

# Chapter 11: Air Defense

This page is a section of TC 7-100.2 Opposing Force Tactics.

Air defense is an integral component of combined arms combat. The OPFOR system of air defense includes the strategic, operational, and tactical levels. This chapter concentrates on tactical-level air defense. It discusses operational-level air defense only when it contributes to an understanding of tactical air defense and the relationship between the two. For more detailed information on air defense at the strategic and operational levels, see FM 7-100.1.

## Air Defense System

OPFOR air defense supports combined arms combat by the comprehensive integration of a large number and variety of weapons and associated equipment into an effective, redundant air defense system. Employment of this system pursues the basic objectives of air defense by employing certain concepts and principles. This is best accomplished by establishing an integrated air defense system (IADS). Overall, the OPFOR employs a three-phase approach to air defense, in which tactical air defense is primarily part of the third phase.

## Objectives

The objective of OPFOR tactical air defense efforts is to reduce the effectiveness of enemy air attacks and prevent enemy air action from interfering with maneuver force operations. This objective can be accomplished by any of the following means:

- Destroying enemy aircraft.
- Forcing the aircraft to expend their munitions before reaching the optimum or effective range.
- Diverting the aircraft before reaching their targets.
- Mitigating the effectiveness of the attack.
- Forcing the enemy to break off and/or discontinue the air attack.

## Concepts

OPFOR air defense doctrine emphasizes three key and interrelated concepts. The first is that every unit is immediately responsible for defending itself from aerial observation and air attack by whatever means are available. All units conduct air surveillance whenever aerial threat is imminent.

The second concept is that air defense is an integral part of combined arms combat. A maneuver unit commander who disregards the enemy air threat or fails to properly plan for defending against it risks mission failure. All units are required to report the presence of enemy aerial systems on detection.

The third concept is that air defense weapons, radars, and associated equipment cannot be regarded as single pieces of equipment or even units engaged in combat actions but as parts of an IADS. Proper integration of these assets as both a system and integral part of mission planning and execution for mission accomplishment is the ideal way the commander can effectively deal with the enemy air threat.

## Principles

The OPFOR follows several basic principles when conducting air defense: surprise, firepower, mobility, continuity, initiative, coordination, and security. Of these, the element of surprise is the most critical.

## Surprise

Achieving surprise is fundamental to any successful air defense battle. At the tactical level, surprise can be achieved through a variety of means, including

- The positioning of air defense systems in unexpected locations.
- The use of camouflage, concealment, cover and deception (C3D).
- The use of non-air defense systems in conjunction with air defense systems.

## Firepower

The OPFOR force structure includes a wide variety of air defense weapons (missiles and guns). This mix of capabilities gives ground force commanders outstanding firepower for air defense. It is important that air defense planning consider and employ all assets available, across all arms, to achieve maximum firepower. Almost all tactical vehicles and many support vehicles have guns for self-defense against aerial systems. Other weapons, even improvised weapons, can be used against some aircraft.

## Mobility

Air defense assets must have mobility comparable to the ground forces for which they provide cover. When planning air defense, the commander must always consider the mobility of air defense weapons and the time required for their deployment. The ground forces, for which air defenses provide cover, are quite mobile and frequently change formation as they deploy. The air enemy is mobile and can attack from many directions or altitudes. Therefore, the commander must use to the maximum the mobility and firepower of his assets, creating optimum groupings and fire plans. Improvements in mobility and fire control now allow more air defense weapons and sensors to operate and engage air targets while moving on difficult terrain. Mobility contributes directly to continuity.

## Continuity

Air defense forces must provide continuous protection of critical organizations and assets. This includes keeping up with dynamic maneuver elements to ensure comprehensive coverage. That requires constantly moving air defense units with adequate logistics support (or self-contained logistics). They must provide air defense day or night in all weather conditions. Shorter emplacement, displacement, and response times, and radars that can operate while moving can support the requirement. Most air defense systems have integrated fire control, with local sensors needed for autonomous operation.

## Initiative

The modern battlefield is a fluid and volatile environment where air defense unit commanders must respond to constant changes in the situation. This demands aggressive action, initiative, and originality. If the supported unit receives a modified mission, the commander must reevaluate his own unit's deployment in light of the new requirements. He also must be aware of changes in the tactics enemy air forces employ.

## Coordination

The OPFOR stresses coordination between supported maneuver and supporting air defense units, between air defense units, and with other arms. Commanders must operate efficiently even when communications with other air defense units fail. All tactical-level air defense weapons must coordinate precisely with supported and flanking units, with senior airspace management, and supporting aviation assets (if available).

## Security

The OPFOR recognizes that enemy air assets can attack from any quarter. Therefore, it must provide security for units at any depth and from any direction. Air defense units are positioned to assure radar security and overlapping coverage of sectors. Because of the threat from enemy ground elements, air defense units must coordinate with supported maneuver units to ensure sufficient ground security.

## **Integrated Air Defenses and the Tactical Fight**

OPFOR air defense weapons and surveillance systems at all levels of command are part of an integrated air defense system (IADS). This ability provides a continuous, unbroken (usually overlapping) umbrella of air defense coverage and presents a significant threat to any potential enemy air activity.

## **Organization**

Each level of command with air defense assets has its own IADS. This system is capable of passing early warning, acquisition, tracking, and firing data

- Upward to higher-echelon IADS.
- Horizontally to adjacent IADS.
- Down to the lowest levels of air defense radars and maneuver units.

Use of IADS enables the OPFOR to mass the effects of air defense assets from dispersed sites to protect the most critical targets. It also facilitates the use of passive air defense techniques, including dispersal, deception, and camouflage. The ability of the OPFOR air defense and maneuver units to receive early warning, target acquisition, tracking, and firing data remotely from the dispersed radars significantly reduces the physical and electronic signature of air defense systems.

## **Sectors**

The OPFOR recognizes that it is unlikely to be able to defend its entire airspace adequately. Therefore, it must establish priorities to ensure denser coverage of key assets or areas. These priorities may change during the course of combat, as the tactical, operational, or strategic situation changes. The OPFOR is prepared to adapt its air defense operations and tactics to use IADS at sector levels. Within sectors, the OPFOR may be able to challenge even the most modern air forces, at least initially, and perhaps temporarily prevent them from attaining air supremacy.

The OPFOR offsets limitations of sector defense by overlapping sector coverage, and by employing an IADS at each echelon above battalion level. A division or division tactical group (DTG) IADS divides its area into overlapping sectors for subordinate brigade or brigade tactical group (BTG) IADS. In most cases, a tactical air defense sector will overlap other tactical IADS sectors, and will be within the larger sector of an operational-strategic command (OSC).

In choosing to fight within sectors, the OPFOR accepts risks, since air defense sectors present seams in the defenses and may be unable to provide mutual support. On the other hand, sector air defense can help reduce the physical and electronic signature of defensive systems. It can also enable the OPFOR to mass the effects from dispersed sites to protect critical targets within sectors. Within air defense sectors, the OPFOR develops air defense ambushes along the most likely air avenues of approach.

## **Phases**

Essential to integration and successful employment at the strategic and operational level is the use of three phases. The phases are defined by where the enemy aircraft are and what they are doing:

- Phase I. Actions against enemy aircraft and control systems on the ground before they are

employed. This phase is conducted using primarily strategic- and operational-level assets of the Army and the Air Force.

- Phase II. Actions against enemy aircraft while in flight but before they enter the airspace over OPFOR ground maneuver forces. Again, this mission is performed primarily at the strategic and operational levels.
- Phase III. Actions against enemy aircraft that have penetrated into the airspace over OPFOR ground maneuver forces. Thus, the "target area" consists of the area where enemy aircraft have penetrated over the OPFOR disruption, battle, and support zones. OSC-level tactical fighters and the short- to medium-range surface-to-air missiles (SAMs), antiaircraft (AA) guns, and other weapons of the ground maneuver units execute this phase. It is in this phase that ground-based tactical air defense plays its primary role.

For additional information on the phases of the air defense, see FM 7-100.1.

## Command and Control

The intent of IADS is for air defense forces at all levels of command to create a continuous, unbroken umbrella of air defense coverage. An integrated communications system provides target information and early warning to air defense and ground maneuver units. Integration is both vertical and horizontal. Vertical integration is between the strategic, operational, and tactical levels, while horizontal integration is within each of these levels. Enemy capabilities may present a situation where a totally integrated system at the strategic and or operational level is neither possible nor even desirable (see FM 7-100.1).

At the tactical level, the commander normally strives to achieve horizontal integration. His ability to integrate or be integrated vertically will depend on the air defense course of action taken at the next- higher level.

## Centralized Versus Decentralized Air Defense

Air defense command and control (C2) relationships are subject to conflicting pressures for centralization and decentralization. Factors favoring the former include greater efficiency and effectiveness of centralized target detection systems and the increased ranges of modern SAM systems. Factors favoring the latter include the need for flexibility to support fast-paced operations by maneuver units and the many contingencies that can arise in local situations.

Centralized control is necessary, especially during defense, to ensure that the coverage of air defense units is mutually supporting and comprehensive. Without centralization at some level, the air defense umbrella does not exist, and target tip-off will not be received. At the same time, decentralized control is required, since OPFOR air defense commanders are expected to demonstrate aggressive action and originality, responding to changes in the tactical situation and operating effectively when cut off from communications with other air defense units.

Even with a decentralized control, the ability to receive information concerning inbound enemy aircraft is essential. This may be accomplished by air defense data link or other automated communications such as battlefield management systems, or simply radio or telephone communications passing essential information on enemy aircraft. With or without centralized control, information from human intelligence (HUMINT) sources can be quite valuable.

## Duties and Responsibilities

At all levels above the maneuver battalion, air defense is directed by the chief of airspace operations (CAO). However, the unit commander is ultimately responsible for the success or failure of these operations. For example, during the planning phase, a division or brigade commander (assisted by the CAO and force protection staff officers) personally directs the deployment of his air defense weapons to support his mission and establishes priorities and

procedures for logistics support. At the maneuver battalion level, the battalion commander has overall responsibility for the organization and conduct of air defense.

On the primary staff at division, DTG, brigade, and BTG level, the operations section is responsible for air defense. Within that section is the airspace operations subsection (AOS), headed by the CAO. This subsection does the planning and insures that those plans are executed within the commander's intent. The AOS is assisted in this effort by the force protection staff element. It is the force protection staff element that receives liaison teams from constituent, dedicated, and supporting air defense units associated with the division, DTG, brigade, or BTG.

At division, DTG, brigade, and BTG, the commander of the air defense units at that level has the following duties and responsibilities:

- Organize, plan, and conduct the air defense of the organization.
- Prepare recommendations on the employment of air defense assets.
- Contribute to the maneuver commander's decisionmaking process.
- Know the situation, status, and capabilities of air defense units at any stage of the battle.
- Issue orders to air defense units and staffs of subordinate units.
- Direct the regrouping of forces during the battle.
- Coordinate logistics support of air defense units.
- Establish coordination between air defense units.
- Organize communications.
- Provide liaison to the division, DTG, brigade, or BTG staff.
- Monitor the execution of orders.
- Assist subordinate units and staffs.

In most situations, an OSC commander can direct the employment of the air defense assets of at least his immediate tactical-level subordinates—divisions and DTGs or separate brigades or BTGs. The OSC may also allocate air defense assets down to DTG, BTG, or even battalion-size detachment if the conditions warrant. Brigades and BTGs that are part of a division or DTG provide coverage for their own units and vertically integrate with division or DTG coverage. When not part of a division or DTG, they vertically integrate with OSC-level coverage, which would be part of their next higher level of command. There may be skip-echelon situations when the OSC will specify how divisional maneuver brigades or BTGs employ their air defense battalions. Normally, however, the division or DTG will dictate that.

The division or DTG can dictate how maneuver brigades or BTGs employ their air defense battalions and/or may allocate air defense assets down to cover gaps. Finally, the maneuver brigade or BTG's air defense commander has overall responsibility for the coordinated air defense coverage and administrative control of the man-portable air defense system (MANPADS) platoons constituent to the maneuver battalions.

## Command Posts and Communications

Every air defense unit above platoon level (and sometimes at that level) has an air defense command post (CP). That CP serves as the mechanism for linking surveillance, fire control, weapons, and support activities. The division air defense CP normally colocates with the division staff at the division main CP. Many CPs also have colocated air surveillance radar, sometimes mounted on a command vehicle, to perform air defense battle management on site. A communications vehicle and staff vehicles are usually colocated with the CP for support. Most air defense batteries and some air defense platoons have CPs (often armored command or command and reconnaissance vehicles).

The division, DTG, brigade, or BTG CAO and his staff in the AOS normally colocate with the main CP at that level of command. The AOS is responsible for airspace management. (See chapter 10 for more information on airspace management, CAO, and AOS.) An AOS staff member is located at the forward CP to represent the CAO and advise the maneuver commander.

The OPFOR IADS includes an integrated communications system that provides early warning and targeting information to all air defense and ground maneuver units. If dedicated air defense communications with other air defense units fail, commanders switch to other communications means and use their own initiative and flexibility, in order to adapt to frequent changes in the ground or air situation.

Enemy jamming of dedicated data links does not necessarily stop the IADS from passing necessary information to the air defense and ground maneuver units. Information obtained by components of the IADS is generally directly transmitted using the IADS network. In a backup situation, however, it can be also be transmitted by numerous other methods such as

- Automated battlefield information systems.
- Radio (voice and/or Morse code).
- Satellite communications.
- Data transmission.
- Cellular phone.
- Telephone.
- Fiber optic cable or hard wire if located in proximity (or relayed via switchboard).
- Retransmission.
- Any other real time (or even near-real time) methods.

Sufficient early warning or tracking data used in a backup situation only needs to be basic information about the enemy aircraft. The air defense unit only requires actionable information such as time, bearing, range, speed, altitude/height, and aircraft type (if possible). This simple data is sufficient for the receiving radar to determine exactly where and when to look and the appropriate time to turn on his radar in order to track and fire. Air defense assets may also be positioned close enough together to be hardwired.

The OPFOR has the ability for its lowest air defense and maneuver units to receive air defense information remotely relayed from the most powerful high-level surveillance systems. This enables OPFOR air defense units to operate with the radar turned off and still receive sufficient information to track and fire on approaching enemy aircraft within their respective sectors. It provides several levels of redundancy, which prevents the enemy from breaking the systems integration by merely knocking out one (or several) radar and/or communications means.

The basic rule for the establishment of communications between supported and supporting unit is that the higher command allocates landline, radio relay, and mobile communication means, while radio equipment is allocated by both higher and subordinate levels. This ensures proper coordination of communications. If communication is lost, the commanders and staffs of all units involved are responsible for the immediate restoration of communication. Redundant communications systems with multiple operating frequencies are often available to assure communications integrity even under electronic warfare (EW) conditions. A multi-aspect attack warning system sends immediate alarm of incoming enemy aircraft to maneuver units, the staffs, and logistics units. The warning is communicated through signal equipment that is specially allocated for this purpose. Within air defense organizations, alerts are sent via acoustic signal and graphic computer display, and on portable azimuth displays (plotting boards).

## Airspace Management

The OSC is the lowest level of joint command with control of both Army and Air Force units. Under the operations officer on every staff from OSC down to brigade and BTG level, the CAO is responsible for airspace management issues and procedures. The CAO maintains the airspace control net for controlling the command's airspace and all related matters. These headquarters typically receive liaison teams from all constituent, dedicated, and supporting Air Force, army aviation, and air defense units associated with the command. An OSC headquarters allocated Air Force assets would also receive an Air Force liaison team. All these units and their liaison teams are on the airspace control net. For additional information on airspace

management, see FM 7-100.1.

To reduce air-to-ground coordination problems during the execution of tactical missions, the OPFOR employs proactive staff elements and control measures. Primarily, the OPFOR employs a system of identification, friend or foe (IFF) between aircraft and air defense systems. To protect friendly aircraft from fratricide from non-IFF-capable systems, strict procedural controls are enacted that separate airspace horizontally, vertically, or both. This buffer zone minimizes the possibility of fratricide while maximizing ordnance effects. For specifics concerning airspace coordination procedures and zones, see chapter 10.

Unless otherwise notified, air defense weapons consider the airspace a *free fire zone* and will fire on all aircraft. *“If you fly, you die”* is the OPFOR default. The air defense coverage may be temporarily *switched off* to allow friendly aircraft to pass on a mission planned in advance and then *switched on* as they exit the area. For other missions, air defense coverage may allow aircraft to transit only on *safe corridors* based on air routes or other procedural methods. If aircraft deviate from these coordinated areas, they will be shot down by friendly ground force units. The OPFOR views the possible loss of aircraft through fratricide as a lesser risk than allowing gaps in its radar and air defense coverage that the enemy might exploit. See also chapter 10 for more information on airspace coordination and management.

Airspace coordination is critical to those ground maneuver units and others using unmanned aerial vehicles (UAVs). Otherwise, they stand a very good chance of losing the UAVs. Due to the proliferation of UAVs in recent years, coordination responsibility has reached very-low-level tactical units. If an OPFOR air defense unit acquires an unidentified UAV, it will shoot it down. That is because the enemy is also likely to be using UAVs. The unit launching the UAV must coordinate with the appropriate AOS or CAO prior to launching. Maneuver battalions may have a forward air controller (FAC) assigned to coordinate with supporting air elements and air defense units. In the event the maneuver battalion does not have a designated FAC, the battalion operations officer will facilitate the coordination. Maneuver companies will notify their parent battalion when the company plans to launch UAVs.

It is imperative that air defense units be notified when friendly aircraft (or UAVs) are flying within the air defense umbrella. Failure to coordinate with these elements will result in fratricide. The senior air defender in the command is responsible for airspace deconfliction and the notification of air defense units.

## Air Surveillance

Air surveillance is the key factor in guaranteeing the earliest possible warning of impending enemy air attack. It is conducted by electronic and electro-optical means and by visual observation. Radar is used for technical surveillance, providing all-weather detection capability. EW systems, acoustic systems, unattended ground and aerial sensors, and other assets are used to provide early warning of aircraft activities and alert air defense systems to engage air targets. Although this chapter primarily addresses ground-based air defense at the tactical level, the addition of UAVs in tactical organizations provides organic aerial surveillance for various roles, which can include air defense.

Ground-based and airborne air surveillance assets at the operational level play a major role in gathering, integrating, and disseminating information to tactical units. The objective is to establish a system that not only provides the earliest possible warning of approaching enemy aircraft but also develops target information sufficient to plan and conduct effective air defense.

OPFOR tactical air defense units receive preliminary early warning target data passed from higher-level or adjacent radar units to air defense commanders and their firing batteries via automatic data links or other communications. This practice reduces the vulnerability of battery radars and radar-equipped gun carriages and missile launchers to jamming or destruction. Ideally, only those aircraft that have been positively identified as hostile will be engaged.

## Sensors

Sensors are a critical component of air defense systems. They perform surveillance and tracking functions against fleeting air targets. The primary target detection and acquisitions means for air defense units are radars. Radars can more easily detect and track aircraft with less operator input than other sensors. However, many detection and acquisition packages are sensor suites using multiple sensors, including acoustics, optics, and electro-optics.

## Radars

Air defense units employ a mix of radar systems operating at different frequencies, in varied intervals and with overlapping coverage. Radars fall into the general categories of surveillance and fire control. Surveillance radars include early warning, target acquisition, and height-finding radars, while some perform all of these roles. Air defense unit target acquisition radars can acquire and track targets and assign them to the fire control system for engagement. Some fire control radars also have a limited target acquisition capability. Dual-mode radars perform both functions simultaneously. (For additional information on the technical capabilities of air defense radars, see the Worldwide Equipment Guide.)

The OPFOR is fielding more modern mobile radar systems with the ability to quickly employ radars or operate radars while moving. Early warning radars with long-range capability detect approaching aircraft and cue the IADS. The IADS identifies air targets and assigns its own target acquisition radars to acquire and track aerial targets. Then it assigns an air defense unit to engage those targets. Some air defense surveillance radars can perform both early warning and target acquisition roles.

Units containing older radars (requiring some operational down time for maintenance) generally use at least two radars that are set up at critical terrain points to insure continuous overlapping coverage. Usually only one radar will move at a time. To reduce the likelihood of detection by enemy electronic intelligence (ELINT), the radars on tactical air defense systems may not be operated unless the requirement for their use outweighs the risk of detection. Radars are emplaced to provide integrated overlapping cover to prevent air attack against any single radar. Overlapping coverage ensures any aircraft attacking a radar will be covered by at least one radar and possibly several radars. The data transmitted by the covering radars allows several air defense systems to fire on the attackers.

An example of the integration of multiple sensors is the air defense brigade subordinate to a division. It contains an early warning/target acquisition battery that includesâ€”

- Early warning, target acquisition, and possibly height-finding radars.
- IFF interrogators.
- Communications vehicles.
- CPs.

The surveillance section of the battery provides redundancy in that it can take over the CP function in an emergency. If required (especially while covering a moving unit), the commander may receive additional radars from higher level. One is usually placed at the forward portion of the moving unit and the other with the main body.

## Other Electronic and Electro-Optical Sensors

Some OPFOR air defense weapons are integrated with passive sensors, such asâ€”

- Optics.
- Electro-optics.
- TV cameras.
- Night-vision sights.



- Auto-trackers.
- Laser rangefinders.
- Acoustic sensors.

Multiple units are simultaneously alerted on aircraft approach for overlapping sector coverage. Azimuth warning systems, such as azimuth displays and plotting boards of dismounted guns or MANPADS teams are also alerted.

Acoustic sensors include acoustic arrays, both stationary and vehicle-mounted. Passive sensor systems can also include acoustic-triggered unattended ground sensors.

Air approach alarms are available for tactical ground force units, and may be linked to MANPADS teams. Most of these alarms provide bearing and range. Night sights are also now common on MANPADS, AA guns, and other air defense equipment. The OPFOR uses all types of infrared devices to detect "hot spots" and subsequently tip off other acquisition means to acquire and begin tracking the aircraft. For additional information on equipment, see the Worldwide Equipment Guide.

## Visual Observation

An effective system of visual surveillance often provides the first warning of an enemy air attack. This is especially true of attacks conducted by low-flying aircraft or armed helicopters using nap-of-the-earth (NOE) techniques. When operating close to enemy forces or in areas where enemy air attack is considered likely, all units post air observers to continually observe the sky. Observers may also use hand-held or vehicle-mounted optics, electro-optics, and laser rangefinders, and unattended or remote sensors. Despite the presence of a technologically advanced early warning system, the OPFOR continues to stress the importance of visual surveillance. This is especially true at the small unit levels.

In the defense, air observation posts (air OPs) are set up at suitable locations, usually on terrain offering good visibility, near CPs, and/or close to air defense units in firing positions. During tactical movement and during both the defense and offense, observers are posted on each vehicle. Observers are changed frequently to reduce fatigue and maintain their effectiveness.

Visual air surveillance is conducted on a 360-degree basis, and observers are assigned sectors of airspace to monitor. OPFOR air defense units realize that an aircraft can be visually detected at ranges of 2 to 5 km when the observer is assigned a 60- to 90-degree sector of observation, and at ranges of 6 to 7 km when assigned a 30-degree sector. Naturally, these distances are affected by terrain and lighting conditions. The use of binoculars can increase detection ranges to approximately 12 km. Aircraft can be observed much further (30+ km) when using modern electro-optical equipment. Aircraft flying at high altitudes may be detected at ranges up to 50 km when more sophisticated optical ranging equipment is used.

To visually observe activity at enemy airfields in or near the area of responsibility (AOR), whenever possible, the OPFOR makes extensive use of "eyes on the ground":

- Special-purpose forces (SPF) teams.
- Human intelligence (HUMINT) agents.
- Sympathetic civilians.
- Affiliated irregular forces.
- Any combination of these.

These observers report by radio or telephone the number and types of aircraft taking off or seen, and their direction of travel. Other observers stationed along probable approach routes can monitor and report the progress of the enemy aircraft en route to their targets. The OPFOR also prefers to establish complete early warning "skywatch/air observation" networks using local civilian personnel. This information, combined with electronic tip-off from radar units, enables OPFOR air defense units to leave their radars turned off and still be able to detect, track,

and (with some systems) fire on incoming enemy aircraft.

Every tactical air defense battalion has a subordinate air observer platoon (AOP). This is a specialized high-mobility unit designed to fill or close gaps in tactical air defense coverage. This platoon becomes especially critical during a dispersed fight. While the AOP typically engages with enemy units only in self-defense, it is equipped with a laser designator to lase high-value targets such as forward arming and refueling points (FARPs). Another common tactic is for air defense ambush teams (MANPADS or AA guns) to accompany the AOP while they are en route to conduct an ambush. Prior to deployment, the AOP conducts a map terrain analysis of friendly radar coverage. The resultant analytical overlay provides the AOP critical locations to surveil based on radar terrain masking. Based on this, the air defense ambush teams are dropped off to provide air coverage while the AOP continues farther away to provide early warning. This platoon and/or its subordinate squads are routinely suballocated to maneuver units.

Every maneuver brigade has a subordinate reconnaissance company. A primary mission of this reconnaissance unit is to provide early warning of any enemy air activity. Within this reconnaissance company are several specialized long-range and high-mobility reconnaissance platoons. Each of these platoons is designed to range across the disruption and battle zones and report any enemy air activity. For specific details on the organization structure, see FM 7-100.4.

## **Tactical Assets**

Air defense assets available to the tactical commander are a blend of air defense units and combined arms units using weapons well suited in the air defense role. Commanders must properly integrate these assets into a system (IADS) and make them an integral part of mission planning and execution.

## **Organizations**

The OPFOR ground force structure includes air defense units. These units are equipped with a variety of systems having the firepower, mobility, and range to fully support fast-moving tank and mechanized forces in dynamic offensive operations. For information on organizational assets and equipment above the tactical level (OSC and above) and IADS, see FM 7-100.1. For specifics on tactical organizations, see FM 7-100.4.

## **Divisions**

Most maneuver divisions contain at least an air defense brigade. The brigade is fully capable of providing air defense coverage for the entire division. Divisions can be assigned to create task-organized division tactical groups (DTGs). When this occurs, consideration must be given to allocating additional air defense assets to ensure protection of the augmented force. In some situations, the DTG may be allocated assets normally associated with operational-level organizations. The division or DTG commander also has the option of further allocating or task-organizing some, or all, of these assets to subordinate units.

## **Divisional and Separate Brigades**

Like the division, maneuver brigades may be task-organized as brigade tactical groups (BTGs) and may require additional air defense assets to protect newly allocated units. Divisional maneuver brigades contain organic air defense assets, usually an air defense battalion. Separate brigades may contain a more robust air defense battalion. Depending on a number of circumstances, BTGs formed from either type of brigade may also have additional assets either at the brigade level or allocated down to their assigned battalions. However, separate brigades typically contain a more robust capability than divisional brigades, even without augmentation. Thus, air defense augmentation of a separate brigade (task-organized as a BTG) may be the equivalent of an air defense brigade.

## Battalions

Maneuver battalions can be task-organized as detachments to perform a specific mission. When assigning air defense assets to battalions forming detachments, brigade planners need to pay special attention to the command and support relationships they assign (see chapter 2).

Maneuver battalions typically have a MANPADS platoon for self-protection. Other air defense assets may also be allocated to the battalion. The platoon leader of the MANPADS platoon (or the senior air defender) also coordinates with the appropriate staff member, or FAC if present, to deconflict any possible fratricide issues.

## Companies

The MANPADS platoon at battalion may be retained at battalion level, or the battalion may allocate its MANPADS squads down to maneuver company level. Most OPFOR tactical vehicles are equipped at least with a 7.62-mm general-purpose machinegun that can engage enemy aircraft in addition to ground targets. All OPFOR units receive training in the employment of massed small arms weapons fire to engage low-flying enemy aircraft. This technique is routinely practiced by troop units and is usually employed under the supervision of the company commander when he has been notified that an enemy aircraft is approaching. For additional information, see All-Arms Air Defense below.

## Weapons

The OPFOR force structure includes a wide variety of weapons providing ground force commanders outstanding firepower for air defense. Air defense planning must consider and employ all assets available, across all arms to achieve maximum firepower.

## Air Defense Weapons

The OPFOR inventory of tactical ground-based air defense weapons includes a variety of missiles, guns, and support equipment. Tactical-level air defense includes short- and medium-range SAMs, short-range AA guns, and MANPADS. Tactical air defense assets are increasingly using combination AA gun and missile systems, offering added flexibility and quick and lethal engagement of all aerial targets, especially low level targets. The OPFOR's tactical air defenses support the need to protect ground forces and the desire to seize any opportunity to shoot down high-visibility (flagship) enemy airframes.

The assets contained in the division's air defense units are capable of providing the commander with area defense, point defense where required, and ground to medium-altitude coverage. Their mission is to protect the division's maneuver elements and other units within its AOR. Assets redeploy as necessary to maintain coverage of advancing forces. Many systems are capable of providing air surveillance on the move and launching from a short halt to respond to detected enemy aircraft. They can also displace by pairs or as batteries and halt in intervals to provide coverage of the force as it moves. Some air defense weapons, such as MANPADS, can be fired while on the move.

Nearly all self-propelled AA guns can fire on the move with passive electro-optical fire control systems. Some still only have optical sights. Others have onboard radars that can operate on the move, or in seconds with a short halt. Most have an alert system with sufficient warning to ambush approaching aircraft. Aside from short-range air defense, AA guns also can be employed against all but the heaviest of enemy ground force systems, as well as against personnel, with devastating effects. Some typical infantry weapons such as the automatic grenade launcher, machinegun, and recoilless rifle are also equipped with ballistic fire computers and radars. All are extremely lethal in the air defense role.

A variety of relatively new systems, which significantly enhance air defense capabilities, have entered the OPFOR inventory. These include but are not limited to remote helicopter infrared sensing devices and passive acoustic acquisition systems. Antihelicopter mines are widely available and increase the OPFOR ability to deny low-altitude approaches, firing positions, and landing sites to enemy rotary-wing aircraft.

## All-Arms Air Defense

The OPFOR recognizes that air defense is an all-arms effort. Thus, all OPFOR units possess some type of an organic air defense capability to differing degrees, depending on the type and size of the unit. The OPFOR continuously looks for new and adaptive ways of employing not only air defense systems but also systems not traditionally associated with air defense. Many OPFOR weapons not designed as air defense weapons will also damage and/or destroy tactical aircraft when within range.

Throughout maneuver units, there are a number of systems designed for air defense and other systems that can be used in an air defense role. The heavy AA machineguns on tanks are specifically designed for air defense. Machineguns on APCs and automatic cannon on IFVs can engage both ground and air targets. Most antitank guided missiles (ATGMs) are extremely effective against low-flying helicopters. Several ATGM manufacturers offer antihelicopter missiles and compatible fire control, which are especially effective against low-flying rotary-wing aircraft. Field artillery and small arms can also be integral parts of the air defense scheme. All these weapons can be extremely lethal when used in this role.

Many maneuver units have modified selected infantry vehicles into fire support vehicles, specially equipped for multiple-role use with cannons, ATGMs, and MANPADS. These vehicles are employed in air defense or antitank platoons, which carry dismount teams with missiles to engage aerial and other targets. Some MANPADS and their vehicle-mounted versions are capable of antitank roles as well as air defense. The OPFOR attempts to adapt these systems and develop new tactics that may help to fill the void when a specific capability is denied by a more sophisticated enemy.

Note. Some air defense systems also lend themselves to multiple roles. An example of this capability is the Starstreak High Velocity Missile, which is available in vehicle-mounted and man-portable configurations. Although designed as a hypervelocity MANPADS with a range of over 7 km in an air defense role, the Starstreak can also penetrate vehicles with over 4 inches of armor at the same range. It is a high-precision missile and is countermeasure resistant, with laser beam-rider guidance. Starstreak has a very high probability of hit against less maneuverable aircraft, especially helicopters conducting terrain flying such as NOE. Hypervelocity speed permits destruction of an aircraft at 7-km range in about 5 seconds, and denies the aircraft time to engage targets or evade or counter the missile. This combination gives multipurpose weapons like the Starstreak a permanent place in the ground role as well as air defense weapons.

The OPFOR considers every soldier with a MANPADS to be an air defense firing unit. These weapons are readily available at a relatively low cost and are widely proliferated. Therefore the OPFOR is acquiring as many MANPADS as possible and issues them in large numbers to a wide variety of units. It can also disseminate them to selected affiliated forces. The small size and easy portability of these systems provides the opportunity for ambush of enemy airframes operating in any area near OPFOR units. The OPFOR also employs them to set ambushes for enemy helicopters, especially those on routine logistics missions.

To counter the helicopter threat, a wide variety of tactical and combat support vehicles have MANPADs or machineguns with AA sights to engage aircraft. Two of the greatest advantages of helicopters are weapons stand-off and ability to use terrain cover on approach. Many ground force and air defense weapons can match the stand-off and inflict damage to force aircraft to disengage. When flying in an NOE mode (20 to 25 ft above ground level), a helicopter rotor is

approximately 40 ft off the ground. A helicopter flying NOE cannot easily engage targets or evade missiles, and it be easily targeted by ground weapons. Nearly all SAMs, small arms, direct-fire crew weapons, ATGMs, antitank grenade launchers, automatic grenade launchers, and machineguns can engage it.

Anti-helicopter mines can be placed on likely enemy helicopter firing positions. This area can then be left unattended. The technique can be used at sights to economize assets. For additional information on anti-helicopter mines see, Air Defense Ambushes and Roving Units below.

OPFOR maneuver squads and above are routinely trained to use their weapons to engage tactical aircraft and have incorporated the engagement techniques into their tactics, techniques, and procedures. Below are typical examples of these weapons and their air defense capabilities:

- ATGMs (out to 5,500 m).
- Antitank grenade launchers (800 m +).
- 35- and 40-mm automatic grenade launchers (2000 m +) (ballistic computers; some may be radar-guided).
- Machineguns (7.62-mm 1,200 m; .50-cal 2,000 m +) (ballistic computers; some may be radar-guided).
- Antimateriel rifles, .50-cal or 14.5-mm (2000 m).
- Sniper or marksman rifles, .30 cal or 7.62-mm (600 m).
- Recoilless rifles, 73- to 106-mm (1,100 m +) (ballistic computers; some may be radar-guided).
- Air-to-surface rockets (improvised from air-to-surface pods), example 57-mm (3,000 m).
- Antitank disposable launchers.
- Infantry rocket flame weapons (thermobaric).
- Mini-UAVs and micro-aerial vehicles, with or without warheads (can attack or harass rotary-wing aircraft).
- Volley fire by squad, platoon, or company with assault rifles when aircraft are within range and passing overhead.
- Tank main guns (laser-guided missiles offer precision beyond 5 km).

For additional information on weapons capable of damaging and/or destroying tactical aircraft, see the Worldwide Equipment Guide.

## Employment

The details of the employment of air defense assets are not templated, carbon-copy solutions. Employment options depend on several factors, some examples of which areâ

- Missions assigned.
- Scale of the missions.
- Availability and capability of systems.
- Enemy air order of battle.
- Priority of the protected target.
- Conditions under which combat is waged and the type of combat.
- Specific terrain and meteorological conditions.

Whatever the nature of combat being conducted by maneuver forces, the actions of supporting air defense units are, as the term implies, inherently defensive. Assigning specific missions to air defense units requires an understanding of the types of missions, the planning considerations involved, and the engagement procedures used.

## Missions

The primary mission of OPFOR ground-based air defense systems is to protect maneuver units and installations from attack by fixed- and rotary-wing aircraft. This reduces the availability of enemy air assets to influence the development of the ground battle. As part of the overall air defense effort, these forces perform a variety of missions, including the following:

- Timely detection of incoming aircraft, continuous tracking of airborne targets, and warning troops of attacking aircraft.
- Protection of the support zone with a primary emphasis on protecting targets that play key roles in supplying troops.
- Prevention of observation and reconnaissance by aircraft or UAVs.
- Destruction of airborne or air assaults during overflight, airdrop, or landing.
- Prevention of deeper penetration by enemy aircraft, in cooperation with adjacent air defense units.
- Prevention of reinforcement or resupply of encircled enemy forces.
- Protection of units or forces from attack by unmanned combat aerial vehicles and attack UAVs.
- Protection of units or forces from attack by missiles and artillery rockets.
- Countering of enemy aerial system activities, such as jamming, communications transmission, and infiltration or exfiltration.

## Planning Considerations

A number of factors determine the appropriate employment of an air defense unit. Prior to the employment of the unit, consideration is given toâ€”

- Effective range and altitude. If the effective range of the air defense unitâ€™s specific weapon system(s) does not exceed 10 km, the air defense unit is not assigned a mission covering 30 km. The same applies to altitude. A unit of small-caliber AA guns is not assigned a mission of independently protecting an object that can be successfully hit by an air strike from altitudes over 2,000 m.
- Probability of kill. Effectiveness of fire of an air defense unitâ€™s weapon usually is described by its probability of destroying an air target. If the probability is small, the object may be covered by several air defense weapons.
- All-weather capability. If enemy aircraft are capable of striking the object during any weather condition, units without fire control radar are not capable of providing adequate air defense.
- Mobility. An air defense system chosen to defend a given object must have at least the same mobility as the object or unit defended.
- Supporting systems. This includes the availability and capability of early warning and target acquisition radars, weapons, electronic jamming and electronic protection measures, and the operating requirements of these systems.

The essence of an air defense unitâ€™s combat mission can be expressed in two words: â€”to cover.â€” Combat orders indicateâ€”

- The object(s) or combat unit(s) to be covered.
- The starting time and duration of the air defense mission.
- The degree of readiness and procedures for conducting fire.
- Procedures for organizing early warning, target acquisition, and communications.
- Routes of movement to the fire or launch position area.
- Coordination between ground troops and friendly aviation, control, communications, and logistics elements.
- Other applicable instructions.

Air defense planning is not strictly limited to considerations for the employment of air defense systems. It also includes coordination with other arms. Air defense planners should view air defense as pulling together all aspects and potential contributions of other arms to supplement and complement the air defense plan. Airspace management is one obvious requirement. However, there is also the need to identify likely air avenues of approach and hovering sites for enemy rotary-wing aircraft. The hovering sites would be submitted through artillery channels as preplanned targets available on-call. Similar coordination is also required with EW elements and engineers.

## Objects and Units Covered

The characteristics of the objects to be defended are the determining factors in the tactical employment of air defense units. Primary among these are the combat function and location of the defended unit or object. This is determined primarily by the role and location of ground combat units, logistics units, and the current tactical situation. Other factors have a considerable influence on a decision as to the type and quantity of air defense units assigned, such as

- Sensitivity of the target. A fuel dump is more sensitive to air strikes than a fuel depot. A mountain road is considerably more critical than a road on a plain, since damage to the road surface would force troops to halt in the first case, but not necessarily in the second.
- Geometric dimensions of a target. The larger the target, the greater the probability of its being hit. If a target's dimensions are large, it can be attacked from horizontal flight at medium-to-high altitudes. In most cases, targets of smaller dimensions would be attacked from very low altitudes or by diving aircraft.
- Mobility of a target. Targets maneuvering on the battlefield are harder to locate and attack than are fixed targets. Therefore, the enemy will most likely attempt to destroy them immediately upon detection. Stationary or immobile targets are not necessarily subject to air strikes immediately upon their detection, but as the tactical situation warrants.
- Weather and visibility. Various kinds of weather and nighttime conditions can affect the possibility of attacking aircraft locating a target. Reference points on the approaches to the target, and at the target's location, can be used for navigational fixes to more accurately acquire the target.

The tactical importance of units and facilities is not constant but changes during the course of combat as assigned missions are accomplished. For example, the role of a battalion advancing along the main axis and that of a battalion removed to the reserve are not of equal importance with respect to successful accomplishment of the combat mission. Also, a water-crossing site loses value after the main body of troops has crossed it. Over time, there is a systematic and continuous reappraisal of the role and function of combat units and support facilities. Their role and significance in accomplishing the overall mission can change, and therefore their priority for protection can change also. In certain cases, there may be insufficient air defense assets to cover all targets. In those cases, air defense units are relieved from covering targets that have become of secondary importance. Instead, they are assigned to cover new, more important targets to ensure the combined arms forces can complete their missions without interference from enemy air action.

## Zones

Air defense units of an OSC conduct an overlapping sector-based area defense, engaging enemy aircraft at some distance from the supported maneuver divisions and themselves. In the best-case situation, a division or DTG will have sufficient assets to provide coverage over its entire AOR, primarily conducting area coverage. However, there is a significant element of point defense in support of the division or DTG's maneuver brigades or BTGs.

At maneuver brigade or BTG level, there is a significant element of point protection in support of subordinate units and brigade-level assets. This is due to the nature of the units defended and the relatively short range of air defense weapons at this level. Batteries of the brigade- or BTG-level air defense battalion and the MANPADS platoons of the maneuver battalions generally conduct a point defense protecting high-value targets. These targets include radars, EW systems, main CPs and communication nodes, key material support, engineer equipment, and artillery. Other instances of point defense include use at key air approaches shielded by terrain from other air defense units.

Ideally, brigades or BTGs should also be able to provide coverage for their own units and vertically integrate with divisional coverage. The degree to which these assumptions apply

depends on mission, assets available, and enemy capabilities. Employment of air defense varies among the three basic zones that make up a supported organizationââ AOR.

## Disruption Zone

Air defense in the disruption zoneââ is neither offense or defenseââ should provide area coverage to defend forces in the zone and provide point defense for key assets involved in conducting fires. It is essential that air defense assets assigned have mobility and survivability equal to those they are defending. Even the systems providing point defense must be highly mobile and capable of moving with units as they displace to hides or new firing positions or conduct survivability moves.

Paramount to the success of air defense in the disruption zone is participation in the counterreconnaissance effort. This effort must be both creative and aggressive. Early warning, tracking, and remote cueing are key. When necessary, the OPFOR will move air defense assets normally located in the battle zone well into the disruption zone to accomplish this and to assist in area coverage. This, in conjunction with the well-planned use of other arms to achieve air defense missions, allows the OPFOR to attack air platforms in the disruption zone and beyond.

Coverage for maneuver forces in the disruption zone is a priority. However, air defense units may be assigned missions that are offensive in nature and not directly tied to the defense of a specific organization or site. The extensive use of air defense ambushes located along likely routes of ingress and egress is essential. Missions can include an integrated effort to destroy FARPs or aircraft using FARPs, and actions to destroy UAVs before they reach the battle zone.

The commander may create a disruption zone that extends well into enemy-held territory. In this case, disruption forces operating in that area may or may not have air defense coverage. SPF and affiliated irregular forces may rely strictly on C3D for protection from enemy air attack. Regular forces should have sufficient man-portable assets to provide protection for the force. Some of the stay-behind forces may be air defense teams, equipped with man-portable assets and assigned pre-planned targets to ambush.

## Battle Zone

Air defense in the battle zone requires assets that provide coverage and have the mobility to move with supported forces. In the battle zone, air defense emphasis is on protecting the fighting forces. This is accomplished through a combination of area and point defense. Elements of the maneuver brigadeââ or BGTââ air defense unit deploy to cover its maneuver battalions. Brigades and BTGs that are part of a division or DTG vertically integrate with division or DTG coverage. (When not part of a division or DTG, they vertically integrate with OSC-level coverage, which would be their next-higher level of command.) Where necessary, divisional assets are assigned supporting missions to brigades or BTGs. Brigade or BTG assets are pushed down to battalions when required. MANPADS from brigade or BTG level can augment the maneuver battalions, to close gaps in the coverage or establish ambushes. The use of other arms to attack enemy helicopters at their firing positions is also part of the air defense effort. Artillery using proximity fuzes is especially effective against these helicopters while they are hovering or slow moving, such as preparing to fire.

In the offense, most air defense assets would normally be within the battle zone. Their main role is to allow friendly ground forces the freedom to maneuver as the situation develops. Air defense can create the window of opportunity for offensive action.

In support of defense in the battle zone, priority for air defense assets is the protection of those forces where an enemy penetration is expected or those assigned to kill zones. Protection of long-range fire systems and reserves are the next priorities.

In fluid battle conditions, portions of the battle zone can become part of the disruption zone. In



such cases, some air defense assets may be designated to stay behind and move to hide positions until activated to conduct air defense ambushes from within the enemy's depth.

## Support Zone

In the offense or defense, some air defense units may be deployed in the support zone. Their role is to help keep this zone free of significant air action and thus permit the effective logistics and administrative support of forces. Compared to the battle and disruption zones, the commander can afford to assign less mobile air defense assets here. The use of point protection is increased relative to the other zones within the AOR. Throughout the support zone, the OPFOR makes extensive use of passive air defense measures, including maneuver, dispersal, and C3D (particularly the use of deception positions).

## Deployment and Redeployment

The location of the air defense unit is critical, whether it is to protect a high-value asset or to accompany and provide air defense of a tactical unit. There is no fixed pattern of deployment. The decision for deployment depends primarily on the supported unit's mission, the terrain, and the ground and air tactical situations. As the supported unit performs its assigned missions, its location and combat formation can change. The air defense unit commander must respond to these changes and redeploy his weapons in a timely manner to provide continuous and effective coverage to the supported unit. Deployment and redeployment take into account the requirements for

- Maintaining mutual support among air defense units.
- Covering the main threat.
- Providing comprehensive coverage to all elements within the AOR.

In addition to maneuver units, coverage must include headquarters, artillery units, and logistics units. C2, terrain mobility, and dispersion to reduce vulnerability are also considered in both deploying and redeploying.

Both the commander of the supported maneuver unit and the commander of the supporting air defense unit usually conduct terrain reconnaissance. A preliminary map reconnaissance can tentatively identify positions for deployment of air defense weapons in defensive positions, along movement routes, or in areas to be seized by advancing forces. Significant emphasis is placed on identifying all potential attack routes for low-flying enemy aircraft of all types. Routes of approach suitable for armed helicopters and positions from which these helicopters might fire ATGMs are of special concern.

## Offense

The employment of air defense units in the offense depends on

- The situation.
- Missions of the supported units.
- The effective range of air defense systems.
- Their maneuver capabilities.

The two basic types of OPFOR tactical offensive action are the attack and the limited-objective attack.

## Attack

There are two forms of attack: the integrated attack and the dispersed attack. For either form, an attack from the air represents the greatest danger when ground forces are moving and deploying for the attack. Therefore, mobile air defense units should be able to accompany maneuver forces at a distance close enough to maintain effective coverage. It is especially important to prevent

the enemy from conducting air reconnaissance and locating the movement of forces and assets. During the attack, the positions of supported maneuver units continue to change, and the supporting air defense units must also redeploy. Air defense must also provide point or area coverage for other units in the AOR, including headquarters, artillery, and logistics units.

### **Integrated Attack**

An integrated attack may be conducted from positions in direct contact with the enemy, or require a tactical movement forward from behind forces in contact. In the former case, the forces in contact constitute the bulk of the fixing force. While protection of the fixing force is important, the situation may permit the allocation of fewer air defense assets there in order to provide greater protection for other enabling or action forces.

### **Dispersed Attack**

In the dispersed attack, there may be times when dispersion is so great that it is not possible to provide coverage for all units in the supported commandâs AOR. In these cases, the commander must allocate and position his air defense assets in those areas where the air threat is perceived to be the greatest. Priority is also given to providing protection for those maneuver units most critical to the success of the attack.

According to these priorities, maneuver brigades or BTGs normally have their organic air defense assets augmented by divisional air defense assets. If these batteries are equipped with medium-range SAMs, they need not operate in the maneuver brigadeâs or BTGâs formation. The range capability of their radars and missiles allows them to provide support from positions farther away. This provides an additional advantage to the commander in enabling him to more quickly shift priorities of air defense coverage in the event the enemy increases his air attacks in other areas.

In trying to protect dispersed forces, commanders may have to accept some risk in certain areas. In those areas, commanders should plan for increased C3D and the increased use of other arms to assist in air defense.

### **Limited-Objective Attack**

Air defense systems or organizations have a key role in conducting a limited-objective attack. Since such attacks are generally conducted against a stronger enemy, they may be extremely vulnerable to enemy air attack. Air defense may also be the principal means of destroying certain airborne flagship systems. Proper air defense planning and task-organizing to support the maneuver and fire support units conducting these attacks are critical to mission success. There are two types of tactical limited-objective attack: spoiling attack and counterattack.

Those units conducting either type of limited-objective attack may not have enough constituent or dedicated air defense assets to protect themselves. So, coverage may have to come from assets located at higher levels of command. The higher command may have to reposition some air defense units so that they can provide coverage for the limited-objective attack, while hopefully still being in position to contribute to area coverage of the higher command. Air defense units also must be prepared to shift their priorities on short notice, to support the limited-objective attack if it is within range from their position or with a minimum of repositioning.

### **Spoiling Attack**

The spoiling attack allows little time for the commander to allocate additional assets to the force conducting the attack. This problem can be largely mitigated when initially allocating assets to the forces that typically conduct this mission. The commander must also be prepared to shift the

priorities of other available air defense units on short notice. Forces that deploy by means of helicopters would be equipped with man-portable systems, and the requirement for a quick reassignment of priorities of other air defense units within range takes on extra importance.

## Counterattack

The counterattack also allows little time for the commander to allocate additional assets for air defense. Compared to a spoiling attack, however, larger forces are generally involved due to difference in purpose. Commanders must be prepared to make rapid shifts in priority assignments. They should also begin anticipating requirements to support a rapid transition of the remainder of the force to offensive actions. Fixing forces involved in the counterattack should not require extensive changes in air defense mission assignment. The assault force, if one is used, needs sufficient assets to allow it to effectively engage helicopters that will likely be part of any mobile forces committed against it. The action force requires sufficient assets to defend against air attack once discovered and to allow it to consolidate its gains.

## Defense

As in the offense, the division and its subordinate brigades ideally have sufficient assets to provide air defense coverage for all of their units during defensive actions. In cases where a DTG or BTG has been formed, additional air defense assets should be allocated to satisfy increased requirements. In a situational defense, there is limited time available for allocating or reallocating air defense assets. Maneuver defense and area defense are the two basic types of defensive actions.

## Maneuver Defense

The key to air defense support of the maneuver defense lies in mobility. Air defense units must be positioned to cover defending forces but capable of displacing with rapidly moving ground maneuver forces. Air defense covers the contact and shielding forces as they maneuver from one defensive array to another. Ideally, most air defense assets can be positioned with the shielding force and provide adequate coverage for the contact force. Distances between the two forces are key in determining if systems can provide coverage at the ranges required. In any case, it is essential that sufficient mobile assets be allocated to the contact force to cover its movement away from the enemy and to cover the flanks.

In the maneuver defense, air defense units must displace more frequently than in the area defense. This displacement requires units or parts of units to move by alternating bounds. One element continues cover while the other moves. This means reduced coverage for at least part of the time. Taking this into account, additional assets could be allocated to make up the difference. In any case, moves should be planned in detail and every effort made to reduce the number required. In the maneuver defense, the need for frequent displacement often mitigates the requirement for survivability moves.

As the contact force initiates its movement to begin the hand-off to the shielding force, there are two options for air defense assets positioned with the original shielding force to cover the contact force. One is to remain with the shielding force as it becomes the new contact force. Another is to begin movement by bounds to the defensive array where the former contact force will take up its position as the new shielding force. In many situations, it may be possible to position longer-range systems where they can cover the initial positions of both the contact and shielding forces and possibly of the new shielding force. This increases the time and continuity of coverage. Again, units could displace to positions where they can cover subsequent contact or shielding force positions. It is essential that planners allocate and position systems that are capable of responding to a highly fluid situation. Commanders should take advantage of range, mobility, and creative means of positioning to allow sufficient standoff to prevent their

systems from being destroyed by enemy direct fire systems.

Air defense planners need to take into account the requirement to support rapidly executed ground counterattacks. Assets supporting and moving with counterattacking forces could be MANPADS. Longer-range systems are positioned with defending forces where they can cover the counterattacking force.

## Area Defense

In an area defense, air defense considerations in the disruption zone are similar to those found in the maneuver defense. The disruption force must be capable of rapidly attacking the enemy or shifting to a maneuver defense or a combination of the two. Frequent displacement is the rule. In many cases dispersed ambush forces and precision weapons systems will require point protection. Area coverage is desirable in trying to attack enemy aerial reconnaissance assets and preventing effective employment of ground-attack platforms. The disruption zone will require a relatively high density of MANPADS and a well thought-out and executed air defense ambush plan.

In the battle zone, the main defense force occupies battle positions set in complex terrain. This presents a whole set of problems that the air defender must solve. Complex terrain limits the capabilities of line-of-sight systems. This includes acquisition, tracking, and firing systems. A detailed terrain analysis, which takes into account the masking features of the terrain, is essential. Although not desirable, some acquisition systems will have to be positioned on high ground to be effective. The use of C3D is key to mitigating the vulnerabilities of systems so sited. No matter what techniques are used, there will be gaps in coverage. Some of these gaps may be areas in which the commander chooses to take risks. Others can be covered by shorter-range but more suitable systems. The use of ambushes from hides could be particularly effective as the enemy attempts to exploit these gaps. Often aerial observers will be employed, with links to air defense units for rapid response in the area.

## Techniques

Whatever the nature of combat actions conducted by maneuver forces, the actions of supporting air defense units must prevent enemy aircraft from successfully attacking maneuver forces. The OPFOR uses a variety of techniques to ensure the survivability of air defense units and their ability to protect maneuver forces and other key assets during either offensive or defensive actions.

## Movement of Air Defense Units

Ideally, air defense units conduct major movements at night or in adverse weather. The OPFOR seeks to maintain effective air defense coverage by ensuring that not all elements relocate at the same time. This typically involves leaving one or more firing batteries in their positions to provide coverage while others move.

If the enemy air threat is serious, air defense unit(s) supporting a maneuver unit will usually move as part of that unit, integrated into its march column. If the air threat is not imminent, the air defense unit may move separately to its new position. In this case, the air defense battery commander usually conducts an initial map reconnaissance and designates the movement route and tentative firing positions in the new area. He sends out a reconnaissance patrol that normally consists of one of the firing platoon leaders, several soldiers, and a vehicle. This patrol conducts route reconnaissance, identifies temporary firing positions along the movement route, and conducts limited CBRN reconnaissance. The reconnaissance patrol then confirms the suitability and location of the new positions. The reconnaissance patrol can operate as part of a supported maneuver unit, as a reconnaissance patrol, as part of the reconnaissance patrol of the next-higher air defense unit, or it can carry out its mission independently.

Where time permits, the OPFOR reconnoiters and prepares alternate positions in advance. Ideally, every air defense unit should have two to three alternate positions. Movement to them can be carried out at night or under conditions of limited visibility whenever possible. Air defense units would most likely move to alternate positions under one of the following conditions:

- Immediately after enemy reconnaissance aircraft have overflown their current position.
- After an air strike has been repulsed.
- After units have been at a single position for an extended period.

For divisional air defense assets, this extended period of time would consist of approximately 4 to 6 hours, after which they would move to alternate positions. This time could obviously be reduced when there is a high threat of air or precision attack. In some cases, given the systems' capability to do so, moves could take place as often as every 10 minutes. For more information, see Maneuver and Dispersal, below.

The total time for movement of air defense units includes the time for leaving the position, moving to the area of the new position, and occupying this position. It is the mission of commanders and staffs to reduce this time to the minimum, since during this period the unit is removed from battle. However, a necessary condition for air defense effectiveness is the destruction of enemy aircraft on the approaches to the supported units. This must be taken into account, along with survivability considerations, when determining the frequency of changing positions. The procedure and time periods for movement, and occupying and preparing positions, are determined during planning for combat.

## Local Security and Self-Defense

Air defense units at division and below usually deploy close to enemy ground forces, where vulnerability to both ground and air attack is significantly greater. When in proximity to supported ground units, air defense units often rely on them for their local ground security. However, this is not always the case.

Self-defense against air attack is accomplished through the use of the unit's primary weapons and small-caliber AA guns and MANPADS. Units equipped with AA guns can defend themselves against ground attack, to some extent, through the employment of their systems in a direct fire role. Air defense unit personnel armed with light antitank weapons can augment local ground defense capabilities. If SAM batteries are threatened by ground attack, they can often move to more secure positions without seriously degrading their capability to continue their primary mission.

## Air Defense of Tactical Movement

The OPFOR anticipates that units conducting tactical movement may be subjected to intense attacks by both fixed-wing ground-attack aircraft and armed helicopters. These attacks can occur anywhere on the battlefield. Accordingly, units engaged in movement are protected by their organic assets and, in many cases, are allocated additional air defense assets from their parent unit.

In general, air defense units are integrated into moving tactical units and are ready to fire. Many SAM and AA gun systems can be fired on the move. However, stationary engagements are preferred. SAM units that require setup time may move along separate routes by bounds, alternating moves by platoon or battery. Tactical units may also receive air defense coverage from air defense units of higher echelons and possibly adjacent units. In the interests of secrecy, air defense radars and associated communications systems of the moving unit are placed in a standby and receive-only mode, respectively, unless absolutely required to engage enemy aircraft.

Enemy air attacks are considered particularly likely at

- Obstacles (such as river crossings).
- Choke points (bridges, mountain passes, defiles, or places where off-road movement is restricted, such as in swampy areas).

To ensure air defense coverage for units moving through such areas, a portion of a unit's air defense weapons may be dispatched ahead of the unit to deploy in and around the obstacle or choke point to provide effective coverage as the unit passes. The remainder is spread throughout the supported unit.

If adequate coverage of the unit can be maintained by higher-echelon and adjacent unit assets, then the entire air defense unit may be sent forward of the parent unit formation. Alternatively, individual batteries or sections may be sent ahead. If the restricted terrain area is of such size as to exceed weapon and or sensor coverage of the air defense weapons, then air defense elements may move by bounds ahead of each other to provide continuous coverage by the parent unit.

Reconnaissance and air surveillance are vital to protecting moving units from air attack. Air observers are posted on all vehicles. Air defense elements, including MANPADS gunners, remain ready to engage targets at all times. If the tactical situation requires and terrain conditions permit, surveillance and target acquisition radars may be set up at suitable locations adjacent to the movement routes to provide continuous radar coverage. As in other tactical situations, MANPADS gunners are assigned specific sectors of observation and fire to preclude several gunners engaging one target. Vehicle-mounted weapons are also employed. For example, AA machineguns on tanks are specifically designed for this purpose. Missile-firing tanks have a capability against helicopters.

Brigade air defense weapons play a major role in the defense of units on the move. These systems are normally employed in mutually supporting pairs. System range determines the distance that can be maintained between them. The systems must also ensure that they maintain sufficient distance from other vehicles to ensure an unobstructed field of fire in engaging low-flying aircraft. Whenever a column stops, even for brief periods, brigade systems pull off to the side of the road with the rest of the column and remain ready for action. Battery personnel who are not operating with the firing platoons may be directed to engage enemy aircraft with small-arms fire.

In some circumstances, a supported unit may continue to move while the air defense elements halt to engage enemy aircraft. This is not the recommended course of action, because it leaves the supported unit with reduced or no coverage while the air defense elements are engaged.

## Engagement Procedures

Aircraft posing the greatest threat are engaged on a priority basis. Aircraft are engaged with as many weapons as possible and in the shortest time possible in order to achieve the greatest destructive and deterrent effect. The preferred engagement technique is to continue firing at an already engaged target rather than to switch from target to target, unless a later-acquired target seriously threatens the air defense unit itself or a high-priority target. The OPFOR would rather engage an enemy aircraft prematurely and waste some ammunition than wait too long and allow the aircraft to gain a favorable attack position. Suspected enemy aircraft are fired on as long as they remain within range. Air observers and weapons crews outside the attacked sector maintain continuous observation and readiness to fire in order to prevent the enemy from conducting a successful attack from several directions simultaneously.

The OPFOR emphasizes that air defense units do not have to destroy aircraft to accomplish their mission, although such destruction is obviously desirable. The mission is accomplished if air defense units prevent enemy aircraft from conducting successful air activities. For example, air defense units can force enemy aircraft to break off their attacks or to expend their ordnance inaccurately without having to destroy the aircraft. In fact, the mere presence of active and effective air defense weapons systems can reduce the effectiveness of enemy air activities by

forcing aircraft to avoid the systems or to operate using less than optimum procedures.

The OPFOR prefers to either leave target acquisition and tracking radars off, or turn them off, to preclude exposing their presence and location. This is especially effective when the unit or system with the air defense radar is receiving real-time information via either direct data transmission from radar to radar or other communications. If required, the radar will turn on at the last few seconds to acquire the target before launching and/or firing.

OPFOR AORs are free-fire zones, unless OPFOR aviation missions are scheduled. Free-fire zones do not require IFF checks. The air defense weapons usually launch or fire on first detection.

## Air Defense Ambushes and Roving Units

The OPFOR recognizes the disproportionate effects that sudden, unexpected destruction of an aircraft or small group of aircraft can have on enemy tactics and morale. For example, the surprise destruction of one or two lead aircraft on what the enemy thought was a clear avenue of approach could cause an enemy air assault to be called off or seriously disrupted. Air defense ambushes and roving air defense units can cause the enemy to believe that significant air defense units are located in areas where actually there are only a few weapons. This can reduce the effectiveness of enemy reconnaissance and the likelihood of enemy air attack in the area concerned. Ambushes and roving units can also employ antihelicopter mines.

## Air Defense Ambushes

Air defense ambushes may set up at temporary firing positions to surprise and destroy enemy aircraft and disorganize enemy fixed-wing aircraft and rotary-wing operations. Typical missions include defending

- Maneuver units.
- Possible air avenues of approach.
- CPs.
- Reserves.
- Artillery and missile units.
- Other air defense units in firing positions.
- River-crossing sites.

Air defense ambushes are often employed when there is a perceived inadequacy of air defense assets. Tactical air defense ambushes usually comprise a single AA gun or MANPADS team, section, platoon, or battery with the mission of engaging enemy aircraft from a hidden or unexpected position. The senior air defender (or perhaps an AOP) conducts a map terrain analysis of friendly radar coverage prior to deployment. The resultant analytical overlay provides the air ambush unit(s) critical locations to surveil based on radar terrain masking. Based on this, the air defense ambush teams are dropped off to provide air coverage.

Deployment. Air defense ambushes are placed

- In the disruption zone.
- On secondary and tertiary air avenues of approach.
- Along flanks, forward, behind and in gaps between units.
- In terrain that offers poor fields of observation, to fire "window shots."
- In valleys or defiles likely to be used as ingress or egress routes by infiltrating aircraft, or on adjacent heights to shoot down onto them.
- Just behind a crest to catch aircraft from behind as they clear a ridge.

Single-launcher MANPADS ambushes may be set up on wooden platforms built in treetops to catch aircraft flying low over a forest.

A typical OPFOR air defense ambush might be a MANPADS team dropped off by a reconnaissance patrol enroute to conduct a reconnaissance mission. The MANPADS team may

or may not be picked up by the returning patrol. If not, they may exfiltrate on their own and possibly rendezvous at a different location. These MANPADS ambushes may be single teams, but more likely the teams will be numerous and dispersed widely throughout the battle zone or disruption zone. Air defense systems that lend themselves to multiple roles are especially appropriate for air ambushes.

The unit or weapon assigned to an air defense ambush usually occupies the site under cover of darkness or poor visibility conditions. The unit or weapon is carefully camouflaged and keeps all its emitters off or in a dummy mode until ordered to engage a target. It may assume a hide position and establish local ground security and air observers. Depending on the unit or weapon involved and the situation, it may be able to receive automated surveillance and target tracking data from its parent unit. More than one air defense ambush, involving more than one weapon type may be established along an air avenue of approach. These may work independently or in concert, depending on the situation.

**Preparation.** Air defense ambushes may be planned and executed on short notice with little preparation. However, they may also involve elaborate preparation and camouflage. Preparation can include tracking enemy aircraft over several days to discern operational patterns and possibly weaknesses, and optimum weather patterns for a specific ambush site. These ambushes are the most effective when they are coordinated with local combined arms units. The fires from the combined arms units may either assist in deterring the attacking aircraft or vector them into the air defense ambush kill zone.

Detailed preparations can involve removal of tracer ammunition from AA gun ammunition belts so that near misses do not alert the target aircraft. They can also involve construction of tree-stands in remote locations for air observers or MANPADS gunners, with provision made for the alert of the ambush unit through wire, visual, or radio signals. Decoys or derelict weapons may be placed to draw the attention of enemy aircrews, causing them to enter the ambush zone or fire at the wrong target. Visual decoys can be made more believable through the use of imitative communications or even decoy emitters. The key to a successful pre-planned ambush is creating a credible target or set of targets that the enemy will attack.

**Execution.** Target engagement decisions may be left up to the ambushing unit commander. Special engagement techniques may be used, such as delaying radar illumination until the last possible moment, coupled with a favorable cloud base and remote tracking information from other sensors. Occasionally AA guns may choose not to employ their radars, using strictly electro-optical sights. This tactic takes into account the capability of modern aircraft, including attack helicopters, to detect radar and infrared systems.

When a target is detected, the ambushing weapon or unit prepares to engage. This may involve removal of some camouflage or a short movement from its hide position to its firing position. The ambushing unit fires on the target until it is destroyed or until the target moves out of its firing zone. After ensuring that it is safe to move, the ambushing unit or weapon immediately displaces via a concealed route to a new ambush site or returns to its parent unit.

## **Roving Air Defense Units**

Employment of roving units is similar to that of air defense ambushes. The primary difference is that, while an ambushing unit lies in wait for approaching enemy aircraft, a roving unit moves to the most likely areas of enemy air attack and occupies a series of predesignated positions in the supported unit's AOR. The commander of the roving unit identifies these positions during his terrain reconnaissance and coordinates them with the air defense and maneuver unit commanders. The roving unit occupies these positions according to a prearranged schedule or on order of the air defense unit commander. Roving units terminate their missions and return to previously designated primary firing positions upon direction of their commander.



## Antihelicopter Mines

The OPFOR routinely employs antihelicopter mines to support air defense ambushes and roving units. Areas protected by antihelicopter mines can also be left unattended and therefore preserve needed combat power. The intent of these mines is not so much to destroy helicopters as to accomplish one or more of the following:

- Force low-flying helicopters to rise or change course, exposing them to more lethal means.
- Alert air defenders to trigger the ambush.
- Distract pilots while engaging them with ground weapons.
- Cause the attacking aircraft to break off and/or discontinue the attack.

The OPFOR emplaces antihelicopter mines in locations it believes the enemy will use as firing (battle) positions for attack helicopters or in possible landing zones for lift helicopters. Antihelicopter mines use a combination of sensors and fuzes to acquire the helicopter and initiate the mine once the helicopter enters the lethal zone. More advanced mines use a fairly sophisticated data processing system to track the helicopter, aim the ground launch platform, and fire the kill mechanism toward the target. As the helicopter nears the mines, the acoustic sensor activates or cues an infrared or millimeter-wave sensor. This second sensor initiates the mine when the helicopter enters the lethal zone of the mine. These mines may have multiple-fragment warheads that are more than capable of destroying tactical aircraft. Alternate warhead designs include high-explosive warheads and single or multiple explosively formed penetrators. For additional information on antihelicopter mines, see the Worldwide Equipment Guide.

## Defensive Measures Against Unmanned Aerial Vehicles

The OPFOR recognizes the increasing importance of UAVs on the battlefield, to both its own forces and those of the enemy. They can perform high- and low-altitude missions, collect the full spectrum of intelligence, and immediately downlink the data to a ground station. They have the capability to loiter or to fly deep and can collect against a predetermined target or look for targets of opportunity. Their construction can make them difficult or easy to detect.

Typically, the enemy conducts reconnaissance missions using UAVs operating in the window between low-flying helicopters and higher-altitude fixed-wing aircraft. This altitude window is between 300 and 4,000 m. The most common technique is to approach the target area at high altitude. Then, once at the target area, the UAV drops down to a lower altitude that optimizes the capabilities of the sensor package on board. Once the mission is complete in the target area, the UAV climbs to higher altitude and departs the mission area. Countering tactical UAVs requires not only an IADS but also an integrated all-arms approach.

Most UAV systems consist of three basic subsystems:

- The air vehicle.
- The ground station.
- The launcher.

In some cases the latter two may be one vehicle, or they may all be man-portable. There are also a variety of communication data links between the ground station and the air vehicle. Some systems also include satellite links.

Air defense commanders and planners should view the three UAV subsystems as three separate targets that can be countered through a variety of means. This view reinforces the concept of an integrated system that includes coordination with other arms to ensure all targets are addressed. These means are both passive and active.

### Passive

Since the mission the UAV is executing may not be apparent, actions should be taken to counter

all possibilities. The integrated use of the passive measures described below under Nonlethal Air Defense Measures can reduce the effectiveness of UAVs. The use of a variety of decoys provides a false picture of the mission area to the enemy and to a large extent can deny information or distort the information collected by the UAV.

Other passive measures may include monitoring UAV data links. Often UAV satellite up- and downlinks use commercial telecommunications. Many of these communications links, including satellites, are not protected and can be easily intercepted through readily available commercial software. Monitoring these various links can be very effective because they provide valuable information such as flight data, system capabilities (location as well as collection), and attack priorities and/or intentions.

Signals reconnaissance units may also be able to determine the general location or direction of UAV flight by intercepting the downlink (UAV transmission) and using direction finding equipment. Based on this intercepted data, they may also be able to determine the number of UAVs in flight. In this event, the signals reconnaissance unit may be able to tip off air defense or other units in the projected path of the UAV(s) for further action.

## Active

A wide variety and large number of active measures are available to the OPFOR to counter UAVs. The effectiveness of air defense radars can vary depending on the radar cross section (RCS) and altitude of the vehicle. Of course, this does not preclude the use of radar, since these factors are considerations in detecting any aircraft. The relative small size of many UAVs obviously reduces their RCS.

Sound-ranging systems are available, which can provide early warning and azimuth of an approaching UAV. This in turn provides air defense weapons and maneuver unit weapons an opportunity to prepare for the vehicle's approach and to put up a large volume of fire, provided the UAV can subsequently be visually detected. The early warning provided by sound ranging increases the probability that visual observers will be able to spot the vehicle.

The location of UAV ground stations and launchers is a high priority for reconnaissance. UAVs can support targeting and fires from enemy artillery, multiple rocket launchers, or aircraft that can quickly engage targets once the information is received. Therefore, their priority for destruction increases. SPF operating in the enemy rear can also be a valuable asset in locating launchers and ground stations. They can either take direct action to destroy the targets or relay location information to allow other means to be employed against them.

Jamming can counter UAV system data links. The effectiveness of this procedure varies depending on the UAV system being attacked. High-power spot or barrage noise jammers can effectively mask ground targets from side-looking airborne radars. Supporting satellites and infrastructure can also be jammed to some degree, depending on the type of UAV employed. Airborne jammers may serve as the ideal platform for jamming UAVs. GPS jammers, preferably mobile, are also effective in interfering with UAV guidance.

Additional techniques for countering UAVs could also include targeted air, SSM, or artillery strikes. Ground targets could as be as simple as bombing a UAV airfield runway or destroying a petroleum storage facility. Effective air targets could include destroying an airborne C2 platform, which would disable the UAVs. An example of this is to destroy relay and retransmission UAVs that are electronically tethered to other airborne UAVs. Destruction of retransmission stations or vehicles can either limit the range of a UAV or completely disable it, causing it to crash.

Some of these techniques are limited to UAVs requiring improved runways and petroleum fuel. Others are limited to UAVs that fly at medium to high altitudes. Also, some of these techniques and targets will not be effective against micro, mini, or other tactical UAVs.

## Air Defense in Urban Areas

In urban areas, AA guns or blinding lasers could be set up within the top or middle floors of buildings to fire laterally or even down on low-flying aircraft while remaining unseen from almost every angle. Weather conditions may also facilitate the use of an air defense ambush. For example, low cloud bases may force enemy aircraft down into the envelope of a particular weapon. Ambushing units may work in concert with smoke or aerosol dispensing units, or ground-based jammers that jam a low-flying aircraft's terrain-following radar, forcing it up into the ambush weapon's optimum engagement envelope.

Some air defense systems may prove useful in close combat in urban areas. Air defense weapons usually have a very high angle of fire, allowing them to target the upper stories of buildings. The high-explosive rounds allow the weapons to shoot through the bottom floor of the top story, successfully engaging enemy troops and/or equipment located on rooftops. The accuracy and lethality of air defense weapons also facilitates their role as a devastating ground weapon when used against personnel, equipment, buildings, and lightly armored vehicles.

## Air Defense at Night

Air defense is conducted at night and during other periods of reduced visibility almost as effectively as during periods of normal visibility. This is because of the numerous surveillance and fire control radars in air defense units and the inherent limitations of enemy aircraft maneuvers and coordination at night. Commanders prefer to move or realign units at night or during other periods of reduced visibility to reduce the likelihood of detection by the enemy, and such moves must be covered by air defenses.

Air defense units frequently deploy closer to supported units at night. Like other units, they are more likely to conduct maintenance and resupply at night. The OPFOR recognizes, however, that the increasing night capabilities of aircraft and the proliferation of night strike packages requires that air defenses be ready 24 hours a day. In order to meet this evolving threat, the OPFOR continually upgrades its night air defense capability.

The OPFOR employs various clip-on image-intensifier night sights, which are fitted to some MANPADS launchers. Most radar-guided SAMs have electro-optical tracking backup that can be used in daylight hours in the event the radar is jammed, and a night low-light-level television channel for engagements in clear nighttime conditions. On some systems, the electro-optical mode is considered the primary mode for target engagement, with radar-only engagement mode being the second (or nighttime) choice. Many newer OPFOR air defense systems have thermal sights, or some older systems have been upgraded with them. For additional information, see the Worldwide Equipment Guide.

## Air Defense of Assembly Areas

While assembly areas are most commonly used in the offense, the air defense employment methods used there also apply to any situation in which a tactical unit requires assembling for any reason. Brigade or BTG assembly areas are essentially composed of a series of battalion assembly areas. The brigade or BTG commander assigns air defense elements, normally a platoon of AA gun or gun-missile systems, the mission of supporting a particular battalion for a specified period of time. This period can begin before the battalion moves into its assembly area, in which case the platoon provides protection to the battalion during movement to the assembly area.

The air defense unit may also join the maneuver battalion in the assembly area. However, it is preferable to have both arrive at the same time, in order to ensure the battalion is not exposed to possible enemy air attack. In either case, the air defense platoon leader reports to the maneuver battalion commander, and direct communications are established between the two units. The

platoon continues to maintain communications with its parent air defense battery and/or battalion. It also receives information from the divisional air defense target identification and warning network. This ensures timely receipt of information on the tactical situation.

While in the assembly area, the maneuver battalion commander uses all available C3D techniques to reduce the likelihood of detection. Additionally, a 360-degree surveillance of the surrounding airspace provides early warning. The maneuver battalion commander and the supporting air defense platoon leader work closely to integrate their weapons into an effective air defense plan. The battalion commander provides guidance for the placement of all air defense systems, while the air defense platoon leader supervises the details of the placement of his weapons. Proper placement of air defense weapons increases the engagement envelope to the maximum extent possible. As is the case in most tactical situations, the platoon leader must ensure that his AA gun-missile or gun systems are kept within mutually supporting distance. As a rule, one crew in each pair of systems remains alert, except when warning of an air attack is received. Any attached or organic MANPADS supplement the defense, and the attached air defense platoon leader may be given some degree of control over the MANPADS gunners. Radio silence and light discipline are observed. If the supported unit is to remain in the assembly area overnight, the air defense systems are dug in.

Air OPs and firing positions are often colocated. This is especially true in the case of MANPADS. The OPs and firing positions should be positioned to provide comprehensive observation and interlocking fires on the most likely approach routes for low-flying fixed- or rotary-wing aircraft. All other weapons, to include AA machineguns on tanks, general-purpose machineguns, ATGMs, and anything else that may cause attacking aircraft to discontinue an attack are further integrated. Even planning for the use and integration of massed small-arms fire, antitank grenade launchers, and other weapons is essential to an effective air defense at the tactical level.

Proper planning and execution at maneuver battalion level and further integration into the overall air defense scheme of the brigade, division, and higher levels of command should result in enemy aviation having to pass through overlapping coverage to attack the assembly area. Attacking enemy aircraft must first penetrate the OSC and division engagement envelopes formed by their respective missile units. The aircraft then come within range of the maneuver brigade and battalion systems. Missile, gun, and gun-missile systems and any other weapons the commander deems appropriate engage enemy aircraft as soon as they come within range. MANPADS gunners engage aircraft that maneuver to avoid these systems or pass over the MANPADS positions. Finally, small arms (in volley) and vehicle-mounted weapons engage enemy aircraft that pass over the maneuver unit's positions.

## Innovative Techniques

The OPFOR will use any means and methods to mitigate enemy air capabilities. This often involves the use of innovative and adaptive methods and techniques. The OPFOR views these as part of the overall air defense effort. The extent to which creative techniques can be applied is limited only by

- The commander's and staff's knowledge of the enemy air threat.
- The capabilities of their own systems.
- Their ability to apply that knowledge to come up with innovative solutions.

An adaptive method proven to be effective is for engineers to string cables across convergent air avenues of ingress or egress and potential landing zones. These cables are especially lethal against helicopters flying NOE. Their use is generally tied to or supported by an air defense ambush. The use of artillery in conjunction with antihelicopter mines against attack helicopter firing positions is another example of an adaptive approach.

SPF teams can infiltrate MANPADS close to airfields or along identified and potential flight routes. These teams are best employed in pairs. Early warning can be achieved to some extent

through the use of a team watching an airfield and transmitting enemy aircraft departure time and direction to SAM teams.

SPF teams equipped with man-portable ATGMs can target aircraft on the ground, maintenance vehicles and facilities, and even air traffic control and communications vans. Infiltrated or stay-behind SPF and infantry can conduct on-order raids against airfields and ground support facilities away from the airfields. These raids can be timed in conjunction with other methods so that they assist in keeping the target under constant pressure. SPF can also conduct small team ambushes along lines of communications (LOCs) with the specific purpose of destroying certain types of vehicle or equipment related to air operations.

Affiliated irregular forces, possibly using terror tactics, can intimidate (enemy) host country civilian contractors to force them to sabotage enemy operations they are supporting. Examples include contaminating fuel and lubricant supplies, placing bombs on generators or ground support equipment. Irregular forces or local civilians can be contacted and/or supplied and trained to perform missions that support the objectives of air defense operations.

## **Nonlethal Air Defense Measures**

In order to meet the progressive increase in enemy air capability, the OPFOR realizes it must maximize both the lethality and the effectiveness of its air defense. The overall effectiveness can be enhanced by the use of nonlethal air defense means, especially when employed in conjunction with lethal SAM and AA gun systems.

### **Active**

The OPFOR deploys active jamming assets, in conjunction with lethal systems, to defend what the OPFOR has identified as high-value assets. Examples of these include air bases, logistics centers, critical LOCs and choke points, and higher-level CPs.

### **Air Defense Jammers**

Air defense units at division or DTG and below only have air defense jammers if they have been task-organized down from operational level. When available, the OPFOR uses such jammers to limit enemy air advantage in the tactical fight.

Air defense jammers target the onboard emitters enemy aircraft use for terrain-following, navigation, and radar-aided bombing. They can also target airborne radar reconnaissance systems. The goal of jamming these systems is twofold. The primary goal is to force the attacking enemy aircraft to alter their flight profile, bringing them into the targeting umbrella of SAMs or AA guns. Jamming the terrain-following radars or radar altimeters employed by attacking aircraft does this by forcing low-flying aircraft to gain altitude. The secondary goal is to cause the aircraft to miss their target or abort the mission through the disruption of radar-aided bombing and target acquisition systems.

### **GPS Jammers**

The OPFOR also can employ low-cost GPS jammers to disrupt aircraft navigation and precision munitions targeting. GPS jammers are also effective against UAVs and cruise missiles.

### **Passive**

In addition to active air defense, the OPFOR practices a variety of passive air defense measures. When conducting actions against a superior foe, the OPFOR must seek to operate on the margins of enemy technology and maneuver during periods of reduced exposure. Other passive measures include C3D and the use of maneuver and dispersal to degrade the effects of enemy

systems.

## **Camouflage, Concealment, Cover, and Deception**

The OPFOR emphasizes the use of natural terrain and vegetation, camouflage netting and other artificial materials, smokescreens, and decoy equipment to provide C3D. These measures include, but are not limited to, vehicle-mounted camouflage nets that reflect radar and reduce vehicle thermal signature. Similar materials can be used as screens for personnel and equipment, to reduce detection and identification by aircraft.

Deception includes dummy positions, mockups, decoys, and false electronic, acoustic, and thermal signatures. The OPFOR can use quick-setup, high-fidelity decoys; derelict vehicles; radar emitter decoys; quick-hardening foams; and many other types of manufactured and field-expedient means. It also employs simple heat sources to confuse infrared sensors and weapons seekers.

The dispersion measures discussed below should be employed with consideration of the protective and screening properties of natural and artificial screens, and would be combined with thermal camouflage and engineer preparation of positions. Natural screens consist of vegetation, terrain folds, populated areas, and local features or objects. Artificial screens include camouflage nets that would enhance natural screens, and radar-opaque screens using local features, radar nets, metallic nets, and corner reflectors. Concealment would be combined with the use of dummy positions, using decoy equipment and activities. Like real positions, dummy positions would be changed periodically. Dummy emitters and jammers would be used to attract enemy reconnaissance and targeting.

## **Maneuver and Dispersal**

Maneuver and dispersal of air defense assets, both emitters and other types of equipment, is important for their survival in both combat and march formations. Sudden maneuver and periodic changes of position are simple and effective means to counter enemy reconnaissance and precision weapons. These measures are planned and implemented at the tactical level.

All, or only a portion of, the elements of an air defense unit may maneuver to alternate positions. When and how they do this depends on such factors as the degree of air threat, time of day, and meteorological conditions. The first elements to shift positions are those that have performed combat alert duty for an extended period, or that have been deployed in the position they currently occupy since before the onset of combat. The optimum configuration for shifting to alternate positions involves no more than one-third of the assets of a given unit shifting at one time, in order to maintain adequate air defense coverage.

Distances related to dispersion and distances of air defense units from supported units vary with the situation and the threat. Of special concern is the enemy ATGM and precision weapon capability. If it is high, the OPFOR increases the spacing between SAM launchers, AA guns, or gun-missile systems and the distances of air defense systems from the battle line. Ideally, the degree of dispersal for units would be the same whether the enemy is employing conventional or precision weapons or even tactical nuclear weapons. A general rule for the degree of dispersion is that the enemy strike should not destroy two adjacent units simultaneously. A maximum of one-third of a unit should be vulnerable to a single precision weapon or nuclear strike.

## **Security Measures**

The OPFOR employs a number of air defense security measures and tactics to counter enemy air attack and suppression of enemy air defense (SEAD) operations. Measures taken to improve air defense system security include the following:

- Signals security. SAM, AA gun, and gun-missile system radars, which move forward to cover an

initial assault, remain silent until after the assault begins.

- Frequency spread. Each of the air defense systems operates within separate radar frequency bands. (No one jamming system could operate simultaneously against all bands.)
- Frequency diversity. Tracking and guidance radars change frequencies to overcome jamming.
- Multiple and interchangeable missile guidance systems. Some OPFOR systems work on pulsed radar; others work on continuous waves. Some radar tracking systems also possess optical tracking for continued operations in a high jamming environment. Other systems use infrared homing.
- Mobility. All OPFOR tactical air defense systems and most operational-level systems are mobile. They quickly change positions after firing or after enemy reconnaissance units detect them.

Table 11-1 lists additional examples of measures that can provide security for air defense units from enemy air attacks and SEAD.

**Table 11-1. Example security measures**

Considerations	Examples
Protection and Countermeasures	<p>Use concealment, mixing with civilian sites and traffic.</p> <p>Use cover (dug-in positions, hardened facilities, and urban structures). Disperse assets and use autonomous capabilities.</p> <p>Relocate frequently.</p> <p>Use protection envelope of friendly forces.</p> <p>Use deception operations for convoys and river crossings.</p>
Tactics	<p>Conduct movement using bounding overwatch for air defense. Use passive (electro-optical) mode (radars turn on just at launch).</p> <p>Direct attacks against airborne warning and control system (AWACS) aircraft, SEAD aircraft, airfields, and FARPs.</p> <p>Engage SEAD and EW aircraft from an aspect outside of the jamming arc. Conduct beyond-border operations against air capabilities.</p> <p>Engage enemy air infrastructure when possible—including UAV infrastructures.</p>
Reconnaissance, Intelligence, Surveillance, and Target Acquisition (RISTA)	<p>Identify likely aircraft ingress and egress routes. Use passive radar and electro-optical modes. Use IADS links for target acquisition data.</p> <p>Use emissions control measures.</p> <p>Use civilians and irregular forces links.</p> <p>Use numerous OPs and air OPs linked to air defense units, including civilians, reconnaissance units, and forward-based SPF.</p> <p>Employ non-air defense sensors and units available to feed reports to IADS.</p>
C2	<p>Use mobile, redundant, concealed systems.</p> <p>Use communications and operational security measures.</p>
Weapons	<p>Engage aircraft, air-to-surface missiles, and antiradiation missiles beyond their firing range.</p> <p>Prepare all weapons to respond to aircraft.</p> <p>Have all units conduct air watches with weapons at ready at all times.</p>