ATP 3-01.8

Techniques for Combined Arms for Air Defense

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Techniques for Combined Arms for Air Defense

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Preface

Army Techniques Publication (ATP) 3-01.8 provides guidance to combined arms commanders on how to defend against air defense threats. Its focus is to assist in understanding the possible air and missile threats combined arms forces may encounter, providing techniques to counter the air threat while placing the threat in its proper perspective including passive and active air defense measures that that ground commanders can utilize in order to protect their units from air attack.

The principal audience for ATP 3-01.8 is commanders, leaders, and staff who employ combined arms air defense planning within their operations. Trainers and educators will also use this publication to support the employment of combined arms air defense into their curricula.

Commanders, staffs and subordinates ensure their decisions and actions comply with applicable United States, 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 (ROE) (see FM 27-10).

ATP 3-01.8 uses joint terms where applicable. Selected joint and Army terms and definitions appear in the glossary and the text. For definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition. This publication is not the proponent for any Army terms.

Unless this manual states otherwise, masculine nouns and pronouns do not refer exclusively to men.

ATP 3-01.8 applies to the Active Army, Army National Guard/Army National Guard of the United States, and United States Army Reserve unless otherwise stated.

The proponent of ATP 3-01.8 is the United States Army Fires Center of Excellence. The preparing agency is the Directorate of training and Doctrine, Air Defense Artillery (ADA) Branch. Send written comments and recommendations on a DA form 2028 (*Recommended Changes to Publication and Blank Forms*) to, United States Army ADA School, Fires Center of Excellence, ATTN: ATSF-DD, 700 McNair Avenue, Suite 128, Fort Sill, OK 73505; by email to usarmy.sill.fcoe.mbx.dotd-doctrine-inbox@mail.mil; or submit an electronic DA Form 2028.

Introduction

ATP 3-01.8, focuses on how a combined arms force protects themselves from an adversary's air attack. Aerial threats include Unmanned Aircraft Systems (UAS); fixed- and rotary-wing aircraft; rockets, artillery, and mortars (RAM); ballistic missiles (BM) and cruise missiles (CM). Commanders at all levels face the challenge of being able counter the air threat and adversarial reconnaissance within their operational environment. Countering air threats is a shared joint and combined arms responsibility. Dedicated ADA forces assigned within a theater are primarily responsible for detection and direct engagements of fixed and rotary wing aircraft, and missile threats to ground forces within an area of operations.

ATP 3-01.8 contains four chapters and a supporting appendix that includes; air threat description and employment planning, warnings and self-defense, passive defense measures, active defense measures, and unit training. This publication also introduces the measures that can be taken to counter unmanned threats. The four chapters and appendix are:

- Chapter 1 discusses air and missile threats.
- Chapter 2 provides details on each type of adversarial aerial threat
- Chapter 3 discusses active and passive air defense techniques
- Chapter 4 discusses unit security and intelligence operations planning to include reconnaissance and counter reconnaissance activities.

Appendix A discusses integration of aerial threats and combined arms training as a component of unit combined arms training strategy.

Appendix B discusses asset protection considerations.

Summary of Changes

This publication addresses a holistic approach to training, planning, preparing, and implementing combined arms defense techniques against the full range of air threats. Changes include recent measures captured from lessons learned when countering unmanned air threats. It also discusses asset protection considerations in the form of area and point defense protection in Appendix A.

- Chapter 1 discusses air and missile threats. It further describes, in general, defensive active and passive measures units must implement in order to defeat aerial attacks.
- Chapter 2 provides details on each type of adversarial aerial threat that may be encountered, how the enemy may employ them and measures units must plan for, and implement in order to defeat them.
- Chapter 3 discusses active and passive air defense techniques all units must employ within their organic capabilities. It further discusses available support from external sources including Aviation and ADA units as well as other service capabilities to protect personnel and equipment from enemy aerial reconnaissance and aerial attack.
- Chapter 4 discusses unit security and intelligence operations planning to include reconnaissance and counter reconnaissance activities.
- Appendix A discusses integration of aerial threats and combined arms training as a component of unit combined arms training strategy. It also describes methods for unit training as it pertains to its preparation to implement active and passive air defense measures.

  Appendix B discusses asset protection considerations.

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Chapter 1

AERIAL THREATS AND DEFENSIVE PLANNING

This chapter defines aerial threats and lays the foundation for basic air and missile defense (AMD) planning in support of combined arms operations. Commanders must understand the circumstances that shape the operational environment and the potential threats in order to preserve combat power. This chapter also outlines potential negative effects on combat power to include collecting and analyzing data in order for the commander to destroy or counter these air threats.

ANTICIPATE AERIAL THREATS

1-1. Our enemies are developing new strategies for conducting operations in the vertical dimension that are enabled by technology and adaptive operations. Combined arms forces must anticipate and plan to defend against multiple aerial attacks while operating in and around contested areas on the battlefield. They must assume the enemy uses both conventional and unconventional tactics employing a range of aerial threats. Aerial threats may be any combination of large or small, manned or UAS, missile type platforms and rockets, artillery and mortars (RAM) used to carry out attacks or support attack functions. The smaller platforms for example, are commonly used to perform supportive functions such as detection, targeting assistance or surveillance prior to the actual attack.

1-2. An enemy may employ small unmanned, remotely piloted networked or non-networked systems in an effort to observe and report friendly information or troop movements. Actions similar to this can go totally unnoticed by friendly troops unless properly trained in counter techniques. Surviving an air attack may be as simple as practicing avoidance or damage limiting techniques through proper planning and training.

1-3. Combined arms commanders understand the tactical situation and continuously assess their plans weighing the unit's effectiveness in carrying out its mission. This assessment also examines the unit's capabilities to respond to and survive an unexpected aerial attack. The commander's goal is to keep the unit on task and to protect his forces allowing the unit to continue functioning and complete the mission. Combined arms forces can survive a range of aerial attacks by being prepared and anticipating the attacks. They must also recognize enemy patterns and attempts which may preclude an assault. The units' ability to rapidly detect, identify and report a threat eases transitioning the force from offensive maneuvers to a defense posture. Early detection of any threat is crucial to defend against and highly beneficial when countering attacks.

1-4. Planning includes the commander's intent, mission objectives, threat estimates, availability and type of active and passive defense systems. Planning must focus on current threat intelligence capitalizing on suspected and reported enemy information that may shape near term objectives within their area of operations. Passive and active defense techniques may be employed at any given time to best preserve unit strength.

1-5. Other planning factors for consideration are the enemy's order of battle, their combat capability, the readiness and willingness to fight will also determine the times and rates of attacks or harassments. Some enemy actions for example, observations and reconnoitering positioning of friendly formations may go unnoticed by friendly troops.

1-6. Combined arms forces must remain vigilant scrutinizing suspected enemy action to prevent multiple attacks. Friendly forces must assume they are always vulnerable to enemy targeting attempts. This is especially true when conducting convoys for troop movements or performing supply actions and as they move through open areas or concentrate at choke points along the convoy route. Traditional forms of aerial threats consist of rockets, artillery, mortars, missiles or attack aircraft in the forward area near lines of contact.

These attacks were normally made against massed forces in convoys or within built up areas using strike aircraft or fighter bombers.

1-7. Modern types of hybrid threats (for example, unmanned remote piloted) differ in their capabilities and in the manner in which they are employed. These systems can be configured to perform or support other tactical operations presenting a distinctly different threat profiles. Locating the smaller UAS groups, their launch points or operators is often difficult using air defense radars and other sensors.

AIR AND MISSILE DEFENSE THREATS

1-8. Combined arms forces defend against variety of conventional and hybrid AMD threats. The primary AMD threats (air breathing threats and tactical ballistic missile [TBM] threats) require a joint and combined arms approach in order to defeat them. Threats categorized as air breathing include UAS, CM, rotary-wing (RW) attack helicopters, and air support, ground-attack, and fixed-wing (FW) aircraft. Air support aircraft will conduct reconnaissance, surveillance, interdiction, anti-armor, and troop support missions. Elements in the division and corps rear, mission command facilities, and reserve forces can expect repeated attacks by manned and unmanned high-performance aircraft of all types.

1-9. Enemy TBM and CM strikes against airbases can limit or disrupt timely friendly air support operations over the combat zone. The inability of air assets to operate from airfields close to ground forces combined with increasing numbers of enemy short range anti-air weapon systems will require extended range support operations from remote locations, decreasing the time on station. These threats could force friendly air operations to operate at higher altitudes (beyond 700 feet above ground level) influencing current operations and future plans.

1-10. Short and medium range Surface-to-Air Missiles are plentiful, inexpensive, easy to operate, easy to hide, and effective. Their proliferation created an exploitable low-level threat that has changed the battlefield dynamic. This is not limited to only newer generation weapons but also to older weapons systems and affordable high technology subsystems combined for adaptive warfare.

1-11. The low-level threat includes the use of low, slow, small (LSS) UAS that are difficult to detect. UAS is a system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft. UASs are remotely piloted, pre-programmed or controlled vehicles that can perform an array of tasks such as, surveillance, reconnaissance and targeting support. UASs can also be operated from close proximity enabling precision retargeting support limiting or slowing US advancements. Short-range air defense (SHORAD) capabilities are critical to counter the growing arsenal of mixed aerial weapons platforms that are available to financially limited, rogue or failing states or non-state actors.

1-12. Helicopters are commonly used over short distances as attack and transport platforms because they have exceptional low altitude flight capabilities. These aircraft are easily masked and maneuverable as they near a target even in rugged terrain. Both FW and RW aircraft tend to become exposed at some point when traversing open terrain or nearing their target locations.

1-13. Air support aircraft conduct roles such as; reconnaissance, surveillance, interdiction, anti-armor, and troop support missions. Elements in the division and corps rear, mission command facilities, and reserve forces, can expect repeated attacks by manned and unmanned high-performance aircraft. Surveillance for threat aircraft is a 24- hour mission.

1-14. Other factors to consider when planning a defense against any aerial threats are:

- Identification and distances
- Precision requirements
- Geographic conditions (Environmental- human and physical effects)
- Priority targeting issues
- Operational locations for theater air assets
- Coordination between air and ground platforms (air-ground integration) and their mission command elements.

1-15. Detect, Track, and Identify of all targets remains difficult. Sensor planning considerations include:

- Target saturation

- Distinguishing from nonmilitary threat platforms
- Potential decoys
- Ground clutter
- Complex terrain and adverse weather conditions
- Operator training and confidence
- Quick resolution of low, slow, small moving air systems

1-16. Planning a defense is a major consideration during any air or ground operation. Combined arms forces will operating in environments where airspace deconfliction and control is essential. Commanders must anticipate cross-echelon planning for airspace coordination and integration. Airspace deconfliction prevents mutual interference of airspace users. Airspace control methods are implemented to halt or suppress unintended airspace use. Airspace control provides positive control mechanisms that can mitigate fratricide in heavily congested environments.

COLLECT AND ANALYZE THREAT

1-17. When analyzing threat data, include the commander's critical information requirements and priority intelligence requirements. Use the following as a guide in establishing threat information:

- What is known about the enemy's air operations and tactical objectives?
- Which objectives may be targeted for destruction, jamming or suppression?
- Where do friendly air defense assets fit into the enemy's objectives? Do they need to be destroyed, jammed, or suppressed for the enemy plan to work? (Answers to these two questions may result in modification to air avenues of approach.)
- What is the enemy's air order of battle? How are the assets organized? (Knowledge of threat organization and who has operational control will indicate the importance of the area of operations. For example, if the enemy's bombers are at theater level and are in the area of operations, then that area is probably receiving the theater's main attack.) What is the size of the enemy's ballistic missile brigade, battalion, and battery? Does it fire as a unit? Does the threat have mobile, fixed, or both types of launchers?
- Who has tactical control of aircraft at the point of attack?
- How will UASs be used; for example, reconnaissance, surveillance, fire support and target acquisition, and or attack. What are the associated profiles? What group UAS do they have? What formations are supported by each of the UAS platforms the threat employs?
- How does the enemy doctrinally attack? Are they expected to carry out low to medium intensity attacks or create a sizable advance? Will the enemy use airborne, air assault, or special operations forces in conjunction with an air or ground attack? Will the enemy use UAS group 1 or 2 for kinetic operations? Will the identification small (micro) UAS be a precursor to some type of enemy attack? What sizes are these forces and to what depth are they used? Will the enemy synchronize the air attack? Does the enemy have the capability to coordinate an air attack (possibly with varied air threat platforms that can overmatch friendly air defense capability)?
- What are air system combat ingress and egress speeds?
- Where is the possible launch point for the missiles and UAS? What are the ranges, endurance, and profiles of these systems?
- What are the doctrinal distances for forward arming and refueling points? If the enemy's maximum range falls short of the area of operations, where is the enemy likely to stop and refuel or be aerially refueled? Does the enemy possess an aerial refueling capability?
- How and where will the enemy attack ground targets for interdiction?
- At what altitudes will the enemy approach the target; deliver munitions, and exit the target area? What is the release authority of certain types of ordnance? This is particularly important when dealing with chemical, biological, radiological and nuclear **(**CBRN) threats.
- How does the enemy employ reconnaissance assets?
- How has the enemy historically fought?
- What has the enemy learned from out most recent conflict?

Analyze Air Threat Capabilities

1-18. Combined arms forces must request updated intelligence and air threat information related to their area of operations. They analyze and evaluate enemy air threat capabilities based on this information and collection efforts. This process will guide them while developing defense plans. The analysis should complement theater specific threat estimates, and reflect current intelligence, preparation of the battlefield estimates. This analysis is as simple as providing answers to the following questions.

AIRCRAFT

1-19. What are the enemy's capabilities regarding aircraft:

- Coordination of air-to-ground attacks?
- Coordination of air and artillery operations?
- Forward air controllers?
- Suppression of friendly air defense?
- Performance (speed, altitude, airfield restrictions, troop and weapon load capacity)?
- Endurance and range (ingress and egress altitudes and speeds)?
- Levels of combat readiness and sortie generation rate?
- Ability to conduct pop-up maneuvers. What is the standoff range?
- Target acquisition capability, night and adverse-weather capability, and identification ranges?
- Standoff ranges for cruise and tactical air-to-surface missiles?
- Ordnance load (maximum weight, type, load mixture, and level of sophistication)?
- Combat personnel load?
- Navigational capability (type of radar; can it fly at night or in adverse conditions)?
- Combat radius (with or without external tanks, ordnance, and location of staging bases)?
- Loiter time (how long will it have on station over the target area)?
- Countermeasures. For example, will standoff jammers, ground-based jammers, reconnaissance or chaff laying UAS, or aircraft degrade friendly air defense systems?
- Type, quantity, and quality of pilot training?
- Do they follow their doctrine?
- Do they execute centralized engagements tied to pre-briefed routes, targeting, tactics, and doctrine?
- Have they conducted decentralized engagements supporting independent operations and engagement adjustments?
- Is the attacker operationally linked to a ground controller?
- Ability of pilots to fly at night or perform contour flying? During peacetime, did the pilot conduct wartime mission profiles?
- Is the attacker working with a ground controller?
- How long can each type of aircraft loiter within the directed area of operations?
- Type of threat ordnance evaluated as follows:
  - Range: Assume engagement at maximum range
  - Accuracy
  - Release altitude: How high or low must the aircraft fly?
  - Reload and fire time: What is the missile basic load?
  - Warhead type (for example, mass casualty, conventional, and sub munitions). Guidance systems? How does the pilot acquire and engage?

UNMANNED AIRCRAFT (UA)

1-20. What are the capabilities of threat UA regarding:

- Size?

- Performance (speed, altitude, and launch restrictions)?
- Endurance and range?
- Contour flying or terrain-limiting factors?
- Target acquisition and standoff range?
- Sensor package and payload (maximum weight, type, and load mixture)?
- Loiter time (how long can the UAS stay on station)?
- Visibility effects on acquisition?
- Modes of recovery and turnaround time?
- Real-time, data-link capability?
- Guidance modes (ground-controlled and preprogrammed)?
- Crew proficiency?
- Weapons carried?

TACTICAL BALLISTIC MISSILES (TBM)

1-21. What are the capabilities of threat TBM systems regarding:

- Performance (flight time, speed, trajectory and launch restrictions)?
- Maximum and minimum ranges?
- Circular error of probability?
- Crew proficiency?
- Reload and fire time? What is the number of TBMs available per transporter erector launcher?
- Mobile missile launch capabilities: Time required to stop, launch, and get underway.
- Warhead type and size?
- Guidance modes?
- Location of surveyed launch sites?

CRUISE MISSILES (CM)

1-22. CM's are unmanned, guided, self-propelled, expendable weapon systems that sustain flight by aerodynamic lift over most of their flight path. Most CM's are ground or sea-launched in order to strike targets on land. Advancements in propulsion, guidance systems electronics and warhead design have resulted in the development of highly sophisticated CM. Significant operational characteristics of state-of-the-art CM include low-level flight profiles (as low as 20-50 meters above ground level).

1-23. CM profiles include ground level, subsonic speeds, high-to-pinpoint accuracy, small radar cross section and infrared signatures, longer stand off ranges, all-aspect attack capability, with few intent-to-launch indicators as well as several warhead options. These warhead options include penetrator warheads for hard targets, anti-runway, anti-armor, anti-personnel and anti-materiel sub munitions, anti-armor smart sub munitions, and weapons of mass destructions. CMs have traditionally been used to strike high value stationary targets, but with the advent of smart sub munitions, real-time video guidance, and sensor-to-shooter links, moving targets can also be attacked.

1-24. CMs are employed from long ranges and launched from various platforms. CM's are relatively small and are normally much smaller than manned aircraft. In the terminal phase, CMs may employ different attack modes to maximize their target zone penetration capability and potential to inflict lethal effects on their targets. Although a formidable threat, they have exploitable vulnerabilities as well. A CM cannot deviate from their pre-programmed flight if detected, attacked, or encounter adverse weather conditions. The CM threat is projected to increase in both quantity and technology because CMs offer a practical, easy to use, inexpensive method of building a theater missile inventory; are more accurate in targeting specific high value targets than TBMs; and do not endanger pilots or put sophisticated and costly FW aircraft at risk.

1-25. Technology enhancements may provide a capability for increased ranges, improved accuracy, increased use of countermeasures (such as signature reduction), improved synchronization of simultaneous attacks from multiple azimuths, the ability to fly at even lower altitudes, greater maneuverability, and greater

lethality by employing CBRN capabilities. CM's are generally perceived as less provocative than ballistic missiles and may result in lower export or technology control standards.

1-26. What are the capabilities of threat CM regarding:

- Performance (flight time, speed, altitude, and launch restrictions)?
- Maximum and minimum ranges?
- Circular error of probability?
- Targeting capabilities and type?
- Contour flying capability?
- Vulnerability to countermeasures?
- Guidance modes?
- Warhead type and size?
- Launch platform: fixed, mobile; time to set up/ launch/move?

UNMANNED AIRCRAFT SYSTEMS (UAS)

1-27. UASs complement new styles of air operations and are affordable and easy to employ. UAS employment can significantly increase the situational awareness of the battlefield and may be used to influence current and future operations. UAS platforms are highly versatile providing precision strike and surveillance capabilities employing man in the loop guidance or autonomous guidance options.

1-28. The primary UAS threats to Army land operations are categorized as groups 1 thru 3. This is due to their minimal or no radar cross section allowing them to come in extremely close proximity to friendly forces undetected. These groups are generally tactical assets employed by maneuver units engaging in direct contact operations. They can fly extremely low underneath traditional radar detection zones. They fly very slow and can even hover in place preventing any Doppler based sensor from detecting them. They are generally very small making them hard to hit with direct fire weapons. UAS groups 4 and 5 are predominantly strategic level assets (see UAS categories in Chapter 4).

ROTARY-WING AIRCRAFT

1-29. RW aircraft versatility and survivability make it ideal for troop and equipment transportation, logistics resupply, air assault, and serve as heavily armed weapons platforms for attack roles. RW aircraft currently exist in every potential theater that forces may enter. Many countries around the world possess attack helicopters and have the ability to inflict heavy casualties on the force and destroy critical assets.

1-30. Threat helicopter forces supporting ground operations operate nearly the same as a friendly helicopter force. Helicopters are agile and make good use of cover and concealment offered by folds in the earth and trees. Their armament may include antitank guided missiles, free-flight air-to-air missiles, and radar-directed machines- or Gatling-type guns. Antitank guided missiles can be electronically controlled or laser-guided to engage and destroy armored vehicle at standoff ranges of more than three kilometers.

1-31. Using pop-up and launch techniques (Figure 1-1, page 1-7), attack helicopters can deliver a devastating blow against exposed maneuver units. Their lethality is somewhat softened by practical considerations. They must detect a target to engage it and remain in the open long enough to aim and fire their weapons. For some antitank guided missiles, attack helicopters must maintain track on both the missile and target throughout the missile's flight, which leaves the helicopter exposed for up to 23.2 seconds. The 57-millimeter Folding Fin Aerial Rocket is an area weapon and is effective against exposed troops and lightly armored vehicles at ranges greater than 1,000 meters.

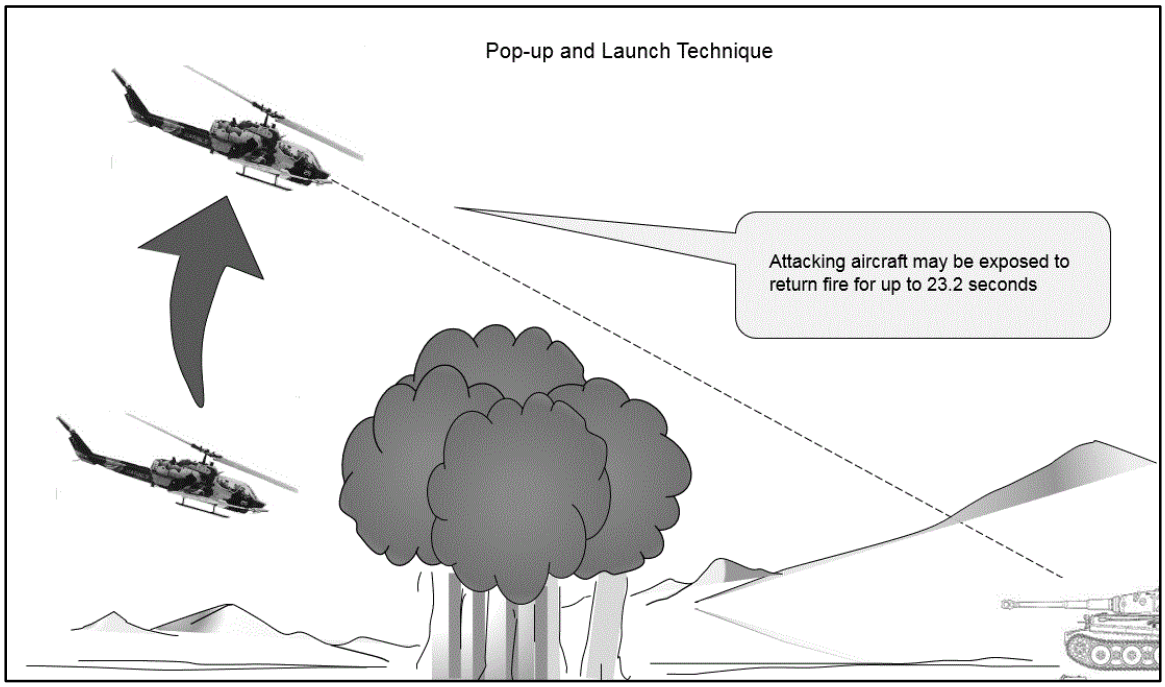

Figure 1-1. Pop-up and launch technique (Rotary Wing)

FIXED-WING AIRCRAFT

1-32. Although missile threats have taken the place of FW aircraft as the principal air threat to ground forces. The enemy against friendly forces may employ the following types of FW aircraft; bombers, fighter-bombers, fighters, and close air support aircraft. Any of the FW family may carry tactical air-to-surface missiles while only the larger ones will carry CMs. Improvements to FW aircraft will include increased survivability measures and improved fire control accuracy.

1-33. High-performance aircraft, operating in a ground attack role, attack at relatively high speeds. They normally operate under centralized control and are directed against preplanned targets. These aircraft target areas where ordnance delivery optimizes destructive effects. If they have ordnance remaining after completing their primary mission, the aircraft may be released to attack targets of opportunity on their return flight. Whether against preselected targets or against targets of opportunity, the attack will usually include a high-speed, low-level penetration run to a point near the target area to avoid low and medium-altitude air defenses. Ground attack aircraft are effective against preplanned targets. The pilot will carry the correct ordnance for the target location. Effectiveness decreases against targets of opportunity. Pilots must locate their targets, plan their attack, and deliver their ordnance in a short time. As a result, accuracy and effectiveness are degraded. The use of area type weapons such as cluster bombs or folding fin aerial rockets can be expected on the initial attack run, while cannon and machine-gun fire will likely be used in the follow-on attack.

THREAT APPLICATION

1-34. Air threat employment against ground forces may vary from country to country. Threat equipment, capabilities, organizational structures, and military political goals will drive this employment. By understanding air threat capabilities, the commander can make assumptions on how a threat may employ air assets to interdict operations. The following information describes the type of threat that can be countered with each stage of warfighting function operations.

ENTRY PHASE

1-35. Entering forces may be required to deploy into hostile environments where enemy forces possess equal or less air power capabilities. We can expect the threat to use his entire aerial assets against lucrative targets in the areas of debarkation. Low-altitude aerial threats will probably be employed in attack operations against ports of debarkation (air or sea), assembly areas, lodgments and supply points.

EXPANSION AND BUILDUP

1-36. Potential threats may focus on conducting reconnaissance and surveillance operations to locate friendly unit movements, assess unit sizes and strengths, and determine their positions during expansion phase. The UAS is the most challenging and prevalent threat platform to combined arms forces and therefore, a logical choice for enemy use. Information obtained by aerial reconnaissance and surveillance will be relayed back to the enemy who can be expected to use any attack means necessary to inflict maximum casualties, slow momentum, and destroy forces. These aerial attack systems could be any combination of RW or FW aircraft, CMs, or UASs.

OPERATIONS

1-37. We can expect continued activity from threat forces throughout the range of combat operations. It is also probable threat forces will attempt to counter our defensive actions and offensive air operations using any combination of threat platforms and tactics available. The threat commander will seize any opportunity to capture information determining friendly unit locations, movements, and objectives. Aerial and artillery strikes can be generated from the intelligence gathered against the following targets:

- Maneuver forces.
- Forward arming and refueling points.
- Forward Operations Bases.
- Command posts.
- Reserve troop concentrations.
- Logistical support areas.
- Terrain features.
- Obstacles constricting unit movements as forces advance to close with the enemy forces.

1-38. UAS can be effective in disabling or interrupting the conduct of military operations, their communications networks, information related activities, or destruction of equipment and facilities. Group 1 UAS can assist in coordinating complex attacks or used like an improvised explosive device to degrade, delay, and disrupt friendly movement. Group 5 is highly suitable to conduct drone strikes. Tactical UASs and CMs will probably be used against logistical concentrations, command posts, or paired with sub-munitions for anti-access and area denial. RW aircraft will be used to attack forward elements and the flanks of the advancing maneuver force to slow their tempo, cause confusion and, thereby, inflict maximum casualties. These armed attack helicopters constitute the most widespread and capable air threats to friendly ground forces in the battle.

Defensive Considerations

1-39. Friendly forces may be the most vulnerable to threat actions from enemy aerial platforms when conducting everyday operational tasks supporting the defense. The enemy will attempt to use aerial platforms to monitor friendly forces for targeting. We can expect the enemy to use UAS, RW, and FW aircraft, to determine locations of friendly forces, command centers and sensor locations. Once these sites are located, threat forces will likely disrupt operations or destroy these sites with artillery and rocket fire, air attacks, air insertion or a combined approach. Electronic attack capabilities may also be employed in an attempt to counter an attack, especially against UAS threats adding to an already congested air environment.

1-40. The enemy's preferred weapons against air defense weapon systems and forces may be artillery and rocket attacks. Most artillery and rocket systems are plentiful, inexpensive, highly mobile and survivable, adaptable, and highly effective. UAS will be employed to attack or provide targeting data during this phase

of the operation. UAS are extremely effective in this role due to their small size, small radar cross section, and standoff capability. RW and FW attacks are less likely during this phase due to the poor survivability of these systems. In most cases, they are limited to daylight operations. These attacks will be supported with pre-attack and post attack reconnaissance.

1-41. Enemy forces may conduct air insertion operations with either FW or RW assets during the hours of limited visibility. The enemy will likely conduct daytime reconnaissance of landing sites and target areas within 24 hours prior to an attack. These operations will fly at low levels attempting to avoid detection from sensors and infiltrate into friendly unoccupied areas.

Offensive Considerations

1-42. While conducting offensive actions, enemy forces will likely attempt to use maneuver and fire support assets to gain the initiative. Threat air activity will most likely support their own combined arms operations. UAS are best suited for these types of operations, especially if enemy forces have developed effective mission command capabilities. RW assets can be used in attack, air insertion, or reconnaissance. RW in the reconnaissance role will operate in the same manner as UAS to support artillery targeting and maneuver. In the attack, the unit can expect spoiling attacks that usually consist of at least two or more helicopters to disrupt friendly operations.

1-43. FW assets may be limited and countered in their offensive role by the employment of friendly FW aircraft. The enemy's use of FW aircraft to stall or stop friendly forces advances cannot be entirely ruled out since the ground commander may see limited aircraft used during a spoiling attack. An air attack may be non-coordinated with enemy forces given the number of aircraft involved.

DEFENSIVE PLANNING

1-44. Combined arms forces must create a defensive plan that provides the most flexibility for all elements operating within the area of operations. Planning a defense must also be coordinated with higher and lower echelons operating in areas that may be impacted during operations. Collaboration assists units during planning and development by sharing information and intelligence collection products. Collaboration also directs the commander's intent and objectives amongst echelons. Defense plans and rehearsals enforce training standards and likely result in suitable counter responses to most situations encountered. Defensive planning identifies the commander's priorities. For example; threat sets, assigned levels of protection of assets, required actions the unit must take to defend itself in the event of attack and allows for reassessment and possible reengagement coordination.

DETERMINE THREAT COURSES OF ACTION

1-45. The commander will determine threat courses of action for both enemy air and ground situation through military decision-making process, which includes commander's critical information requirements processes. Commanders must attempt to determine the enemy's likely objectives and what course of action (COA) are available to him. The G-2/S-2 develops threat models that depict the enemy air and missile COAs. They also prepare event templates and matrices that focus intelligence collection on identifying which COA the threat will execute.

THE OPERATIONAL EFFECTS

1-46. Applying methods that identify the effects of the operational environment on friendly and enemy courses of action is important. Specific considerations include:

- Determine most likely air avenues of approach.
- Potential target areas.
- Possible landing and drop zones.
- Locations of air defense weapon systems, sensors and launch areas.
- Enemy threat aircraft standoff ranges.

Determine Air Avenues of Approach

1-47. An enemy will use air avenues of approach that permit maneuver while taking advantage of terrain masking from surface-to-air weapon systems. Common air avenues of approach include direct lines from the enemy point of origin that offer optimal concealment, for example, valleys, and riverbeds. Air courses of action are determined through the supported command's intelligence, preparation of the battlefield (IPB) products, including threat assessments and situational templates. Courses of action are portrayed to determine how the threat might utilize their air power. Considerations for the air avenue:

- Terrain masking (cover and concealment)?
- Speed restrictions?
- Radar masking and detection?
- A standoff orbit?
- A standoff orbit distance?
- Does the air avenue of approach affect freedom of maneuver?
- Restrict or canalize the air system?
- Provide access to other potential avenues?
- Provide the ability to identify, acquire, and fire on a target?
- Have identifiable reference points to assist in navigation?

Type of Air Threat, Attack Profile, and Ordnance

1-48. The type of air threat, attack profiles and ordnance available must be considered when determining courses of action. Once in a target area, the threat may fly an orbit in an attempt to stay out of engagement ranges of friendly air defenses. Most surface-launched CMs follow the terrain taking advantage of terrain masking. They are capable of flying low (Nap of the earth), but operate at all altitudes. Their extended range provides them the ability take indirect approach routes. Suspected UAS threats need special consideration since most are small and elusive.

1-49. RW aircraft primarily conduct contour flights. They follow ridgelines and military crests, using the terrain to mask their approach to the target area. FW aircraft usually follow major terrain or man-made features. Depending on range, they may fly at very high altitude and straight line to the target. You must also consider the air systems and pilot options. Can the air threat:

- Perform contour flying?
- Fly at night?
- Fly in all weather conditions?
- Range the targets?

1-50. Ballistic missiles usually travel using predetermined flight trajectories directly from their launch platform to their target or objective. Ordnance or payload may affect range and altitude of the air system and, thus, influence the selection of avenues of approach for airborne and air assault operations.

Air Threat Point of Origin

1-51. When estimating threat points of origin the commander and staff looks at enemy air avenues throughout the entire area of interest to determine any threat points of origin. Analysis begins at known and suspected points of origin, for example, enemy airfields and missile launch sites, and ends at the probable enemy objective. This analysis allows the commander to look at the big picture. The commander and staff should consider counter air and counter-UAS planning. UAS groups 1 thru 3 have the ability to be launched from close range and short notice to current air defense measures. While their point of origin could help locate the operator, depending on mission of the platform, the launch position may not have staffed personnel following the launch.

Probable Threat Objective

1-52. Each avenue of approach must end at a target, drop zone, landing zone, or within reconnaissance, surveillance, or target acquisition range of a target. Reverse IPB is a technique used to pick threat objectives.

Potential to Support Maneuver Forces

1-53. Air assets, which are used to achieve ground objectives, could use air avenues of approach coincident with ground avenues of approach. Although, attacking air assets are not limited to routes that support ground maneuver forces, they may choose to follow them in order to create a tactical advantage. The tactical advantage could include potential targets of opportunity or in a supporting role.

Aircraft Considerations

1-54. Cloud cover restricts aircraft operations providing low operational ceilings and restricting visibility and target engagement. Low ceilings, overcast, and clouds may restrict visually directed combined arms air defense detection and acquisition ranges. Extreme temperatures and humidity may have a severe effect on aircraft and UAS continuous operations by decreasing combat range, altitude, and ordnance loads. Cloud cover, heavy foliage, and built up urban areas provide ideal cover and concealment from tactical UASs. RW UAS can go undetected against a dark cloud or tree line while providing ideal surveillance, target location information and unit intelligence collection.

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Chapter 2

TECHNIQUES FOR WARNING AND CONTROL

This chapter describes how to use several methods to implement self-defense measures against air attack. This includes air defense warnings (ADWs), weapons control statuses (WCS), and ROE used to mitigate the effects of potential air threats and attack.

OVERVIEW

2-1. U.S. forces have predominantly achieved air superiority and fought on battlefields with little apprehension towards enemy surveillance or attack from the air. However, in future operations we could face a significant air threat challenge where potential enemies could have significant air capabilities.

2-2. We can expect that friendly units operating within a threats capability will be targeted attacked from the air and the ground. Due to limited air defense resources and defended asset priorities, many Army units and facilities may not receive adequate levels of dedicated air defense protection. These units and facilities must be prepared to protect themselves. All units must reduce their vulnerability to air action by implementing passive and active air defense measures.

AIR DEFENSE WARNING AND ALERTS

2-3. Air defense mission command implement standardized ADWs to alert all forces of air and missile attacks. Commanders have the ability to issue local ADWs, which provide additional guidance alerting all members within their area of operations. Supported units may monitor the ADA early warning network that contains specific information for air defense units to include more detailed track information. However, the format of directed early warning does not necessarily follow the size, activity, location, unit, time, and equipment report format. Hostile track information and targeting data may be reported using the same systems as directed early warning. Frequencies used to monitor ADA early warning networks are located in the unit's communications plan.

2-4. ADW conditions demonstrate the degree of air attack probability based not only on current threat assessments but also on future air threats as required. The area air defense commander (AADC) issues ADWs for the joint operations area, based on current threat intelligence and disseminated through mission command channels to subordinate air defense commanders.

2-5. There are three types of ADWs; red, yellow, and white, with red being the most urgent. Any commander, after coordination and approval from the AADC, may issue a higher level of warning for their command but- may not lower the level. The chain of command must ensure that every Soldier knows the current ADW. ADWs will be disseminated through mission command systems throughout a theater. It is the responsibility of supported units at every echelon to inform their respective commanders of the current ADW. Army commanders must then inform their subordinate units of the ADW. For further discussion on ADWs, see FM 3-01. Descriptions of the ADWs are as follows:

- ADW Red. An attack by hostile aircraft or missile is imminent or in progress.
- ADW Yellow. An attack by hostile aircraft or missile is probable.
- ADW White. An attack by hostile aircraft or missile is improbable.

ALERT STATES AND READINESS CONDITIONS

2-6. ADA commanders use weapons alert designators, alert states and readiness conditions to ready their forces and configure their systems rapidly against an enemy air attack. An example of this is the ready for action drills conducted upon receiving a new surface to air missile tactical order, which heightens a unit's alert state. In conjunction with elevating the unit's readiness, the commander also retains the ability to stand

down units for rest or maintenance. Alert states and readiness conditions are implemented locally and coordinated with guidance from the deputy AADC and designated controlling authorities. The Combined arms force should understand ADA brigade commanders establish and control the alert state for their subordinate units operating in support of maneuver areas of operation. Actual timelines and manning requirements are determined by theater or joint operations area plans. Alert state and readiness condition information is normally found in the unit's tactical standard operating procedures which also takes into account the factors of mission, enemy, terrain and weather, troops and support available, time available, and civil considerations (METT-TC).

RULES OF ENGAGEMENT

2-7. ROE at all echelons are positive and procedural directives that specify the circumstances and limitations under which forces will initiate or continue combat engagements with enemy forces. The joint force commander approves the theater ROE. These established ROE enable the air defense commanders to delegate the authority to execute air defense operations. The ROE also permit the senior air defense commander to retain control of an air battle by prescribing the exact conditions under which engagements may take place. ROE are a direct reflection of the centralized control with decentralized execution principles of air defense. ROE apply to all warfare participants in the theater and disseminated to all echelons of air, land, and sea forces. Commanders have the responsibility to take whatever action is necessary to protect their forces and equipment against air or missile attack. When under attack, the right of self-defense takes precedence over any other established rules and procedures, which normally govern engagement. There are seven ROE categories. The first three ROE are applicable to all air defense contributors. The others are primarily for ADA forces.

- Right of self-defense.
- Hostile / Identification criteria.
- WCS.
- Level of control.
- Modes of control.
- Autonomous operations.
- Fire control orders.

Right of Self-Defense

2-8. Commanders have the responsibility to use all necessary means available and to take all appropriate actions in self-defense of their unit and other forces in their vicinity in response to a hostile act or demonstrated hostile intent. Self-defense operations allow friendly units to defend themselves against direct attacks or threats of attack with the use of organic weapons and systems. The right of self-defense is inherent in all ROE and weapons control procedures.

Hostile / Identification Criteria

2-9. The AADC and Airspace Control Authority establish procedures within the airspace control plan to positively identify all airborne assets, and permit active air defense. Active air defense measures protect the force reducing delays during tactical operations, and prevents fratricide. Positive identification of aircraft is normally the preferred method of operation. In the absence of positive identification, procedural identification is used, which employs previously established and disseminated airspace coordinating measures. Procedural identification separates airspace users by geography, altitude, heading, time, and/or maneuver. Generally, some combination of positive and procedural identification will be used.

2-10. Proper employment of air defensive weapon systems enables; early detection, identification, classification, and alert of threat aircraft and missiles which maximizes the units' beyond-visual-range engagements helping avoid fratricide. Identifying and classifying friendly characteristics from enemy assets while employing various weapon systems is a highly complex task. This includes the difference between visual identification and the use of combined arms from the early detection of air defense sensors and supporting systems. Tasks will differ based on the type of threat platform detected whether manned, unmanned, close proximity, or ballistic. Additional considerations include time of detection, range, projected

flight path, and possible battle effects. Ballistic missiles have a distinct flight profile and specific ROE for immediate engagement. While the ROE for aircraft may allow additional time before engagement.

2-11. Hostile criteria are basic rules that assist in the identification process of friendly or hostile air platforms. These rules are promulgated through subordinate commanders from the joint force commander or AADC when so authorized. The commander who establishes hostile criteria parameters may consider the factors of speed, altitude, and heading or other requirements within specified volumes of airspace. The local commander may also consider specific enemy threat characteristics or hostile acts.

2-12. Echelons having engagement authority use hostile criteria to determine the identification of detected air targets. The highest echelon capable of managing engagement operations normally retains identification and engagement authority. Upon target detection, fire units and sensors with real time and near-real-time data transmission capability assist controlling authority by forwarding targeting information. The controlling authority makes final target identification and delegates' engagement authority. Engagement authority centrally controlled with decentralized execution given to lower echelon units in coordination with higher echelon.

Weapons Control Status

2-13. Weapon control status is a control measure designed to establish procedures for forces using surface air defense weapons (including small arms weapons) to engage threats. Weapon control statuses can apply to weapon systems, volumes of airspace, or types of air platforms. The tactical situation normally determines the degree or extent of control necessary over particular weapon systems. Air defense officers at headquarters planning cells or AMD coordination and liaison teams typically establish or recommend separate weapon control statuses for various air threats, including fixed- and RW aircraft, missiles, or UAS at their supported headquarters. Air defense is optimized when all forces have the ability to rapidly receive and disseminate weapon control statuses for all air platforms. The three weapon control statuses are:

- Weapons-Free. Engage any target that is not positively identified in accordance with current ROE as friendly may be engaged. This is the least restrictive weapon control status.
- Weapons-Tight. Engage targets only identified as hostile in accordance with current ROE.
- Weapons-Hold. Units may fire only in self-defense or when ordered by proper higher authority. This is the most restrictive weapon control status.

2-14. Any unit can receive ADW or directed alert of possible or immediate threats to their forces or to a specific area of the battlefield. The AMD cell provides the air defense expertise for integration into the corps/division air defense plan (ADP). The air defense airspace management (ADAM) personnel contribute to the brigade and below unit's airspace plan. Although the airspace control element reviews and deconflicts the corps or division ADP with other division control measures, the control measures for the ADP are normally sent to higher headquarters through AMD channels.

Level of Control

2-15. Level of control describes the ADA echelon at which positive management of the air battle is conducted. This can be an AADC, regional air defense command, sector air defense commander, ADA brigade, battalion, or the individual unit. Different levels of control are normally established for engagements of FW aircraft, RW aircraft, UASs, CM and ballistic missiles. The AADC will specify the level of control in the AADP, which may change over the course of an operation.

Modes of Control

2-16. Combined arms forces must be familiar with the overall area ADP that specifies the modes of control, trigger events and when they should be changed, and who has the authority to change them. The mode of control selected may depend upon the capabilities of the communications system, the weapons systems employed, and both the friendly and enemy air situations. There are two modes of control, centralized and decentralized refer to FM 3-01 for more information.

Autonomous Operations

2-17. A unit assumes autonomous operations after it has lost all communications with higher and adjacent echelons. The unit commander assumes full responsibility for control of weapons and engagement of hostile targets. Normally, the ROE and supplemental fire control measures in effect at the time of communications loss remain in effect until communications are regained. Changes to ROE and supplemental fire control measures scheduled to go into effect after communications are lost will be implemented as scheduled.

Fire Control Orders

2-18. Fire control orders are commands used to control engagements on a case-by-case basis, regardless of the prevailing WCS. Higher ADA echelons, when monitoring the decentralized operations of subordinate units, most often use these commands. Fire control orders can be transmitted electronically or verbally; however, not all of the fire control orders shown below can or will be used by every type of ADA unit.

- ENGAGE is an order issued by the engagement authority to engage a specified target with the intent to destroy it.
- HOLD FIRE is an emergency fire control order to stop engagement of a specific target. Missiles already in flight must be prevented from intercepting by diversion or destruction, if technically possible.
- CEASE FIRE is a fire control order instructing ADA units to refrain from firing on, but to continue to track, an airborne object. Missiles in flight are allowed to continue to intercept. This fire control order is normally issued to preclude engagement of the same aircraft by two or more weapons systems.
- CEASE ENGAGEMENT is a fire control order used to direct units to stop the firing sequence against a designated target. Missiles already in flight will continue to intercept.
- ENGAGE HOLD is an order applicable to Patriot and Terminal High-Altitude Area Defense (THAAD) only. When operating in the automatic mode, ENGAGE HOLD prevents engagement of the specified target by the system. Missiles in flight are allowed to continue to intercept.
- STOP FIRE is an emergency order to temporarily halt the engagement sequence due to internally unsafe fire unit conditions. It is seldom transmitted outside the fire unit. This command can be given by anyone in the fire unit who detects an unsafe condition. The engagement may continue after the unsafe condition has been corrected.
- COVER is used to order a fire unit to assume a posture that will allow engagement of a target if directed. This order can be used for targets that are presently being engaged by another fire unit or for targets that have yet to become a significant threat, to receive this command report tracking, and ready to fire at higher echelons.

Chapter 3

PASSIVE AIR DEFENSE TECHNIQUES

This chapter discusses passive air defense measures units may employ to safeguard its personnel and equipment from air threats. Units may be exposed, bunched up, or in a situation where they are vulnerable to attack or taking unnecessary casualties. If attacked under these conditions, the unit has options to protect itself by minimizing damage while preparing a counter attack and fighting back. The decision to engage hostile air must consider the unit's assigned mission and the tactical situation. In cases where the enemy aerial platforms are outside the range of the unit's weapons, a unit's most lucrative option can be to disperse and seek cover. In other cases, commanders may decide to place the enemy aerial platform under fire with organic weapons with the intent to either destroy or avert their flight path.

PASSIVE AIR DEFENSE

3-1. Passive air defense is all measures, other than active air defense, taken to minimize the effectiveness of hostile air and missile threats against friendly forces and assets (JP 3-01). These measures include camouflage, concealment, deception, dispersion, reconstitution, redundancy, detection and warning systems, and the use of protective construction. There are two types of passive defense measures; attack avoidance and damage-limiting.

3-2. Commanders employ passive AMD measures to improve their units' survivability by increasing the likelihood of not being detected and targeted (attack avoidance) from the air and by mitigating the potential effects (damage-limiting) of an air attack. Air defense units perform passive air defense techniques, which include the tasks of detecting air and missile launches, predicting impact points, and providing threat identification and alerting forces of possible CBRN events through disseminating early warning. Examples of tasks that help reduce a unit's vulnerability or minimize damage caused by missile attacks are:

- Positioning and dispersion.
- Hardening of positions and facilities
- Cover, concealment and protection of major assets and forces.
- Recovery and reconstitution plans.

3-3. It is likely an enemy has the capability to attack from the air. Units without dedicated air defense are not defenseless against air attack. Simple measures can be taken by any unit to avoid and limit damage of an attack. If routinely followed, passive air defense measures will not only reduce the probability detection from an air threat but will, also limit damage if an attack cannot be avoided

3-4. The first line of defense against air attack is to employ passive air defense measures. Upon detection of an approaching hostile aerial platform that is not attacking the unit, the commander has a decision to make. Based on the unit's assigned mission the commander may not want to fire and disclose their position. Secondly, based on the ROE, the commander needs to decide whether to engage a non-attacking aerial platform.

CAMOUFLAGE AND CONCEALMENT TECHNIQUES

3-5. Attack avoidance is taking the actions necessary to avoid being seen by the enemy to include concealment and, lacking concealment, camouflage. What can be seen can be hit, and if you cannot be seen, the probability of being hit diminishes to near zero. The techniques used for concealment from aerial observation are the same as used for concealment from ground observation (see Figure 3-1).

Figure 3-1. Attack avoidance

Concealment

3-6. There are three concealment principles employed (site, discipline, and construction) to eliminate the factors of recognition. Site refers to positioning your unit in the most advantageous area in which to hide a man, equipment or an activity. Discipline success in any attack avoidance effort is the strict maintenance of concealment discipline by both the unit and by the individual Soldier. All activities should be avoided that change the appearance of an area or reveal the presence of military equipment. Laxness and carelessness will undoubtedly reveal a position. Tracks, spoil, and debris are the most common signs of military activity, which indicate concealed objects. Ensuring wheeled/track/foot movement follows existing paths, roads, fences, or natural lines in the terrain pattern. Do not end exposed routes at a position, but extend them to another logical termination. If practical, tracks should be brushed out, camouflaged, or covered. Spoil and debris must be covered or placed to blend with the surroundings. Artificial camouflage is added when the terrain and natural vegetation are such that natural concealment is not possible.

3-7. While concealing a position it is best to use natural construction materials to blend-in with the surrounding terrain, which augments this type of concealment. Concealment techniques are hiding; blending, and disguising:

- Hiding. Hiding is the concealment of an object by some form of natural or man-made screening. For example, sod over mines in a minefield hides the mines; the overhead canopy of trees hides the objects beneath from aerial observation; a camouflage net hides an object beneath it; a defilade position hides objects from ground observation. In some cases, the screen itself may be invisible. In other instances, the screen may be visible, but it hides the activity or object underneath it.
- Blending. Blending is the arrangement or application of camouflage materials on, over, and around the object so that it appears to be part of the background. For example, applying face paint to the exposed areas of skin; adding burlap, paint, and live vegetation to helmets and clothing to closely resemble or blend into the background. The same technique can be applied for equipment or structures.
- Disguising. Clever disguises can often mislead the enemy concerning identity, strength, and intention, and may draw fire away from real assets. Therefore, the simulation of objects, pieces of equipment, or activities may have a worthwhile military significance. Rubber tanks, placard tents and buildings and other decoys, as seen from the air may appear natural or real to an aerial observer.

Camouflage Detection Avoidance

3-8. The difference between concealment and camouflage is that concealment is using natural terrain while camouflage is normally constructed from artificial material for concealment. Additional detection avoidance techniques include using mud for glassy surfaces and unfilled sandbags or a sleep matt over windshields (Figure 3-2). Camouflage is one of the basic weapons of war. The importance, the principles, and the techniques of camouflage must be completely understood. All personnel must ensure the effectiveness of all camouflage detection measures while maintaining strict camouflage discipline enforcement.

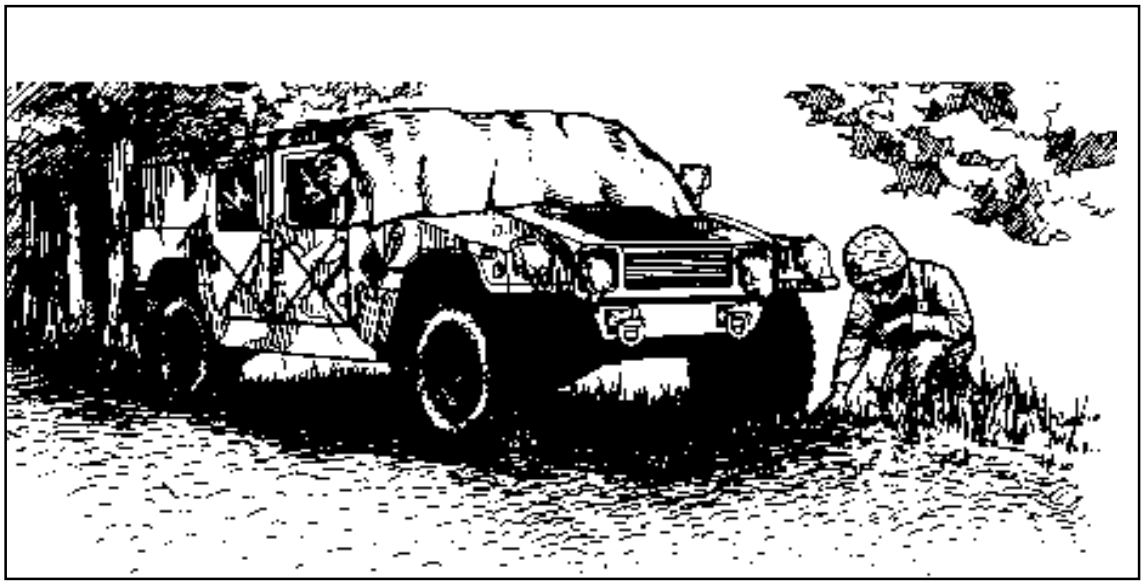


Figure 3-2. Detection avoidance.

3-9. Dispersion is another type of passive air defense measure, which may limit damage if an enemy air threat detects and attacks the position. This forces the enemy to target and attack one piece of equipment at a time. This will minimize the likelihood of a unit being put out of action with just a single attack. The same measures (dispersion, protective construction, and cover) are taken to limit possible damage from rocket and artillery attacks.

- Dispersion. Dispersed troops, vehicles, and equipment will force the attacker to concentrate on a single target. The wider the dispersion increases the potential for limiting damage.
- Protective Construction. The use of cover, natural or manmade reduces damage and casualties. Folds in the earth, natural depressions, trees, buildings, and barriers offer damage-limiting cover, which should be sought out and habitually used. Digging in or sandbagging can offer some protection to a unit that is positioned in flat terrain lacking cover. Smoke can be effectively used if the unit is moving and cannot use natural cover. Smoke makes visual target acquisition difficult for the attacker.
- Cover. Cover is protection, prohibiting observation of friendly ground forces and their operations by an enemy. Cover can also shield forces from the effects of enemy fires. Cover and dispersion techniques should be used to limit the amount of damage to the unit.

CONVOY SELF-DEFENSE MEASURES

3-10. The majority of all convoys are vulnerable to air attack since they are easily seen and identified from the air. Movements along well used routes can be dangerous during times of heavy conflict and should be avoided unless used during times of limited visibility. Roads may present obstacles such as soft shoulders, deep ditches and embankments, which may restrict a unit's ability to quickly disperse and seek cover. Convoys represent high-value, hard-to-defend, easy to hit targets to enemy air and ground attack aerial platforms.

A high probability of attack must be assumed in planning convoy operations. Not all convoys will be provided dedicated air defense assets and must be prepared to employ organic passive and active air defense measures for protection.

Attack Avoidance

3-11. The enemy may find it difficult to locate a convoy that takes precautions to reduce its visible signature. While it is not possible to become totally undetectable, the convoy commander must take every measure to decrease the likelihood of being spotted. Examples of effective passive measures are:

- Change the profile or shape of vehicles. Can it be accomplished by rigging tarps and bows over the cargo compartment?
- Train operators, as they disperse, to look for a bush, tree, or some other means of concealment to break their vehicles' shapes as seen from the air
- If vehicles are not already painted in a pattern to blend with the terrain and to break the outline, use mud, camouflage nets, or vegetation to achieve this effect.
- Try to reduce the dust clouds that usually accompany a convoy. If possible, try to avoid unpaved secondary roads. Reduce speed to reduce dust on unpaved roads.
- Try to eliminate glare by using mud, tape, cardboard, tarps, camouflage nets, or ponchos to cover headlights, window glass, and other glossy surfaces. See Figure 3-3.
- Use smoke or other obscurants to conceal positions and movements to deceive the enemy as to mission and intent (draw attention to deception operations).
- Operate at night or during periods of limited visibility as much as possible.
- Position vehicles and facilities inside wood lines and erase vehicle tracks left outside of wood lines. Dedicate air guards and understand the signs of UAS in the area (for example: noises that are not normal for that area of operations).

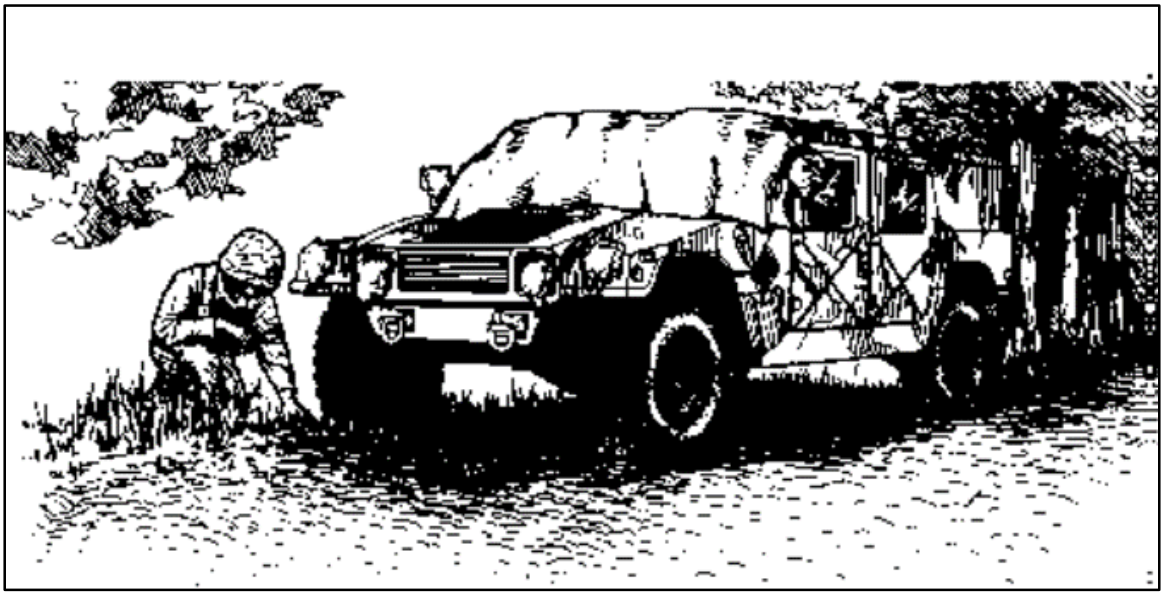


Figure 3-3. Eliminate Glare.

Damage-Limiting Measures

3-12. Cover is the best damage-limiting factor. Since convoys are highly visible, you should plan routes that offer damage-limiting features in case you become exposed. If your signature reduction efforts are not successful, selecting natural cover such as ditches and embankments to the sides of the roads, offer cover and should be used if the unit is attacked. See Figure 3-4 on page 3-5.

Figure 3-4. Selecting natural cover.

Dispersion

3-13. Dispersion may be your best damage-limiting measure. Proper dispersion of your unit and equipment lessens target density and reduces the lethal effects of the ordnance used against you. Most of the munitions that aerial platforms deliver against vehicles must make a direct hit to be effective. Even area weapons become less effective if the unit is dispersed. The commander must weigh the need for dispersion against the need to stay concentrated to accomplish the mission.

3-14. A technique to achieve dispersion is to travel in an open column with 80 to 100 meters between vehicles during daylight movements and 25 meters during night movements. Air guards can be posted throughout the column constantly watching the skies ready to give early warning of a detected hostile aerial platform. The earlier an aerial threat is detected, the more time your unit will have to react. Air guards search and scan for approaching aerial threat while observing their assigned sectors. Crewmembers must also scan their sectors for ground targets while remaining aware of possible air threats. Crews should use the horizontal search-and-scan technique or vertical search-and-scan technique for detecting air targets.

3-15. Crewmembers should periodically check the air space above their assigned sector using the rapid-scan technique. As each crewmember completes a rapid scan across their sector and field of view where it meets the horizon, they should switch to a detailed search and make a careful, deliberate search of tree lines, valleys, and possible air corridors. When an aerial platform is detected, alert the vehicle commander by calling out the type of platform (plane or unmanned aircraft) and pointing to the aerial platform. Examples of dispersion methods include:

- Increase the number of serials for convoy movements and decrease the number of vehicles in each serial. This procedure provides a smaller target and increases the level of control over each convoy element. This also allows for greater dispersion and reaction time between convoy elements.
- Do not park vehicles in a straight line; instead, stagger the vehicles to present a poor target. Park the vehicles under cover if available. Arrange with the drivers so that if an attack occurs, they can drive the vehicles to the opposite sides of the road to seek cover. For example, the lead vehicle (odd numbered) is driven to the left; the second vehicle (even numbered) pulls off to the right, and so on (Figure 3-5 on page 3-6).

Figure 3-5. Vehicle dispersion.

Detect

3-16. Fixed-wing and rotary-wing aircraft are difficult to identify as they usually engage at extremely long ranges beyond visual recognition. UAS groups 1-3 can also be difficult to readily identify because they can operate low to the ground, move very slowly and have small radar cross sections. To prevent fratricide leaders must keep crews informed of friendly and hostile aircraft and aircraft systems operating in their unit's sector. Crews must make every effort to correctly identify a target as friend or foe prior to an engagement.

3-17. Based on METT-TC the combined arms commander may elect to establish air guards within sections, platoons, or convoys. If an Avenger team is attached to the unit, they should assume the role as primary air guards. Air guards are responsible for spotting aerial threats within close proximity to the units' location. Air guards can be the first line of defense especially detecting and coordinating enemy LSS targets and their positions. It is important to engage all aerial targets at the earliest possible time. Air guards search for aerial targets using search and scan techniques as crewmembers within the convoy. Air guards and gunners search not only their assigned sector using the passive air defense techniques, but also ensure:

- Sector limits established for the gunner must cover likely helicopter locations and avenues of approach.
- Gunners must make sure ground reference points are always within their field of view in order to maintain directional control and situational awareness.

Estimation of Upper Search Limits

3-18. When scanning for aircraft, crewmembers may miss high-flying aircraft if they limit their search near the horizon while also missing low-flying aircraft if they concentrate their search too high above the horizon. The correct upper limit of search is 20 degrees. Estimate 20 degrees using the technique illustrated below in figure 3-6 on page 3-7. With the fingers fully spread, the tip of the thumb is the upper search limit.

Figure 3-6. Estimating 20 degrees technique.

Note. You should expect enemy aircraft typically operating in pairs that may include one or more pairs of aircraft conducting the attack mission.

Protective Construction and Use of Obscurants

3-19. Using natural or manmade cover reduces the probability of detection, damage, and casualties. Cover can prevent the projectile from striking the intended target while reducing the target area exposed to damage, and absorbing part of the blow. Folds in the earth, natural depressions, large trees, buildings, and walls offer damage-limiting cover and should be used whenever possible. Digging in or sandbagging can offer some protection.

3-20. While moving and natural cover is unavailable or sporadic, and fortifications cannot be rapidly built, smoke can be used as a concealment method. Smoke and other obscurants not only make target acquisition much more difficult for the air threat but also may degrade control of laser guided precision munitions. Smoke and other obscurants can be used to deny enemy aircraft the use of avenues of approach, landing and drop zones, air battle positions, and key terrain as navigational aids.

CONVOY MOVEMENT TECHNIQUES

3-21. In terms of vulnerability to air threats, a convoy of vehicles usually presents a lucrative target. Convoys are easily visible from the sky, and shoulders of a road, ditches, or embankments restrict their freedom of maneuver. The linear array of a large convoy can underscore mission command making control difficult. Convoys are high-value, hard-to-defend, easy-to-see and hit targets for enemy air. The unit must assume there is a high probability of air attack when planning a convoy. A unit's movement plan will consider their routes of travel, the convoy size, timing of staging and initial movement, and available air defense capabilities.

Routes

3-22. Consider using routes that offer the greatest natural concealment. Trees and the shadows they cast offer concealment. The shadows cast by mountain ridgelines in the early morning and late afternoon also, provide concealment. When crossing open country, travel should occur when the sun is high to avoid casting long, highly visible shadows. When possible, use multiple routes to reduce convoy lengths. Travel in an open column with 100 meters between vehicles. Vehicles stretched out in a long thin line in a convoy are less of a target than vehicles that are located closer together.

Small Convoy Units

3-23. The convoy can also be broken into small platoon size units and dispatched separately with at least 1,000 meters between units (use separate march units). This technique minimizes convoy size and increases the level of local control over each convoy element.

Breakout Plan

3-24. Arrange to defend against an attack by moving the vehicles to opposite sides of the road to seek cover: The lead vehicle goes to the right, the second vehicle pulls to the left, and so on. This technique is called the Herringbone (see Figure 3-7). If possible, have vehicles drive 45 degrees off the road and move to a covered and concealed position. Establish rally points for the convoy to reassemble after the attack. In cases where not all vehicles in the convoy have radios, the unit must develop a means to signal drivers that enemy aircraft are coming. The use of protective vehicle-launched or hand grenade smoke can cause the threat air to lose weapons lock or disrupt target acquisition long enough for convoy vehicles to find suitable concealed or dispersed positions.

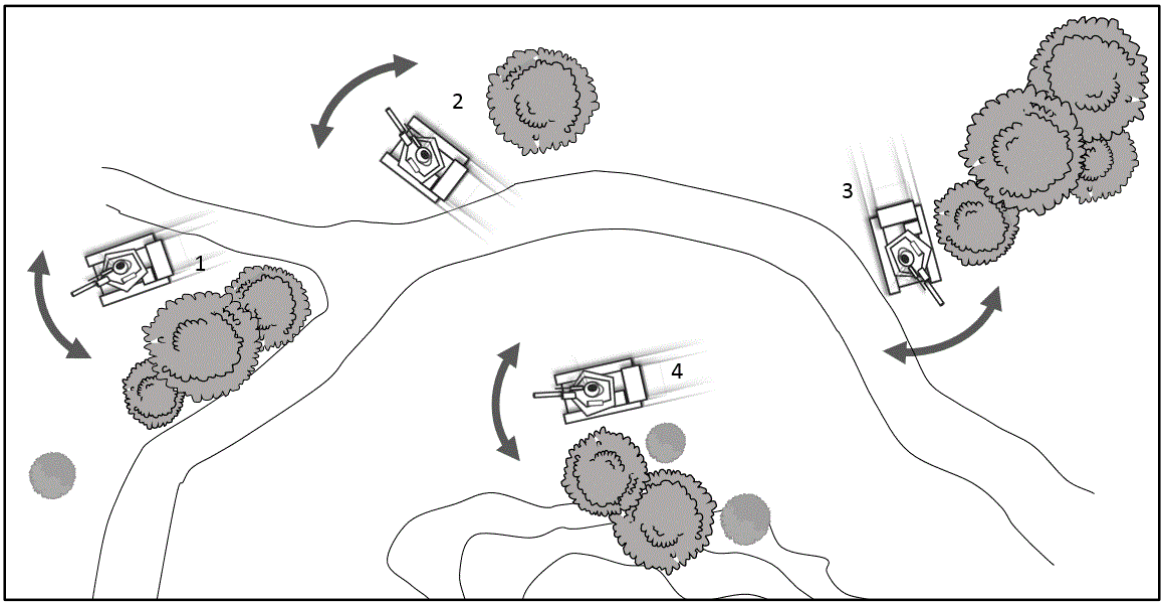


Figure 3-7. Herringbone technique.

3-25. In the event hostile aircraft pass over your convoy and does not attack, the convoy still needs to disperse and prepare to return fire in case the aircraft returns. If attacked prior to reaching an established rally point, crewmembers should engage attacking aircraft with available weapons including small arms. Accomplished by determining the correct aiming point and firing upon command. The unit will engage the target until the aircraft is hit or flies out of effective range. Small arms alone can provide a limited amount coverage (Figure 3-8 on page 3-9).

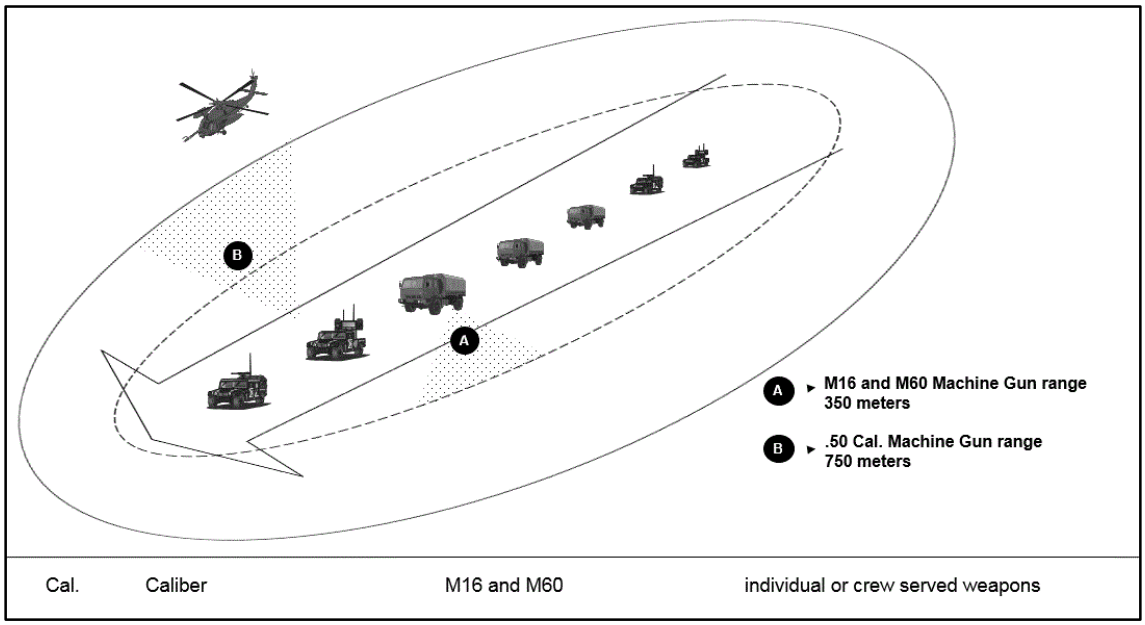


Figure 3-8. Small arms convoy coverage.

Integration of Air Defense Capabilities

3-26. Vehicles with air defense weapons that are effective against short-range air threats should be integrated into the convoy every fourth or fifth vehicle if possible. Many simple, commonsense measures can be taken by a unit to avoid attack and limit damage if attacked. Combined arms forces should make planning, coordination and integration of AMD standard practice during planning development. For example, the commander should coordinate the unit's plans for short-range air defense systems from general support or direct support ADA units whenever possible. Coordinating a units movement routes with ADA coverage can also preserve units' survivability.

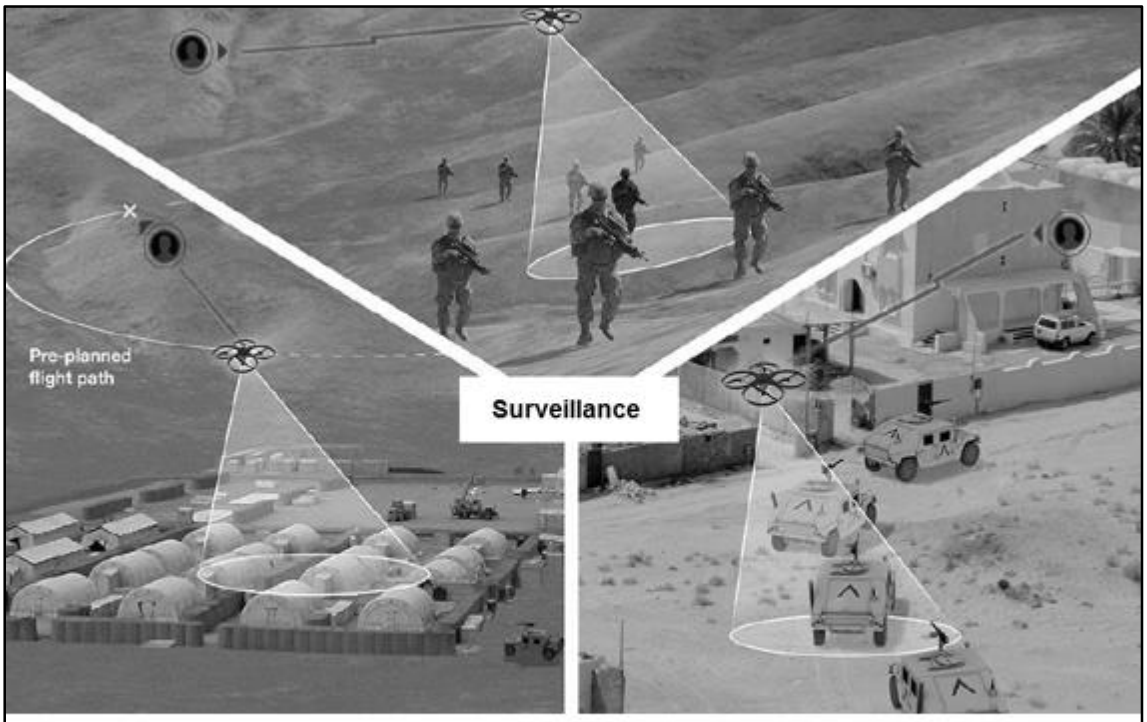
COUNTERING UAS GROUPS 1 AND 2

3-27. UAS group 1 and 2 presents the greatest challenges for Army forces. These unique platforms have the ability to operate within the commander's operational time and space, down to the smallest echelon. The enemy will use UAS to fulfill multiple attack roles. UAS used as a single point or area attack weapon, a sensing platform, or function in support of either role. UAS used in clusters combining multiple mass effects. The smaller platform also provides the user with the ability to meet reconnaissance, surveillance, and information collection requirements without being noticed. These systems are more mobile and less noticeable than dismounted scouts with the added benefit of greater standoff enhanced by electronic optics.

Planning for Potential Threat use of UAS

3-28. Combined arms commanders must consider an enemy's probable use of UAS. The smaller UAS can complement any attack plan providing real time battle information and insight for expected countermeasures. Some of the most exploitable roles in which UAS group1 and 2 are the most beneficial are:

- Surveillance. UAS has the ability to parallel dismounted and mounted elements, and in most cases undetected and operating at close proximity (see figure 3-9 on page 3-10). This allows for detailed surveillance from multiple vantage points, within the commanders time and space as mentioned previously. This may be the most probable COA as it allows for continued use of the system without destruction.

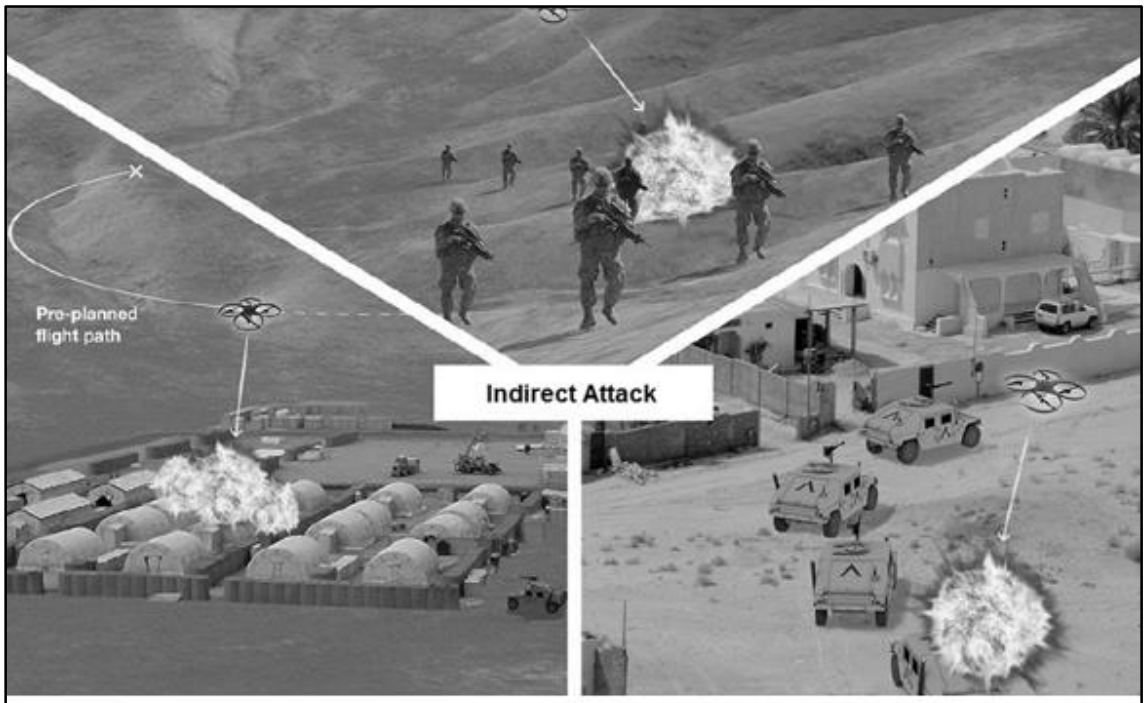


Surveillance: UAS gains situational awareness of friendly forces and activities or provides command and control and directs ground attacks through a video feed.

UAS unmanned aircraft system

Figure 3-9. UAS surveillance role

- Indirect Attack. In the role of the indirect attack, the UAS can guide indirect fires, observe/spot fires, adjust fires and or serve as the indirect attack weapon or munitions. As an indirect attack platform, the UAS has the ability to carry the improvised explosive device or become the improvised explosive device. See figure 3-10 on page 3-11.



Indirect Attack: UAS release hazards (explosives, toxic materials, CBRN, etc.) to cause damage, injury, chaos, or death.

CBRN	chemical, biological, radiological and nuclear
UAS	unmanned aircraft system

Figure 3-10. UAS indirect attack role

- Direct Attack. Flying at close proximity to designated targets, UAS can be directed towards point targets or placed around area targets. The probability increases with the size of the target and whether the target is stationary or in motion. These drones can have the ability to seek out their intended targets (see figure 3-11 on page 3-12).

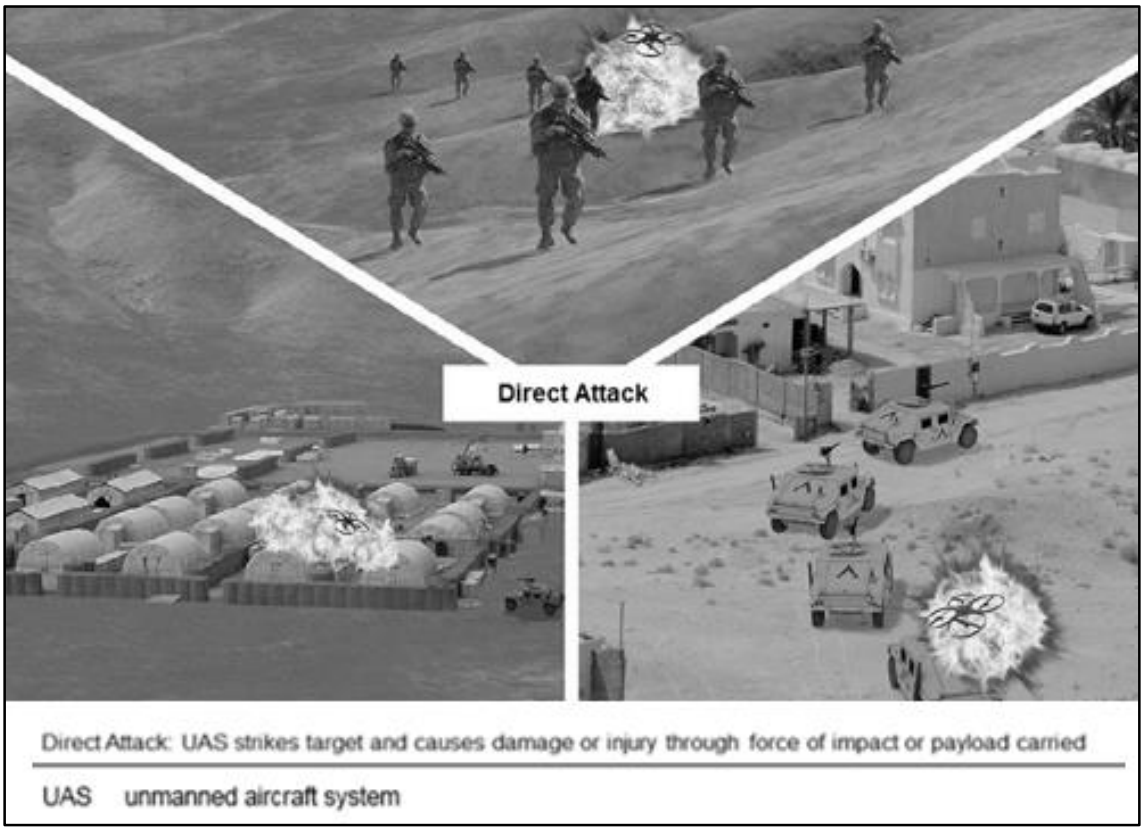


Figure 3-11. UAS direct attack role

- Swarm Attack. Perhaps the most dangerous COA, even though it may not be the most probable is the Swarm, see figure 3-12 on page 3-13). Clusters of UAS can be used for all three purposes (Surveillance, Indirect Attack and Direct Attack). They can be preprogrammed or remotely piloted as an expendable asset at relatively low cost. The Swarm itself can be used to disrupt our own reconnaissance efforts or overwhelm an entry control point.

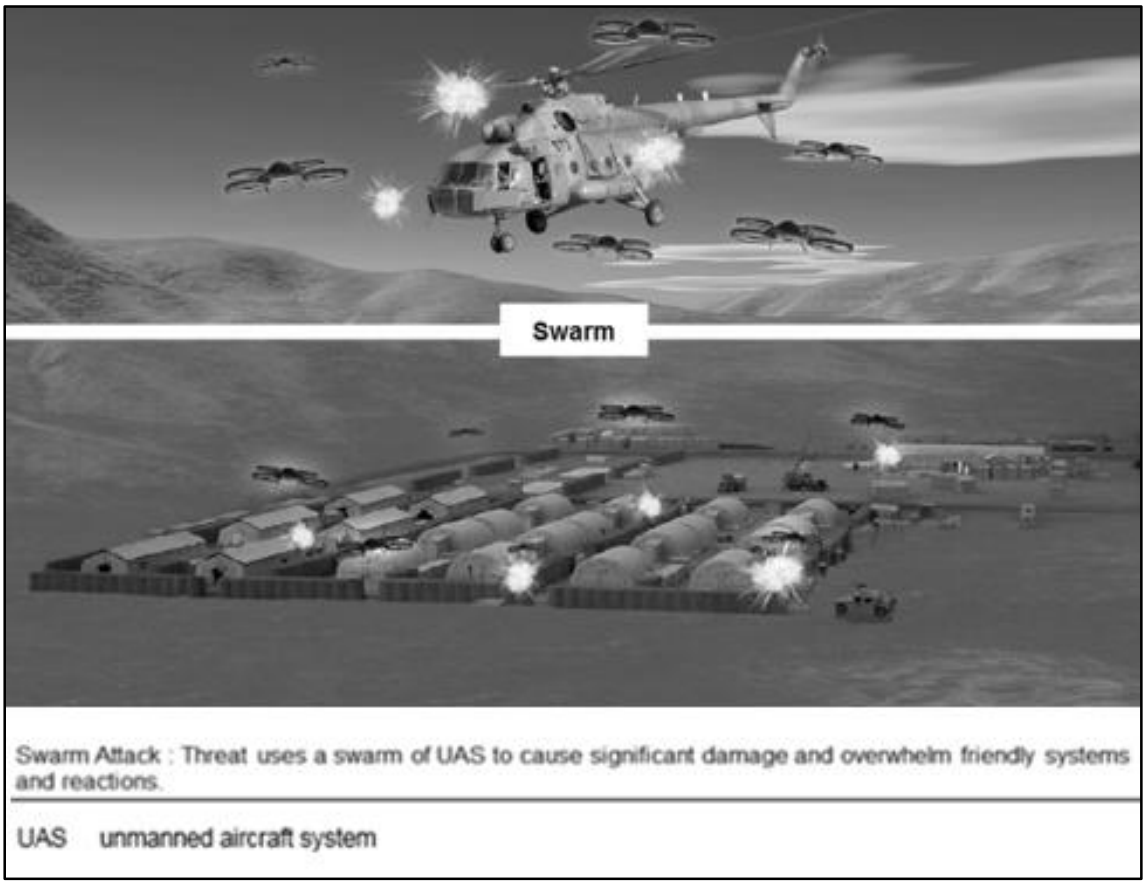


Figure 3-12. UAS swarm attack role

Find the Unmanned Aircraft System, Detect and Identify

3-29. Use Air Guards. Designate a person or team depending on unit's size to observe above the horizon. Pay close attention at key times such as immediately after indirect fire attacks, during or after key leader engagements or during and after raids. Commanders must articulate to their Soldiers to report and properly coordinate with operations and intelligence elements or asymmetric warfare division personnel to define if enemy UAS are establishing a pattern. All mission command elements should know who to call to determine if airspace is clear of friendly air.

3-30. Awareness of a LSS threat, prior to the mission can drastically aid the Soldier's ability to detect and identify UAS. Knowledge of pattern of life within an environment can assist Soldiers to spot threat UAS in their vicinity. During foot patrols with limited noise, both seeing and hearing will be the primary organic capabilities to detect a UAS group 1 or 2 (Figure 3-13 on page 3-14). During convoys or scenarios with greater noise levels, sight will be the primary capability to detect UAS group 1 or 2.

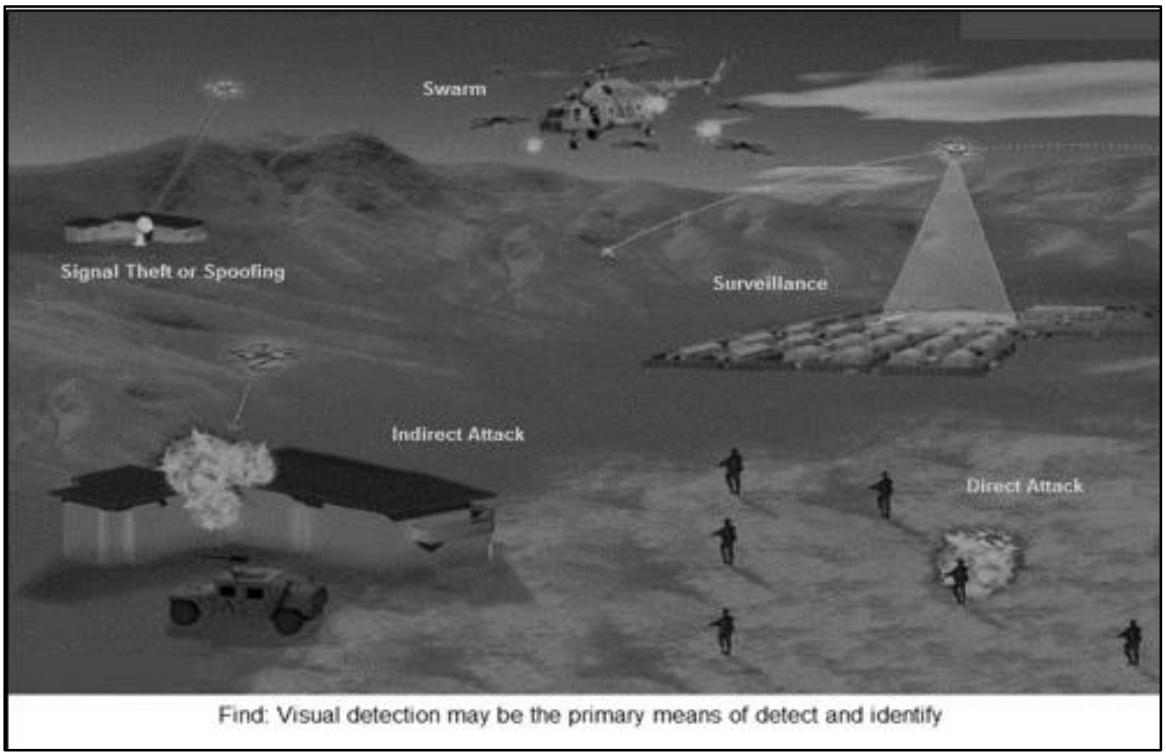


Figure 3-13. Find, Detect, Identify UAS

What to do

3-31. Proper planning by leaders will ensure that units employ adequate force protection measures to counter the UAS threat. Units must develop tactics, techniques and procedures to counter this threat in their respective areas of operation. Units must request and coordinate current air threat information from their intelligence sections, and observe all enemy techniques used and define an operational tactic, technique or procedure (Direct Fire, Reporting Criteria, etc.). Notify higher and adjacent units (Clear airspace and pass early warning). Move to overhead cover. Get distance and bearing to the threat. Recommended format to use in reporting threat UAS shown in table 3-1 on page 3-15.

3-32. Understanding the capabilities and limitations of UAS group 1 or 2 can increase a Soldiers ability to react and defeat a threat. Reacting to a threat UAS should include reporting timely and relevant information to mission command and security control personnel if the UAS does not pose an immediate threat. Defeat does not equate kinetic means; however, it is an option. Other defeat solutions could be limiting a surveillance threat from gaining information or following the air path of the UAS to the operator.

Table 3-1. Recommended Threat UAS Reporting Format

Line	*Information Example*	*Example*
1	Unit call sign and frequency	Red 1, FHXXX
2	Unit location	6 to 8 digit grid coordinate
3	Location of threat unmanned aircraft system	Grid or distance and direction from reporting unit location
4	Time threat unmanned aircraft system asset spotted/detected	Date/time group (DTG):
5	Estimated time on site	Was threat unmanned aircraft system asset approach observed or was it spotted overhead? How long might it have been there?
6	Flight characteristics	Is threat unmanned aircraft system loitering in one spot (possibly already spotted reporting unit), is it flying straight (en route to loitering location), what is the direction of flight, or is it flying randomly (searching)?
7	Estimated size, elevation, and physical description	Wingspan, height, color, tail configuration, other distinguish markings.

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Chapter 4

ACTIVE AIR DEFENSE MEASURES

This chapter discusses active air defense techniques. Active air defense is direct action taken to destroy enemy aerial platforms or reduce their effectiveness. Commanders must prepare their units to actively engage air threats if attacked. The decision to engage air threats should include consideration of the unit's mission and tactical situation. If the enemy aerial platforms are outside the engagement range of the unit's weapons, a unit's most attractive option could be to seek cover.

ACTIVE AIR DEFENSE

4-1. Active air defense is a direct defensive action taken to destroy, nullify, or reduce the effectiveness of hostile air and missile threats against friendly forces and assets. It includes the use of aircraft, air defense weapons, electronic warfare, and other available weapons (JP 3-01). Active missile defense requires early detection of missiles in flight to permit cueing, acquisition, tracking, classification, identification, and destruction as soon as possible after launch.

4-2. At theater level, the AADC exercises control of active air defense operations through integration of army and joint AMD systems and forces into counter air operational plans. Counter air operations include; offensive and defensive counter air tasks performed during the execution of AMD operations. Active air defense techniques are measures taken in support of a commander's intent using ROE, defended asset priorities, and airspace control measures to protect the force.

4-3. Combined arms approach to active air defense is defending against a threat as a coordinated unit with all available forms of defense. Combined arms active air defense employs coordinated tasks and available capabilities in response to a threat using prescribed engagement techniques. Active air defense by a combined arms unit may not be successful if the response cannot be coordinated. Combining resources during combined arms operations based on coordinated planning and efforts across all echelons.

ENEMY AIR THREAT

4-4. If passive air defense measures fail to conceal and enemy air threats are within range, units can conduct active air defense (right of self-defense) by engaging the threat with all available weapons. All units if authorized can engage enemy air threats to protect their forces by:

- Neutralizing or destroying the threat.
- Forcing the threat away from friendly positions.
- Forcing the threat to fly higher, so that friendly aerial platforms or air defense weapon systems can destroy them.
- Deprive or spoil the hostile pilots' aim as they engage friendly forces.

Note: Right of Self-Defense-The inherent right to fire at attacking aerial platforms is derived from self-defense doctrine refer to FM 3-01. A unit may defend itself from direct attack but may not engage aerial platforms, which do not pose a threat except on the command of the appropriate authority or in following the current ROE.

ACTIVE MISSILE DEFENSE

4-5. Air defense forces possess a wide range of capabilities that are employed to perform both active AMD from the strategic to the tactical level supporting the force. Active missile defense is similar to active air

defense with exception of tasks focused primarily on ballistic and CM threats which identify launch points, classify the type of threat and project potential impact points. Characterization of a missile threat is significant for combined arms units as these threats typically traverse multiple operational areas requiring protection from a nearby air defense weapon system. Active missile defense is the continuous actions to detect, identify, classify and engage hostile missiles.

4-6. Air defense forces have a variety of different systems at their disposal that contribute to or perform active missile defense. These systems are generally referred to as either sensors or shooters based on their intended purpose but equally contribute to active missile defense.

4-7. Sensors play an important role in active missile defense. Whether acting as a stand-alone sensor reporting to a single mission command node or functioning as part of a sensor network, sensors enable situational awareness of the commander's operational environment. It gives commanders the early warning capabilities needed to mitigate risk to personnel and equipment minimizing effects from missile attack.

Contributing Sensors

4-8. Examples of sensors that contribute to active missile defense are:

- The theater event system that provides comprehensive tactical warning architecture supporting geographic commands and theater warning elements.
- The Defense Support Program is a satellite system using space-based infrared detection capabilities to detect and report near or real time missile launches
- The Joint Tactical Ground Station is a transportable information processing system that receives and processes in-theater, raw, wideband infrared data down linked from Defense Support Program sensors. The system disseminates early warning, alerting, and cueing information on ballistic missiles and other tactical events of interest throughout the area of operations using existing communications networks.
- The AN/TPY-2 forward based mode radar provides long-range surveillance, tracking, external sensor cueing, and launch and impact point estimates for ballistic missile defense.
- The Sentinel radar provides 360-degree surveillance coverage at a range of approximately 40 kilometers. It has the capability to acquire, track, and classify CMs, UAS, fixed and rotary wing aircraft. The sentinel provides track data to Air Defense Airspace Management cells and is normally deployed with Indirect Fire Protection Capability /Avenger and organic to Avenger battalions and Target Acquisition Platoons at division.

4-9. Although these sensors cannot actively engage threats, they do provide weapon system cueing and early warning functions needed by combined arms commanders to make an informed decision. These systems are normally tied into an established early warning network where tactical commanders can integrate their units through the deployment of air defense airspace management cells or AMD elements at the brigade combat team or division. Based on the information given on a potential threat, a commander can make a decision on active defense or employ passive defense measures. The commander may also have time available to take force protection measures against a threat such as an inbound ballistic missile if there are no available air defense systems that can defend against it. Above all, coordinating sensor plans with air defense elements prior to and during operations can increase a unit's survivability especially when located separately from the main effort. Implementing sensor plans using varying routines will also reduce an adversaries targeting and counter-target effectiveness. When combined arms forces operate their sensors they must consider the following:

- Positioning sensors and forces within the effective range of an air defense weapon system.
- Coordinating with supporting Signal for spectrum management.
- Operating radars other sensors using intervals and frequency diversity techniques.
- Plan for low, slow, small UAS used for counter-sensor and targeting operations.
- Prepare for electronic warfare directed at overwhelming sensor networks (including counter-fire).
- Enemy employment of heavy or mobile jamming tactics.

Contributing Shooters

4-10. Examples of shooters that contribute to active missile defense:

- The THAAD missile system is a defensive weapon system within the theater used to protect against hostile incoming TBM threats. The system provides the upper tier of a two-tiered layered defensive shield to protect high value strategic or tactical sites such as airfields or populations centers. Combined arms forces may operate in areas where coverage by THAAD exists by default through a theater early warning system.
- The Patriot air defense system provides air defense coverage against TBM's and ABT's within the area of operations. Patriot can defend against the larger UAS platforms (groups 3, 4, and 5), lower tier TBMs, CMs, fixed-wing aircraft, and rotary wing aircraft. Combined arms forces may transition through areas where Patriot coverage is coordinated or dedicated to them through theater early warning operations.
- Avenger missile systems are highly mobile and versatile. Avenger can be queued to search a specific area or tied into the division's early warning sensor networks. Avenger can support and coordinate lower tier AMD engagements within their designated zones.

ACTIVE AIR BREATHING THREAT DEFENSE

4-11. As a component of active air defense and closely related to missile defense is air breathing threat defense. Combined arms commanders must plan to counter this threat as it may pose an even greater risk to friendly forces due to the variety of delivery systems. The enemy may choose a combination of attack and delivery methods to inflict maximum damage. The air breathing threat set includes all forms of fixed- and RW aircraft and unmanned aircraft (see FM 3-01, Chapter 9 that addresses AMD Threat). This threat set also includes CMs, rockets, artillery, mortars, and other guided and unguided systems.

4-12. Along with employing small arms, defense techniques there are specific air defense weapon systems that can counter these threats. Examples of air defense systems that are designed to counter air breathing threats are:

- Patriot (see paragraph 4-10 above).
- Avenger weapon system provides air defense of UAS, fixed and rotary wing aircraft with 8 stinger missiles and an M3P .50 caliber machine gun. This system is highly mobile and can be used to provide SHORAD security for maneuver forces.
- Indirect Fire Protection Capability. This system complements a commander's layered air defense capabilities supporting a point defense against immediate area aerial threats such as; UASs, RAM, air-to-surface pop-up missile launches, aerial launch platforms.
- Combined arms commanders have the options to employ a point defense warning capability Rockets, Artillery, and Mortar- Warn (RAM-Warn) System. The RAM-Warn provides early detection and impact point prediction of inbound rocket, artillery, and mortar during attack.
- Stinger (Dismounted Avenger)
- Sentinel (see paragraph 4-8)

UNMANNED AIR THREAT

4-13. Unmanned air threats employ characteristics similar to CMs. Air threats are one of the two primary elements of enemy AMD threats (air threats and ballistic missiles). Unmanned air threats are UAS or other remotely piloted systems that present an elusive target, which is difficult to detect, identify, and engage. UASs are often used for intelligence collection in a surveillance or reconnaissance role, but can also be fitted as a small munitions delivery or re-supply system. Weaponized UAS perform targeting roles which provide precision strikes or operate in open areas taking advantage of targets of opportunity or forces operating in the open. UAS can also be configured to conduct sensor jamming or act as communications relay device.

4-14. UAS have become an increasing greater threat to combined arms forces in recent years. They have become more readily available and unmanned technology has become less expensive to buyers from nations who wish to use them to gain an advantage over conventional military forces or employed as a threat. This

increased availability can make it difficult for friendly forces to distinguish between friendly and enemy UAS platforms.

UAS Groups

4-15. UAS platforms are identified by groups ranging from 1 thru 5 based on their capabilities with each group presenting a unique set of capabilities or problems for commanders. UAS threats are the greatest near-term concern for SHORAD and combined arms forces.

4-16. UAS are grouped based on the physical and performance characteristics of weight, operating altitude, and airspeed. UAS groups 4 and 5 are larger systems with endurance normally deployed to conduct operational or strategic mission sets. These groups normally operate at altitudes up to 18,000 feet and require runways or roads for launch. UAS groups 2 and 3 are smaller with missions that center on tactical operations. Group 3 UASs normally operate at a comparable elevation as groups 4 and 5 but do not have the payload capacity. UAS group 2 operate at a much lower altitude (less than 3,500 feet above ground level), have a limited payload, and 2 require some logistical support. UAS group 1 consists of small or micro systems that are easily deployable within line of sight of its operator and primarily used for surveillance and reconnaissance at very low altitude (less than 1,200 feet), see figure 4-1 below.

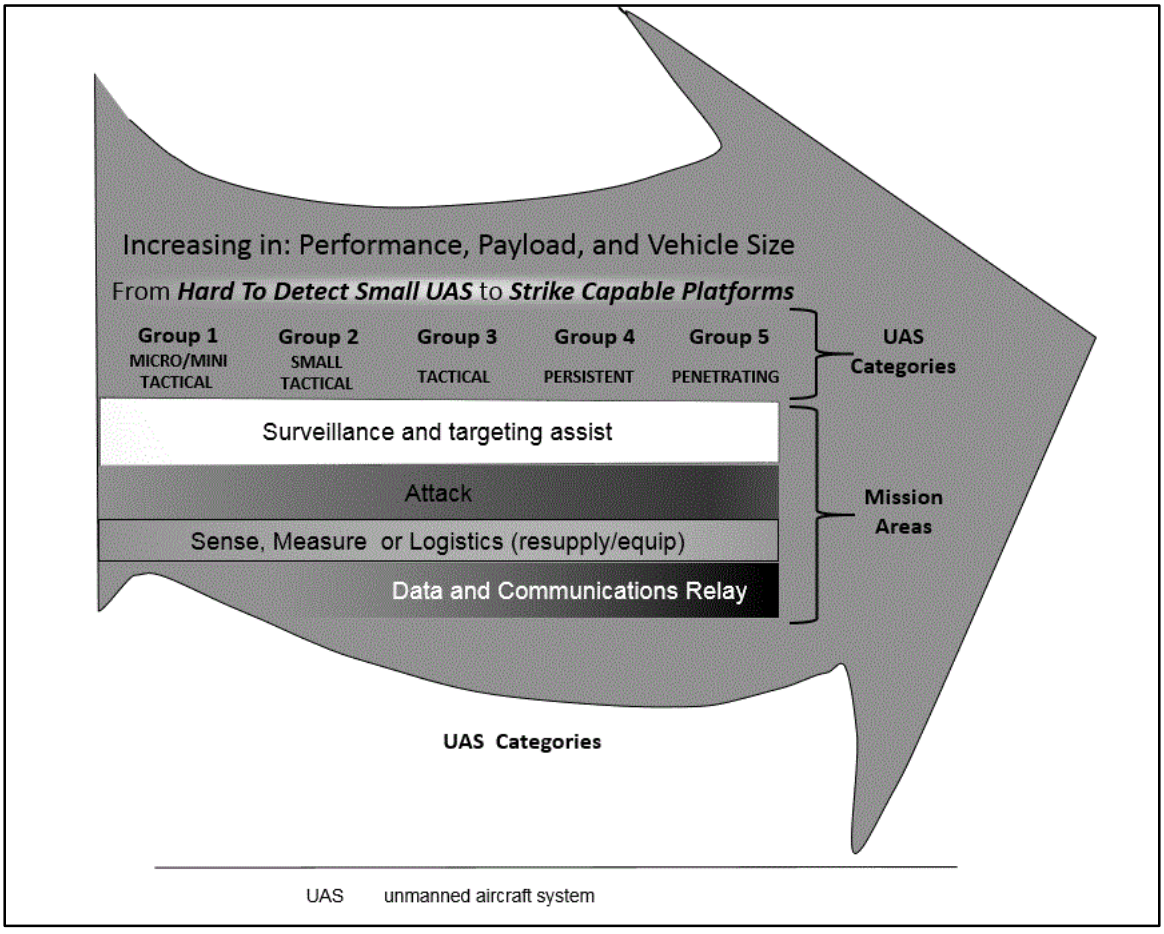

Figure 4-1. UAS groups 1 – 5 Mission Areas

4-17. UAS groups 1 thru 3 are more prevalent throughout the world due to their cheap costs, tactical ability, and operational impacts. For mission planning purposes, the technology of these platforms and the ability of the operator remain the major limitations of groups 1 thru 3. From the Soldiers on the ground to strategic assets in storage, small UAS pose a significant threat to all levels of the force.

4-18. The tasks of correctly identifying aircraft is often challenging in itself; however, performing these tasks on unmanned platforms having limited or no identification, friend or foe capabilities, increases a unit's difficulties in achieving positive identification.

4-19. Combined arms commanders will be challenged with the tasks of detecting, identifying, and defeating the unmanned threat platforms that enter into their airspace. During planning, a commander must consider the capabilities of the unmanned threat within their area of operations, the capabilities of friendly air defense systems and how they can contribute to countering the 4-20, threat.

4-20. Cloud cover, heavy foliage, and built up areas provide ideal cover and concealment for groups 1 thru 3 and these platforms can operate at ranges varying from 25 to 800 kilometers with flight times up to 72 hours. UAS roles include; reconnaissance, surveillance, target acquisition, suppression of enemy air defense, ground attack, decoy, communications relay, and chemical detection. The enemy's surveillance mission may incorporate UAS to locate friendly maneuver forces and key assets with the ability to pass real-time information to long-range systems. The commander must assess his unit's methods (tactics, techniques, and procedures) that will be used to confirm and report unknown and hostile UAS activity, and how to counter a possible UAS threat.

4-21. Planning considerations at the tactical level include:

- Incorporating early warning network capabilities including ADAM and Brigade Aviation Element cells.
- Identify capabilities and profiles of hostile UAS platforms.
- Address locations of likely targets
- Train ground troops to identify a UAS either visually or acoustically.
- Required coordination and synchronization actions with supporting command posts and air defense units for integration into sensor plans and targeting priorities.
- Establish UAS reporting procedures.
  - Identification of unknown UAS.
  - Notification forwarded to supporting air defense or integration officer.
- Minimize the unit's exposure to threatening UAS while coordinating UAS position.
- Monitor threat UAS actions and coordinate engagement support of threat UAS if needed.

4-22. Combined arms forces that encounter hostile UAS may have limited time to engage due to the speed and altitude of the UAS. Air space control officers may encounter similar difficulties based on; the capabilities of sensors used within their early warning network, the low radar cross sections of many UAS, or targeting impacts due to congestion of the airspace. Considering these factors, engagement control should be released to the lowest levels of engagement authority to ensure early engagement opportunities.

4-23. Air defense operations and air ground integration personnel have established coordination techniques and reporting procedures available to aid commanders' in countering unmanned air threats. See ATP 3-91.1 and FM 3-01 for further reference on C-UAS threat and reporting.

Reporting of Enemy UAS

4-24. Proper force protection planning measures and training of personnel will assist commanders with detecting, identifying and defeating UAS threat. Units must have established enemy UAS reporting procedures. Units must also develop counter-UAS tactics, techniques and procedures within their area of responsibility. These methods should include; observation techniques, airspace coordination, self-defense techniques, accurate time on station reporting, UAS position and heading estimations, as well as proper coordination with ADAM, air ground integration elements, and maneuver targeting cell for airspace clearances. Reporting procedures must integrate with other units including signal personnel for spectrum management and alerting activities.

4-25. Once an enemy UAS is identified and its location is confirmed an engagement will be coordinated. The commander will need to know if there are any patterns that can be established to assist in determining their employment (time or event driven). The focus of engaging any enemy UAS platform is also finding and neutralizing its launch point and controller. Finding the point of origin may require gathering and leveraging

all sources of information and intelligence from a variety of sources. For example, using sensors (audible, radars, imagery, and human intelligence) or maintaining visual means.

SMALL ARMS DEFENSE TECHNIQUES

4-26. Small arms techniques used in air defense incorporate the use of volume fire and proper aiming points according to the targets direction. If Soldiers are trained to apply an appropriate sequence of engagement techniques for aircraft based on the rules for selecting aiming points, the response will be automatic upon command. You will have effective air defense using the small arms available to your unit. Small arms are limited to the range and destructive capability of the weapon and should be used only on low flying aircraft.

Small Arms Engagement

4-27. The decision to fire small arms against threat aircraft is the unit commander's and is based on his judgment of the situation. Considerations should at a minimum include the severity of the threat versus the potential impact of the units effectiveness and the area of engagement (urban versus rural). Techniques for delivering small arms fire remains standard across all services. For example, a general rule to follow when engaging attacking aircraft with small arms is to use a technique known as volume fire.

Volume Fire

4-28. Volume fire is an effective method to employ when using small arms fire against aerial threats. The key to success in engaging enemy aircraft with small arms is to put out a high volume of fire towards the immediate threat. The more bullets a unit can put in the sky, the greater the chance the enemy will fly into them (Figure 4-2). Even if these fires do not hit the enemy, throwing up a wall of lead in the sky can intimidate enemy pilots, ultimately breaking off their attack or distracting them from taking proper aim. One of the most important points about volume fire is that once the lead distance is estimated, you must aim at the estimated aiming point and fire at that single point until the aircraft has flown past that point. Maintain the aiming point, not the lead distance. Once you start firing, do not adjust your weapon.

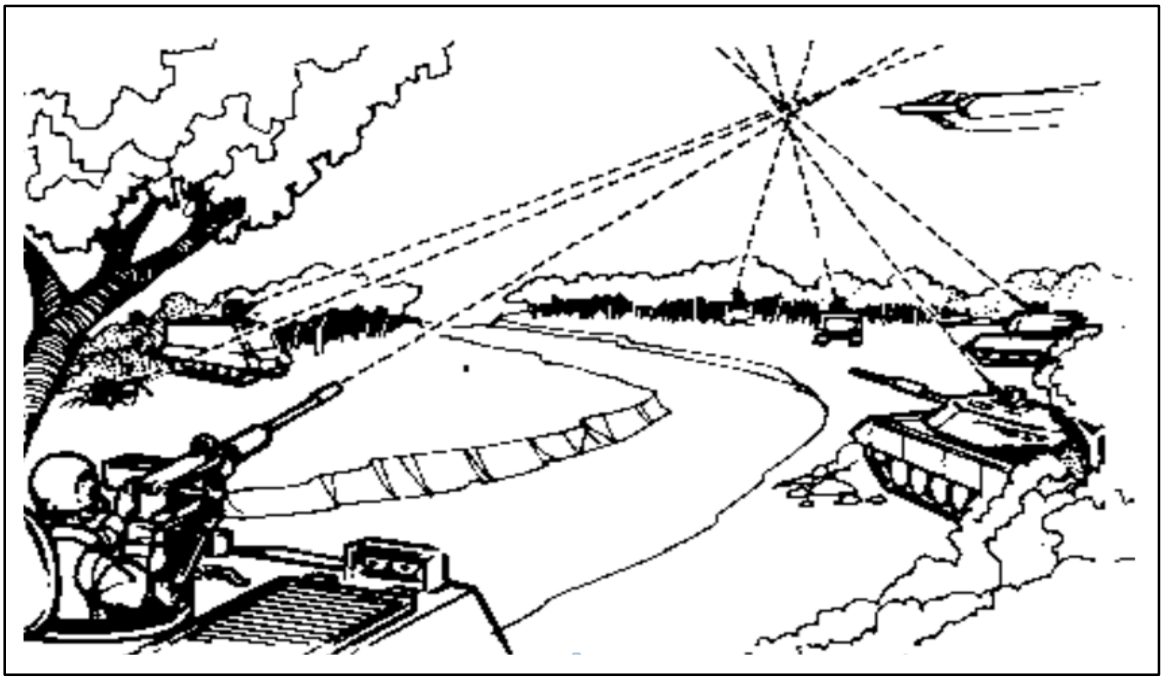

Figure 4-2. Volume fire.

4-29. When the decision is made to engage an aircraft with small arms, every weapon (M4, M240, M249, and M2) should be used with the goal of placing as many bullets as possible in the enemy's flight path. That does not mean that everyone fires in some random direction. Instead, each individual selects an aiming point

in front of the target and fires at that point. This aiming point is determined using the football field technique. When deciding to fire upon an enemy aircraft, practical considerations need to be taken into account before engaging. An example is engaging a helicopter attacking you from a standoff range of 3 kilometers. It is important to consider the capabilities of the weapons you have available to you. Using small arms at this range is ineffective while the best possibility may be the use of the main gun on a tank or tracked vehicle.

4-30. Small arms have a low probability of kill against attacking aerial platforms due to their travel speeds and maneuverability. The use of coordinated group firing, using all organic weapons will make the pilot aware that they are under fire disrupting their concentration and potentially causing them to miss their target or abandon their attack.

Football Field Technique

4-31. The football field technique is a simple method of estimating lead distance. The theory is that most people have played or watched football and have a concept of how long a football field is. When told to lead the target by one football field, everyone aims at approximately the same point in space. One person's error in making the football field estimate will be offset by another person's error. The variation in aiming points will ensure that massed fire is delivered into a volume of space in front of the target rather than on a small point. Also, the differing perspectives from which the Soldiers view the target will act to further distribute the fire over a volume of space. Figure 4-3 and figure 4-4 below shows an example of this technique used with aiming points for both fixed- and RW aircraft.

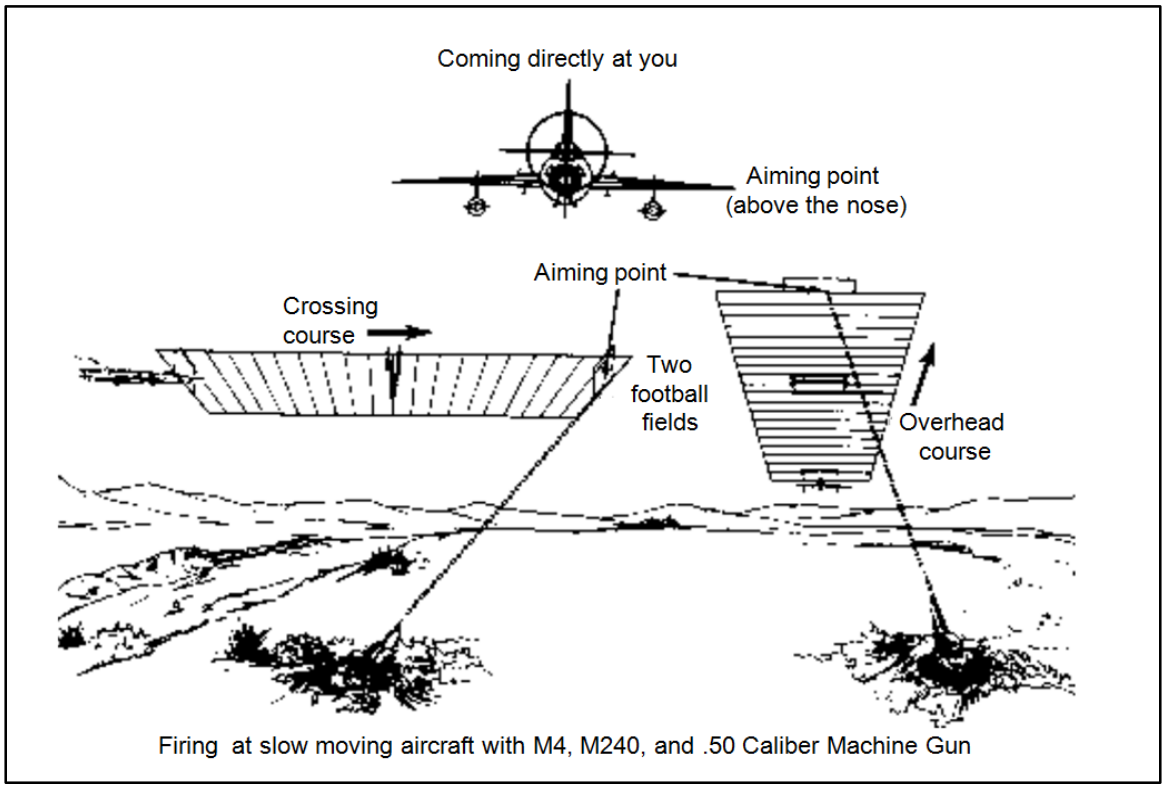

Figure 4-3. Football Field Technique: Jet aiming points.

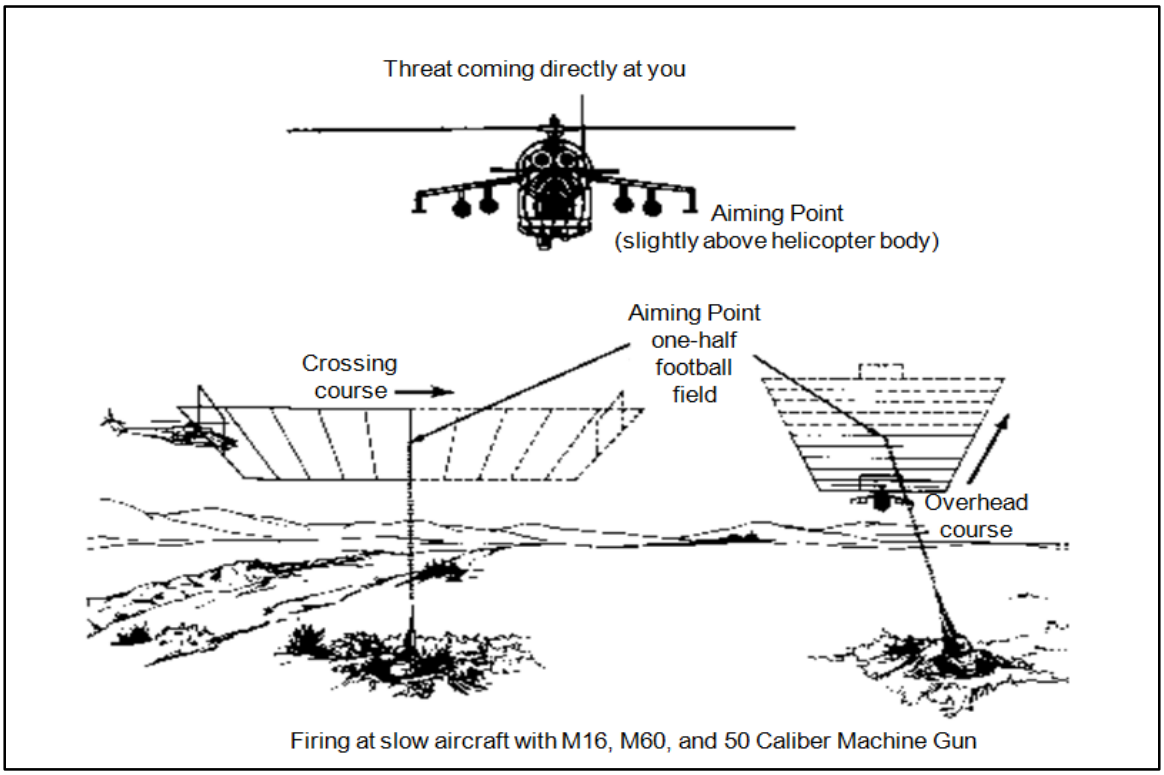

Figure 4-4. Football Field Technique: Helicopter aiming points.

Aiming Points

4-32. Aiming points used to engage hostile jets and helicopters are different but may be used on a variety of different threats. An example of this technique would apply if missiles were detected and the decision was made to engage, they should be engaged using the FW aiming point technique. UASs should be engaged using the helicopter aiming point technique. The rules for selecting aiming points are simple, easily learned, and retained. The various aiming points are summarized in Table 4-1.

Table 4-1. Aiming Points.

AERIAL PLATFORM TYPE	*COURSE*	*AIMING POINT*
JET / CM	Crossing	Two football fields in front of the nose of the platform
JET / CM	Overhead	Two football fields in front of the nose of the platform
JET / CM	Directly At You	Slightly above the aerial platform nose
Helicopter	Hovering	Slightly above the helicopter body
Helicopter	Directly At You	One half football field in front of the nose
UAS / LSS	Crossing	(UAS Group 1) half a football field in front (UAS Groups 2 and 3) one and a half football fields in front
UAS / LSS	Directly At You	Slightly above UAS body
UAS / LSS	Hovering	Slightly above UAS body

CM cruise missile
JET JWICS earth terminal
LSS low, slow, small (UAS)
UAS unmanned aircraft system

FIRING POSITION TECHNIQUES FOR SMALL ARMS

4-33. Except for the prone position, the firing positions used in rifle marksmanship are the same firing positions used to counter aerial threats with small arms (see Figure 4-5). Firing at aircraft when lying down means the individuals are lying on their backs (supine), aiming their rifles into the air. If you are in an individual fighting position, stay there and return fire from the supported standing position. If you are not in an individual firing position, you should look for a tree, a large rock, or supportive object to help stabilize the weapon and provide protection. Use the following firing positions accordingly:

- You can use all the basic firing positions for air defense except the prone position. Instead, use the reverse position; lie on your back (supine) and point your weapon upward.
- Always take cover when available. If you are in an individual fighting position, stay there. Assume a supported standing position and return fire. The bipod on the M249/240 machineguns rifle assists you in firing your weapon more effectively at hostile aerial platforms.
- If cover and concealment are good, use the high-kneeling position. If cover and concealment are less substantial, use the low kneeling position.

4-34. When using the M240 machine gun, the gunner will also fire from a protected position if possible. He needs to get the weapon up in the air. He can hold it up or use some support such as a tree limb. In an emergency, another Soldier can act as a hasty firing support.

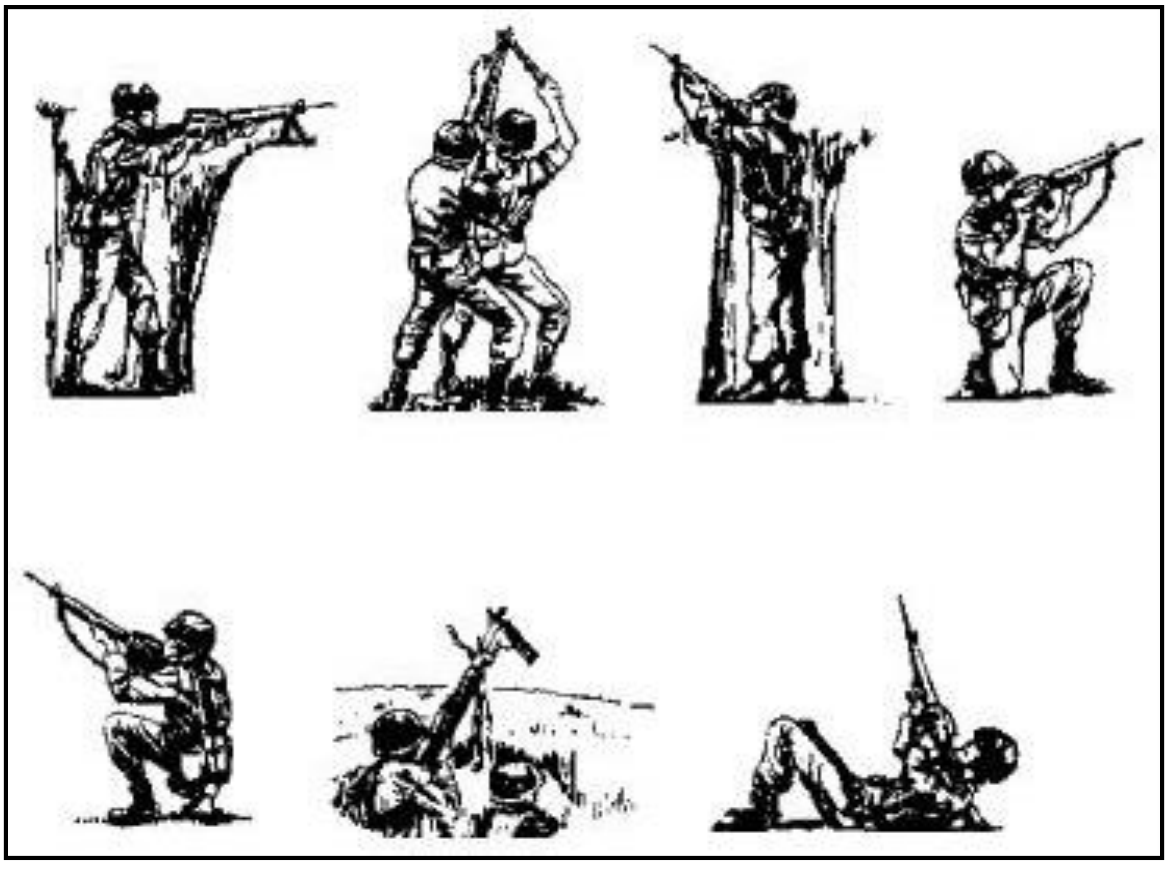

Figure 4-5. Firing positions.

ENGAGING WITH M1 SERIES TANK or STRYKER MACHINE GUNS

4-35. The machine gun is effective against slow-moving, FW aircraft and helicopters. To sustain the volume of fire and kill a target, a continuous burst of 20-to-25 rounds fired using a tracer on target method, allowing the gunner to adjust rounds on target. If equipped with MK19 grenade launchers, the greater dispersion factor gives the use of high explosive rounds a higher probability of kill against the threat.

4-36. Tank commander's machine guns are useful weapons against unarmored threats. They can be fired quickly unleashing a high volume fire. Ensure that the area is clear of friendly personnel. Use the following guidelines when using crew served weapons:

- When targets are hovering or inbound, aim high with the machine gun and fire a continuous burst, adjusting onto target by observing the travel and impact of tracers remembering, tracers may appear to be striking the target when they are actually going under it.
- If engaging a moving target, track along its flight path using a lead of 50 meters or half a football field. Fire a continuous burst, forcing the target to fly through the cone of fire.

4-37. Stryker squads are trained to use machine guns against FW aircraft, unarmored helicopters, and airborne troops (it is ineffective against heavily armored helicopters such as the Hind). When used, the machine gun must fire a continuous burst (50-to-100 rounds) at the aiming point, while squad and crewmembers use time on target to bring the rounds on target. Just as in ground engagements, the maximum effective range of the specific machine gun will apply.

4-38. Ideally, when the Stryker must engage high-speed aircraft, mounted and Infantry rifle elements, direct small-arms weapons and controlled machine gun fire on a designated point. The platoon leader, platoon sergeant, or squad leader can initiate this type of fire by issuing a predetermined command or by firing tracers to indicate the target. He applies a 200-meter lead (the length of two football fields) on approaching aircraft. When coordinated effectively, the aircraft will fly through the platoon's cone of fire. Vehicle commanders must not try to track high-speed aircraft because they fly too fast.

4-39. When enemy aircraft fly directly at Stryker vehicles, vehicle commanders are responsible for engaging them with controlled machine gun bursts of 50-to-100 rounds. They are trained to select an aiming point slightly above the nose to position the aircraft in the cone of fire.

4-40. To engage aircraft, the squad leader or vehicle commander chooses one or more reference points (Figure 4-6). For example, the platoon leader alerts the platoon. Then as an aircraft nears a reference point, the platoon leader will order, ENEMY AIR, REFERENCE POINT TWO, and then FIRE. The Stryker(s) and rifle Infantry Soldiers fire all weapons at a 45-degree angle above the reference point.

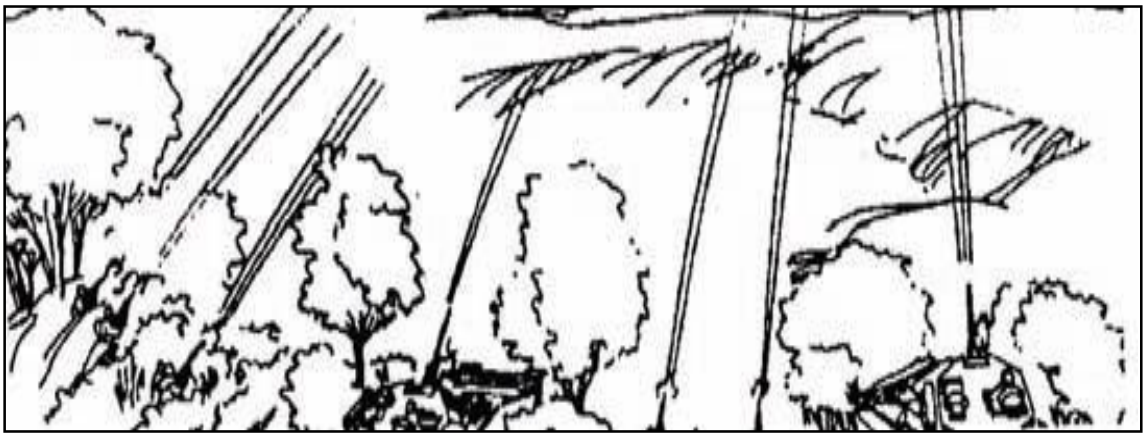

Figure 4-6. Reference-point technique.

ENGAGING FAST-MOVING AIRCRAFT

4-41. Because of the speed of jets, the best technique to use against them is to fire all tank automatic weapons in continuous bursts. If the jets are inbound, aim slightly above the nose or fuselage and fire. If the jet is crossing, use a lead of 200 meters (two football fields) and fire letting the jet fly through the cone of fire from the machine guns. Do not try to track or traverse your fire with the jet since it flies too fast.

PRACTICE SEQUENCE OF ENGAGEMENT

4-42. A coordinated, high volume of fire will get results; precision is not important. Fire is delivered on command and not at the option of the individual Soldier. The sequence of engagement might be as follows:

- An aircraft commences an attack on the unit.
- The soldier or the air sentries spot the attacker. In either event, the unit is alerted to the attack and decide to engage the target.
- Alert the unit. For example, "Air attack, inbound 5 o'clock, prepare to fire."
- Each member of the unit prepares his weapon to fire by placing the weapon in full automatic mode. Each soldier locates the target, finds their aiming reference point as determined by the rules and waits for the command to fire.
- The leaders estimate the right moment and give the command, "Fire."
- Each individual fires at the aiming point until all ammunition is expended, or until ordered "Cease fire." Everyone immediately reloads and prepares to engage follow-on attackers.

Engaging Helicopters with the Tank Main Gun or TOW

4-43. The main gun should be used against armored threat helicopters. Speed is essential in engaging an attack helicopter. If an attack helicopter is hovering, it is probably preparing to fire a missile. Time is essential; fire any round that is preloaded. The M830A1 multipurpose antitank round is, by design, the most accurate round for engaging helicopters and should be the next round fired after any preloaded round. Several other types of main gun ammunition are effective against helicopters, including high-explosive antitank and armor-piercing discarding sabot rounds. When engaging moving helicopters with an M1 series tank, smoothly track the target while aiming at the center of mass. Lase to the target, wait for the automatic lead to be induced (about 2 seconds), and fire. Be prepared to fire a second round using the same technique used for the first round. The tube-launched, optically tracked, wire-guided missile is a command-guided surface-attack weapon that can also be used to destroy helicopters. It can destroy fortified bunkers, gun emplacements, and other protected positions as well. The tube-launched, optically tracked, wire-guided missile system destroys armored vehicles at ranges from 65 to 4,250 meters, depending on the type of missile used.

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Appendix A

ASSET PROTECTION

This appendix describes the concept of AMD operations in the context of employing ADA capabilities in the defense of area and point protection.

CONCEPT OF AMD OPERATIONS

A-1. AMD is inherently a joint effort due to its role in defensive counter air operations. The joint force commander is responsible for providing the guidance, priorities, tasking, and concept of operations to subordinate commanders operating within a joint operations area. The joint force commander and his staff develop the operations plan (OPLAN) that describes the mission, situation (including intelligence, preparation of the battlefield), concept of operations, and tasks that must be accomplished to effectively execute coordinated counter air operations. This leads to the issuance of an operations order (OPORD) which identifies the priorities and critical assets that must be protected and levels of protection required. These assets are identified in the defended asset list (DAL), which is prioritized by operational phase.

A-2. The OPORD also defines the protective relationship between AMD forces and the combined arms units. The OPORD describes; command and support relationships, provides coordinating instructions and ROE for the AMD threat sets which includes air breathing threats (manned and unmanned aircraft platforms) and ballistic missiles.

A-3. The command and support relationship between air defense units and tactical level commanders may differ depending on METT-TC. For example, units in direct support to the corps and division normally remain under the operational control of the corps or division, whereas ADA units in a theater role support corps and division with area coverage. Due to the limited resources of air defense, tactical control is retained at the air operations center and the level of protection will vary depending on the supported commander's priorities and location. In this case, combined arms commanders must coordinate with the corps or division air-ground operations element for protection during operations that takes them outside the established area of protection.

A-4. During movement and at a halt, the combined arms forces may have attached SHORAD weapons systems and sensor capabilities that provide lower-tier air defense for point a defense which includes early warning to alerting functions. It is recommended that combined arms commanders plan their operations taking into consideration that unit movements often affect local air defense coverage within their area of operations. Combined arms forces should conduct preliminary planning and coordination with air-ground integration activities. Coordination should also be made with adjacent air defense airspace management cells, battlefield coordination detachments or AMD liaisons informing them of plans to continue air defense coverage and early warning while maneuvering.

A-5. Air defense planning integrates AMD capabilities and airspace requirements to include air and missile warning, cueing information requirements, combat identification procedures, and engagement authority as required. Based on this planning, air defense units will be task organized by either the U.S. Army AMD Command (AAMDC) or corps based on the capability needed. Coordinated planning ensures the combined arms effort is integrated and synchronized with the overall AMD effort.

MISSION PLANNING

A-6. Mission planning involves steps and process for determining the critical asset list (CAL) and the DAL. This includes risk management used to protect the commander's critical assets. Risk management considers all hazards that have the potential to injure or kill personnel, damage or destroy equipment, or otherwise impact mission effectiveness. Risk management provides an adaptive process for combined arms units to conduct continuous assessments and assists in identifying control measures where specific standards may not

exist. For commanders and staff, risk management begins during planning and continues throughout the operations process.

A-7. DAL development is an interactive process that involves subordinate commands. After reviewing the initial DAL, subordinate commanders and their staffs may nominate additional assets for inclusion in the DAL. The joint force commander and his staff may incorporate one or more nominees and issue an updated (re-prioritized) DAL, which then becomes the basis for AMD planning and defense design.

A-8. Other critical planning guidance provided by joint force planners includes the airspace control order (ACO) and the air tasking order (ATO). The ACO implements the airspace control plan, and provides the details of the approved request for airspace control measures. The ATO also provides specific instructions for tasking forces/capabilities/sorties to specific missions and targets. The ACO is part of the ATO, although it may be transmitted separately. Both are provided to all subordinate echelons of command. All components of the ACO and the ATO should be included in the planning process to give commanders and staff a complete understanding of the air battle.

A-9. The service and functional component commander (for example, Army Forces Commander or Joint Forces Land Component Commander or the Joint Forces Air Component Commander) reviews the joint force commander 's OPORD, including the mission, situation, concept of operation, tasks to be accomplished, DAL, and other pertinent mission related information. The joint force commander will normally task the Joint Force Air Component Commander (JFACC) and AADC to develop the DAL with input from all components. Part of the planning process along with the DAL will contain the levels of engagement effectiveness needed to protect defended assets. The role of the JFACC and AADC is to provide centralized direction, coordination, and integration for counter air operation capabilities.

A-10. The joint force commander defines the JFACC's authority and responsibilities, which may include, but are not limited to, planning, coordinating, allocating, and tasking for joint civil affairs operations based on the joint force commander’s concept of operations and air apportionment decisions.

A-11. JFACC or AADC staff planners develop and distribute a rough first-order ADP to the components. The role of the AADC is synchronizing land-based air and missile operations. With input from other components, the staff then produces an operation's plan or OPORD conveying the joint force commander’s strategic and operational objectives but focusing on the service and functional component area of operations. The threat composition must be evaluated in the planning process to determine the objective. The OPORD is then sent to subordinate commands, which include the AAMDC and corps.

AAMDC PLANNING

A-12. The AAMDC has overall responsibility for planning Army AMD operations in support of the ARFOR commander or Joint Forces Land Component Commander. Planners review the assigned mission, critical assets to be protected, the enemy situation, and the composition and disposition of AMD resources available to protect critical assets against the known threat. This is based on the IPB process. They then perform a top-level defense lay down to estimate if available AMD resources can adequately protect critical assets. If required, levels of protection cannot be achieved; additional resources are requested from the service or functional component commander (or the commander is advised of the risk to forces or assets) to support asset defenses. See FM 3-01 for AMD planning responsibilities of each echelon.

A-13. Based on this planning, the AAMDC task organizes the subordinate ADA brigade(s) and assigns missions to the brigade(s). If the AAMDC is not present in theater, the responsibility for this planning falls to an ADA brigade. To ensure the overall Army AMD effort within the theater is coordinated and synchronized, the AAMDC must coordinate planning with the corps and division ADA elements.

CORPS PLANNING

A-14. Corps planners perform essentially the same planning functions and produce the same planning products as the AAMDC planners, except the focus is on protecting maneuver forces and critical assets within the corps area of operations. Because the corps lacks robust automated AMD planning capabilities, it may rely upon a supporting ADA brigade to perform most of the AMD planning. This planning may include development of the AMD support annex to the corps OPLAN. In developing the AMD annex, the ADA

brigade, in coordination with the corps (and division level elements if applicable) will use its organic planning staff and capabilities to best meet mission objectives. The ADA brigade may leverage subordinate units to assist in this development. This will likely include Patriot battalion staff personnel and air defense airspace management personnel as well.

A-15. Based on this planning, the corps task organizes its subordinate air defense elements and coordinates with the supporting ADA brigade and liaisons for support. AMD asset availability and mission assignments are based on priorities and overall scheme of maneuver. The ADA brigade also coordinates with the AAMDC to ensure the corps effort is integrated and synchronized with the theater Army's AMD effort.

ADA Brigade Planning

A-16. The brigade commander and his staff review the OPORD received from higher headquarters, including the mission, situation, concept of operation, tasks, Air Defense priorities and other information. He and his staff then produce an OPLAN that describes how tactical operations in the brigade area of operations will be carried out. This plan includes the restated mission, tasks to be performed, resources to be allocated, assets to be protected, number of FUs needed to protect assets, and coordination and control measures to be followed.

A-17. The number of fire units needed to defend an asset can be determined by using the DAL and the levels of engagement effectiveness prescribed by the joint force commander. Critical assets are posted to a database/overlay, and provided to subordinate battalions along with the OPORD. Changes by phase to the DAL or reprioritization of critical assets on the DAL will normally affect support priorities and require continual assessment by the staff.

A-18. The approved risk mitigation measures, risk decisions, the CAL and the DAL are incorporated into appropriate plans and orders. The protection cell is responsible for developing the concept of protection in the base order, the fires appendix to the operations annex and applicable tabs.

A-19. This is normally accomplished during mission preparation through training, rehearsals, task organization, and resource allocation.

Plans and Orders

A-20. The joint forces commander is responsible for providing the guidance, priorities, tasking, and concept of operations to subordinate commanders. The joint force commander and his staff develop an OPLAN that describes the mission, situation (including IPB), concept of operations, and tasks that must be accomplished to effectively execute defensive counter air operations. After the OPLAN has been issued, an operational order is then developed. The OPORD is a directive issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. The OPORD identifies critical assets that must be protected and levels of protection required. These assets are identified in the DAL, a prioritized listing of assets by operational phase. The OPORD also describes command and support relationships and provides coordinating instructions and ROE for both TBMs and hostile aircraft.

A-21. Depending on the situation and the threat, protection tasks may be conducted for either a short or a long duration, covering the course of several missions or an entire operation or campaign. The staff must coordinate the commander’s protection priorities and risk control measures and clearly communicate them to—

- Superior, subordinate, and adjacent units.
- Civilian agencies and personnel that are part of the force or may be impacted by the task or control.

A-22. Upon publication of the OPORD, the protection cell and the protection working group are responsible for monitoring the situation to ensure that the protection tasks approved by the commander are executed according to the plan.

A-23. The command staff incorporates risk management into their running estimates and provides recommendation for control measures to mitigate risk within their particular area of expertise. The unit’s protection coordinator has primary responsibility for ensuring risk management is integrated during all operations process activities:

- Commanders and staff use the factors of METT-TC to support hazard identification.
- Insufficient time for mission preparation often forces commanders to accept greater risk in planning, preparation, and execution of orders and plans associated with mission planning.
- During hazard assessment, the members of the protection cell identify and prioritize the commander's critical assets through the use of the vulnerability assessment and criticality assessment.

AIR AND MISSILE DEFENSE PLANNING

A-24. AMD planning involves joint, multinational, and Army units including the joint forces command, service or functional component commands, AAMDC, the corps, the ADA brigades, the Patriot battalions, and batteries. At each level of command, planning begins with the receipt of a mission from higher headquarters and culminates in the issuance of an OPLAN, which provides planning direction to subordinate commands. The designation plan is usually used instead of order in preparing for operations well in advance. An operation plan may be put into effect at a prescribed time, or on signal, it then becomes the operation order.

A-25. AMD planning is performed concurrently at all echelons, a process known as parallel planning. Figure A-1 shows the planning process performed at each echelon as well as the planning products exchanged between echelons. This planning is summarized in the paragraphs below.

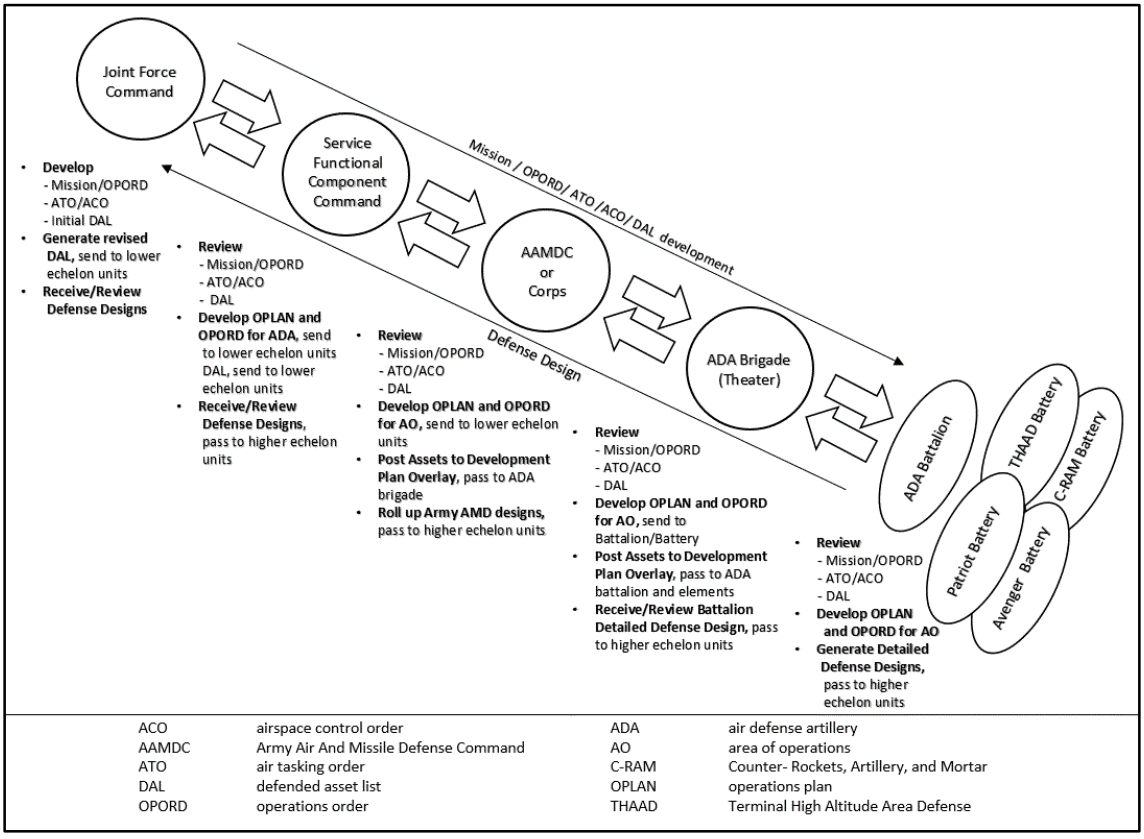

Figure A-1. AMD planning process

CAL/DAL AND MISSION PLANS

A-26. Planning tasks for CAL/DAL development include, joint targeting and coordination, and defense design which continue throughout all phases of an operation. CAL/DAL development is based on the commander's priorities by phase of an operation, availability of AMD resources, and levels of desired protection for each asset.

CRITICALITY ASSESSMENT

A-27. A criticality assessment identifies key assets that are required to accomplish commander's mission. It addresses the impact of temporary or permanent loss of key assets or a unit's ability to perform its mission. It examines costs of recovery and reconstitution including time, dollars, capability, and infrastructure support. The staff must gauge how quickly a lost capability can be replaced before giving an accurate status to the commander. The general sequence for a criticality assessment follows:

- List the key assets and capabilities.
- Determine whether critical functions or combat power can be substantially duplicated with other elements of the command or an external resource.
- Determine the time required to substantially duplicate key assets and capabilities in the event of temporary or permanent loss.
- Prioritize responses threats to personnel, physical assets, and information.

A-28. DAL development is an interactive process that involves subordinate commands. After reviewing the initial DAL, subordinate commanders and their staffs may nominate additional assets for inclusion in the DAL.

A-29. The joint force commander and his staff may incorporate one or more nominees and issue an updated (re-prioritized) DAL, which then becomes the basis for AMD planning and defense design.

A-30. Other critical planning guidance provided by joint force planners includes the ACO and the ATO. The ACO implements the airspace control plan, and provides the details of the approved request for airspace control measures. The ATO also provides specific instructions for tasking forces/capabilities/sorties to specific missions and targets. The ACO is part of the ATO, although it may be transmitted separately. Both are provided to all subordinate echelons of command. All components of the ACO and the ATO should be included in the planning process to give commanders and staff a complete understanding of the air battle.

A-31. The protection cell staff continuously updates the hazard assessment during the operations process. As the staff identifies and modifies a friendly COA, reconnaissance confirms or denies information requirements. As the threat changes, the risk to the force changes. New risks may require different mitigating measures. The protection cell analyzes changes that may require modifications to protection priorities.

A-32. A vulnerability assessment is a command, or unit-level evaluation (assessment) to determine the vulnerability of an air terrorist attack against an installation, unit, exercise, residence, facility, or other site. It identifies areas of improvement to withstand, mitigate, or deter air attack acts of violence or terrorism. The staff addresses the questions of who or what is vulnerable, and how it is vulnerable. The vulnerability assessment determines the susceptibility of the commander's assets to an air attack by the previously assessed threats. The product of the vulnerability assessment is the identification of physical characteristics or procedures that render critical assets, areas, or special events vulnerable to the range of known or potential threats. The assessment provides a basis for developing controls to eliminate or mitigate vulnerabilities. Vulnerability is the component of risk over which the commander has the most control and greatest influence. The general sequence of a vulnerability assessment is below:

- List assets, capabilities, and the threats against them.
- Determine common criteria for assessing vulnerabilities.
- Evaluate the assets and capabilities for their vulnerability

A-33. After determining what assets to protect and comparing them to the risk, the protection cell develops risk mitigation measures and makes recommendations to the commander. The CAL is the primary tool used by the protection cell to mitigate risk.

Critical Asset List (CAL)

A-34. The CAL is a prioritized list of assets, normally identified by phase of the operation and approved by commander that should be defended. Once the staff has completed the hazard, criticality and vulnerability assessments, the prioritized list of critical assets is presented to the commander for approval. Commanders typically operate in a resource-constrained environment and have a finite amount of combat power to use for

protecting assets. Therefore, the staff must determine which assets are critical for mission success and recommend priorities with available resources. The list will vary depending on the factors of METT-TC.

Defended Asset List (DAL)

A-35. The vulnerability and criticality assessments, when compared to the assessed hazards, provide the commander with information to make decisions of which assets are the most critical and must have combat power dedicated to their protection and which ones to he can accept risk. For instance, one of five critical assets considered in a given criticality assessment cannot be replaced during an operation, while the other four can. This lack of replacement may then cause that critical asset to become the first priority for protection.

A-36. Not all assets listed on the CAL will receive protection from continuously applied combat power. Critical assets with some protection from applied combat power become part of the DAL. The DAL is a listing of those assets from the CAL prioritized by the commander to be defended with the resources available. The combat power applied may be a weapons system, electronic sensor, obstacle, or some combination of them all. Both the CAL and DAL are dynamic lists.

A-37. Figure A-2 illustrates how the protection cell determines the CAL during planning. This list is dynamic; it changes depending on the mission, phase of the operation, and situation. The protection cell helps commanders to integrate the risk management process with the decision-making process.

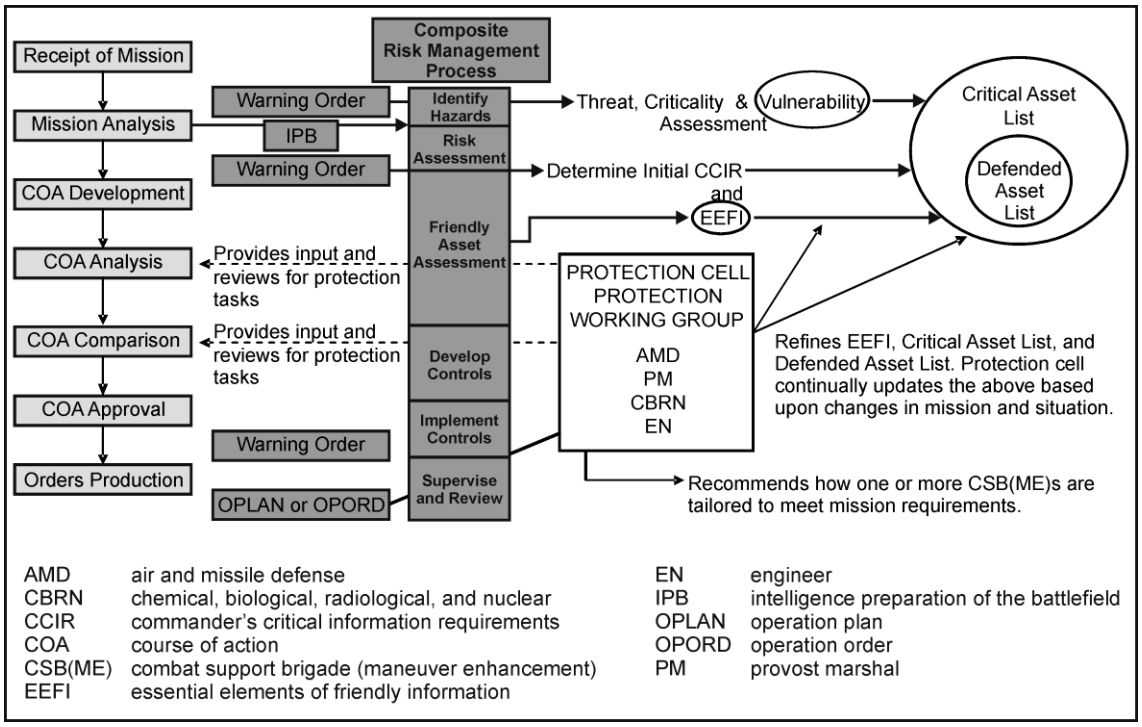

Figure A-2. Example CAL and DAL development.

A-38. All of the information gathered during planning is can be compiled into a matrix. These matrices become useful tools for determining which critical assets present a good target for the enemy and should be on the DAL. Ultimately, the commander approves both prioritized lists for dissemination.

Appendix B

UNIT TRAINING

This appendix discusses methods for unit training as it pertains to the combined arms approach to active and passive air defense measures. Because self-defense against aerial attack is closely related to the defensive measures you take against ground attack, training methods can be focused on varying the perspective attack from the air as opposed to attack from the ground. This is especially true for training techniques related to the application of passive air defense measures (camouflage, concealment, and the use of cover).

SELF DEFENSE ACTIONS

B-1. Soldiers must learn to protect themselves while on the battlefield and the right to self-defense is never denied. Combined arms training should emphasis the importance of recognizing signs and identifying enemy patterns when anticipating air attacks before they happen. Units can survive air attacks by mastering active and passive air defense techniques. Combined arms for air defense measures must be taken when early warning and early recognition fails. Learning techniques for delivering volume fire in the path of attacking aircraft can dramatically effect a unit's survivability changing the outcome. Combined arms forces must be trained to overcome their natural tendencies used to detect, track and identify aerial targets, fire directly at crossing targets, and not to utilize so-called Kentucky windage and Tennessee Elevation techniques. The doctrinal leads have been calculated to give the highest probability of massing the target with fire. In order for Combined Arms for Air Defense to be effective the Soldier must adhere to the unit's ROE and training program. Other training tasks related to Combined Arms for Air Defense is available on the web at Combined Arms Training Strategies (CATS).

PASSIVE AIR DEFENSE

B-2. Training in passive air defense measures is continuous and is integrated with other field training undertaken by the unit. The trainer should vary the training exercise occasionally by injecting an air attack situation. On command, the unit should immediately disperse and seek cover from the attack. If available, use radio control and/or coordinate actual aircraft to fly simulated attack missions so that the troops can get an idea of the time element of an attack. See Table B-1 for an example checklist of items the trainer should review before and during the attack.

Table B-1: Example Passive Air Defense Training Checklist

BEFORE THE ATTACK			
Action			
1	Is an air watch being maintained?	YES	NO
2	Are vehicles and equipment camouflaged?	YES	NO
3	Do the troops know the air attack warning signals?	YES	NO
4	Is dispersion the maximum permitted by the terrain and the tactical situation?	YES	NO
5	Is available cover used for maximum advantage?	YES	NO
DURING THE ATTACK			
Action			
1	Was the warning disseminated in time for the unit to take damage-limiting measures?	YES	NO
2	Did all elements of the unit receive the warning?	YES	NO
3	Was the available cover used effectively?	YES	NO
4	Was dispersion used effectively?	YES	NO
5	Did the commander maintain close control during the attack?	YES	NO
6	Could the unit have engaged the aircraft had the order been given?	YES	NO
Note: If the trainer must mark a "No" in any item under "Before the Attack," stop the training exercise and take corrective action. If he marks a "No" in any item under "During the Attack," he must then assess the unit accordingly.			

ACTIVE AIR DEFENSE

B-3. When training in active air defense measures, the trainer assumes that, the individual Soldier knows how to fire his personal weapon. Therefore, training should concentrate on coordination of fire and on correct lead estimation. Fire coordination consists simply of ensuring that the unit acts as a group and in response to command and/or air attack alarms. This means that each individual knows what he is going to do in response to the command "air attack" and that he does it without further instructions. It also means that he holds fire until he receives the "fire" command.

B-4. All Soldiers need to train on combined arms tasks, whether collective or individual in order to be prepared for air attacks in future conflicts. Units must integrate training for air defense and protection into their tactical training and standard operating procedures. Units must practice the passive and active air defense skills they will employ when deploying, while moving cross-country in tactical formations, or moving in convoy, and while stationary. Units must practice and be evaluated on such skills as posting air guards; maintaining cover, concealment, and dispersion (or seeking cover and concealment if attacked in the open); and proper employment of their weapon systems against air threats. Units must follow the guidance contained in their unit's Standard Operating Procedures. References to assist unit trainers include:

- ADRP 1-03 AUTL, ART 3.4.2.4 Employ Combined Arms for Air Defense
- ADRP 1-03 AUTL, ART3.4.3 Deny Enemy Use of Airspace
- Plan convoy security, FM 3-21.10 The Infantry Rifle Company

Glossary

SECTION I – ACRONYMS AND ABBREVIATIONS

AADC	area air defense commander
AAMDC	army air and missile defense command
ACO	airspace control order
ADA	air defense artillery
ADAM	air defense airspace management
ADP	air defense plan
ADW	air defense warning
AMD	air and missile defense
ATO	Air Tasking Order
BM	ballistic missiles
CAL	critical asset list
CBRN	chemical, biological, radiological and nuclear
CM	crusie missile
COA	course of action
DAL	defended asset list
FW	fixed-wing
IPB	intelligence preparation of the battlefield
JFACC	joint force air component commander
LSS	low-slow-small
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, and civil considerations
OPORD	operations order
OPLAN	operation plan
RAM	rockets, artillery and mortars
ROE	rule of engagement
RW	rotary-wing
SHORAD	short-range air defense
TBM	tactical ballistic missile
THAAD	Terminal High-Altitude Area Defense
UAS	unmanned aircraft systems

SECTION II – TERMS

active air defense

Direct defensive action taken to destroy, nullify, or reduce the effectiveness of hostile air and missile threats against friendly forces and assets. It includes the use of aircraft, air defense weapons, electronic warfare, and other available weapons (JP 3-01).

airspace control authority (ACA)

The commander designated to assume overall responsibility for the operation of the airspace control system in the airspace control area. (JP 3-52)

airspace control order (ACO)

An order implementing the airspace control plan that provides the details of the approved requests for airspace coordinating measures. It is published either as part of the air tasking order or as a separate document (JP 3-52)

air defense (AD)

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

Army forces

The Army component and senior Army headquarters of all Army forces assigned or attached to a combatant command, subordinate joint force command, joint functional command, or multinational command. Also called ARFOR. (ADRP 1-02).

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. Also called CAL. (JP 3-01)

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. Also called DAL. (JP 3-01)

engagement

1. In air defense, an attack with guns or air-to-air missiles by an interceptor aircraft, or the launch of an air defense missile by air defense artillery and the missile's subsequent travel to intercept. (JP 3-01) 2. A tactical conflict, usually between opposing lower echelons maneuver forces. (JP 3-0) See also battle; campaign.

mission command

The exercise of authority and direction by the commander using mission orders to enable disciplined initiative within the commander's intent to empower agile and adaptive leaders in the conduct of unified land operations. (ADP 6-0)

perational environment

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)

passive air defense

All measures, other than active air defense, taken to minimize the effectiveness of hostile air and missile threats against friendly forces and assets. (JP 3-01)

risk management

The process of identifying, assessing, and controlling risks arising from operational factors and making decisions that balance risk cost with mission benefits. Also called RM. (JP 3-0)

rules of engagement

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 1-04)

References

All URLs were accessed on 1 December 2015.

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These sources must be available to intended users of this publication.

ADRP 1-02. *Terms and Military Symbols*. 7 December 2015.

JP 1-02. *Department of Defense Dictionary of Military and Associated Terms*. 8 November 2010.

RELATED PUBLICATIONS

These sources contain relevant supplemental information.

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JP 3-0. *Joint Operations*, 11 August 2011

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29 July 2016

By Order of the Secretary of the Army:

MARK A. MILLEY
General, United States Army
Chief of Staff

Official:

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