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COMBINED ARMS FOR AIR DEFENSE

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COMBINED ARMS FOR AIR DEFENSE

Contents

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Contents (continued)

Preface

Air defense artillery units are a limited resource on the battlefield. Available ADA resources will be dedicated to the protection of assets deemed by commanders to be critical to the success of the tactical plan, leaving other assets without dedicated ADA coverage. All units with or without dedicated ADA support must contribute to their own defense against air attack. This manual is addressed to all unit commanders. It explains the air threat to units on the ground and places the threat in its proper perspective. It also explains how ground commanders can protect their units from air attack through the use of passive and active air defense measures.

This publication implements the following international standardization agreements:

STANAG	TITLE	EDITION
2014	Operation Orders, Warning, and Administrative/Logistics Orders	7
2019	Military Symbols for Land Based Systems—APP-6	3
2034	Land Forces Procedures for Allied Supply Transactions	4
2041	Operations Orders, Tables and Graphs for Road Movement	4
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3805	Doctrine and Procedures for Airspace Control in Times of Crisis and War—ATP-40 (A)	4
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The proponent of this publication is HQ TRADOC. Submit changes to improve this manual on DA Form 2028 and forward to Commandant, US Army Air Defense Artillery School, ATTN: ATSA-DOT-SH, Fort Bliss, TX 79916-3802.

Unless this publication states otherwise, the masculine gender applies to both men and women.

INTRODUCTION

Force-projection operations doctrine reflects the shift towards stronger joint operations. Army operations have evolved into a variety of choices for a battlefield framework and a wider interservice arena, allowing for the increasing incidence of combined operations.

Army participation in air defense is no longer the sole responsibility of army air defense assets. Members of the combined arms team can use their organic firepower along with air defense assets to provide self-defense, suppress enemy air defenses, and provide maneuver force protection.

The table below outlines the Army's participation in air defense operations. It describes the assets of the combined arms team as well as the contributions of each member's organic weapons capabilities to air defense. Army units can use their organic firepower to destroy attacking aircraft and drive others away. Field Artillery, Infantry, Armor, and Aviation contribute to the air defense fight by engaging enemy aircraft in self-defense and by making attacks on enemy airfields and logistics assets that support their aviation units.

ARMY PARTICIPATION IN AIR DEFENSE

ARMY ELEMENTS	AIR DEFENSE CONTRIBUTIONS
AIR DEFENSE ARTILLERY: • THAAD System • Patriot System • SHORAD Systems: •• Avenger •• MANPAD System •• BSFV Linebacker	Maneuver force protection High-value asset protection Counter-RISTA
FIELD ARTILLERY: • Missiles • Cannons • Rockets	Attack critical air assets FARPs Transporter-erector-launchers SEAD
ARMY AVIATION: • Helicopters	Self-defense/AD on order Maneuver force protection SEAD
CHEMICAL: • Smoke Units	Concealment Deception/denial
OTHER COMBINED ARMS: • Organic Weapons	Self-defense Attack critical air assets SEAD
SPECIAL OPERATIONS FORCES: • Skilled Soldiers	Provide surveillance, intelligence, and targeting Attack critical air assets

Chapter 1

Evaluate the Battlefield

This chapter describes how the unit uses the IPB process to assist in executing and integrating air defense into combat operations. This is especially true in special staff sections and units outside the combat arms. The particular needs of these elements require a slightly different focus in the application of the IPB process due to their mission requirements. At the very least, these products must be refined to meet the particular needs of staff or unit that will use them. Primarily, the S2 is responsible for IPB.

THE BATTLEFIELD ENVIRONMENT

1-1. In defining the battlefield environment, one must take into account the actual and possible limitations of the third dimension– the element of altitude. Some areas to consider are–

- Location of threat airfields and launching points.
- Range of aircraft and missiles.
- Physical constraints in the friendly AO.
- Buildings and other structures.
- Power lines and antennas.
- Hills, trees, and other natural barriers to movement and observation.
- Weather.

1-2. The overall structure of the battlefield, at the tactical level of war, consists of the area of interest, battlespace, the area of operations, and battlefield organization. This provides the commanders a way to associate their forces to the enemy in terms of time, space, and purpose.

AREA OF INTEREST

1-3. The area of interest is that area of concern to the commander. It is the geographic area and airspace above it from which information and intelligence are required to successfully conduct the commander's operation. This area also includes areas occupied by enemy forces who could jeopardize accomplishment of the mission.

BATTLESPACE

1-4. Battlespace is a physical volume that expands or contracts in relation to the ability to acquire and engage the enemy. It varies in width, depth, and height as the commander positions and moves assets over time. Battlespace is not assigned by a higher commander and can extend beyond the commander's area of operations.

AREA OF OPERATIONS

1-5. The area of operations is the geographic area, including the airspace above, assigned to a commander in which he has responsibility and the authority to conduct military operations. It is usually defined by lateral, forward, and rear boundaries assigned by a higher commander.

BATTLEFIELD ORGANIZATION

1-6. The commander arranges and synchronizes the battlefield activities throughout his AO to accomplish deep, close, and rear operations simultaneously. The objective is to attack the enemy simultaneously throughout the depth of the battlefield. As a result of battlefield organization, the commander can accomplish the mission more effectively and efficiently.

THE BATTLEFIELD EFFECTS

1-7. Identify the effects of the battlefield on friendly and enemy courses of action. Specific considerations include–

- Likely air avenues of approach.
- Target areas or installations.
- Possible LZs and DZs.
- Location of ADA weapons and radars.
- Standoff ranges.

DETERMINE AIR AVENUES OF APPROACH

1-8. A good air avenue of approach will permit maneuver while providing terrain masking from surface-to-air weapon systems. Some common air avenues of approach are valleys, direct lines from the enemy point of origin, and riverbeds. Determine air courses of action by acquiring the supported command's basic IPB products, including situation templates. Evaluate the general course of action they portray and determine how the threat might support them with air power. Do not attempt to determine air course of action in isolation from the maneuver forces they support. Use the following factors to determine air avenues of approach, both ingress and egress:

Type of Air Threat, Attack Profile, and Ordnance

1-9. UAVs are small and elusive. They usually fly low, but the altitude can vary. Once in the target area, they may fly an orbit attempting to stay out of engagement range of ADA. Most surface-launched cruise missiles follow the terrain and use terrain masking. Due to their range, they may take indirect approach routes. Ballistic missiles are not terrain-dependent. They fly from launch point to objective. Their flight is not restricted by terrain. Tactical air-to-surface missiles usually fly direct routes from launch platform to the target. Rotary-wing aircraft primarily conduct contour flights. They follow ridgelines and military crests, using the terrain to mask their approach to the

target area. Fixed-wing aircraft usually follow major terrain or man-made features. Depending on range, they may fly a straight line to the target. 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 and Ground Control Radar Positions

1-10. When determining air avenues, the staff looks at the commander's entire area of interest. Analysis begins at the threat airfield, UAV, or missile launch site and works toward the probable enemy objective. This allows the commander to look at the big picture. The staff considers the range of the air systems and location of navigation aids and ground control sites.

Probable Threat Objective

1-11. Each avenue of approach must end at a target, drop zone, landing zone, or within reconnaissance, intelligence, surveillance or target acquisition range of a target. Reverse IPB is used to pick threat objectives.

Potential to Support Maneuver Forces

1-12. Air assets, which are used to achieve ground objectives, will seek to use air avenues of approach coincident with ground avenues of approach. Air assets attacking deep are not limited to these ground avenues. Ground corridors do not limit missiles and RISTA UAVs.

Freedom to Maneuver

1-13. Does the avenue of approach–

- Canalize the air system?
- Have access to adjacent avenues?
- Provide the ability to acquire a target and use available munitions?
- Assist in navigation?

Protection for the Air System and Pilot

1-14. Does the avenue provide the following:

- Terrain masking (cover and concealment)?
- Full use of air system speed?
- Protection against radar detection?
- Protection from air defense weapon systems and tactical air support?
- A standoff orbit location?
- A standoff orbit?

Air Threat and Pilot Capabilities

1-15. Can the air system or pilot do the following:

- Perform contour flying?
- Fly at night?

- Fly in all weather conditions?
- Range the targets?

Cloud Cover and Ceilings

1-16. Cloud cover and ceilings may restrict operations by setting low operational ceilings and restricting visibility and target engagement. Low ceilings, overcast, and clouds may restrict visually-directed ADA weapons' detection and acquisition ranges.

Temperature

1-17. Extreme temperature and humidity have a severe effect on aircraft and UAVs by decreasing combat range, altitude (particularly rotary-wing aircraft), and ordnance loads.

CONDUCT TARGET VALUE EVALUATION

1-18. Evaluating target value determines what targets are to be labeled as high-value targets. High-value targets are assets the enemy or friendly commander has deemed as important for the successful accomplishment of his mission. High-value targets are determined by operational necessity and weapon system capability.

THREAT EVALUATION

1-19. Threat evaluation for air operations consists of a detailed study of enemy air capabilities, organization, and doctrine. The following steps should be used when evaluating the threat:

COLLECT AND ANALYZE DOCTRINAL THREAT DATA

1-20. When analyzing threat doctrine data, include the commander's critical information requirements and priority intelligence requirements. Use the following questions as a guide in establishing threat information:

- What are the major strategic, operational, and tactical objectives of the enemy's air operations?
- Which objectives may be targeted for destruction or suppression?
- Where do friendly air defense assets fit into the enemy's objectives? Do they need to be destroyed 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 UAVs and cruise missiles be used; for example, RISTA, attack, or battle damage assessment? What are the associated profiles?
- How does the enemy doctrinally attack? Will the enemy use airborne, air assault, or special operations forces in conjunction with an air or ground 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 are missile and UAV launch points? What are the range, endurance, and profile 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 altitude 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 NBC threats.
- How does the enemy employ reconnaissance assets?
- How has the enemy historically fought? What has the enemy learned from our most recent adversary?

ANALYZE THREAT AIR CAPABILITIES

1-21. ADA units analyze and evaluate air threat capabilities by providing answers to the following questions.

Aircraft

1-22. What are the enemy's capabilities regarding–

- Coordination of air-to-ground attacks?
- Coordination of air and artillery operations? Are ground forward air controllers used?
- 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 UAVs, or aircraft degrade friendly air defense systems?
- Type, quantity, and quality of training the pilot received?
- How much they conform to doctrine?
- Ability of pilots to fly at night or perform contour flying? During peacetime, did the pilot conduct the type of mission expected to be conducted during war?
- Type of threat ordnance evaluated as follows:
  - Range: Assume engagement at maximum range and two-thirds maximum range.
  - Accuracy.
  - Release altitude. How high or low must the aircraft fly?
  - Reload and refire time. What is the number of missiles available?
  - Warhead type (for example, mass casualty, conventional, and submunitions).
  - Release altitude.
  - Guidance modes. How does the pilot acquire and engage?

UAVs

1-23. What are the capabilities of threat UAVs regarding–

- 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 UAV stay on station)?
- Visibility affects on acquisition?
- Modes of recovery and turnaround time?
- Real-time, data-link capability?
- Guidance modes (ground-controlled and preprogrammed)?
- Crew proficiency?

TBMs

1-24. 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 refire time? What is the number of TBMs available per transporter erector launcher?
- Warhead type and size?
- Guidance modes?
- Location of surveyed launch sites?

Cruise Missiles

1-25. What are the capabilities of threat cruise missiles 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?

THE AERIAL THREAT

1-26. The primary aerial threats that must be countered include UAVs such as the Shmel-1, DR-3 Reys, and D-4 NPU in addition to cruise missiles like the AS-4 Kitchen, AS-15 Kent, and C-101. Also, rotary-wing attack helicopters including the Mi-8 Hip, Mi-24 Hind D/E, and Mi-28 Havoc; close air support, ground-attack, fixed-wing aircraft such as the Su-25 Frogfoot, MiG-27 Flogger D,J, and MiG-29 Fulcrum. These aircraft will conduct reconnaissance, surveillance, interdiction, antiarmor, and troop support missions. Only occasional attack by high-performance aircraft can be expected along the line of contact. Elements in the division and corps rear, command and control facilities, and reserve forces, can expect repeated attacks by high-performance aircraft. Surveillance for threat aircraft is a 24-hour mission. The enemy's order of battle, combat capability, readiness, and will to fight are some of the factors that will determine the times and rates of sorties. Convoys of troops, as well as supply trains, will always be vulnerable targets, especially as they concentrate at choke points along the convoy route. The threat generally will consist of attack helicopters and close air support aircraft in the forward area near lines of contact, and ground attack fighter-bombers in the rear areas and against convoys. Because these types of aircraft differ in their capabilities and in the manner in which they conduct tactical operations, they present distinctly different threat profiles.

UNMANNED AERIAL VEHICLES

1-27. Because UAVs are inexpensive, easily procured or manufactured, and versatile, UAVs may one day be the most common threat. There are over 100 UAV programs being pursued by at least 35 countries. Their small radar cross sections make them very difficult to detect and track. Payloads may

consist of radar seekers, high-explosive warheads, forward-looking infrared cameras, laser designators, television, thermal to imaging devices, chaff, decoy, and electronic attack capabilities. Ranges vary from 25 to 800 kilometers, and the upper limit of night endurance reaches 72 hours. They perform a wide variety of missions including RISTA, suppression of enemy air defense, ground attack, decoy, communications relay, and chemical detection. The RISTA mission, which uses enemy UAVs to locate friendly maneuver forces and key assets with the ability to pass real-time information back to enemy long-range attack systems, is the greatest near-term concern for short-range air defense and the force commander. Three potential threat UAVs, the Shmel-1, DR-3 Reys, and D-4 NPU are shown in Figure 1-1.

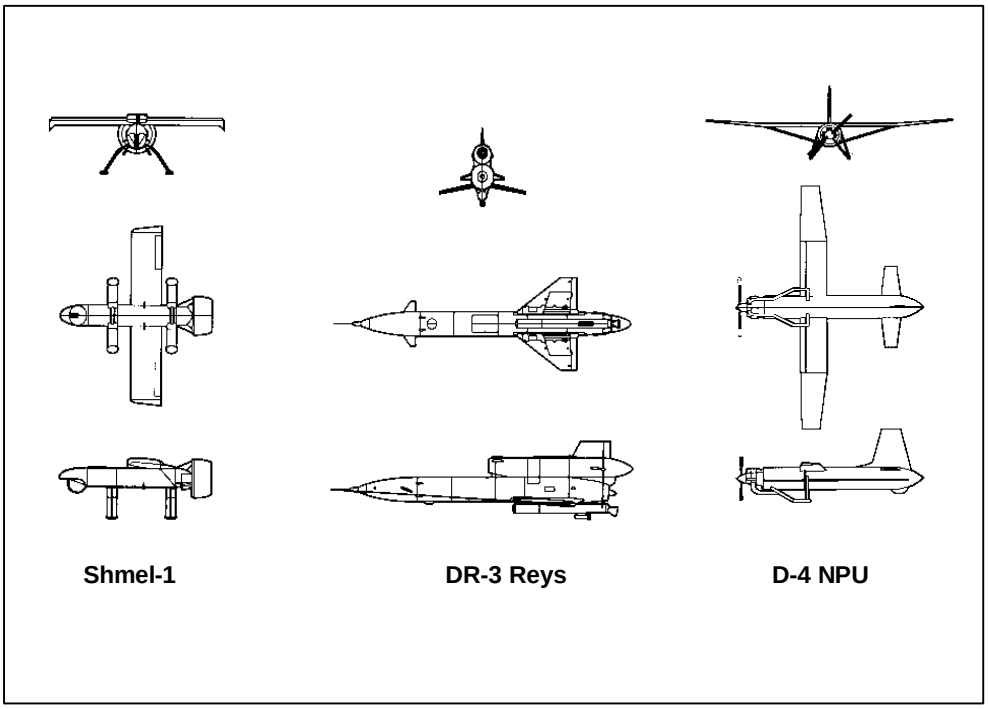


Figure 1-1. Potential Threat UAVs.

ROTARY-WING AIRCRAFT

1-28. Rotary-wing versatility and survivability make it ideal for logistics resupply, air assault, command and control, and heavily armed weapons platforms for attack roles. Rotary-wing aircraft currently exist in every potential theater that US forces may enter. Many countries around the world possess attack helicopters. Armed with stand-off antitank guided missiles, helicopters can inflict heavy casualties on the force and destroy critical assets. The proliferation of helicopters is also of concern. Utility helicopters, combined with stand-off munitions and state-of-the-art target acquisition technology, can produce less expensive, robust helicopter capabilities for any country. Figure 1-2 shows potential threat helicopters, the Mi-8 Hip, Mi-24 Hind, and the Mi-28 Havoc.

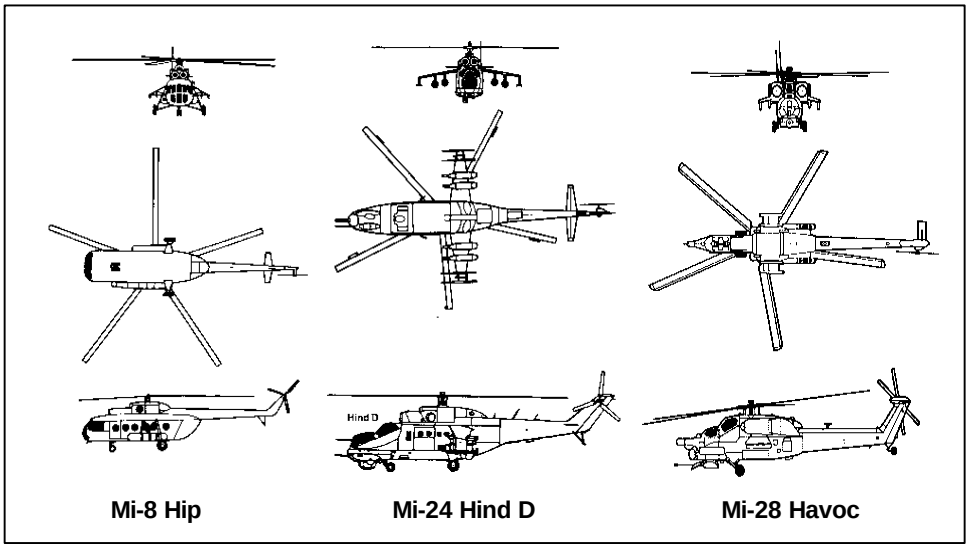


Figure 1-2. Potential Threat Helicopters.

1-29. Threat helicopter forces supporting ground operations operate nearly the same as a US helicopter force. For example, CIS (formerly Soviet Union) helicopters are agile and make good use of cover and concealment offered by folds in the earth and trees (Figure 1-3). Their armament includes antitank guided missiles, free-flight air-to-air missiles, and radar-directed 12.7-millimeter nose or chin-mounted machine- or Gatling-type guns. CIS ATGMs are electronically controlled or laser-guided and can engage and destroy any armored vehicle at standoff ranges of more than 3 kilometers (Figure 1-4). Using sneak-and-peek techniques, 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 ATGMs, attack helicopters must maintain track on both the missile and target throughout the missile's flight, which can be as long as 23.2 seconds. The 57-millimeter FFAR is an area weapon and is effective against exposed troops and lightly armored vehicles at ranges greater than 1,000 meters.

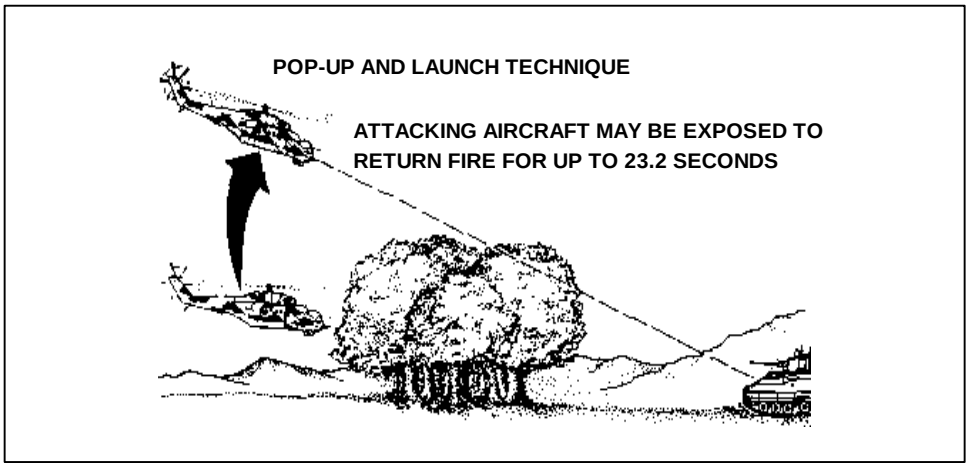


Figure 1-3. Threat Helicopter in Ground Support Role.

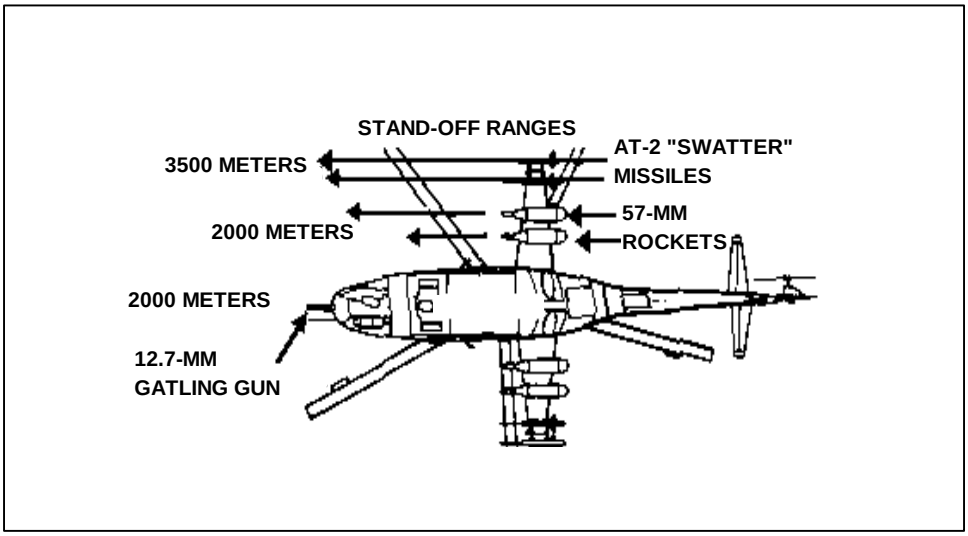


Figure 1-4. Threat Helicopter (Mi-24 Hind) Weapons Range.

FIXED-WING AIRCRAFT

1-30. Although theater missile threats have taken the place of FW aircraft as the principal air threat to ground forces, the following types of FW aircraft may be employed by the enemy against friendly forces: bombers, fighter-bombers, fighters, and close air support aircraft. Any of the FW family may carry TASMs, while only the larger ones will carry cruise missiles. Improvements to FW aircraft will include increased survivability and improved fire control accuracy. Figure 1-5 shows examples of three potentially threat aircraft– the Su-25 Frogfoot, MiG-27 Flogger D, and MiG-29 Fulcrum.

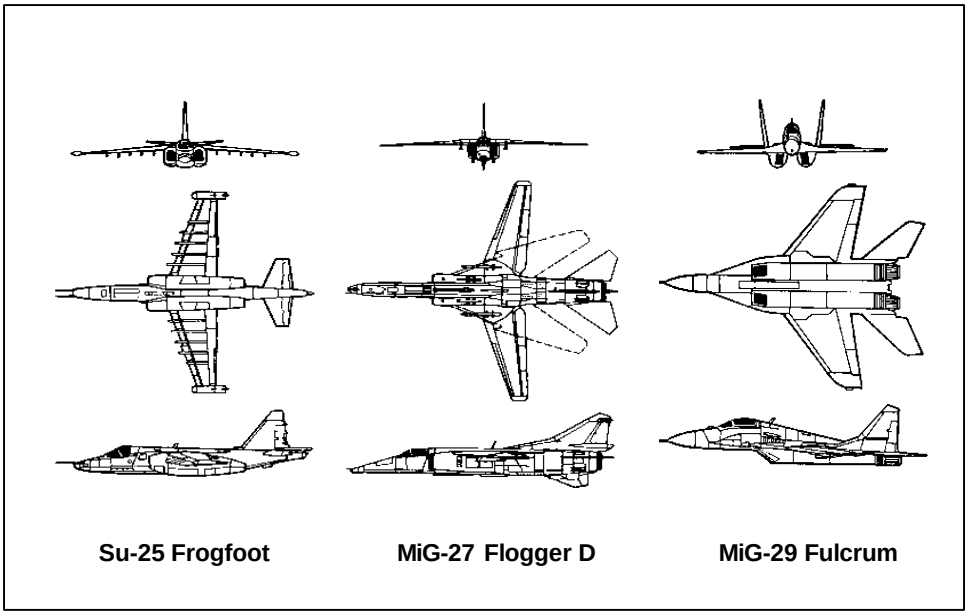


Figure 1-5. Potential Threat Fixed-Wing Aircraft.

1-31. 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 the division and corps rear area where they deliver ordnance selected to optimize destruction effects on the target. 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 generally knows the target location and will carry the correct ordnance for the target. 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 CBUs or FFARs 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

1-32. Air threat employment against US 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 proliferation and equipment, the commander can make assumptions on how a threat may employ air assets to interdict US operations. The following information describes the type of threat to be countered with each stage of force protection operations.

ENTRY PHASE

1-33. Early entry forces may deploy into air inferiority or air parity environment. We can expect the threat to use his entire aerial assets (use or lose) against lucrative targets in the areas of debarkation. Low-altitude aerial threats (RW, CM, and FW) will probably be employed in attack operations against APODs or SPODs, assembly areas, and supply points.

EXPANSION AND BUILDUP

1-34. During this phase, most potential threats will focus on conducting RISTA operations to locate friendly unit movements, assess unit sizes and strengths, and determine their ultimate position. UAVs will be the most challenging aerial RISTA and, therefore, a logical choice for threat use. Information obtained by aerial RISTA 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 RW or FW aircraft, CMs, and lethal UAVs.

OPERATIONS

1-35. We can expect the threat to attempt to counter US defensive and offensive operations with a myriad of aerial platforms. RISTA UAVs will provide the threat commander the necessary information to determine friendly unit locations, movements, and objectives. Aerial and artillery strikes can be generated from the intelligence gathered against the following targets:

- Maneuver force.
- FARPs.
- Aviation FOBs.
- Command and control nodes.
- Reserve troop concentrations.
- Logistical support areas.
- Terrain features.
- Obstacles constricting unit movements as US forces advance to close with the enemy forces.

1-36. Lethal UAVs can be effective in disabling C^3I or destroying armored vehicles. CMs will probably be used against logistical concentration, command and control nodes, or with submunitions for area denial. RW aircraft will be used to attack forward elements and the flanks of the advancing enemy maneuver force to slow their tempo, cause confusion and, thereby, inflict maximum casualties. They can also be expected to conduct operations across FLOT, CAS, and air insertion operations. These armed attack helicopters constitute the most widespread and capable air threats to friendly ground forces in the close battle.

Defensive Operations

1-37. During defensive operations, friendly forces are vulnerable to the full spectrum of threat aerial platforms. The enemy will attempt to use aerial platforms to monitor friendly forces for targeting. We can expect the enemy to use UAVs, RW, and possibly FW aircraft, to determine locations of friendly artillery, command and control, ADA assets, and logistical sites and troop concentration areas. Once these sites are located, threat forces will likely disrupt or destroy these sites with the use of artillery and rocket fire, air attacks, and air insertion.

1-38. The enemy's preferred weapons against air defense assets and US forces will be artillery and rocket attacks. These systems are usually numerous, inexpensive, survivable, and highly effective. UAVs will be employed to provide targeting data during this phase of operations. UAVs 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 preattack and postattack reconnaissance.

1-39. Enemy forces will more than likely conduct threat air insertion operations with either FW or RW assets and probably during the hours of limited visibility. The threat will likely conduct daytime reconnaissance of

landing sites and target areas within 24 hours prior to attack. These operations will fly at low levels attempting to infiltrate into friendly rear areas.

Offensive Operations

1-40. During offensive operations, enemy forces will attempt to use maneuver and fire support assets to regain the initiative. Threat air activity will most likely be categorized by RISTA operations in support of artillery and maneuver. UAVs are best suited for these types of operations, especially if threat forces have developed effective C^3I. Secondary weapon systems the enemy will use are helicopters, either as dedicated attack assets or as armed utility helicopters. Helicopter assets can be used in attack, air insertion, or reconnaissance. Helicopters in the reconnaissance role will operate in the same manner as UAVs to support artillery targeting and maneuver. In the attack, the unit can expect spoiling attacks that usually consist of at least two helicopters or more (taking full advantage of cover and concealment) with the mission of disrupting friendly operations.

1-41. In some cases, the enemy will use helicopters in conjunction with threat armored forces to deter friendly penetrations. However, it is unlikely the friendly commander will see large numbers of helicopters in this role. The enemy will use ground forces first to neutralize friendly air defense assets. Helicopters will be used as the primary CAS aerial platform against maneuver forces.

1-42. Threat FW assets will be limited and their use will be hampered by friendly FW aircraft. Use of enemy FW aircraft cannot be entirely ruled out. If used by the enemy, the ground commander can expect to see no more than one or two aircraft in a spoiling attack, normally not coordinated with enemy ground operations.

THREAT COURSES OF ACTION

1-43. Determine both the threat air and ground courses of action and integrate the results of the previous information into a meaningful conclusion. Given what threat air and missile forces prefer to do and the effects of the operational environment, what are the enemy's likely objectives and what COAs are available to him? The G2/S2 develops enemy threat models that depict the threat's air and missile COAs. They also prepare event templates and matrices that focus intelligence collection on identifying which COA the threat will execute. The process of developing these templates and matrices is covered in depth in FM 34-130.

Chapter 2

Techniques for Self-Defense Warnings

This chapter implements STANAG 2047

This chapter explains how to use proven techniques to accomplish self-defense against air attack. In the past, US forces have had air superiority and the US Army has fought on the battlefield with little concern about surveillance or attack from the air. However, we could face a significant air threat in our next war or military operation. Potential enemies could have significant air capabilities. We can expect that friendly units will be targeted and attacked from the air as well as from the ground. Because air defense artillery has limited resources, many Army units and facilities will not receive 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 EARLY WARNING NETS

2-1. The air defense command and control structure uses air defense warnings, local air defense warnings, and directed early warning to alert all members of the force of hostile air activities. Non-ADA units may monitor ADA early warning nets. These nets contain additional information for ADA units to include more detailed track information. However, the format of directed early warning does not necessarily follow the SALUTE format. Track location will be reported using the same systems as directed early warning. Consult unit SOI to find the appropriate frequencies to monitor.

2-2. Air defense warnings represent the area air defense commander's evaluation of the probability of air surveillance or attack. The AADC issues air defense warnings throughout the entire theater of operations. The three ADWs are red, yellow, and white.

- **ADW Red**. Attack or surveillance by hostile aerial platforms is imminent or in progress. This means that hostile aerial platforms are within a respective area of operations or in the immediate vicinity of a respective area of operations with a high probability of entry.
- **ADW Yellow.** Attack or surveillance by hostile aerial platforms is probable. This means that hostile or unknown aerial platforms are en route toward a respective area of operations.
- **ADW White.** Attack or surveillance by hostile aerial platforms is improbable. ADW White can be declared either before or after ADW Yellow or ADW Red.

2-3. The AADC routinely issues ADWs for dissemination throughout the entire theater of operations. ADWs describe the general state of the probable air threat and apply to the entire area. Any commander, after coordination and approval from the AADC, may issue a higher level of warning for his command but not a lower level. The chain of command must ensure that every soldier knows the current ADW. ADWs will be sent out on ADA command nets and ADA early warning nets at every level. It is the responsibility of air defense officers at every level to inform their respective supported commanders of the current ADW. Army commanders must then inform their subordinate units of the ADW.

LOCAL AIR DEFENSE WARNINGS

2-4. While ADWs describe the probability of hostile air action over the entire theater of operations, LADWs tell with certainty what the air threat is for a specific part of the battlefield. LADWs are designed to alert a particular unit, several units, or an area of the battlefield of an impending air attack. ADA units use LADWs to alert Army units about the state of the air threat in terms of "right here and right now" and can be used in conjunction with ADWs. Examples of LADWS are described below:

- **DYNAMITE–** Attack is imminent or in progress.
- **LOOKOUT–** Attack is likely.
- **SNOWMAN–** Attack is not likely.

LADWs do more than describe the current level of air threat in the immediate area. They also require specific air defense reactions from receiving units. Unit commanders must establish in their TSOPs what they want their units to do when an LADW is received.

RULES OF ENGAGEMENT

2-5. Rules of engagement are the positive and procedural management directives which specify the circumstances and limitations under which forces will initiate or continue combat engagement with encountered forces.

RIGHT OF SELF–DEFENSE

2-6. Commanders at all echelons 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 engagements.

HOSTILE CRITERIA

2-7. Hostile criteria is the description of conditions under which an aerial platform may be identified as hostile for engagement purposes. They are the basic rules for identification of friendly or hostile aerial platforms, established by the appropriate commander. The commander may consider speed and altitude, among other requirements, within a specified airspace

when he establishes the hostile criteria. He may also consider specific enemy characteristics or hostile acts.

WEAPON CONTROL STATUS

2-8. Weapon control statuses—WEAPONS FREE, WEAPONS TIGHT, or WEAPONS HOLD—describe the relative degree of control of air defense fires. Weapon control statuses apply to weapon systems, volumes of airspace, or types of air platforms. The degree or extent of control varies depending on the tactical situation. Establishment of separate weapon control statuses for fixed- and rotary-wing aircraft, UAVs, and for missiles is normal. Air defense forces must have the ability to receive and disseminate weapon control statuses for all classes of air platforms.

- **WEAPONS FREE**: Weapons can fire at any air target not positively identified as friendly. This is the least restrictive weapon control status.
- **WEAPONS TIGHT:** Fire only at air targets positively identified as hostile according to the prevailing hostile criteria. Positive identification can be effected by a number of means to include visual identification (aided or unaided) and meeting other designated hostile criteria supported by track correlation.
- **WEAPONS HOLD:** Do not fire except in self-defense or in response to a formal order. This is the most restrictive weapon control status.

DIRECTED EARLY WARNING

2-9. Directed early warning is designed to alert a non-ADA-supported unit, units, or an area of the battlefield of an immediate or possible threat. It is passed over the supported unit command net or a net designated by the maneuver unit commander as flash precedence traffic. Directed early warning defines the LADW and states whether the aerial platform is friendly or unknown, a cardinal direction, and, if known, the most likely affected asset(s) within the supported force. For example, if an early warning source reports four enemy rotary-wing aircraft inbound from the east, and 1st Brigade is attacking along the eastern axis during a division attack, the ADO reports an LADW and directed early warning message: "Dynamite! Dynamite! Four Hinds from the east against Axis Blue!" Dynamite is the LADW that alerts the division to attack, and the response according to the local SOP must be immediate. The SHORAD battalion TOC will broadcast directed early warning on the division command or O/I net and to the SHORAD battalion.

2-10. When a threat to the supported force is identified, the AD A^2C^2 will transmit LADW on the supported force command net. When the brigade AD LNO receives early warning from the ABMOC or from the ADA sensors, they will direct early warning down on the battery command nets. The AD LNO will transmit directed early warning on the platoon nets and supported force command nets.

2-11. Directed early warning must be quick, simple, and redundant in nature. It is imperative that all units, to include maneuver units, receive early

warning, especially those units that have only minimal air defense coverage. Unit SOP will determine the exact procedures; however, the following elements should be included:

- Preface—A method used to differentiate tracks.
- Identification—Type of aerial platform, location, and time.
- Local air defense warning—Self-explanatory.
- Direction—Self-explanatory.
- Size—Few, many, or actual number.
- Affected asset—Not sent "in the clear" on unsecured nets.

SAMPLE EARLY WARNING SCENARIO

2-12. The following scenario illustrates the use of ADWs, LADWs, and the directed early warning system: The corps commander, based on the recommendation of his ADA brigade commander, declares ADW Yellow to be in effect for the entire corps area of operations as the corps begins its attack. ADA units inform the units they are supporting that the LADW is Snowman. All units assume the appropriate posture for LADW Snowman according to their TSOPs. After a period of time, an aerial platform is spotted in the battlespace but is not threatening, or is inbound and there is time to react. The LADW "Lookout" is sent out to all affected units which heightens the readiness state. Several hours into the corps attack, a maneuver brigade with a direct support ADA battery is making substantial progress along Axis Blue. Suddenly, the ADA battery receives information from air defense channels of an inbound enemy air attack heading for the brigade. The battery commander gets on the maneuver brigade command net and announces, "Dynamite! Dynamite!" When units in the brigade hear "Dynamite!" they should immediately react according to their TSOPs. Responding to the situation, the maneuver brigade commander may increase his ADW to Red. The division and corps commanders may also increase their ADWs to Red. As the air attack approaches, the battery commander would pass on the following DEW message to the affected task force: "Dynamite! Dynamite! Four Hinds attacking from the east against Axis Blue!"

2-13. LADWs may be disseminated in any of several ways in addition to the method described in the preceding scenario. Under ideal circumstances, the ADA battalion or brigade will receive word of inbound enemy air in time to send LADWs to the affected units via the early warning system.

UNIT WARNING

2-14. Air defense, passive or active, is more effective if it is known beforehand that an air attack is imminent. The initial warning should come from the supporting ADA unit or higher headquarters, but the likelihood of a timely alert is increased when an air threat warning system is established within each unit.

AIR THREAT

2-15. Assign air guard personnel and set up a system of TSOP alarms to warn against an impending air threat. Figure 2-1 shows the hand-and-arm signal for air threat.

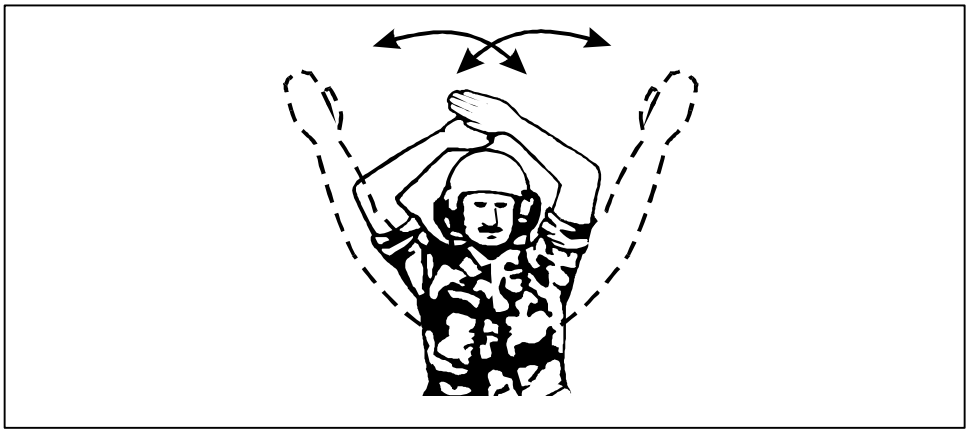


Figure 2-1. Hand-and-Arm Signal for Air Threat.

EMERGENCY AIR ATTACK ALARMS

2-16. To provide a standard method of disseminating emergency warnings within NATO forces, the US armed forces have concurred in the provisions of STANAG 2047. The air attack warning system is included in the unit TSOP. The actual form of a visual signal and method of display are left to the discretion of the local commander. Pertinent extracts are shown in Table 2-1. Only the "red" visual warning in Table 2-1 is mandatory.

Table 2-1. Emergency Air Attack Alarms (NATO).

VISUAL WARNING	AUDIBLE WARNING
Red—imminent air attack (Preferably square in shape)	1. Unbroken warbling siren for 1 minute duration. 2. Succession of long blasts on vehicle horns, whistles, bugles, or other wind instruments in a ratio of 3 to 1; about 3 seconds on and 1 second off. 3. Vocal "Air Attack" or corresponding national term when one nation is involved.
All clear Removal of appropriate warning sign	1. Steady siren note for 1 minute or sustained blast on a vehicle horn, whistle, bugle, or other instrument to indicate absence of all NBC and air attack hazards. 2. Vocal "All Clear Air Attack" or corresponding national term when only one nation is involved.

Chapter 3

Aerial Search

This chapter describes search techniques and systematic methods of search that an observer will use when searching the skies to detect aircraft. An air attack will be sudden and swift. Air guards must learn the techniques of search and how to quickly recognize aircraft performing hostile acts. The use of optical devices such as binoculars and the sighting systems of the M1 and M2 family of vehicles will greatly enhance the air guard's ability to detect and observe enemy aircraft. Air guards can then give the air attack warning immediately to allow maximum reaction time or seek cover and concealment and to prepare their weapons for firing.

AIR GUARD RESPONSIBILITIES

3-1. Assign air guards to be on the lookout at all times for enemy threats. A map reconnaissance of each unit's AO will help locate likely areas from which air targets can attack. Air guards should watch for air threats attempting to take advantage of masking terrain like woodlines, ridgelines, and significant folds in the terrain out to about 5,000 meters. Local OP personnel should incorporate air guard responsibilities into their duties. If an OP does not have a good view of the airspace in his area, position a special sentry to search that sector. Establish a systematic procedure for searching all sectors. Air guards should be rotated frequently, because searching for long periods of time dulls the ability to spot air platforms.

AERIAL SEARCH IN A CONVOY

3-2. In a convoy, every vehicle should have at least one individual assigned as an air guard. Anyone on the vehicle other than the driver may perform this duty. Check the map and mark narrow valleys or other terrain features that may force a unit to bunch together. Then, assign specific search sectors to each air guard keeping those trouble spots in mind. Ensure an air guard watches the rear of the convoy to prevent a surprise attack from this blind side. If the road march lasts more than an hour, have the troops take turns being air guards so that they remain alert.

SEARCH TECHNIQUES

3-3. When searching, especially above the horizon, the eyes will tend to relax and distant objects may become blurred. Focusing the eyes frequently on a distant object such as a terrain feature can prevent blurring. Squinting of the eyes will aid in focusing at long ranges. Squinting changes the eyes' focal length and aids in bringing distant targets into focus. Soldiers should keep their eyes on an air target that they have detected. If they look away, they may lose the target and have to look for it again. If they must look away, they

should try to remember exactly where the air target was and its heading from a specific point such as a terrain feature. Define the search sector size horizontally and vertically, and establish the upper and lower limits of search.

DEFINE THE SEARCH SECTOR SIZE

3-4. The size of a search sector directly affects air platform detection. Air platforms can be detected easier if the search sector is narrow. If assigned a search sector size of 360 degrees, the chances of detecting air platforms are greatly reduced. When supported by an alert warning system, then a fairly large sector of about 90 degrees can be observed. After receiving a warning, narrow the search sector to about 30 degrees and center the search on the air platform's approach azimuth (Figure 3-1).

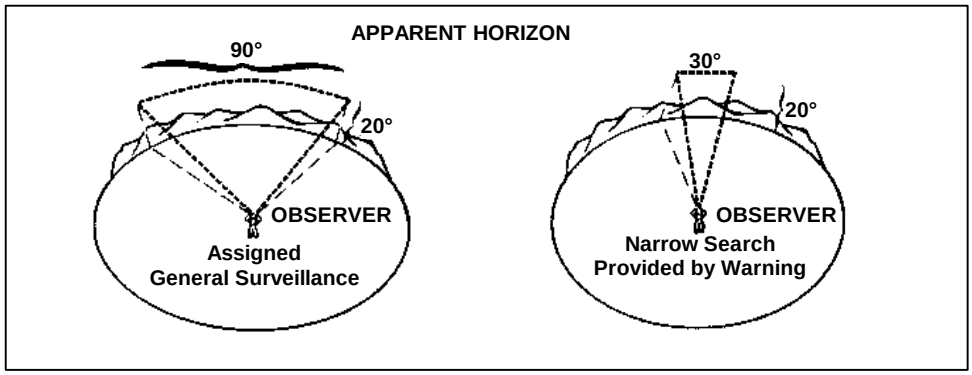


Figure 3-1. Sector Surveillance.

ESTABLISH UPPER AND LOWER LIMITS

3-5. Vertical search limits are helpful in detecting air platforms. When searching the sky for targets, searching too near the horizon will miss higher flying air platforms, while searching too high above the horizon will miss those flying lower. Establish the search area 20 degrees above and 20 degrees below the horizon. This will ensure that targets are detected within the search parameters. To estimate 20 degrees, extend one hand straight in front of the face with fingers fully spread. Point the little finger at the ground and the thumb in the air. With the little finger touching the apparent horizon, the thumb will be at about 20 degrees. The tip of the thumb is the upper search limit (Figure 3-2).

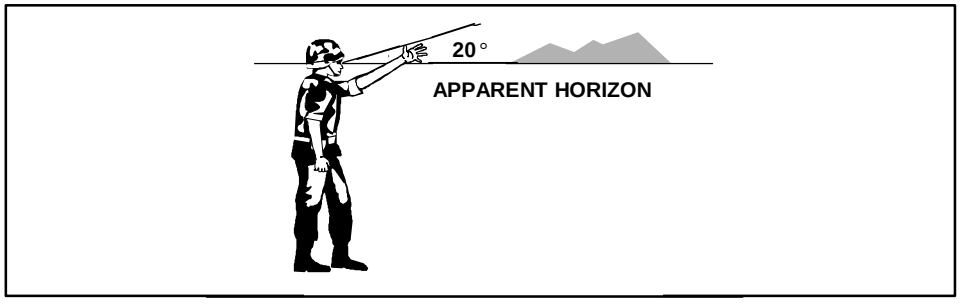


Figure 3-2. One Method of Estimating 20 Degrees.

SYSTEMATIC METHODS OF SEARCH

3-6. There are two systematic methods of search to look for air platforms in any type of terrain. Horizontal and vertical searching are described below.

HORIZONTAL SEARCH

3-7. Search the horizon by moving the eyes in short movements across the sky, working up and across. Continue the searching and search pattern below the horizon to detect air platforms contour flying (Figure 3-3).

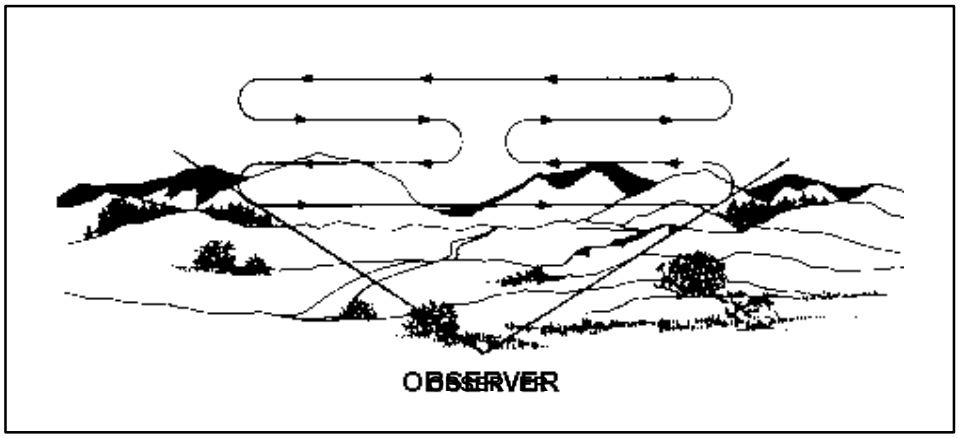


Figure 3-3. Horizontal Searching.

VERTICAL SEARCH

3-8. Search the sky using the horizon as a starting point and prominent terrain features as reference points. Move the eyes in short movements up the sky, then back down, continuing the movement across the terrain. Search in the same pattern below the horizon to detect air platforms contour flying (Figure 3-4).

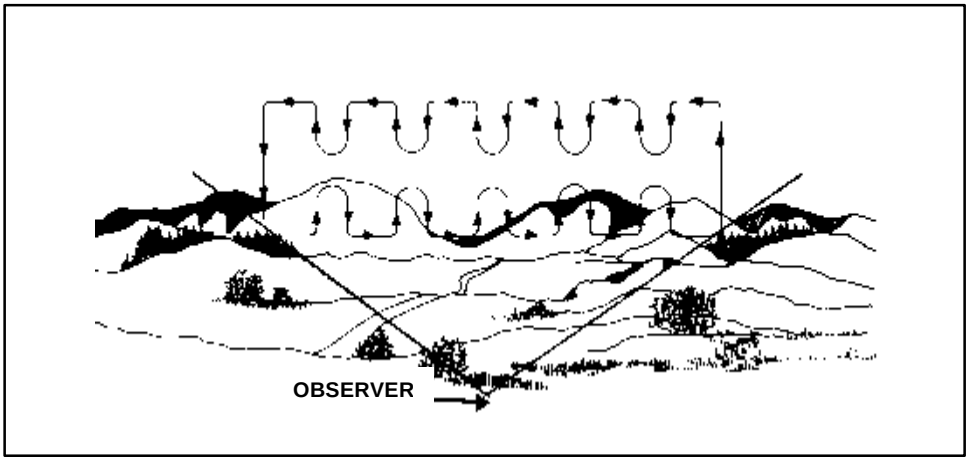


Figure 3-4. Vertical Searching.

VARIATIONS

3-9. With experience, soldiers who possess above average vision may use nonsystematic methods of search. From the following, select one that works best:

- Combination of the two systematic methods.
- Search of the horizon in the shape of an oval to 20 degrees above the horizon.
- General or random search of the horizon.

3-10. Air guards should look for sun reflections from canopies or cockpit windows, blade flash from rotating propeller blades, smoke trails and dust, and excessive movement of treetops and bushes in a particular area. They should listen for noise from propeller blades or aircraft engines. It is likely that these indications will be detectable before the aircraft is plainly visible. The sooner the aircraft is detected, the more time the unit will have to react to an air threat warning.

VISUAL AERIAL PLATFORM RECOGNITION

3-11. All soldiers must be able to visually recognize which aerial platforms are friendly and which are hostile. Depending on where in the world US forces are committed, soldiers may see many different types of friendly and hostile aerial platforms. Regional powers that the US may one day be at war against, or allied with, obtain their air assets from many sources. US forces may encounter air assets originally designed and built in Germany, Britain, Italy, France, or other countries fighting with us or against us. We may even encounter aerial platforms originally built in the US being used and Soviet-built aircraft as allies. Therefore, it is imperative that commanders train their troops in recognizing different types of aerial platforms. If the aerial platform is not positively recognized as hostile, it should be engaged only in self-defense. Soldiers should consult FM 44-80, GTA 44-2-17/18/19 (reference cards), and ACCP Subcourse IS 4400 for this purpose.

Chapter 4

Passive Air Defense Measures

This chapter focuses on types of passive air defense measures, to include self-defense measures in a convoy. Units may be exposed, bunched up, or in a situation where they are vulnerable to taking unnecessary casualties. If attacked under these conditions, the unit has the option of 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 attractive option can be to seek cover. In other cases, commanders may decide to place the enemy aerial platform under fire with organic weapons with the intent to frighten them off.

TYPES OF PASSIVE AIR DEFENSE MEASURES

4-1. Passive air defense measures are all measures other than active defense taken to minimize the effects of the hostile air action. Passive defense measures are of two types: attack avoidance and damage-limiting measures. Both include the use of cover, concealment, and camouflage; protective cover; and deception.

4-2. Accept as a foregone conclusion that the enemy has the capability to attack from the air and that they will exercise that capability. Air attack is not a probability—it is a certainty. Small units do not stand helpless before this threat. Simple, commonsense measures can be taken by a small unit to avoid attack and to limit damage if attacked. Passive air defense measures, if routinely followed, will reduce the probability of attack and will limit damage if an attack cannot be avoided.

4-3. The first line of defense against air attack is to constantly apply passive air defense measures. If the aerial platform is not attacking the unit, the unit commander has a decision to make. First, the commander may not want to fire and disclose the position. Secondly, to engage a nonattacking aerial platform, it must be positively identified as hostile. This may be difficult unless unit personnel have had aircraft recognition training. Remember, if not under attack, the unit commander must give the order to fire at the aerial platform.

ATTACK AVOIDANCE MEASURES

4-4. Attack avoidance means taking the actions necessary to avoid being seen by the enemy—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, procedures, and materials used for concealment from aerial observation are the same as used for concealment from ground observation (see Figure 4-1).

4-1. Attack Avoidance.

Concealment

4-5. There are three **concealment principles** employed (siting, discipline, and construction) to eliminate the factors of recognition:

- **Siting**. Siting means selecting the most advantageous position in which to hide a man, an object, or an activity.
- **Discipline**. Success in any concealment 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. Ensure new tracks follow 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.
- **Construction**. Adding natural materials to blend with the surrounding terrain augments this type of concealment.

4-6. There are three **fundamental method**s of concealing installations and activities: hiding; blending, and disguising. They are explained as follows:

- **Hiding**. Hiding is the complete concealment of an object by some form of physical screen. For example, sod over mines in a minefield hides the mines; the overhead canopy of trees hides the objects beneath from aerial observation; a net hides objects 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 behind 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 his fire from real assets. Therefore, the simulation of objects, pieces of equipment, or activities may have a worthwhile military significance. Rubber tanks, tents, and buildings filled with air can look like the real thing to an aerial observer.

Camouflage

4-7. The difference between concealment and camouflage is that concealment is using natural terrain to hide, and camouflage is constructing concealment. In addition to hiding equipment, detection can be avoided by using mud for glassy surfaces and unfilled sandbags over windshields (Figure 4-2). 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 measures, and must maintain the strict enforcement of camouflage discipline.

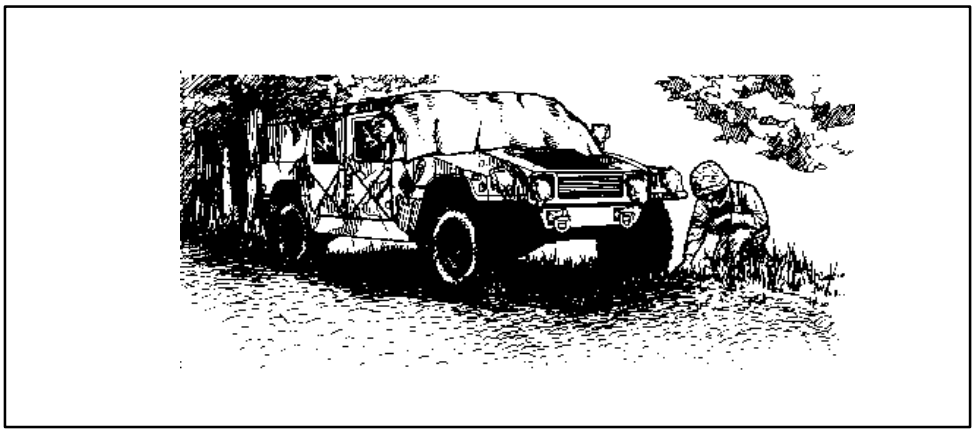


Figure 4-2. Detection Avoidance.

DAMAGE-LIMITING MEASURES

4-8. Another type of passive air defense, damage-limiting, is also used for survival. The measures are an attempt to limit any damages if the enemy detects the position. If the enemy is to destroy any equipment, he is forced to do it one piece at a time. A unit should not be in a position to be put out of action with just a single attack. The same measures taken to limit damage from artillery attack are used—dispersion, protective construction, and cover.

- **Dispersion.** Dispersed troops, vehicles, and equipment will force the attacker to concentrate on a single small target that will likely be missed. The wider the dispersion, the greater the potential is for limiting damage.

- **Protective Construction.** The use of cover, natural or manmade, acts to reduce damage and casualties. Folds in the earth, natural depressions, trees, buildings, and walls offer damage-limiting cover, which should be sought out and used habitually. If deployment is in flat terrain lacking cover, digging in or sandbagging can offer some protection. Smoke is used if the unit is moving and cannot use natural cover or cannot build fortifications. Smoke makes target acquisition much more difficult for the attacker.
- **Cover.** The intent here is to emphasize the importance of passive defense against an air attack. Everything must be done to avoid an attack in the first place. Not succeeding in that aim, then cover and dispersion should be used to limit the amount of damage to the unit.

PASSIVE AIR DEFENSE MEASURES IN CONVOY

4-9. A convoy is vulnerable to air attack since it is easily seen from the air. Movements along a road are endangered by shoulders, ditches, and embankments which restrict freedom of maneuver. Additionally, since vehicles are stretched out in a long line, convoys represent high-value, hard-to-defend, but easy to hit targets to enemy ground attack aerial platforms. This linear array also makes command and control very difficult. A high probability of air attack must be assumed in planning a convoy, and all soldiers must know exactly what to do if attacked. Not all convoys will be provided dedicated air defense assets. Some convoys must rely on organic passive and active air defense measures for protection. As in defended areas, passive air defense includes attack avoidance and damage-limiting measures.

ATTACK AVOIDANCE

4-10. Reduce the visible signature to the point where the enemy cannot find the convoy. While it is not possible to become invisible, every step taken in that direction decreases the likelihood that the convoy will be spotted. Not much can be done to change the shape of a vehicle moving down the road, but the type of cargo being transported can be disguised or concealed by covering it with a tarp. By rigging tarps and bows over the cargo compartment, the nature of the cargo can be concealed from the enemy pilot. Other effective passive measures are—

- 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 cut vegetation to achieve this effect (see FM 20-3).
- Try to reduce the dust clouds that almost always 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 4-3.

- 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 during periods of limited visibility as much as possible.
- Position vehicles and facilities inside woodlines and erase vehicle tracks left outside woodlines.

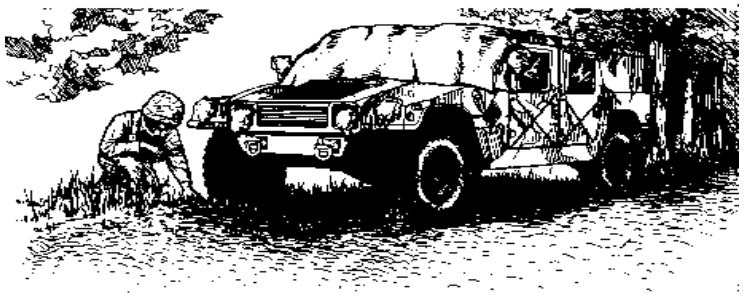


Figure 4-3. Eliminate Glare.

DAMAGE-LIMITING MEASURES

4-11. A convoy is highly visible, and you should plan the convoy to limit damage in case your signature reduction efforts are not successful. Cover is the best damage-limiting factor.

Select Natural Cover

4-12. Ditches and embankments to the sides of the road offer cover and should be used if the unit is attacked. See Figure 4-4.

Figure 4-4. Selecting Natural Cover.

Dispersion

4-13. One of your better damage-limiting measures is the use of dispersion to lessen target density and reduce 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. Dispersion decreases target density and thus reduces the lethal effects of enemy ordnance. The wider the dispersion, the greater the potential for limiting damage. 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. To achieve dispersion—

- Travel in an open column with 80 to 100 meters between vehicles. Air guards will be posted throughout the column, constantly watching the skies in their assigned areas, ready to give early warning of a detected hostile aerial platform. The sooner a threat aerial platform is detected, the more time you will have to react. Air guards will search and scan for approaching aerial platforms, observing their assigned sectors. Alert the vehicle commander after sighting an aerial platform by calling out "plane" and pointing to the aerial platform.
- Divide a convoy into small units or about platoon size and send the units out separately with at least 1,000 meters between units. This procedure provides a smaller target and increases the level of control over each convoy element.
- Do not park vehicles in a straight line; instead, stagger the vehicles to present a poor target. Park the vehicles under cover if available. Make arrangements 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 4-5).

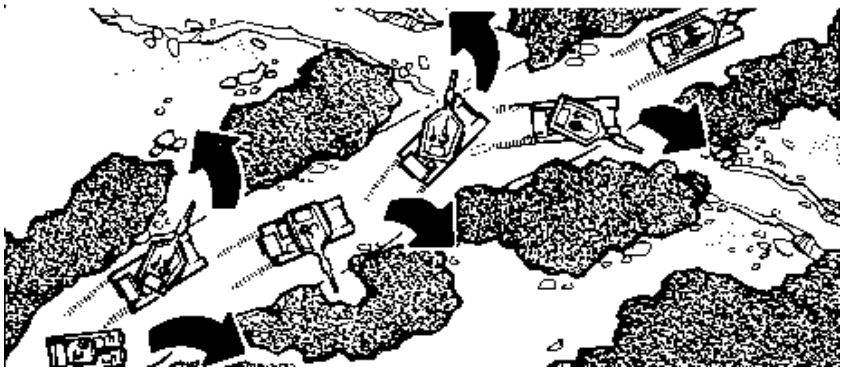


Figure 4-5. Vehicle Dispersion.

Protective Construction and Use of Cover and Smoke/Obscurants

4-14. The use of cover (natural or manmade) reduces the probability of detection, damage, and casualties. Cover can prevent the projectile from striking the target. It reduces the target area exposed to damage, and it absorbs part of the blow. Folds in the earth, natural depressions, trees, buildings, and walls offer damage-limiting cover and should be used whenever possible. Digging in or sandbagging can offer some protection. When moving or when natural cover is sporadic and fortifications cannot be built, use smoke for concealment. Smoke and other obscurants make target acquisition much more difficult for the air threat. They also defeat guidance and control of precision guided munitions. Smoke and other obscurants can be used to deny threat air the use of avenues of approach, LZs, DZs, air battle positions, and key terrain as navigational aids.

4-15. If a hostile aircraft or a flight of hostile aircraft passes over your convoy and does not attack the convoy, you will still disperse the vehicles to the sides of the road. Stagger the convoy and prepare to return fire in case the aircraft returns. If the aircraft attacks, everyone will choose the correct aiming point and fire upon command until the aircraft is hit or flies out of effective range. Small arms alone can give coverage (Figure 4-6).

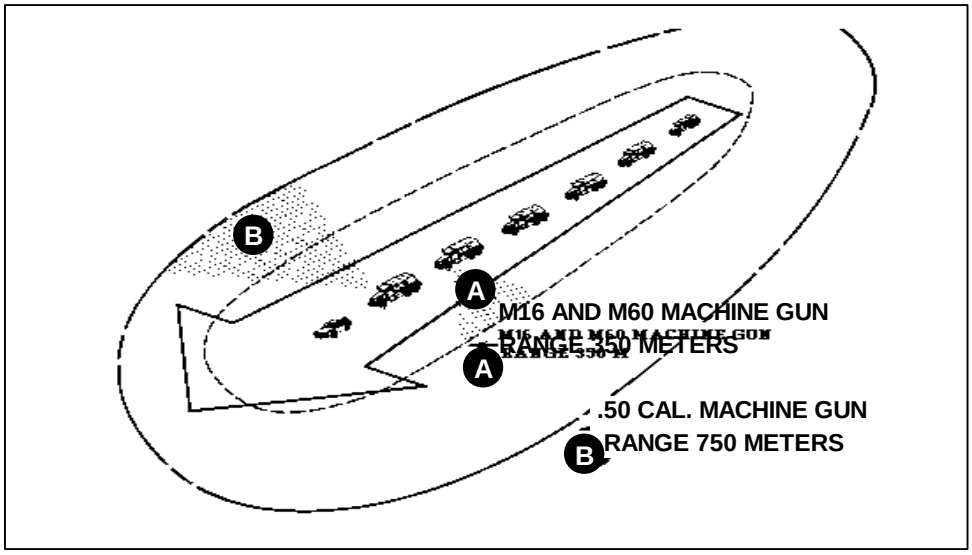


Figure 4-6. Small Arms Convoy Coverage.

CONVOY SELF-DEFENSE MEASURES

4-16. 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 convoy makes command and control difficult. Convoys are high-value, hard-to-defend, easy-to-see/hit targets for enemy air. The unit must assume there is a high probability of air attack when planning any convoy.

ROUTES

4-17. Use routes that offer 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.

DISPERSION INTERVAL

4-18. 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 close together.

SMALL CONVOY UNITS

4-19. 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 procedure minimizes convoy size and increases the level of local control over each convoy element.

BREAKOUT PLAN

4-20. Make arrangements for 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 "Herringbone" (see Figure 4-7). 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.

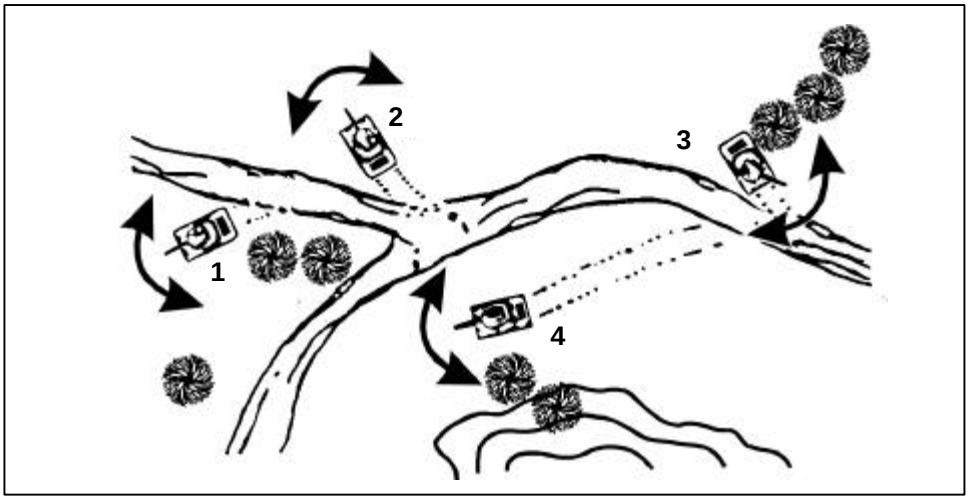


Figure 4-7. Herringbone.

INTEGRATION OF AIR DEFENSE CAPABILITIES

4-21. Vehicles with weapons that are effective against 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 to limit damage if attacked. Units should plan for the use of, and make coordination for, the integration of MANPAD or SHORAD systems from general support or direct support ADA units whenever possible.

Chapter 5

Active Air Defense Measures

This chapter discusses active air defense, to include aircraft engagement techniques for the M2/M3 Bradley. Active air defense is direct action taken to destroy enemy aerial platforms or reduce their effectiveness. While the first line of defense against enemy air is the constant application of passive air defense measures, commanders must prepare their units to actively engage air threats. If attacked, the unit has the option of fighting back. The decision to engage hostile aerial platforms will 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

5-1. Fighting back is active air defense, but it is not undertaken as a one-on-one activity, that is, one soldier acting independently against one air threat. Rather, it is a coordinated group response either undertaken spontaneously or under command using prescribed engagement techniques. If a unit cannot coordinate its fire, it will be ineffective and waste ammunition.

ENEMY AIR THREAT

5-2. When passive air defense measures fail and enemy air threats are within range of organic weapons, units can conduct active air defense by shooting back. All Army units can engage enemy air threats to—

- Destroy the threat.
- Force the threat away from friendly positions.
- Force the threat to fly higher, so that friendly aerial platforms or ADA can destroy them.
- Spoil the hostile pilots' aim as they engage friendly forces.

RIGHT OF SELF-DEFENSE

5-3. Your right to fire at the attacking aerial platforms is derived from the doctrine of self-defense. You may defend your unit from direct attack but do not engage aerial platforms not attacking you except on the command of the next higher authority. Even if you are under direct attack, practical consideration bears on your decision to fire. It makes no sense at all to shoot at a helicopter attacking you from a standoff range of 3 kilometers, except perhaps with the main gun of a tank. Your decision to fire should be tempered by consideration of the capabilities of weapons you have available to you. However, there is another side to the fire decision. Although small arms have a low probability of kill against attacking aerial platform, the use of coordinated group firing, using all organic weapons to make the pilots aware that they are under fire, can disturb their concentration and cause them to miss their target or abandon their attack. The pilots should be made

aware that they are under fire from the ground. Nothing is more disturbing to a pilot's concentration than flying into a hail of tracers, and if practical, tracers should be used.

SMALL ARMS FIRE AGAINST AERIAL PLATFORMS

5-4. Small arms fire against aerial platforms can be effective. A quick review of the record shows this to be true. In the Korean War, our Air Force lost 259 jet aircraft and 285 other aircraft to combined small arms and air defense fire, which is nearly five times as many aircraft that were lost in air-to-air combat. In South Vietnam, we lost 410 fixed-wing aircraft and 2,100 helicopters. In the Mideast War, 36 coalition aircraft were shot down by ground fire.

SMALL ARMS USED FOR AIR DEFENSE

5-5. Small arms used in air defense incorporate the use of volume fire and proper aiming points according to the target. If your soldiers are trained to apply an appropriate sequence of engagement techniques for aircraft based on the rules for selecting an aiming point, the response will be automatic upon command. You will have effective air defense using the small arms available to your unit.

VOLUME FIRE

5-6. To engage aerial platforms effectively, you must follow some basic rules. The first rule to follow is to use a technique known as **volume fire** (Figure 5-1). The key to success in engaging enemy air is to put out a high volume of fire. The more bullets a unit can put in the sky, the greater the chance the enemy will fly into them. 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.**

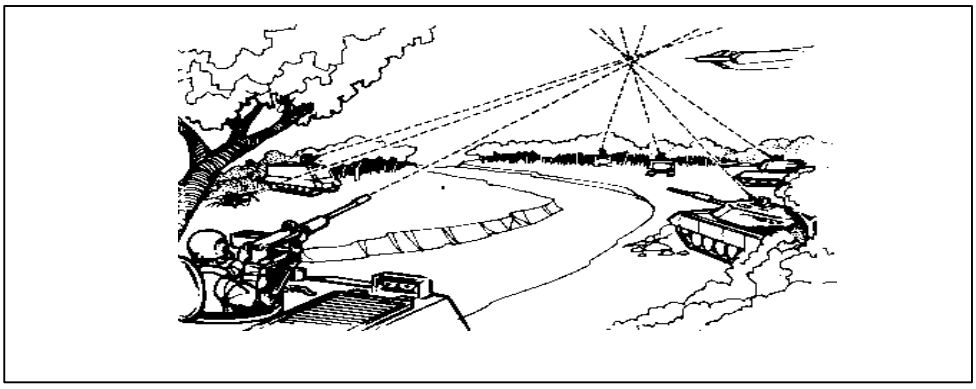


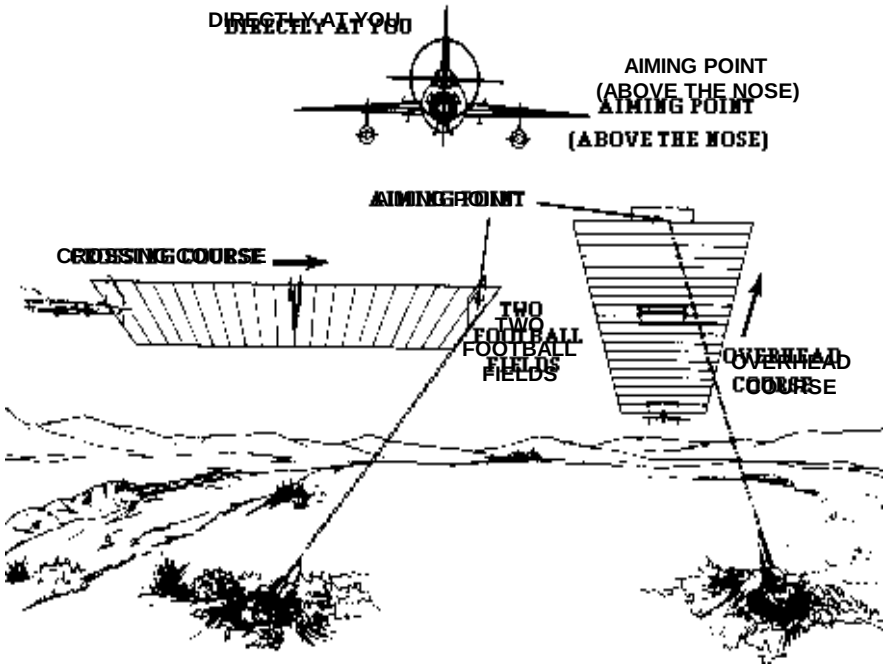
Figure 5-1. Volume Fire.

ENGAGEMENT PRINCIPLES

5-7. The decision to fire is the unit commander's and is based on his judgment of the situation. The techniques for delivering fire are standard. Volume fire is the key to effective small arms fire against aerial threats. Every weapon (M16, M60, M249, and M2) must be used to engage the target 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.

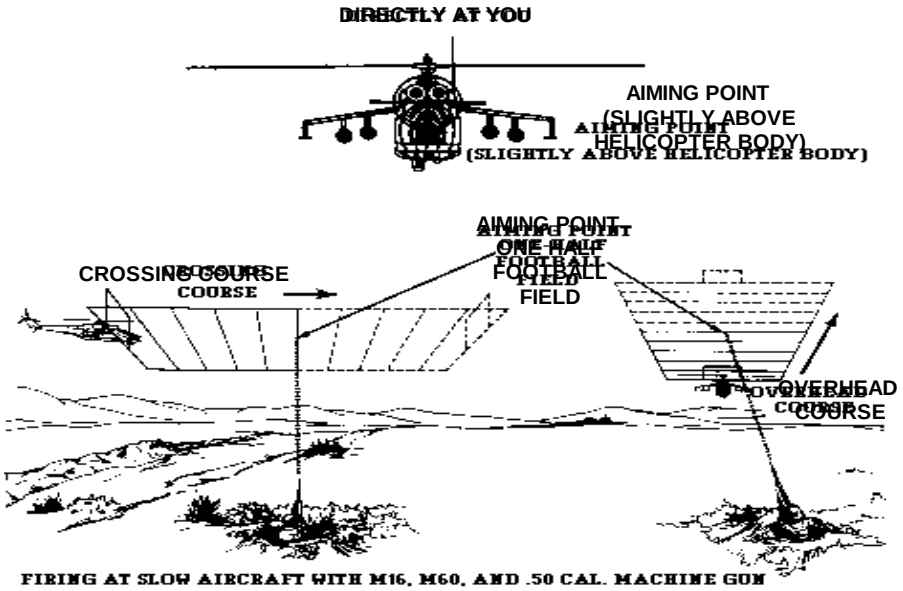
Football Field Technique

5-8. 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. See Figures 5-2 and 5-3.



FIRING AT SLOW AIRCRAFT WITH M16, M60, AND .50 CAL. MACHINE GUN

Figure 5-2. Jet Aiming Points.



FIRING AT SLOW AIRCRAFT WITH M16. M60. AND .50 CAL. MACHINE GUN

Figure 5-3. Helicopter Aiming Points.

Aiming Points

5-9. Aiming points for jets and helicopters are depicted in Figures 5-2 and 5-3. Missiles, if detected, should be engaged using the jet aiming points. UAVs should be engaged using the helicopter aiming points. The rules for selecting aiming points are simple, and easily learned and retained. The various aiming points are summarized in Table 5-1.

Table 5-1. Aiming Points.

TYPE AERIAL PLATFORMS	COURSE	AIMING POINT
JET/CRUISE MISSILE	CROSSING	TWO FOOTBALL FIELDS IN FRONT OF AERIAL PLATFORM NOSE
JET/CRUISE MISSILE	OVERHEAD	TWO FOOTBALL FIELDS IN FRONT OF AERIAL PLATFORM NOSE
JET/CRUISE MISSILE	DIRECTLY AT YOU	SLIGHTLY ABOVE AERIAL PLATFORM NOSE
HELICOPTER	HOVERING	SLIGHTLY ABOVE HELICOPTER BODY
HELICOPTER/UAV	DIRECTLY AT YOU	SLIGHTLY ABOVE HELICOPTER BODY
HELICOPTER/UAV	CROSSING	ONE HALF FOOTBALL FIELD IN FRONT OF NOSE

FIRING POSITIONS FOR SMALL ARMS

5-10. Except for the prone position, the rifleman's basic firing positions stay the same (see Figure 5-4). Firing at aircraft when lying down means the individuals are lying on their backs (supine), aiming their rifles into the air. It will not take you long to learn to fire from some kind of cover and concealment, no matter how small. If you are in an individual fighting position (foxhole), 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 something to help support 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. A bipod on the M16 rifle assists you in firing your weapon more effectively at hostile aerial platforms.
- If cover and concealment are fairly good, use the high-kneeling position. If cover and concealment are less substantial, use the low-kneeling position.
- When using the M60 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.

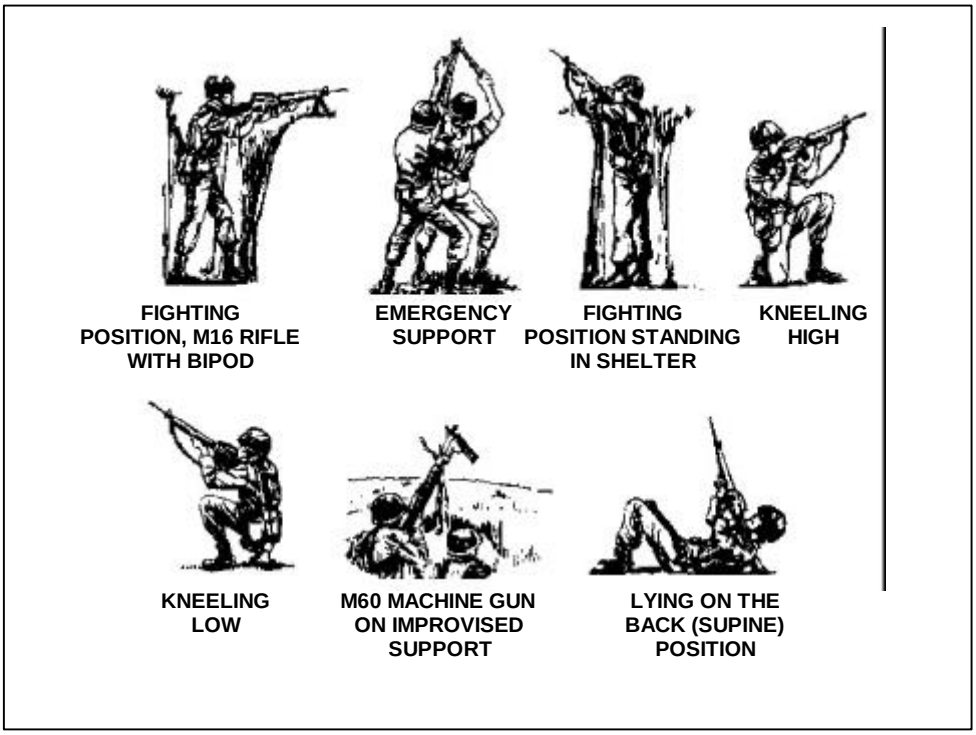


Figure 5-4. Firing Positions.

HELIBORNE INFANTRY AND PARATROOPERS

5-11. Infantry rappelling from a hovering helicopter should be engaged by first destroying the helicopter using volume fire. Airborne troops are more difficult to engage because of their rapid descent (approximately 10 feet per second). When engaging paratroopers, use machine guns by leading two body lengths below their feet. The Geneva Convention of 1949 and our rules of war prohibit engaging crewmen parachuting from disabled aircraft.

AIRCRAFT ENGAGEMENT TECHNIQUES FOR THE M2/M3 BRADLEY

5-12. The technique to obtain volume of fire is simple. All platoon vehicles engage with either the 25-mm gun or coaxial machine gun as designated by the platoon leader either by fire command or by TSOP. The TOW system should be used against helicopters only when necessary or as a last resort. Unit TSOPs should provide guidance for dismounted rifle fires in conjunction with supporting Bradley weapon systems in active air defense. All crews must be alerted to enemy air threat.

AERIAL ENGAGEMENT WEAPONS

5-13. Proper weapon and ammunition selection for the range and target is the key to success. Table 5-2 shows the weapons and the type of aerial targets that they can destroy.

Table 5-2. Ammunition Employed Against Aerial Targets.

	FIXED-WING		HELICOPTER			
	SLOW	FAST	ARMORED	UNARMORED	**UAV**	**PARATROOPER**
COAXIAL	YES	YES	NO	YES	YES	YES
HEI-T	YES	YES*	YES	YES	YES*	YES
APDS-T	YES	YES*	YES	YES	YES*	YES
APFSDS-T	YES	YES*	YES	YES	YES*	NO
TOW	YES	NO	YES	YES	NO	NO
*Secondary source if coaxial is not available or if out of coaxial range.						

The 25-mm Gun

5-14. The 25-mm gun is effective against slow-moving FW aircraft, UAVs, and helicopters. When using the ADR sight, the gunner indexes 1,800 meters. The APDS-T, APFSDS-T, or HEI-T can be used against slow-moving, FW aircraft, UAVs, and helicopters. A continuous burst of 20 to 25 rounds (high rate), using TOT to adjust rounds on target, will sustain the volume of fire and kill the target. The APDS-T/APFSDS-T has a higher probability of hit than HEI-T; however, HEI-T has a higher probability of kill. At ranges beyond 1,200 meters, the APDS-T is more effective against helicopters. At ranges less than 1,200 meters, HEI-T is more effective against helicopters.

The Coaxial Machine Gun

5-15. The coaxial machine gun is used against FW aircraft, unarmored helicopters, UAVs, and airborne troops. It is ineffective against heavily armored helicopters. A continuous burst (50 to 100 rounds) at the aiming point is required, and TOT is used to bring rounds on target. The coaxial machine gun is effective out to 900 meters.

The TOW

5-16. The TOW weapon system should be used against stationary and slow-moving (up to 80 kilometers per hour) aerial targets beyond 1,700 meters. The Bradley must be stationary when engaging targets with the TOW. Before firing the TOW, the gunner must determine if there are any obstacles between the vehicle and the target that might interfere with the missile. If the target is moving, the gunner must determine if the target will be in sight long enough for the missile to reach it.

ENGAGEMENT TECHNIQUES

5-17. The crew's goal is to engage and destroy or suppress targets as fast as possible. (Refer to FM 23-1 for details.) Basic engagement procedures used for all engagements are—

1. The BC may be required to lay the gun for direction if the gunner's scan is away from the target. He will release control to the gunner (target hand-off) and issue the fire command.
2. Once the target is acquired, the gunner identifies and discriminates the target.
3. The BC then confirms the target and gives the Fire command.
4. The gunner completes his switch checks.

AIRCRAFT ENGAGEMENT TECHNIQUES FOR TANKS

5-18. Tank automatic weapons can be used effectively against UAVs, jets, and helicopters—especially when several tanks are firing at the same time. The tank main gun can be used with good results against helicopters. It cannot be used effectively against jets because of the difficulty of tracking high-speed targets.

ENGAGING HELICOPTERS AND UAVS

5-19. Engage hostile targets immediately with the tank commander's automatic weapon (caliber .50 on most tanks) or with the loader's M240 machine gun on M1- series tanks. Firing quickly will—

- Alert other tanks that hostile targets are in the area.
- Destroy the target or spoil the pilot's aim.
- Give the tank commander time to engage the target with the main gun and coaxial, if desired.

Engaging with Tank Machine Guns

5-20. The tank commander's machine guns (or loader's machine gun on M1-series tanks) are useful weapons against unarmored threats. They can be fired quickly with volume fire. Before firing, ensure that the firing fan is clear of friendly units. Do **not** fire into them! Use the following guidelines:

- When the target is hovering or inbound, aim high with the machine gun and fire a continuous burst, adjusting onto target by observing the tracers. When firing against aerial targets with the M85 machine gun on M60- series tanks, use high rates of fire. Remember, at longer ranges tracers may appear to be striking the target when they are actually going under it.
- If the target is moving, track along its flight path using a lead of 50 meters—half a football field. Fire a continuous burst, forcing the target to fly through the cone of fire.

Engaging Helicopters with the Tank Main Gun

5-21. 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. 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.

ENGAGING FAST-MOVING AIRCRAFT

5-22. 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—it flies too fast.

PRACTICE SEQUENCE OF ENGAGEMENT

5-23. 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:

1. An aircraft commences an attack on your unit.
2. You or the air sentries spot the attacker. In either event, you are alerted to the attack and decide to engage the target.
3. You alert the unit. For example, "Air attack, inbound 5 o'clock, prepare to fire." (Table 2-1 in Chapter 2 of this FM lists the methods of giving alarms.)
4. Each member of the unit prepares his weapon to fire by placing the weapon in full automatic mode. He locates the target, finds his aim

reference point as determined by the rules (Table 5-1), and waits for the command to fire.

5. The leaders estimate the right moment and give the command, "Fire."
6. 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.

Chapter 6

Tracer Observation

This chapter describes how to evaluate tracer observation. The information provided focuses on correctly reading the observations and applications. It is important to know how to sense tracers. The observer cannot properly sense the tracers if he cannot read them correctly. He will have to read the tracer the moment it is passing the target. Tracer sensing will play an important part when adjusting the air defense reticle sighting systems to obtain the correct line and lead to hit a target.

TRACER OBSERVATION OF FAST-MOVING AIRCRAFT

6-1. Proper observation and sensing of tracers provides the gunner and observer with information on the trajectories of rounds fired in relation to the target. Corrections can be made in the direction of fire by observing and making proper tracer sensing. The three basic principles of tracer observation are superimposed tracer on the target, localized vision, and tracer path on incoming and outgoing targets.

SUPERIMPOSED TRACER ON THE TARGET

6-2. Considerations in judging superimposed tracers on targets include apparent tracer path, path above or below, firing adjustment, and tracer silhouette and eclipse.

Apparent Tracer Path

6-3. The tracer path will appear to be curving. This is an optical illusion created by a target moving while an observer is moving his line of sight with the target. See Figure 6-1.

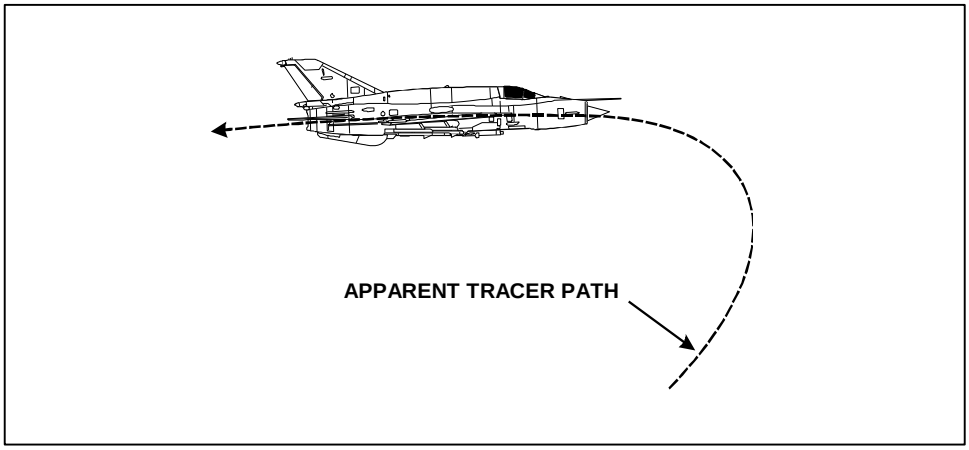


Figure 6-1. Optical Illusion.

Path Above or Below

6-4. If the tracer path is above or below the target, the observer cannot judge whether the tracer is at a greater or lesser range than the target.

Firing Adjustment

6-5. Always adjust rounds on line with the target first, and then adjust rounds to lead the target.

Tracer Silhouette and Eclipse

6-6. Figure 6-2 shows a "silhouette" and an "eclipse." To sense a silhouette or an eclipse, either the tracer or the target must appear in front of the other (superimposed). The round will disappear into the target if it is a hit. To judge for lead, the observer must see a silhouette or an eclipse.

6-7. **Tracer Silhouette**. In a tracer silhouette, the tracer appears to pass between the target and the gun when rounds are adjusted to be on line with the target.

6-8. **Eclipse Silhouette**. An eclipse silhouette occurs when the target passes between the tracer and the gun with line-adjusted shots.

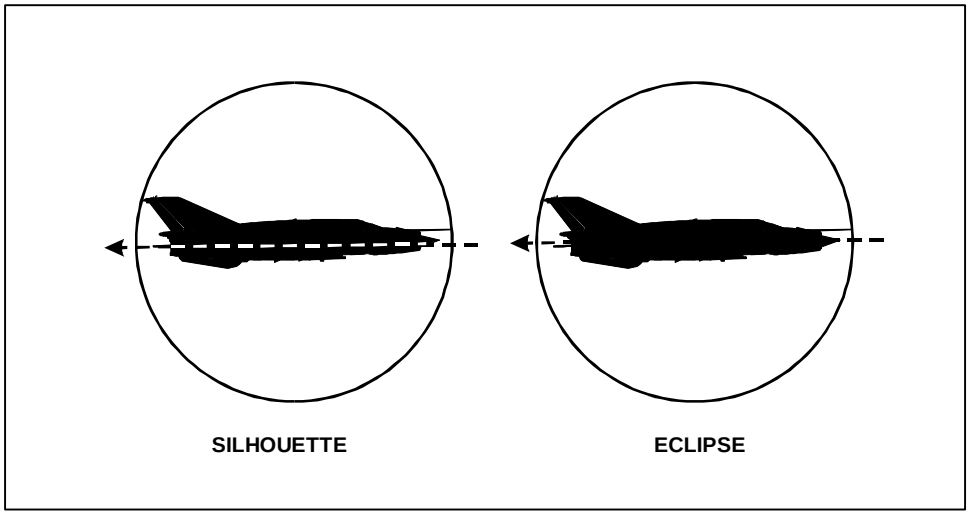


Figure 6-2. Silhouette and Eclipse.

LOCALIZED VISION

6-9. Vision should be localized in the immediate vicinity of the target. See Figure 6-3.

Sight Vision

6-10. A large part of the tracer path can be viewed from the gun. Vision should be localized in the immediate vicinity of the target as mentioned above.

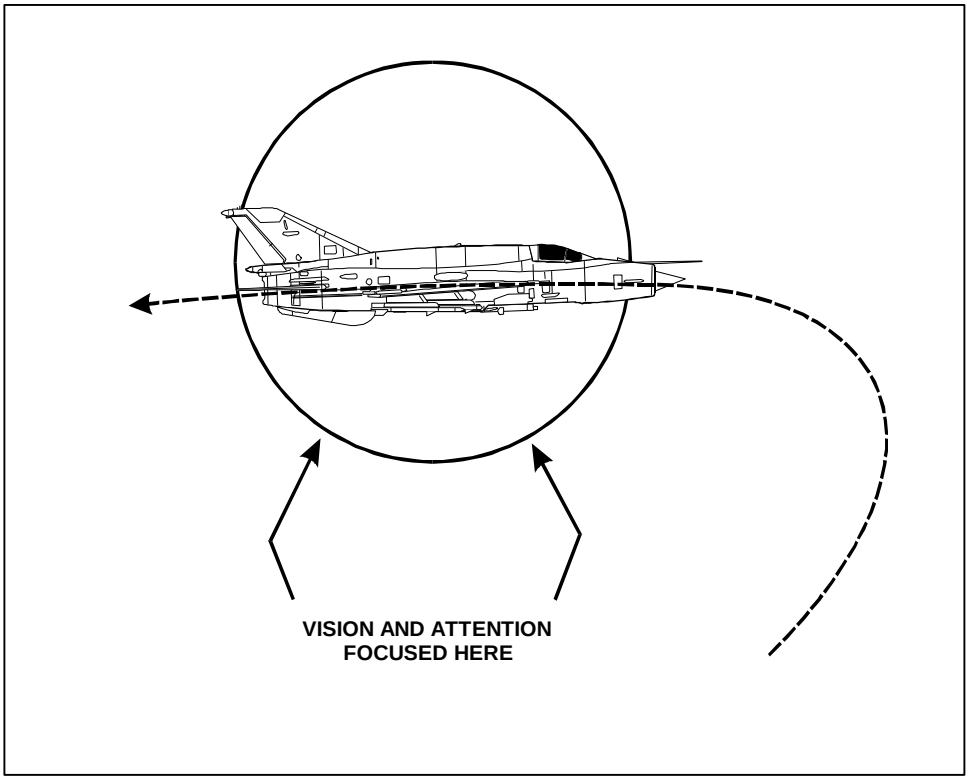


Figure 6-3. Localized Vision.

Tracer Path and Tracer Hump

6-11. Read all tracers from nose to tail on all target courses. In Figure 6-4A, the tracer path appears to enter the nose of the target first and then proceed toward the tail. Locations where maximum curvature appears are called the tracer humps.

Tracer Hump Field of Vision

6-12. Although the observer will see the curve and the tracer hump in his field of vision, he must ignore it completely to make accurate tracer sensing.

Tracer Sensing

6-13. Many observers make tracer sensing at the hump. When this is done, the observer will always read the tracer sensing as ahead of the target, but the true sensing is to the rear of the target. See Figure 6-4B.

TRACER PATH ON INCOMING AND OUTGOING TARGETS

6-14. On incoming and outgoing targets, the tracer will appear to pass the target twice. Many observers make a tracer sensing on the first tracer pass. This is wrong because the tracer is not in the immediate vicinity of the target—the tracer is somewhere short of the target. The observer must read the tracer when it passes the target the second time. See Figure 6-5.

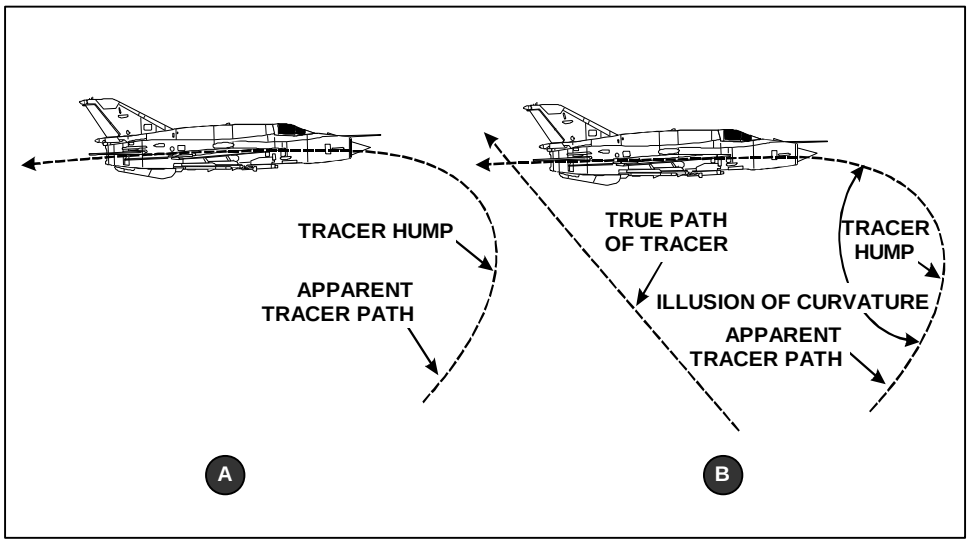


Figure 6-4. Tracer Hump.

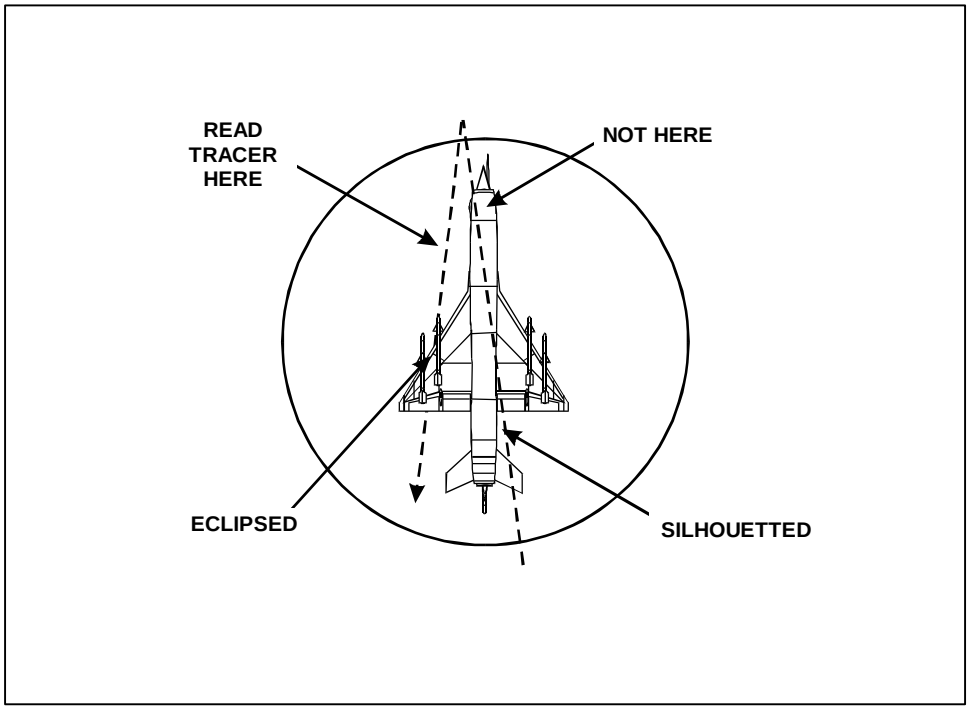


Figure 6-5. Tracer Passing Target Twice.

TRACER OBSERVATION OF SLOW-MOVING AIRCRAFT

6-15. Track slow-moving aircraft, and read and sense tracers in a manner similar to that for fast-moving aircraft. Slow movers are trickier to track than fast movers. Sometimes helicopters cross under cover or will pop up and disappear behind cover making it difficult to track. Consequently, the observer has to sense the tracer and apply corrections to the gun in the least amount of time.

LINE AND LEAD SENSING FOR CROSSING TARGETS

Sensing Low

6-16. In Figure 6-6A, the observer knows the tracer passed low of the target. He reads the sensing low.

Sensing Ahead

6-17. In Figure 6-6B, the tracer is on line and eclipses the target. The observer reads the sensing ahead. Too much lead has been applied.

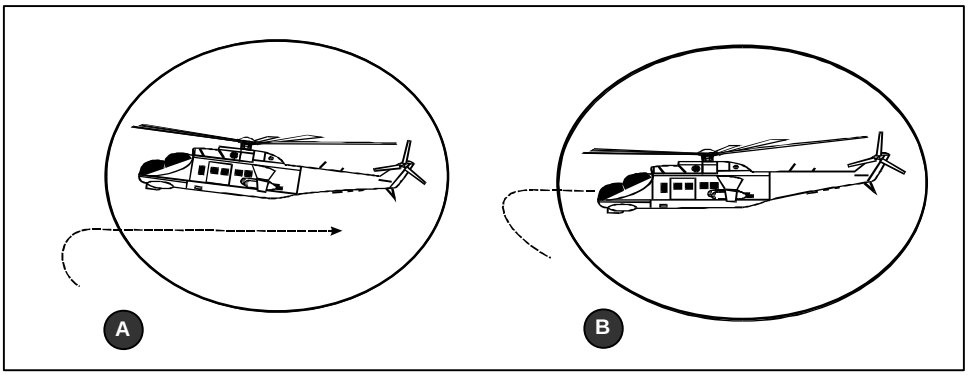


Figure 6-6. Observer—Low and Eclipse, Ahead.

SENSING FOR INCOMING AND OUTGOING TARGETS

Tracer Right

6-18. Figure 6-7A shows the tracer sensing is read as right. Too much right lead has been applied.

Tracer Left

6-19. Figure 6-7B shows the tracer sensing is read as left. Too much left lead has been applied.

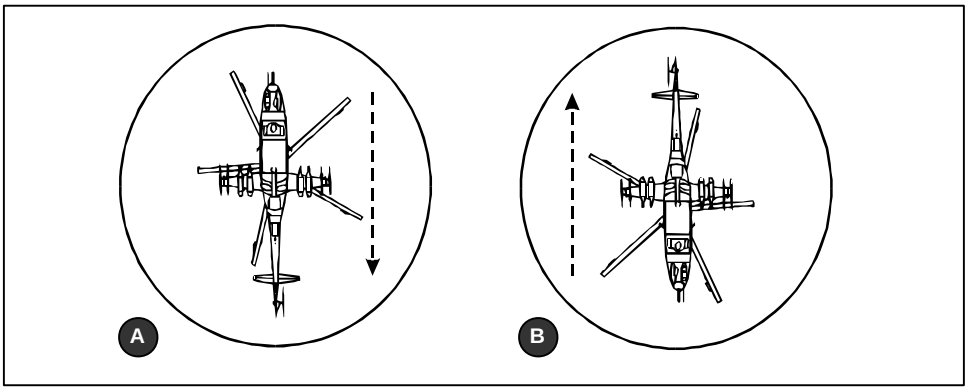


Figure 6-7. Observer—Right and Left.

Tracer Passes Target Twice

6-20. In Figure 6-8, the observer sees the tracer pass the target twice. He reads the tracer when it passes the target from nose to tail. He senses the tracer as ahead because the tracer eclipsed the target.

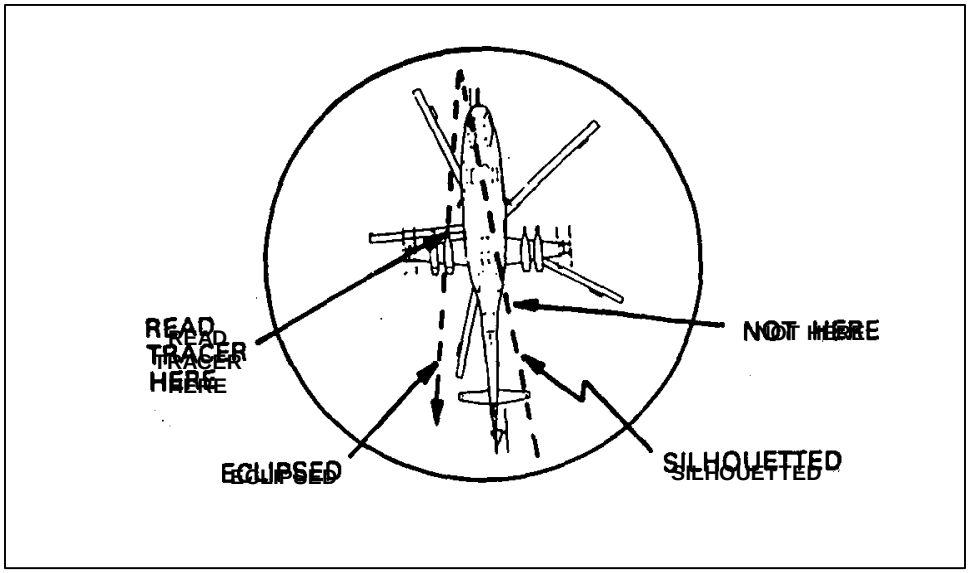


Figure 6-8. Observer—Eclipse, Silhouette.

TARGET FLYING DIRECTLY AT SIGHT

6-21. For a target coming directly at the gun as in Figure 6-9, the observer sees that the tracer passed the target twice. He reads the tracer from top to bottom. In other words, the tracer is read only after the tracer hump, regardless of the type of target and what direction it is flying. The tracer is sensed as ahead.

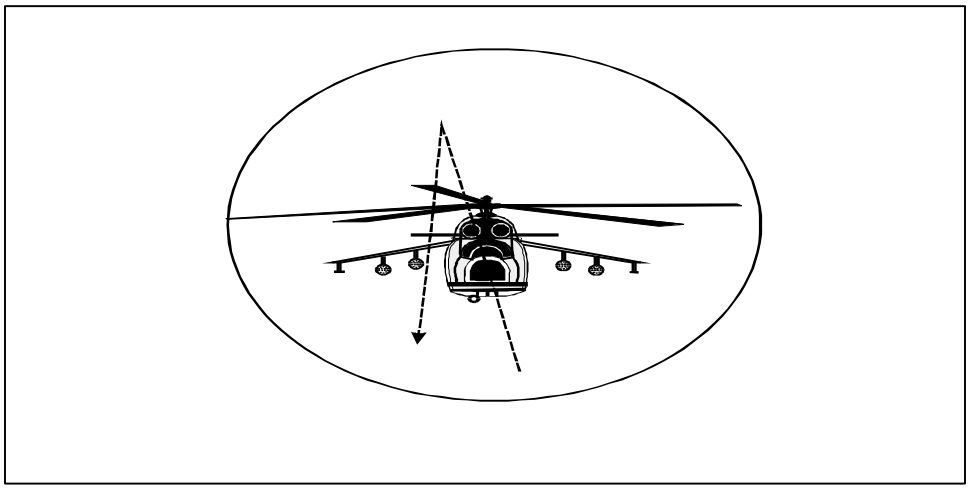


Figure 6-9. Observer—Ahead and High.

POP-UP TARGET

6-22. Line information for pop-up targets is read as the tracer passes the target. In Figure 6-10, the observer sees the tracer pass to the left of the target. The sensing is left.

Figure 6-10. Observer—Sensing Left.

LINE AND LEAD SENSING FOR TARGET CROSSING UNDER COVER

Tracers in Rear

6-23. In Figure 6-11, the observer sees that the round burst is to the rear of the target. The tracer sensing is astern.

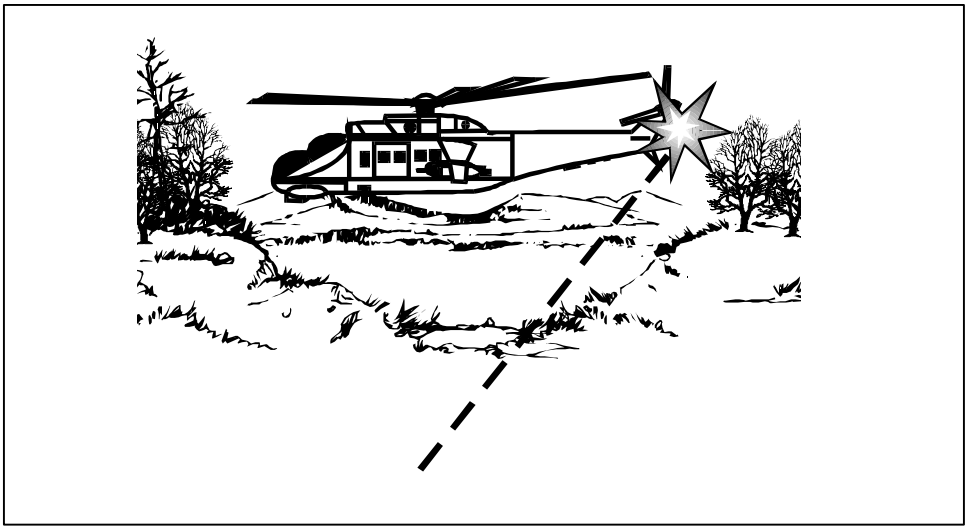


Figure 6-11. Observer—Burst Rear.

Tracers Ahead

6-24. In Figure 6-12, the observer sees the round burst ahead of the target. The sensing is ahead.

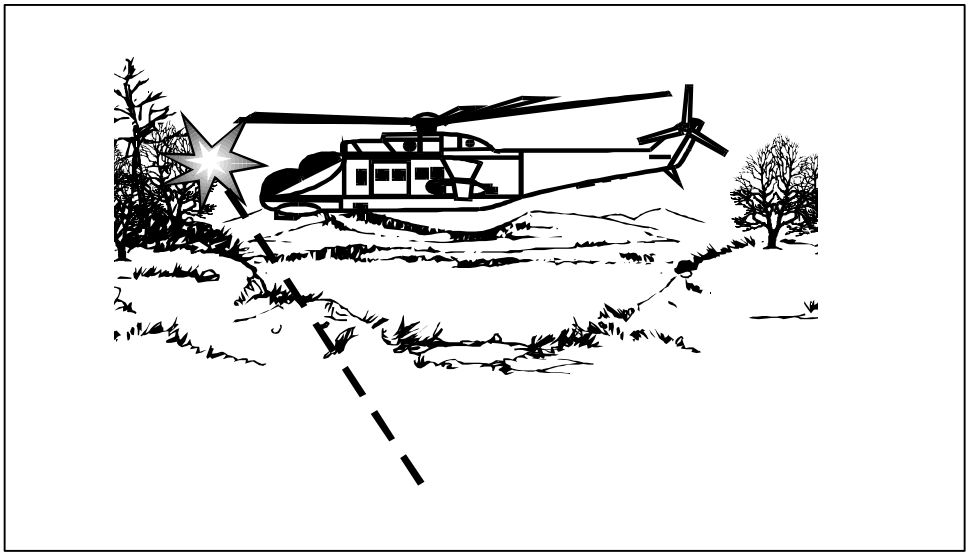


Figure 6-12. Observer—Burst Front.

Tracers Low

6-25. In Figure 6-13, the observer sees that the tracer passes low of the target. Sensing is low.

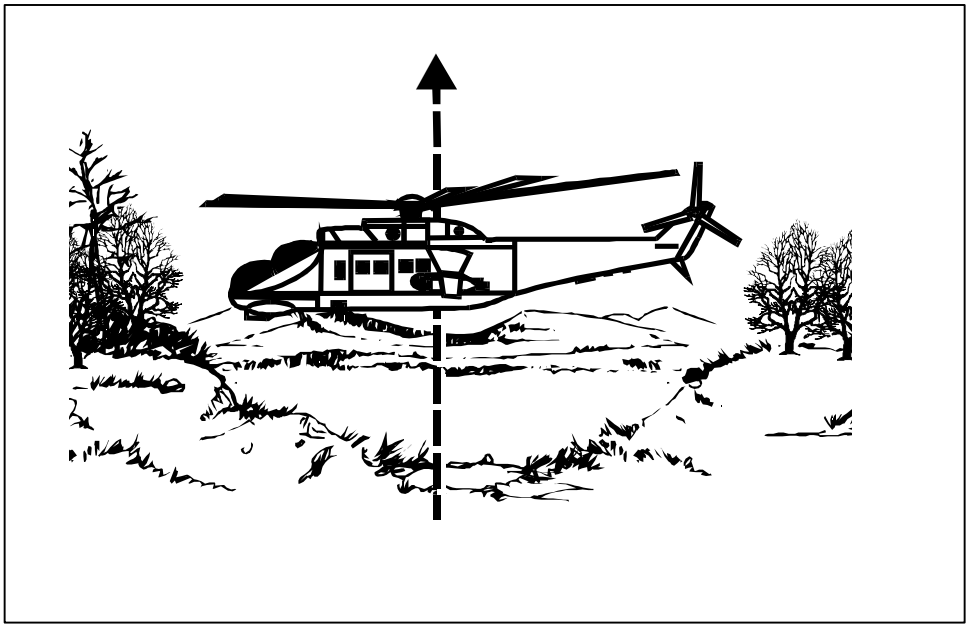


Figure 6-13. Observer—Tracer Low.

Tracers High

6-26. In Figure 6-14, the observer sees that the tracer passes high of the target. The sensing is high.

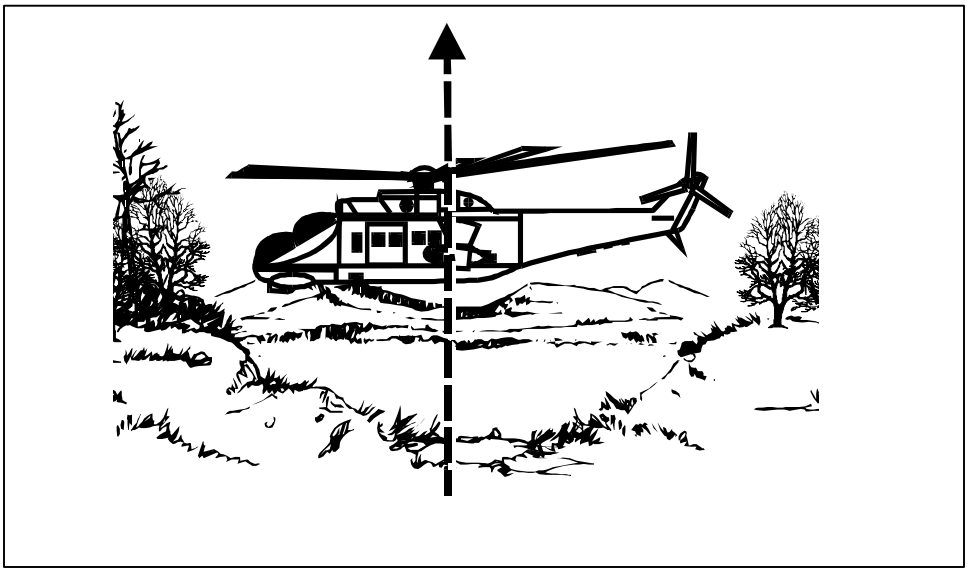


Figure 6-14. Observer—Tracer High.

SENSING TRACERS

6-27. It is important to know how to sense tracers. The tracers cannot be properly sensed if they cannot be correctly read. The tracer will have to be read the moment it is passing the target. Tracer sensing will play an important part when adjusting the air defense reticle sighting systems to obtain the correct line and lead to hit a target.

Appendix A

Unit Training

This appendix addresses training as it pertains to a unit in preparation for active and passive air defense measures. Because self-defense against aerial platform attack is closely related to the defensive measures you take against ground attack, training can be conducted merely by varying the perspective—attack from the air as opposed to attack from the ground. This is especially true for training in the application of passive air defense measures (camouflage, concealment, and the use of cover). Training in the application of active air defense measures presents a special problem, however. Soldiers must learn the techniques for delivering volume fire in the path of attacking aircraft. They must also be trained to overcome their natural tendency to track the target, not to fire directly at crossing targets, and not take Kentucky windage. The recommended leads have been computed to give the highest probability of engulfing the target with fire, and the soldier must adhere to the rules if the system is to be effective.

A-1. 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 proclaiming an air attack situation. The unit should immediately disperse, seek cover, and prepare to engage the attacker. If available, use aircraft to fly simulated attack missions so that the troops can get an idea of the time element of an attack. See Table A-1 for a checklist of items the trainer should check before and during the attack.

Table A-1: Passive Air Defense Training Checklist

BEFORE THE ATTACK **Action**	YES	NO
1. Is an air watch being maintained?	☐	☐
2. Are vehicles and equipment camouflaged?	☐	☐
3. Do the troops know the air attack warning signals?	☐	☐
4. Is dispersion the maximum permitted by the terrain and the tactical situation?	☐	☐
5. Is the available cover used for maximum advantage?	☐	☐
DURING THE ATTACK **Action**		
1. Was the warning disseminated in time for the unit to take damage-limiting measures?	☐	☐
2. Did all elements of the unit receive the warning?	☐	☐
3. Was the available cover used effectively?	☐	☐
4. Was dispersion used effectively?	☐	☐
5. Did the commander maintain close control during the attack?	☐	☐
6. Could the unit have engaged the aircraft had the order been given?	☐	☐
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.		

A-2. 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.

A-3. All members of the combined arms team can take it for granted that they will come under air attack in a future war. They need to train now to meet this threat. Units must integrate training for air defense into their tactical training. Units must practice the passive and active air defense skills they will employ while moving cross-country in tactical formations, 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 caught in the open); and proper employment of their weapon systems against air threats. Units must follow the guidance contained in their ARTEP MTP manuals. Some of these manuals are—

- **ARTEP 7-8-MTP** Mission Training Plan for the Infantry Rifle Platoon and Squad
- **ARTEP 7-10-MTP** Mission Training Plan for the Infantry Rifle Company
- **ARTEP 17-237-10-MTP** Mission Training Plan for the Tank Platoon
- **ARTEP 71-1-MTP** Mission Training Plan for the Tank and Mechanized Infantry Company and Company Team

Glossary

A^2C^2 Army airspace command and control

AADC area air defense commander

ABMOC air battle management operations center

ACCP Army Correspondence Course Program

active air defense Direct defensive action taken to nullify or reduce the effectiveness of hostile air action. It includes such measures as the use of aircraft, air defense weapons, weapons not used primarily in an air defense role and electronic warfare.

AD air defense

ADA air defense artillery

ADO air defense officer

ADR air defense reticle

ADW air defense warning

air defense (AD) All defensive measures designed to destroy attacking aircraft or missiles in the earth's envelope of atmosphere, or to nullify or reduce the effectiveness of such attack.

air defense warning (ADW) Measures used to communicate levels of air threat to all subordinate units and soldiers. Key words are: Red—attack by hostile aircraft or missiles is imminent or in progress; Yellow—attack by hostile aircraft or missiles is probable; and White—attack by hostile aircraft or missiles is improbable.

air guards Personnel assigned the duty of aerial search and scan for aerial platforms or aircraft of any type.

AO area of operations

APOD aerial port of debarkation

APDS-T armor-piercing discarding sabot-tracer

APFSDS-T armor-piercing, fin-stabilized, discarding sabot with tracer

ARTEP Army Training and Evaluation Program

ATGM antitank guided missile

BC Bradley commander

BSFV Bradley Stinger Fighting Vehicle

C³I command, control, communications, and intelligence

cal caliber

CAS close air support

CBU cluster bomb unit

chaff Thin, narrow metallic strips of various lengths and frequency responses used to reflect electronic echoes for confusion purposes on radar screens.

CIS Commonwealth of Independent States

close air support (CAS) Air action by fixed- and rotary-wing aircraft against hostile targets which are in proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.

CM cruise missile

COA course of action

DA Department of the Army

DEW directed early warning

directed early warning (DEW) Early warning given to a specific unit or area of the battlefield about impending air attack.

DZ drop zone

FARP forward arming and refueling point

FFAR free-flight, air-to-air

FLOT forward line of own troops

FM field manual

FOB forward operations base

FW fixed-wing

G-2 intelligence staff officer (division or higher staff)

GTA graphic training aid

HEI-T high-explosive incendiary-tracer

hostile criteria Description of conditions under which an aircraft or vehicle may be identified as hostile for engagement purposes.

IPB intelligence preparation of the battlefield

LADW local air defense warning

LNO liaison officer

local air defense warning (LADW) Measure used by ADA units to communicate the level of air threat to specific units and to recommend specific countermeasures.

LZ landing zone

MANPADS man-portable air defense system

mm millimeter

MTP mission training plan

NATO North Atlantic Treaty Organization

NBC nuclear, biological, and chemical

O/I operations and intelligence

OP observation post

passive air defense All measures, other than active air defense, taken to minimize the effects of hostile air action. They include cover, concealment, camouflage, dummy positions, dispersion, and protective construction.

pop-up point The location at which aircraft quickly gain altitude for target acquisition and engagement. This point occurs at the end of low-level terrain flight to avoid detection or prevent effective engagement by the enemy.

pull-up point The point at which an aircraft must start to climb from a low-level approach to gain sufficient height from which to execute the attack or retirement.

QSTAG Quadripartite Standardization Agreement

RISTA reconnaissance, intelligence, surveillance, and target acquisition

ROE rules of engagement

rules of engagement (ROE) Directives of the force headquarters that delineate the circumstances under which US forces will initiate and continue combat engagement with other forces encountered. In air defense, directives that delineate the circumstances under which weapons can fire at an aircraft. The right of self-defense is always preserved.

RW rotary-wing

S2 Intelligence Officer

SALUTE size, activity, location, unit, time, equipment

SEAD suppression of enemy air defenses

SHORAD short-range air defense

SOI signal operation instructions

SOP standing operating procedure

SPOD seaport of debarkation

STANAG Standardization Agreement (NATO)

TASM tactical air-to-surface missile

TBM tactical ballistic missile; theater ballistic missile

terrain flight The tactic of employing helicopters in such a manner as to use the terrain, vegetation, and man-made objects to degrade the enemy's ability to visually, optically, or electronically detect or locate the helicopter. This tactic involves a constant awareness of the capabilities and positions of the enemy weapons and detection means in relation to available masking terrain features and flight routes. Terrain flying involves flight close to the earth's surface and includes the following flight techniques:

- Contour flight. Flight at low altitude conforming generally to, and in the proximity of, the contours of the earth. It is characterized by varying airspeed and altitude as dictated by vegetation, obstacles, and ambient light.
- Low-level flight. Flight generally carried out above obstacles but at an altitude where detection by a threat force is avoided or minimized. It is, therefore, at a constant indicated altitude and airspeed.
- Nap-of-the-earth flight. Flight at varying airspeeds as close to the earth's surface as vegetation, obstacles, and ambient light will permit while generally following contours of the earth.

THAAD Theater High-Altitude Area Defense

TOC tactical operations center

TOT	tracer on target
TOW	tube-launched, optically tracked, wire-guided (missile)
TRADOC	United States Army Training and Doctrine Command
TSOP	tactical standing operating procedure
UAV	unmanned aerial vehicle
WCS	weapon control status

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