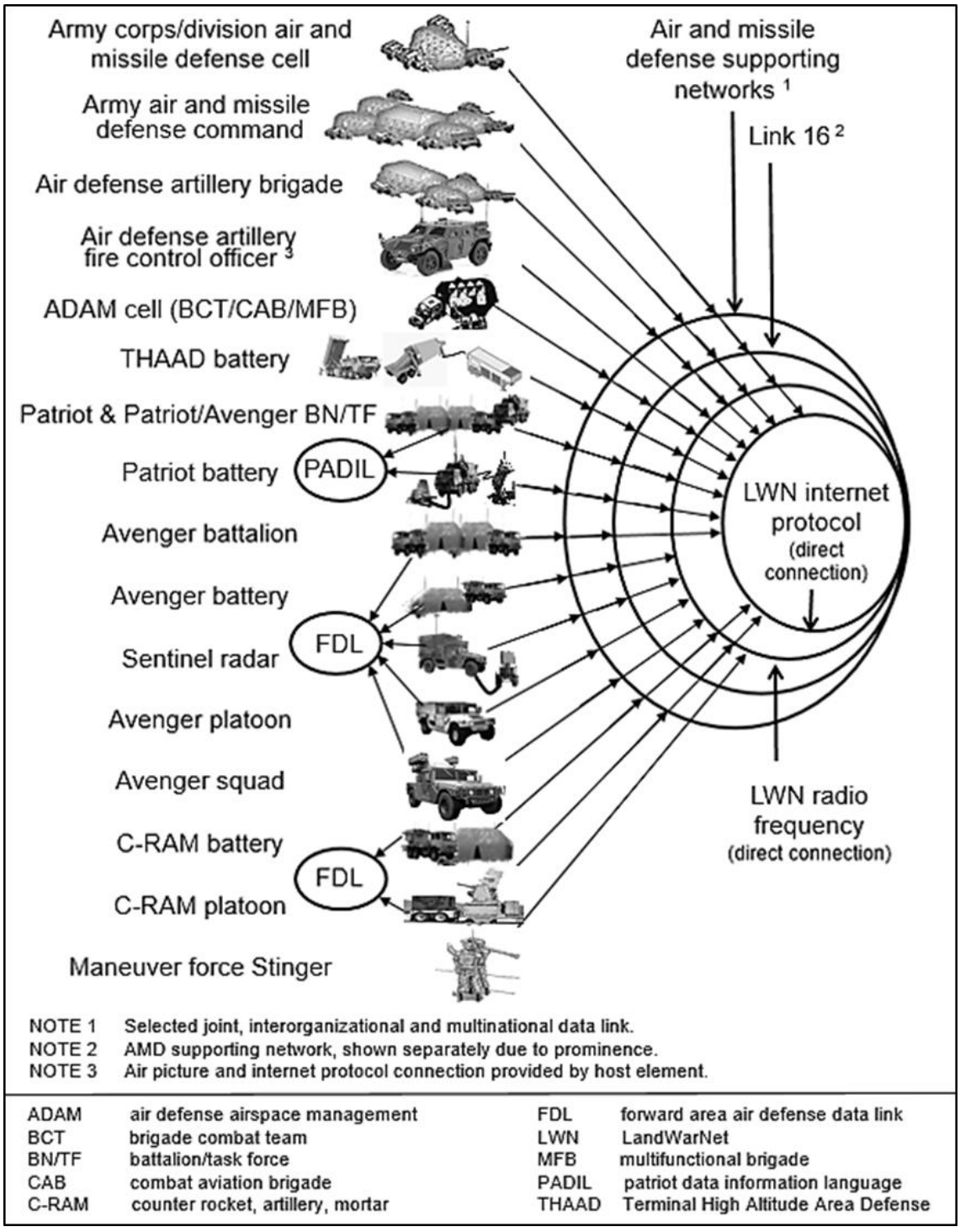


Figure 12-2. Communications and data architechture supporting ADA forces

ENGAGEMENT OPERATIONS CONNECTIVITY

12-21. Tactical data links, such as the PADIL, FDL, and link 16 are used to support and enable AMD situational awareness and engagements. They also enable ADA units to interoperate to some degree with joint, interorganizational, and multinational organizations.

12-22. ADA units use the AMDPCS equipment, the FAAD/C-RAM C2, THAAD C2, or Patriot C2 to execute C2 tasks. All ADA units use the AMDWS to support planning and operations functions. The C2 systems use hierarchical communications links and LandWarNet to effect data distribution for C2 functions. Hierarchical architectures require higher level C2 nodes to link to lower level C2 nodes down to the execution level (firing battery or firing platoon). The execution level organization then connects directly to sensors and shooters.

12-23. Two scenarios are briefly addressed to highlight potential connectivity challenges: a mature theater with joint and Army AMD forces, and an austere theater with predominately maneuver forces.

- Mature theater with joint and Army AMD forces. Engagement authorization flows from the area AADC, RADC, or SADC to the collocated ADAFCO; the ADAFCO passes engagement directions to an ADA task force or battery. The ADAFCO does not have organic direct connectivity into the link 16 and uses voice or a host-provided data link as the primary means of passing engagement data. The ADAFCO may need connectivity through LandWarNet to a BCT ADAM cell because of distance and non-line-of-sight conditions. Once engagement authorization is passed to the AMD echelon exercising C2, internal ADA networks, such as PADIL or FDL, are used to transmit data to the executing elements.
- Austere theater with predominately maneuver forces. If no ADA forces are present, the ADAM cell links directly to a joint or host nation engagement authority. Direct linkage to the joint engagement authority is via link 16 and voice. Linkage to a host nation may be via tactical data links and voice or may be voice only, depending upon the host nation's capability. If ADA is present, link 16 and voice are normally the primary linkages between AMD forces and the joint engagement authority, and between ADA and the BCT ADAM cell. The ADAM cell then provides engagement authorization data to the BCT, based on procedural controls, and any available automated battle aids enabled by its C2 capability and transported by its available communications network(s).

12-24. ADA units work well and integrate with other U.S. and multinational AMD organizations, civilian organizations, and professional fighting forces. To effect that type of integration, and sometimes interoperability, requires extremely complex data and voice communications systems. The data systems have to transfer near-real-time data across the battlefield or across continents to support situational awareness and anti-missile and anti-aircraft engagements. Figures 12-1 on page 12-4 and 12-2 on page 12-5 show the breadth of communications and data transfer systems but do not touch on the complexity or difficulty of implementing the integration required.

Appendix A

Army AMD Strategic Organizations and Systems

Army AMD organizations consist of echelons of command ranging from the strategic to the tactical level and manned by active component and National Guard Soldiers. This appendix briefly addresses organizations and systems that are generally categorized as strategic-level. See FM 3-27 for more discussion of the Ballistic Missile Defense System (BMDS) and JP 3-27 for discussion of AMD of the Homeland, to include the Army AMD mission in defense of the National Capital Region

BMDS

A-1. BMDS is an architectural construct that encompasses the strategic and operational theater missile defense capabilities of the services. BMDS is system-architected by the Missile Defense Agency, with some systems developed by the agency and fielded and operated by service personnel and some systems under service development, fielding, and operation. BMDS encompasses Air Force, Navy and Army systems linked by C2BMC. The Army systems are GMD, JTAGS, and AN/TPY-2 radars operating in the forward-based mode, all discussed below, and Patriot, and THAAD which are presented in appendix B. BMDS capabilities are frequently referred to in terms of tiers:

- ***Upper tier*** **is a layer of airspace that encompasses very high altitudes within the atmosphere to outside the atmosphere in which air and missile defense engagements are conducted.** Upper tier systems are designed to defeat ballistic missiles, from intercontinental to short-range variants, during the mid-course and early terminal phases of their flight.
- ***Lower tier*** **is a layer of low-to-high airspace within the atmosphere in which air and missile defense engagements are conducted.** Lower tier systems are designed to defeat close-, short-, and medium-range ballistic missiles during the terminal phase of their flight.

GMD

A-2. GMD is a major component of BMDS and the U.S. missile defense strategy to counter intermediate-range and intercontinental ballistic missiles in defense of the United States and designated areas. The GMD system consists of multiple sensors, a complex communications system and fire control capability, and ground-based interceptors. GMD fire control and ground-based interceptor components are deployed in the United States, while contributing sensors operated by the Army, Navy and Air Force are deployed around the world and in orbit. GMD is an upper tier system. Figure A-1 on page A-2, show a GMD launch event.

Figure A-1. Ground-based midcourse defense

A-3. United States Army Space and Missile Defense Command/Army Forces Strategic Command has operational responsibility for the GMD system units and exercises administrative control over the GMD-system Soldiers. The National Guard Bureau provides Soldiers to staff and operate the missile defense element and fire direction center. Subordinate to United States Army Space and Missile Defense Command/Army Forces Strategic Command are the 100th Missile Defense Brigade and the 49th Missile Defense Battalion. The 100th Missile Defense Brigade staffs the missile defense element and the 49th Missile Defense Battalion staffs the fire direction center. The missile defense element provides direction to the fire direction center executing global missile defense operations. The fire direction center consists of the GMD system fire control system, communications networks, in-flight interceptor communications system, and launch support system. Either mode can prosecute the battle independently. In normal operations, the fire direction center fights the ballistic missile battle while the missile defense element provides oversight and assesses future battle plans. The missile defense element and the fire direction center are manned 24 hours a day, 365 days a year.

C2BMC

A-4. The C2BMC system is a strategic-level combat information center for the BMDS. It provides planning, situational awareness, remote sensor management, and monitoring of ballistic missile defense operations and communications for friends, allies, deployed forces, and homeland defense. It links, integrates, and globally synchronizes individual ballistic missile defense systems and operations to provide an optimized, layered missile defense against threats of all ranges and in all phases of flight.

A-5. The C2BMC system provides the President and Secretary of Defense a common operating picture and enables combatant commanders to systematically plan a missile defense operation, collectively see it develop, and dynamically direct networked sensors and weapons systems to defeat the ICBM threat. Figure A-2 presents the computers (simple central processing unit and monitors) in the missile defense element 2 node.

Figure A-2. Command and Control Battle Management and Communications

JTAGS

A-6. JTAGS detachments are subordinate to the 1st Space Company, Theater Missile Warning, 1st Space Battalion. Each detachment consists of a headquarters and five crews. Two detachments with overlapping coverage are needed to support the JTAGS mission for 24-hour per day operations over extended periods (ATP 3-14.5). Each unit has three external high-gain, eight-foot dish antennas. JTAGS is presently a transportable information processing system, housed in a standard military shelter, that receives and processes in-theater, direct down-linked data from Defense Support Program satellites. Using existing communication networks, JTAGS disseminates near-real-time warning, alerting, and cueing information on ballistic missiles and other tactical events of interest throughout the theater to combatant commanders and BMDS for the protection of military assets, civilian populations, and geopolitical centers. Figure A-3 on page A-4, shows a JTAGS in a field setting.

A-7. JTAGS is currently being upgraded to a new configuration for operation with the next generation of the Space Based Infrared System and to improve warning accuracy and timeliness. Improvements include information assurance upgrades, new commercial antennas, SIPRNET capability, and the integration of five systems from shelters into operation centers.

Figure A-3. Joint Tactical Ground Station

AN/TPY-2 RADAR

A-8. Missile defense batteries contain the AN/TPY-2 radars operating in the forward-based mode. The batteries are deployed world-wide in defense of the United States, host nations, partners and allies, and deployed U.S. forces. Each battery consists of a headquarters section, radar platoon, and prime power, sensor management, and security operations sections.

A-9. AN/TPY-2 radars are high precision, long range, three-dimensional X-band, phased-array radars having two modes of deployment: forward-based and terminal. (The terminal mode supports THAAD and is discussed in paragraph B-8 on page B-5.) In the forward-based mode, the AN/TPY-2 radar primarily supports BMDS by detecting ballistic missiles early in their flight and providing precise tracking information. The radar provides boost phase identification, discrimination, early warning/surveillance, and tracking of ballistic missiles for the theater and global BMDS kill chains. C2 is enabled through the C2BMC system. Figure A-4 presents an AN/TPY-2 radar and support elements.

Figure A-4. AN/TPY-2 radar

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Appendix B

Air Defense Artillery Systems

This appendix presents brief descriptions of the ADA systems that perform AMD at the operational and tactical levels: Patriot, THAAD, Avenger, C-RAM, Sentinel, and non-system specific C2 systems (titled "Other ADA C2 Systems"). Patriot, THAAD, and AN/TPY-2 forward-based mode radar are generally considered to be operational-level systems, while Avenger, C-RAM, and Sentinel are deemed tactical systems. Such designations, however, are scenario and situational dependent. Patriot, THAAD, and even Avenger, for instance, may assume strategic missions; THAAD's employment in Koreas has strategic implications, as does Avenger's in the National Capital Region.

PATRIOT

B-1. Patriot is a multi-mission system that provides AMD of combat land forces and other critical assets. Patriot forces are capable of defending against ballistic missiles, cruise missiles, UASs, tactical air-to-surface missiles, large-caliber rockets, and fixed- and rotary-wing aircraft. Patriot is organized as battalions and deployed generally as the base capability of ADA task forces, though it may also be deployed in smaller configurations such as batteries or sub-sets of batteries. System components are air transportable by C-17 or C-5 aircraft. For more information on the Patriot system and its components see ATPs 3-01.85 and 3-01.87.

B-2. Patriot radar set, AN/MPQ-65A. The Patriot radar set provides precise three-dimensional search and detection, target track and discrimination, and a Patriot missile uplink to support defense against close-range, short-range and selected medium-range ballistic missiles and the full gamut of air threats. The radar is part of the battery organization and is deployed primarily as a component of an ADA task force or ADA organized battery. Figure B-1 on page B-2 presents the Patriot radar set.

Figure B-1. Patriot radar set

B-3. Patriot launching station. Patriot launching stations, or launchers, house, transport, store, and fire Patriot missiles capable of long-range, low-to-high altitude, all-weather defeat of close-, short-, and medium-range ballistic missiles and the other threat types mentioned above. Patriot provides both lower tier ballistic missile defense and air defense. Figure B-2 shows a Patriot launching station.

B-4. Three types of Patriot missiles are employed, all of which are certified rounds: Patriot Advanced Capability (PAC)-3 cost reduction initiative missile (hereafter referred to as PAC-3), PAC-3 missile segment enhancement (hereafter referred to as the missile segment enhancement missile), and guidance enhanced missile. The PAC-3 missile is a medium-range, low-to-medium altitude, radio frequency, terminal homing hit-to-kill missile. The missile segment enhancement missile is a radio-frequency terminal homing, extended altitude and range, hit-to-kill missile. The guidance enhanced missile is a medium-to-long range, low-to-high altitude, semi-active guided missile optimized against cruise missiles and other air threats. Patriot launchers, depending on version/configuration, can mount 16 PAC-3 missiles, 12 missile segment enhancement missiles, 4 guidance enhanced missile, or a mixed load. Patriot missiles require a Patriot radar to provide uplink commands for midcourse guidance (PAC-3 and missile segment enhancement missiles) or for the full engagement sequence (guidance enhancement missiles).

Figure B-2. Patriot launching station

B-5. Patriot C2. Patriot C2 is uniquely designed to provide the full range of C2 capabilities for Patriot system operations. It consists of echelon-specific components that distribute and collectively accomplish the full set of force and engagement operations for Patriot.

- Information and coordination central. The information and coordination central (ICC) is the Patriot battalion's control center and interfaces with the Patriot firing battery, adjacent battalion ICCs, and other Army and joint AMD systems. It exercises tactical control, fire direction center functionality, and supervision of Patriot batteries. It can, when applicable, integrate with THAAD for engagement coordination and deconfliction when THAAD is attached to a Patriot-based ADA task force. Both Patriot and THAAD normally conduct engagement coordination and deconfliction through the AAMDC's ADAFCO.
- Tactical control station. The battalion's tactical control station directly supports the ICC by providing automated defense and communications planning for the battalion and situational awareness to the commander. The tactical control station is collocated with the battalion's fire direction center. It is equipped with the AMDWS and Patriot tactical planner workstation; the tactical planner workstation along with common data link modules provide unit commanders with tools to create and test the defense design plans. The Patriot tactical planner workstation provides operator access to the joint air picture over link-16. The tactical control station and its components assist the commander with early warning and friendly protection.
- Dismounted Patriot information and coordination central (DPICC). This is a configuration that provides ICC functionality in locations where the physical emplacement of the full-up ICC may not be desirable or possible, such as inside buildings, to support mobile operations ("jump" capability while operations continue in base location), or during rapid initial insertions. The DPICC has data processing and man-machine interfaces to effect air battle management, and data communications, less active transmission capabilities, to link to higher, adjacent, lower, and

supported echelons. Linkage is achieved by fiber optic or copper wire or transmission services provided by supporting Army communications or host nation infrastructure.

- Engagement control station. The engagement control station is the Patriot battery's control center for air battle management. It provides fire direction functionality for the battery. It remotely controls the radar and launchers during air battle operations. Additionally, it establishes tactical data links to the Patriot ICC and adjacent Patriot fire units via the Patriot digital information link (PADIL).
- Battery command post. The battery command post operates in a manner similar to the tactical control station at the battalion. It directly supports the engagement control station during planning and air battle operations. It is also responsible for tracking battery-level force operations and equipment status and reporting these to the battalion. External elements link to the battery command post using standard protocols such as link 11 and link 16. The battery command post cannot transmit on links 11 or 16; it can only receive.

THAAD

B-6. THAAD is an anti-ballistic missile upper tier system that provides the capability to engage and negate short-, medium- and intermediate-range ballistic missiles within and outside the atmosphere. Engagements can be conducted against ballistic missiles in both the late midcourse and terminal phases of their trajectories (see FM 3-27 for more information on defense against ballistic missiles during their flight phases). THAAD is organized and deployed as a battery. THAAD is deployable and globally transportable via air, land, and sea. A THAAD battery consists of four main components. THAAD system components are air transportable by C-17 and C-5 aircraft. THAAD missiles require special authorization to ship and separate shipment (not on the launcher). For more information on the THAAD system see ATP 3-01.91.

B-7. THAAD launcher. The THAAD launcher is a HEMTT-mounted, mobile, stabilized missile launch platform carrying a missile round pallet. The launcher has a high rate-of-fire and can be rapidly reloaded. The pallet contains eight hit-to-kill, passive terminal homing missile rounds per launcher. The THAAD missile round is a certified round composed of a canister and missile containing a single-stage booster and a kill vehicle. There are six launchers in a THAAD battery. Figure B-3 shows a THAAD launcher and missile round at launch.

Figure B-3. THAAD launcher

B-8. THAAD radar. The THAAD radar (AN/TPY-2) is an X-band, solid state, phased-array radar capable of tracking multiple threats and multiple missiles during engagements. In the terminal mode of operations, the THAAD radar supports engagements against missiles by providing surveillance, acquisition, track discrimination, missile communications, and hit assessment for the THAAD fire control and communications equipment. Figure B-4 on page B-6 presents the THAAD radar.

Figure B-4. THAAD radar

B-9. THAAD fire control node. The primary fire control node components in each THAAD battery are the Air and Missile Defense Planning and Control System (AMDPCS) Version B and THAAD fire control and communications. The AMDPCS Version B serves as the battery CP. The THAAD fire control and communications component consists of a tactical operations station, launch control station, antenna support vehicle, cable support vehicle, 30-kilowatt power plant, and THAAD portable planner. The THAAD fire control and communications component supports engagement operations, force operations, embedded and netted embedded training, and interoperability. The fire control crew fights the air battle inside the tactical operations station and launch control station. The fire control section provides a THAAD portable planner to the CP for force operations and remotes a workstation into the CP for situational awareness of the air battle and system status.

AVENGER

B-10. The Avenger weapon system is a mobile lightweight, day or night, limited adverse weather fire unit used to counter enemy reconnaissance, surveillance, and target acquisition efforts and low-level fixed- and rotary-wing threats. Avenger contains missile pods carrying Stinger infra-red homing, fire-and-forget missiles and a M3P .50 caliber machinegun mounted on a high mobility multipurpose wheeled vehicle (also known as HMMWV). It has on-board forward looking infra-red sensors to aid visual acquisition and identification of tracks. Avenger links to the forward area air defense (FAAD) C2 for air battle management, early warning and cueing, and aids for track identification. The Avenger system is air transportable by cargo helicopters (CH-47 and CH-53) and C-130, C-17, and C-5 aircraft. For more information on the Avenger system and Stinger see ATPs 3-01.64 and 3-01.18, respectively.

B-11. Avengers are currently organized as battalions and batteries in Patriot/Avenger battalions, IFPC/Avenger battalions, and Avenger battalions and normally deploy as batteries or platoons. Avenger formations include the Avenger weapon system, Sentinel radars, and FAAD C2. Figure B-5 presents the Avenger system.

Figure B-5. Avenger

C-RAM

B-12. C-RAM is a system-of-systems that consists of sensor, interceptor, and C2 systems. It is a fast reacting, short-range system used to detect and destroy incoming rockets and artillery and mortar rounds in the air before they hit their ground targets, or simply to provide early warning. C-RAM is organized as an intercept battery and deploys as a battery or a platoon. For more information on the C-RAM system see ATP 3-01.81.

B-13. The C-RAM intercept system has an integral sensor for targeting and uses the Land-based Phalanx Weapon System (LPWS), a multi-barrel 20-millimeter gun system, to destroy RAM threats. The LPWS is shown in figure B-6 on page B-8.

B-14. C-RAM leverages ADA and field artillery sensors to provide alerting and cueing of incoming threats. The Sentinel radar and AN/TSQ-50 Lightweight Counter-Mortar Radar (LCMR) are organic to the C-RAM formation; C-RAM pulls data from the AN/TSQ-53 Firefinder radar while Firefinder is executing is primary counterfire mission. C-RAM C2, a FAAD C2 variant with specific C-RAM modifications, provides the requisite battle management.

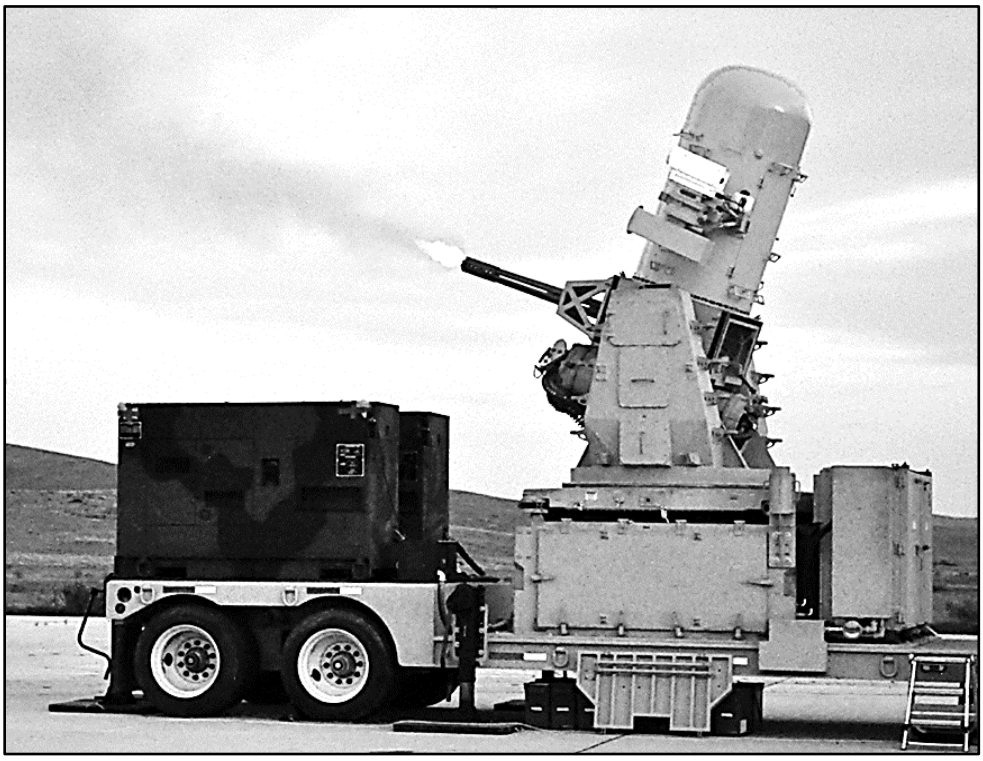

Figure B-6. Land-based Phalanx weapon system

B-15. RAM Warn. The RAM Warn capability provides RAM early warning and impact point prediction and can be used within C-RAM units or as an independent warning capability. RAM Warn is organized as part of the intercept batteries in IFPC/Avenger battalions and is deployed as platoons or sections.

SENTINEL

B-16. The Sentinel radar, AN/MPQ-64, provides persistent air surveillance and fire control quality data. The system features an X-band, 360-degree phased array radar that provides cueing and target identification to an instrumented range of 75 kilometers. It can acquire, track, and classify cruise missiles, UASs, and fixed- and rotary-wing aircraft. It is air transportable by medium-lift helicopters (sling-loadable by UH-60 or CH-47 for the high mobility multipurpose wheeled vehicle (also known as HMMWV) configuration and CH-47 for the tactical vehicle variant) and C-17 and C-5 aircraft. Figure B-7 presents the Sentinel radar. For more information on the Sentinel system and its components see ATP 3-01.48.

B-17. The Sentinel system is normally organized as a section within the Avenger battery and deployed as a section. It is also in the intercept battery in the IFPC/Avenger battalion, C-RAM intercept battery, and division artillery.

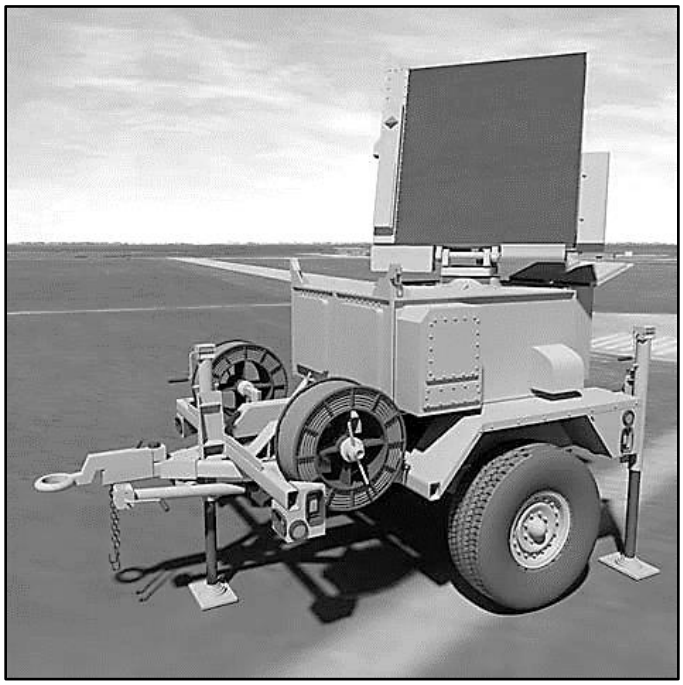

Figure B-7. Sentinel radar

OTHER ADA COMMAND AND CONTROL SYSTEMS

B-18. AMDPCS. The AMDPCS integrates AMD operations at multiple echelons. AMDPCSs are deployed with AAMDCs, ADA brigades, ADA battalions, ADA batteries, and ADAM cells. AMDPCS is also used with BCTs, combat aviation brigades, and multifunctional brigades. AMDPCS is a collection of ADA-unique and Army-common command, control and communications capabilities tailored to the echelon at which they are organic. Key ADA-unique components are described in paragraphs B-19, B-20, and B-21.

B-19. FAAD C2 and C-RAM C2. FAAD C2 is a subset of AMDPCS that provides an engagement operations system which collects, processes, and disseminates real-time target tracking and cueing information to the Avenger system. C-RAM C2 incorporates specific air battle management functions for the C-RAM system and receives and processes data from the LCMR and other Army counter-battery sensors. C-RAM C2 is fully compatible with FAAD C2; FAAD C2 does not provide for the operational control of the C-RAM system. FAAD C2/C-RAM C2 software integrates engagement operations software for Sentinel and the Army Battle Command System, in addition to Avenger and C-RAM, to produce critical situational awareness and automated air track information.

B-20. AMDWS. AMDWS primarily supports force operations and provides the linkage between ADA forces and the Army Battle Command System. AMDWS is fielded in all Army ADA echelons and systems.

B-21. Air defense system integrator (also known as ADSI). The air defense system integrator is a multilink C2 system that interoperates with multiple data links, such as links 11 and 16 and the Integrated Broadcast System, to provide joint AMD situational awareness and intelligence data, to include space-based intelligence. It enables AMD information exchange across the ADA echelons and with the other services and AMD systems. The air defense system integrator displays an integrated, near-real-time air picture, combining the joint air picture with that of a unit's organic or supporting sensors.

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Glossary

This glossary contains acronyms and terms used throughout this publication. An asterisk (*) indicates terms for which the U.S. Army Air Defense Artillery School is the proponent.

SECTION I – ACRONYMS AND ABBREVIATIONS

AADC	area air defense commander
AAMDC	Army Air and Missile Defense Command
ADA	air defense artillery
ADAFCO	air defense artillery fire control officer
ADAM	air defense airspace management
AMD	air and missile defense
AMDPCS	Air and Missile Defense Planning and Control System
AMDWS	air and missile defense workstation
AWACS	Airborne Warning and Control System
BCT	Brigade combat team
BMDS	Ballistic Missile Defense System
C2	command and control
C2BMC	Command and Control Battle Management and Communications
CBRN	chemical, biological, radiological, and nuclear
CEC	cooperative engagement capability
CP	command post
C-RAM	counter-rocket, artillery and mortar
DPICC	dismounted Patriot information and coordination central
FAAD	forward area air defense
FCE	fire control element
FDL	forward area air defense data link
GMD	gound-based midcourse defense
ICBM	intercontinental ballistic missile
ICC	information and coordination central
IFPC	indirect fire protection capability
IPB	intelligence preparation of the battlefield
JAOC	joint air operations center
JFACC	joint force air component commander
JFC	joint force commander
JFLCC	joint force land component commander
JTAGS	Joint Tactical Ground Station

LCMR	Lightweight Counter-Mortar Radar
LPWS	Land-Based Phalanx Weapon System
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, civil considerations
PADIL	Patriot digital information link
RADC	regional air defense commander
RAM	rocket, artillery, and mortar
SADC	sector air defense commander
SHORAD	short-range air defense
SINCGARS	Single-Channel Ground and Airborne Radio System
SLBM	submarine-launched ballistic missile
THAAD	Terminal High Altitude Area Defense
UAS	Unmanned aircraft system

SECTION II – TERMS

air defense

(DOD) Defensive measures designed to destroy attacking enemy aircraft or aerodynamic missiles, or to nullify or reduce the effectiveness of such attack. Also called AD. (JP 3-01)

air and missile defense

(DOD) Direct (active and passive) defensive actions taken to destroy, nullify, or reduce the effectiveness of hostile air and ballistic missile threats against friendly forces and assets. Also called AMD. (JP 3-01)

air defense artillery

(DOD) Weapons and equipment for actively combating air targets from the ground. Also called ADA. (JP 3-01)

air defense warning condition

(DOD) An air defense warning given in the form of a color code corresponding to the degree of air raid probability with yellow standing for when an attack by hostile aircraft or missiles is probable; red for when an attack by hostile aircraft or missiles is imminent or is in progress; and white for when an attack by hostile aircraft or missiles is improbable. Also called ADWC. (JP 3-01)

airspace control plan

(DOD) The document approved by the joint force commander that provides specific planning guidance and procedures for the airspace control system for the joint force operational area. Alco called ACP. (JP 3-52)

***alert state**

A condition that prescribes the amount of resources required to achieve ready to fire and desired radar emissions, and which specifies manning requirements and equipment configurations.

area air defense commander

(DOD) The component commander with the preponderance of air defense capability and the required command, control, and communications capabilities who is assigned by the joint force commander to plan and execute integrated air defense operations. Also called AADC. (JP 3-01)

***assess**

In the air and missile defense engagement sequence, the analysis of the effectiveness of the engagement and of the potential for reengagements.

assign

(DOD) To place units or personnel in an organization where such placement is relatively permanent, and /or where such organization controls and administers the units or personnel for the primary function, or greater portion of the functions, of the unit or personnel. (JP 3-0)

ballistic missile

(DOD) Any missile that does not rely upon aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated. Also called BM. (JP 3-01)

***classification**

The process of characterizing a detected object by its type, model, variant, nationality, and any other distinguishing feature or attribute.

command

(DOD) The authority that a commander in the armed forces lawfully exercises over subordinates by virtue of rank or assignment. (JP 1)

command and control

(DOD) The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Also called C2. (JP 1)

***complex integrated attack**

A synchronized attack of a friendly asset by a mix of air and missile threats arriving near-simultaneously from different directions, altitudes, and ranges.

consolidate gains

(Army) Activiteis to make enduring any temporary operational success and to set the conditions for a sustainable security environment, allowing for a transition of control to other lefitimate authorities. (ADP 3-0)

control

(Army) The regulation of forces and warfighting functions to acceomplish the mission in accordance with the commander's intent. (ADP 6-0)

coordinating altitude

(DOD) An airspace coordinating measure that uses altitude to separate users and as the transition between different airspace control elements. Also called CA. (JP 3-52)

***cover**

In air and missile defense, a fire control order that instructs a unit to assume a posture that will allow engagement of a target.

critical asset list

(DOD) A prioritized list of assets or areas, normally identified by phase of the operation and approved by the joint force commander, that should be defended against air and missile threats. Also called CAL. (JP 3-01)

defended asset list

(DOD) A listing of those assets from the critical asset list prioritized by the joint force commander to be defended with the resources available. Also called DAL. (JP 3-01)

defensive counterair

(DOD) All defensive measures designed to neutralize or destroy enemy forces attempting to penetrate or attack through friendly airspace. Also called DCA. (JP 3-01)

***discrimination**

The process to distinguish real objects of interest from other objects or phenomena and military significant objects from those that are not.

engage

In air and missile defense, a fire control order used to direct or authorize units and/or weapon systems to attack a designated target. (JP 3-01)

***engage hold**

A fire control order which prevents automatic engagement of the specified target by the system when the system is operating in the automatic mode.

engagement

(DOD) An attack against an air or missile threat. (JP 3-01)

engagement authority

(DOD) An authority vested with a joint force commander that may be delegated to a subordinate commander that permits an engagement decision. (JP 3-01)

***engagement operations**

Functions and activities required to execute the air, missile, and counter-surveillance battle.

***engagement sequence**

The successive actions taken by all of the services' air and missile defense systems in the engagement of aerial threats.

flexibility

(Army) The employment of a versatile mix of capabilities, formations, and equipment for conducting operations. (ADP 3-0)

***fire control quality data**

Usable guidance updates to a weapon in flight that allows a seeker to acquire the target.

***firing doctrine**

The application of the methods of fire to achieve the required level of engagement effectiveness.

***force operations**

Actions and functions required to plan, coordinate, prepare for, and sustain the total air and missile defense mission.

identification

(DOD) The process of determining the friendly or hostile character of an unknown detected contact. (JP 3-01)

integration

(DOD) The arrangement of military forces and their actions to create a force that operates by engaging as a whole. (JP 1)

joint force air component commander

(DOD) The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for recommending the proper employment of assigned, attached, and/or made available for tasking air forces; planning and coordinating air operations; or accomplishing such operational missions as may be assigned. Also called JFACC. (JP 3-0)

***keep-out altitude**

The vertical distance above a defended asset at which a successful engagement denies an adversary's desired weapons effects against the defended asset.

***keep-out range**

The horizontal distance from a defended asset at which a successful engagement denies an adversary's desired weapons effects against the defended asset.

***kill chain**

The successive linkage of commanders who can authorize engagements of air and missile threats.

leadership

(Army) The activity of influencing people by providing purpose, direction, and motivation to acceomplish the mission and improve the organization. (ADP 6-22)

***lower tier**

A layer of low-to-high airspace within the atmosphere in which air and missile defense engagements are conducted.

***methods of fire**

The firing options for air defense artillery interceptors employed against aerial threats.

mission command

(Army) The Army's approach to command and control that empowers subordinate decision making and decentralized execution appropriate to the situation. (ADP 6-0)

mobility

(DOD) A quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission. (JP 3-17)

offensive counterair

(DOD) Offensive operations to destroy or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems both before an after launch, and as close to their source as possible. Also called OCA. (JP 3-01)

operational control

(DOD) The authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Also called OPCON. (JP 1)

operational environment

(DOD) A composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander. Also called OE. (JP 3-0)

organic

(DOD) Assigned to and forming an essential part of amilitary organization as listed in its table of organization for the Army, Air Force, and Marine Corps, and are assigned to the operating forces for the Navy. (JP 1)

***out-of-sector**

That part of the air and missile defense footprint which cannot be covered by a sensor or defended by a shooter.

positive control

(DOD) A method of airspace control that relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. (JP 3-52)

positive indentification

(DOD) An identification derived from observation and an analysis of target characteristics including visual recognition, electronic support systems, non-cooperative target recognition techniques, identification friend or foe systems, or other physics-based identification techniques. Also called PID. (JP 3-01)

***primary target line**

An azimuth assigned to a weapon system or unit along which the system fire control personnel and or gunners focus their attention.

principle

(Army) A comprehensive and fundamental rule or an assumption of central importance that guides how an organization or function approaches and thinks about the conduct of operations. (ADP 1-01)

procedural control

(DOD) A method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures. (JP 3-52)

***resilience**

In air and missile defense, the quality of the defense to maintain continuity of operations regardless of changes in or unanticipated tactics by enemy air or losses of critical air and missile defense components.

restricted operations zone

(DOD) Airspace reserved for specific activities in which the operations of one or more airspace users is restricted. Also called ROZ. (JP 3-52)

rules of engagement

(DOD) Directives issued by competent military authority that delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered. Also called ROE. (JP 3-84)

***secondary target line**

A pre-planned alternative target line used to shift the orientation of fires to assure all likely threat avenues of ingress are adequately defended.

sector of fire

(Army) That area assigned to a unit, a crew-served weapon, or an individual weapon within which it will engage targets as they appear in accordance with established engagement priorities. (FM 3-90-1)

***short-range air defense**

Capabilities that provide air defense against low-altitude air threats. Also called SHORAD.

***standoff range**

A range at which an air threat can surveil or attack an asset while staying beyond the engagement capability of a defending air and missile defense system.

tactical control

(DOD) The authority over forces that is limited to the detailed direction and control of movements or maneuvers within the operational area necessary to accomplish missions or tasks assigned. Also called TACON. (JP 1)

***threat evaluation**

The process of determining the intended target of the threat, the threat's predicted impact point upon the defended asset, and the timing of the threat's arrival.

troop leading procedures

(Army) A dynamic process used by small-unit leaders to analyze a mission, develop a plan, and prepare for an operation. (ADP 5-0)

unmanned aircraft system

(DOD) That system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft. Also called UAS. (JP 3-30)

***upper tier**

A layer of airspace that encompasses very high altitudes within the atmosphere to outside the atmosphere, in which air and missile defense engagements are conducted.

weapons control status

(DOD) An air and missile defense control measure declared for a particular area and time by an area air defense commander, or delegated subordinate commander, based on the rules of engagement that establish conditions under which fighters and surface air defense weapons are permitted to engage threats. Also called WCS. (JP 3-01)

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22 December 2020

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