Chapter 6

Command and Control Systems

This chapter discusses the command, control, communications, and intelligence collecting systems used by the Air Defense Artillery. The systems discussed are the Air and Missile Defense Planning and Control System (AMDPCS), Tactical Command System (TCS), Patriot Master ICC (MICC), and FAAD Command, Control, Communications and Intelligence (C3I).

AIR AND MISSILE DEFENSE BATTLE COMMAND ORGANIZATIONS

6-1. ADA commanders and leaders organize their personnel and equipment to command and control their units. There are three types of Command and Control (C2) organizations, which are standard in ADA units: command posts (CP), tactical operations centers (TOC), and fire direction centers (FDC).

COMMAND POST

6-2. The principal facility employed by the commander to control operations is a CP. The commander is located anywhere on the battlefield where he can best command the force and is only present at the CP when necessary. A CP consists of facilities for the commander, coordinating staff, and special staff. The organization of the CP reflects the commander's needs. CPs can be organized by echelon, for example, a tactical CP, main CP, and rear CP. The commander may form an alternate or assault CP. ADA units from AAMDC to platoon level form CPs tailored to their needs.

6-3. A command post is organized to perform the following functions:

- Monitor the execution of operations.
- Synchronize combat activities to sustain tempo and adjust the plan to fit the situation.
- Maintain the current operations situation.
- Effectively manage logistics ensuring a continuity of combat consumables.
- Provide a focal point for the receipt and development of intelligence.
- Plan future operations.
- Monitor combat operations of supported, adjacent, and higher echelon organizations.
- Provide situational information to higher headquarters.

TACTICAL OPERATIONS CENTER

6-4. A TOC is a sub-element of a headquarters CP with members of the commander’s staff. A TOC consists of a physical grouping of the staff

elements concerned with current and future tactical operations and tactical support. A key standardized, digitized element of equipment in the AAMDC and brigade TOCs is the Air and Missile Defense Planning and Control System. At the battalion TOC level, the key standard, digitized equipment is the Air and Missile Defense workstation, which is completely compatible with the AAMDC and brigade equipment.

FIRE DIRECTION CENTER

6-5. A fire direction center is that element of a command post by means of which the commander exercises fire direction and/or fire control (engagement operations). The FDC receives target intelligence and fire control orders and translates them into appropriate fire directions and fire distribution.

AIR AND MISSILE DEFENSE PLANNING AND CONTROL SYSTEM

6-6. The AMDPCS is a mission essential system that provides ADA commanders, staffs and crews with automated capabilities to enhance the execution of air and missile defense operations. The AMDPCS is composed of a set of modular, reconfigurable, and standardized automated data processing equipment, based on common hardware and software (CHS) developed for the Army Battle Command System (ABCS). The AMDPCS components will be designed for use with variants of the army standard integrated command post system (SICPS) appropriate to the mission and mobility requirements of the supported unit. The reconfigurable nature of the AMDPCS provides an inherent “jump TOC” capability to support limited AMDPCS operations. A portion of the AMDPCS is deployed into a theater or new area of operations to provide a capability to perform critical command, control, communications and intelligence (C3I) functions until the entire AMDPCS is deployed. Appropriate configurations of the AMDPCS will be fielded at all echelons of command and control.

6-7. The AMDPCS integrates all air and missile defense sensors, weapons and C3I capabilities into a cohesive, synergistic system capable of minimizing fratricide, protecting the force and defeating or neutralizing the air and missile threat. It provides the automated interface for AMD elements at theater and below with the Army Battle Command System (ABCS) and the Army Global Command and Control System (AGCCS), allowing unit commanders and staffs to plan, coordinate and control the AMD fight. The AMDPCS will also be capable of joint service information exchange and interfacing with appropriate allied C3I systems.

OPERATIONAL CONCEPT

6-8. The AMDPCS is the focal point for air and missile defense planning. It provides the means to horizontally and vertically integrate Army, joint and combined forces to synchronize the actions of all AMD elements on the battlefield.

6-9. The AMDPCS provides a commander the timely information necessary to assess the situation, decide on a course of action (COA) and direct his forces to act within the enemy’s decision cycle. The system is configurable by operators to automatically collect, process, sort, categorize, classify, correlate,

store and display air and missile track data and battle command information. Finally, the AMDPCS provides the commander an automated data processing and exchange means by which to distribute his decisions, orders, plans and requests to higher, adjacent and subordinate units and the supported force. The AMDPCS integrates engagement operations functions, force operations functions, and liaison functions, while allowing for human intervention in the process if necessary.

Engagement Operations functions

6-10. Engagement operations (EO) are those actions required to defeat or deny the air and missile threat, while protecting friendly air assets. Engagement operations include the following:

- employing sensors
- detecting, classifying, and identifying aerial platforms
- assessing the threat
- nominating targets for attack operations
- directing and controlling engagements of hostile platforms
- assessing engagement results
- disseminating tactical warnings, cueing data, and alerting data to support attack operations and passive defense
- assisting other units in early target detection

6-11. The AMDPCS is capable of performing its EO functions using centralized, decentralized, or autonomous modes of operation. The AMDPCS produces a real or near real-time airspace picture and provides the capability to coordinate Army airspace command and control (A2C2) with other Army, joint and combined elements. Through automated support for EO functions, the AMDPCS allows friendly AMD forces to detect, acquire, classify, and identify aerial platforms early and at great ranges, thereby minimizing fratricide and increasing lethality against hostile targets.

Force Operations Functions

6-12. Force operations (FO) are those actions that are required to plan, coordinate, sustain, and synchronize the air, land and sea battle. FO involve the preparation and positioning of friendly forces for maximum exploitation of enemy weaknesses and include the horizontal and vertical exchange of situation awareness and battle command information within the AMD structure, as well as with the other Army, joint and combined forces in the theater. Situation awareness involves continuous updates of the activities and locations of key friendly and enemy elements.

6-13. By providing automated support for FO functions, the AMDPCS reduces the time requirements and increases the accuracy and reliability of the staff planning processes necessary to support AMD operations. Automation of intelligence, operations, logistics and personnel actions, reports and requests ensures timely information and responses are provided to, and shared among, AMD elements and supported and supporting units so as to enhance the AMD unit's capabilities to perform the assigned mission.

Liaison Functions

6-14. The AMDPCS supports liaison functions by providing an automated means for air and missile defense elements at division, corps and theater levels to exchange warnings, alerts, situation awareness data, and battle command information. It also integrates with the airspace control authority, the identification and engagement authorities and space-based and airborne intelligence and early warning platforms.

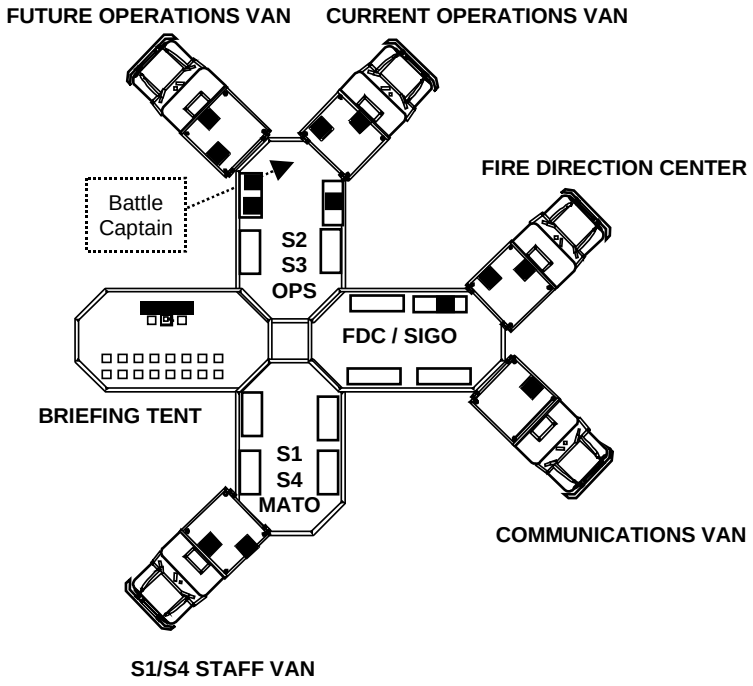

Figure 6-1. Typical ADA Brigade AMDPCS Layout

AMDPCS COMPONENTS

6-15. The AMDPCS brings two major items of automated data processing equipment to the battlefield: the Air Defense Systems Integrator (ADSI) and the Air and Missile Defense Workstation (AMDWS). The ADSI is used at the AAMDC and AMD brigade levels, while the AMDWS is used at echelons down to battery level. Figure 6-1 shows a typical physical layout of an ADA brigade AMDPCS.

6-16. AMDPCSs configured for operations at or above battalion level have significantly greater force operations capabilities than those designed to support the firing batteries and platoons. By contrast, AMDPCS capabilities at firing battery and platoon levels are largely in the engagement operations functional area. Table 6-1 lists all components of the AMDPCS that are configurable for different echelons.

Table 6-1. AMDPCS Components and Functions

Air & Missile Defense Workstation (AMDWS)	Provides real time air picture as a planning tool for radar coverage and system firing fans.
Air Defense System Integrator (ADSI)	EO and FO operations at brigade and above level.
All Source Analysis System (ASAS)	Displays EOB and assists in analysis of and receive, print, and plot intelligence reports and imagery.
AN/ARC-187 UHF Radio	Receives UHF TADIL-A data
Army Field Artillery Tactical Data System (AFATDS)	Assists in fire support management, passes launch points and accesses blue artillery database.
Automated Deep Operations Coordination Cell (ADOCS)	Displays units, airspace control means used to plan deep targets through the corps' DOCC. Provides situational awareness to targeting officer.
Central Communications Display (CCD)	Allows the battle captain the ability to view other component displays.
Commanders Tactical Terminal-3 (CTT-3)	Radio UHF receiver for TIBS and TADIL-B.
Contingency Theater Automated Planning System (CTAPS)	Used to download ATO/ACO and provide input to blue planning.
Generic Area Limitation Environment (GALE)	Terrain analysis using resident databases and can do location suitability modeling for threat systems.
Global Command and Control System (GCCS)	Multiservice C3I data
Harris RF-350 HF Transceiver	Receives HF TADIL-A data
Interim Pager Alert Warning System (IPAWS)	Provides missiles warning and force warning via pagers.
Joint STARS Common Ground Work Station (CGWS)	Provides MTI/SAR data and initiates RSR.
Joint Tactical Information Distribution System (JTIDS)	Receives TADIL-J picture.
Joint Warning (JWARN)	Receives, displays, and transmits NBC messages.
Maneuver Control System (MCS)	Provides comprehensive blue force information and inbound missile warning
Multiple Source Tactical System (MSTS)	Provides real time multispectral imagery and flight following and threat displays.
PSC-7 SATCOM Radio	Receives line-of-sight UHF secure data and voice communications.
Worldwide Origin and Threat System (WOTS)	Receives and correlates JTAGS, ALERT, and TACDR reports and alerts.

6-17. The AMDPCS has the capability to be reconfigured to perform the functions of the next lower or higher echelon AMDPCS. It can be reconfigured

by the addition or deletion of modules, workstations, cells or software or through system initialization procedures IAW the assigned mission and task organization.

TACTICAL COMMAND SYSTEM

6-18. The Patriot Tactical Command System (TCS) is a facility which accommodates the commander and staff of up to ten air defense personnel and provides automated equipment to support force operations (FO) tasks which complement the EO activities in the Patriot ICC. The TCS is mounted on an M934 5-ton expandable van. It is co-located with and interfaces directly to the Patriot ICC using MSE and LAN, uses US Army common hardware and software components, and is powered by a standard US Army 30 kw, 60 Hz generator with UPS backup power.

6-19. Automation is provided through the use of two Tactical Planner Workstations and a communications processor. The TCS workstation standard software package is Air and Missile Defense Workstation (AMDWS) 1.1. Automated functions internal to the TCS include the following areas: defense design (TBM and ABT planning), situation awareness, mission reporting, recording/replay of the air battle, and ICC initialization. The following summarizes the functions performed by the AMDWS:

- Maintain situation awareness of the hostile air threat.
- Provide data required for air intelligence preparation of the battlefield (IPB).
- Maintain situation awareness during ongoing air defense operations.
- Monitor logistical status reports.
- Provide for the interface and data exchange between the TCS and other elements of the ABCS.

MASTER INFORMATION AND COORDINATION CENTRAL

6-20. The Patriot Information and Coordination Central has the capability to function as a master ICC (MICC) fire distribution element. Major features of a MICC include:

- Increased external and internal interfaces
- Brigade wide track management
- Automatic fire distribution and battalion engagement assignment

6-21. A master ICC can work together with external elements. These may be as follows:

- subordinate or lateral battalions (SICC, MICC)
- higher echelons (CRC, TAOC, AWACS)
- up to 12 Fire Units (ECS)

FORWARD AREA AIR DEFENSE C3I SYSTEM

6-22. The FAAD C3I system provides automated engagement operations (EO) and force operations (FO) capabilities at the SHORAD battalion. EO capabilities include near-real-time early warning and target cueing information to SHORAD

weapon systems, friendly aircraft identification, and air-battle management. FO capabilities include automated mission planning, automated staff planning, and interoperability with other command systems. FAAD C3I effectively utilizes joint and combined information by processing the air picture received from USAF E-3 (AWACS), USN E-2C (Hawkeye), and TADIL-B sources such as Patriot.

6-23. Components of the FAAD C3I system include:

- Air Battle Management Operations Center (ABMOC) that monitors and controls the air defense tactical operations for the battalion.
- Army Airspace Command and Control (A2C2) system at the division TOC.
- Sensor/Command and Control (Sensor/C2) system that processes and disseminates track data to firing batteries.
- The Sentinel radar that provides early warning and system cueing information.
- Simplified Handheld Terminal Unit (SHTU) or Handheld Terminal Unit (HTU).

6-24. The ABMOC and A2C2 systems utilize the Army Standard Integrated Command Post System (SICPS) shelter with HMMWV. SINCGARS and EPLRS radios, Mobile Subscriber Equipment (MSE) user terminals (DNVT/DSVT) and the Joint Tactical Information Distribution System (JTIDS) terminal provide communications (voice and data) (figure 6-2, page 6-8). FAAD C3I provides command and control to Avenger, MANPADS Stinger, Bradley Stinger Fighting Vehicle (BSFV), and Linebacker weapon systems and the Sentinel and LSDIS sensor systems. FAAD C3I provides:

- A composite air picture to SHORAD weapon systems from Air and Missile Defense (AMD) sources
- Distributed threat and air battle information to the supported force
- Netted organic sensors (Sentinel, LSDIS)

COMMAND AND CONTROL

6-25. The heart of command and control (C2) is the process of acquiring information, assessing how this information affects current activities, determining a course of action, and directing the implementation of these decisions. The intelligence component provides input to each C2 echelon on the hostile and neutral aspects of the battlefield environment.

6-26. The Command, Control, Communications and Intelligence (C3I) network will allow each SHORAD CP and weapon system to receive:

- target location
- target identification
- target classification
- air defense warning (ADW) and weapon control status (WCS) updates

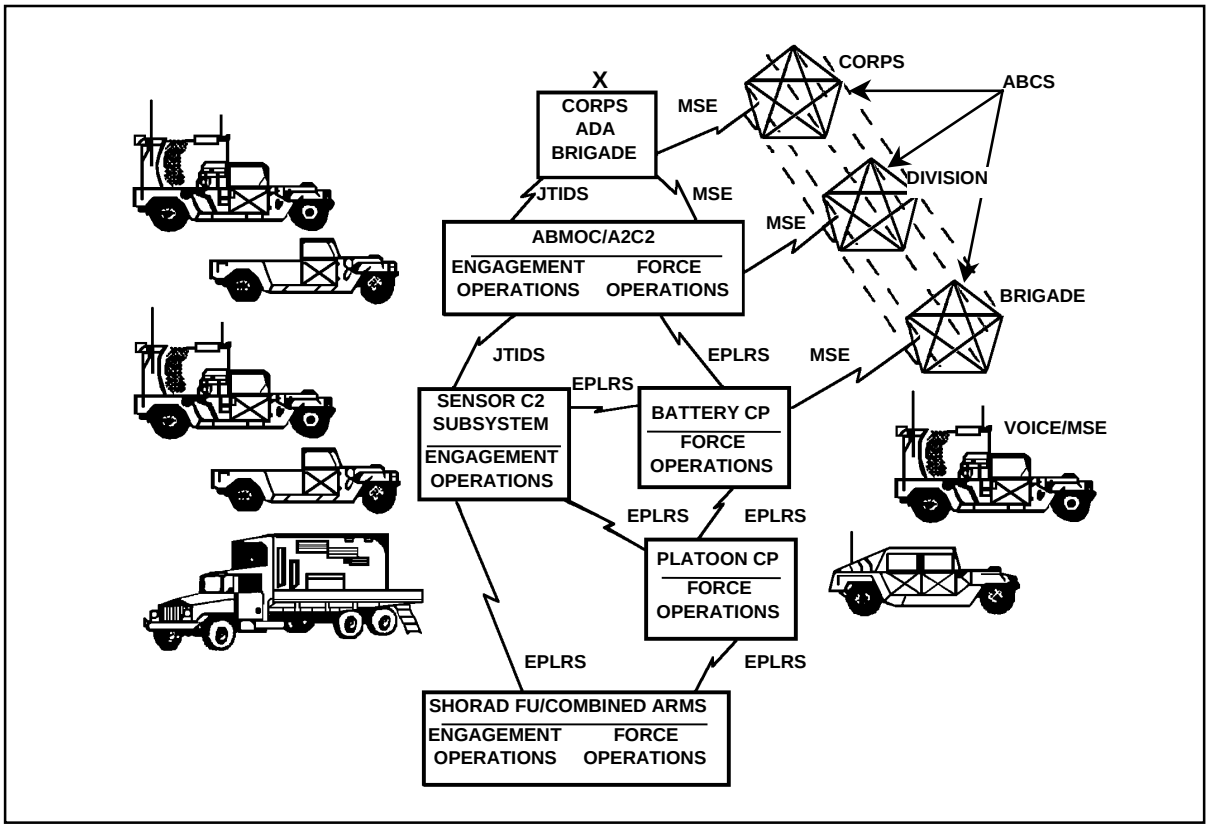

Figure 6-2. FAAD C3I System

COMMUNICATIONS

6-27. Communications and intelligence provide the means to perform the C2 process effectively and in a timely manner. The communications system provides the network that is used to transfer information, orders, instruction data, and intelligence between and within echelons of command. AD commanders must continuously update and coordinate their operations through the integration of communications. Characteristics of FAAD C3I communications are:

- long-range
- mobile
- netted sensors with air battle management operations center (ABMOC) and ADA C2 subsystems
- netted integration (EPLRS only)
- jam resistant
- secure high-speed data distribution
- secure voice communications subsystems

6-28. Major components are the SINCGARS radios, mobile subscriber equipment (MSE) user terminals (DNVT/DSVT), enhanced position location reporting system (EPLRS), and the joint tactical information distribution

system (JTIDS). These components are discussed in the following paragraphs.

Single Channel Ground and Airborne Radio System

6-29. SINCGARS radios are used for both secure voice and digital data in the FAAD C2I equipped SHORAD Battalions. SINCGARS operates in the 30 to 88 MHz frequency range, in 25 kHz steps for a total of 2,320 channels. It can operate in either a single channel or frequency-hopping mode.

Mobile Subscriber Equipment

6-30. Mobile subscriber equipment (MSE) is a common-user, switched communications system of linked switching nodes. The nodes form a grid that provides the force with an area common-user communications system. MSE is digital, secure, and flexible. It contains features that compensate for link failures, functional equipment outages, overload in traffic, and rapid movement of users. FAAD C2I uses Mobile Subscriber Equipment (MSE) to share TADIL-B track data with Patriot battalions and adjacent SHORAD battalions, as well as interface with other Army Battle Command System elements.

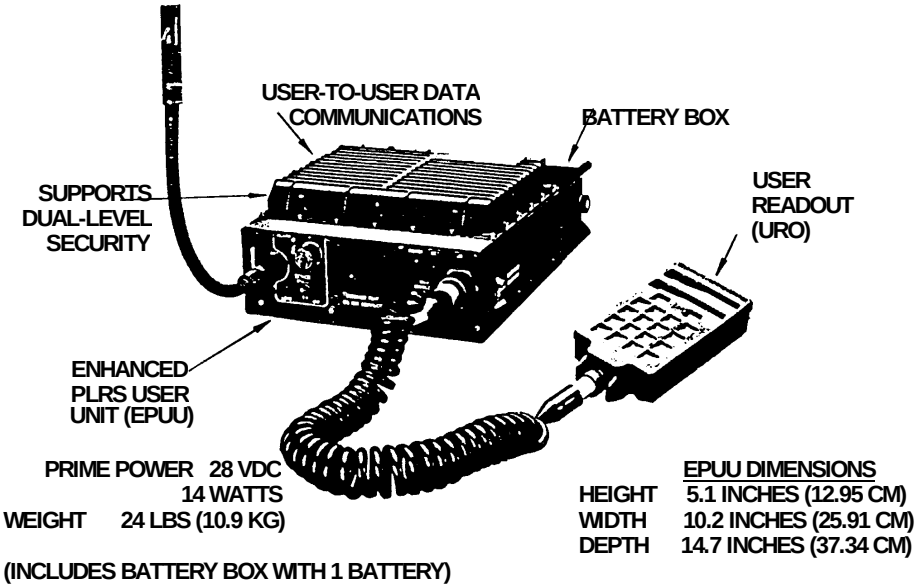

Figure 6-3. Enhanced Position Location Reporting System (EPLRS)

Enhanced Position Location Reporting System (EPLRS)

6-31. Enhanced Position Location Reporting System (EPLRS) radios are used for secure digital data communications (figure 6-3). The EPLRS network supports timely air track broadcast, two-way command and control, communication need-line allocation, and sensor netting. EPLRS resists jamming by waveform design and signal processing techniques, relatively

high values of effective radiated power, automatic network reconfiguration and path redundancy.

Joint Tactical Information Distribution System

6-32. Joint Tactical Information Distribution System (JTIDS) is a jam resistant, secure data and voice communications system used for command, control, and identification. JTIDS provides FAAD C2I with a TADIL-J (link 16) capability to participate on the JDN. JTIDS class 2M radios are located at the divisional level in the Army Airspace Command and Control (A2C2) and at the battalion level in the ABMOC in support of FAAD C2I. The ABMOC and A2C2 use JTIDS to receive long range early warning, classification and identification from the JDN (i.e. AWACS). That data is then correlated with other external sources (i.e. Patriot) and organic sensors, and is then broadcast to the sensor C2 nodes in the battalion. JTIDS provides the ABMOC and A2C2 the means to transmit specific organic SHORAD air tracks (i.e. CM, UAV) to the JDN.

SENTINEL SYSTEM

6-33. The Sentinel is organic to divisional SHORAD battalions, ACRs, and is replacing LSDIS in light and special divisions (figure 6-4, page 6-13). Sentinel is designed to operate in all types of weather, severe ECM environments and survive anti-radiation missile (ARM) attacks. The mission of the Sentinel is to alert the Linebacker, the Bradley Stinger Fighting Vehicle, and MANPADS Stinger teams of hostile and unknown aircraft (FW and RW), cruise missiles, and unmanned aerial vehicles (UAV). It also protects friendly forces from fratricide and provides air situational data to command and control centers.

6-34. Sentinel track data is broadcast to SHORAD weapons and Command Posts through the FAAD C2 system or, in the event a sensor node is not available, directly to the fire units over EPLRS or SINCGARS. The method of transmission is operator-selectable from the remote control terminal (RCT) during initialization.

6-35. The Sentinel system consists of an Antenna-Transceiver Group (ATG) mounted on a high-mobility trailer, and a HMMWV Group consisting of a M1097A1 HMMWV, a MEP-813A 10 kw 400 Hz generator, power conditioning equipment and communications equipment. The system is march-ordered and emplaced by two soldiers and operated by a single soldier. It incorporates automatic fault detection and built in test equipment (BITE). The Sentinel is transportable by aircraft (to include helicopters), rail, or ship.

Sentinel Radar

6-36. The Sentinel radar is a mobile, compact, modular, multifunction, phased-array radar. It consists of a radar antenna unit mounted on top of the transceiver unit. The radar antenna unit also includes an IFF interrogator, an IFF antenna, and an auxiliary ECCM antenna mounted on a single pedestal that rotates during operation. The antenna unit is lowered by hand crank to the stowed position for road march.

Table 6-2. Sentinel Radar Unit Characteristics

Dimensions

Height
- Antenna erected ..... 131.7 inches
- Antenna stowed ..... 94.8 inches

Width (mirrors folded) ..... 85 inches
Length ..... 167.26 inches
Length (with HMMWV) ..... 312 inches
Weight ..... 3,740 lb.

Environmental Characteristics

Temperature
- Operating ..... -50 to 125° F (-46 to 52° C)
- Non-operating ..... -70 to 160° F (-57 to 71° C)

Altitude
- Operating ..... Up to 10,000 feet
- Non-operating ..... Up to 50,000 feet

Wind
- Operating ..... 52 mph with gusts to 75 mph
- Non-operating ..... 65 mph with gusts to 100 mph

Rain ..... 5 inches per hour with winds to 52 mph

Electrical Requirements

Voltage ..... 208 VAC $\pm$ 10% 3-phase; 120 VAC $\pm$ 10%
Power ..... 10 kilowatt, 400 hertz

Mobility

Transport
- Level highway ..... 40 mph
- Graded gravel road ..... 30 mph
- Cross country terrain ..... 8 mph
- Side slope ..... 20 %
- Longitudinal slope 32%

Fording ..... Water up to 30 inches deep

Table 6-3. Sentinel Radar Operating Characteristics

RADAR SEARCH	
Elevation	20° to 25° scan, selectable between -15° and +55°
Azimuth	360° CW or CCW scan
Search Perimeter	> 40 km
RADAR TRACK	
Elevation	-10 through +55°
Azimuth	360° CW or CCW scan
Beam Width	2 x 2° pencil beam
Track Perimeter	40 km instrumented range
RADAR REPORT	
Target Track	Azimuth, elevation, and heading in degrees or mils Range in miles or kilometers Altitude in feet or meters Velocity in feet per second or meters per second
Target Discrimination	Fixed wing or helicopter Unknown, designated unknown, or known/friendly
Jammer Discrimination	Azimuth and elevation in degrees or mils
Report Reference	Respective to DLRP or site MGRS/MSL coordinates
Report Capabilities	FAAD C2I Data Link: track report, IFF/SIF report, and ECM intercept messages EPLRS Radio Link: Track report messages SINCGARS Radio Link: Track report messages
RADAR TYPE	**TARGET TYPE**
X Band	Fixed Wing
3-dimensional Pencil Beam	Rotary Wing
Range-gated, Pulse Doppler	Cruise Missile/UAV
30 RPM rotation (2-second update)	
SURVEILLANCE	
360 Degree Surveillance Volume	
Range	40 kilometer (software instrumented)
Altitude	0-4 kilometer; -10 degrees to +55 degrees
FAAD DATA LINK INTERFACES	
SINCGARS VRC-92A Enhanced Position Location Reporting System (EPLRS) PJHI Hardwire to C2	
ECCM	
Extremely Low Sidelobes	Track on jam strobe
Wide Band Frequency Agile	Variable Pulse Repetition Rate (PRF)
Sector Blank	
IFF	
Modes	1, 2, 3A, and 4
Range	>72 km
Beam width	18° Azimuth, 40° Elevation

Remote Control Terminal

6-37. The Remote Control Terminal (RCT) is a display and control input device used with the Sentinel radar. It is a rugged, compact minicomputer with graphic display screen and multifunction control input keyboard. The Sentinel operator controls the operation of the radar with the keyboard.

6-38. The RCT provides a real-time tactical air picture on a graphic display screen at remote locations. Sentinel radar target tracks are displayed to the operator in target symbology that shows range, elevation, velocity, and track number information.

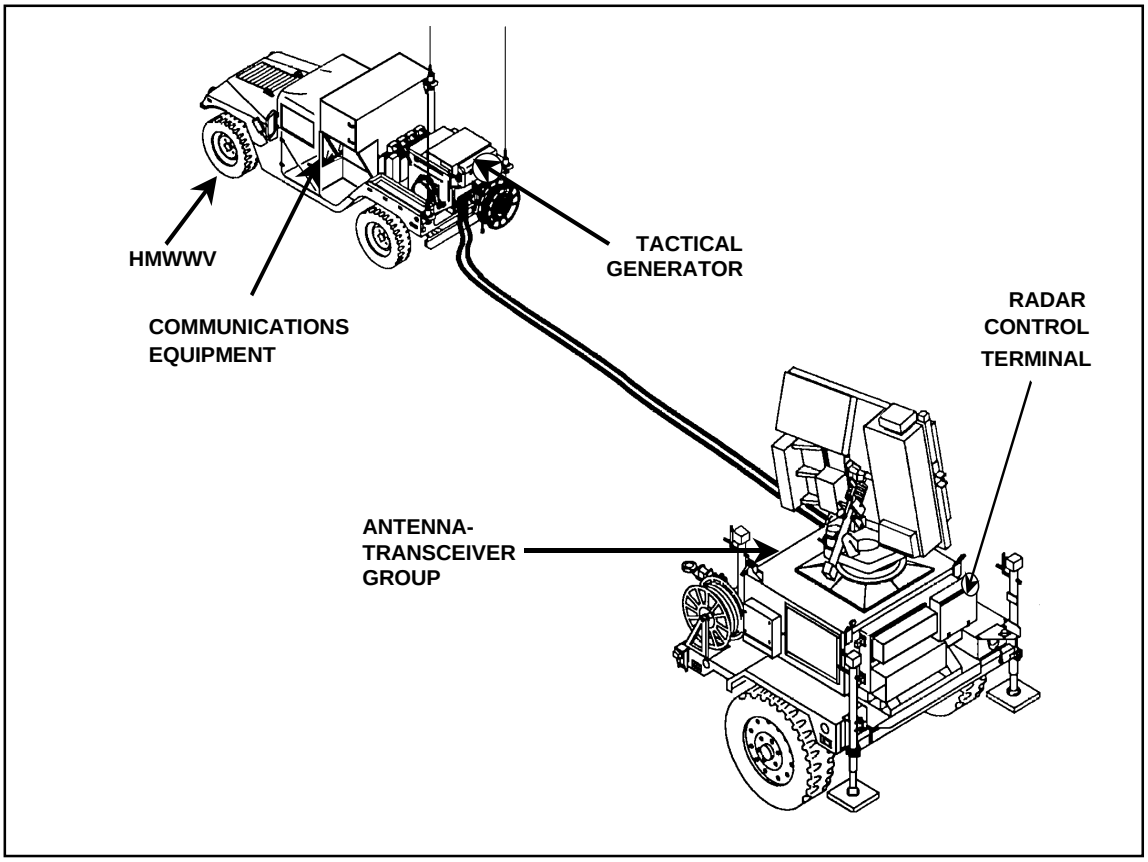

Figure 6-4. Sentinel System

Employment

6-39. Common methods of employment are as follows:

- Method A. Sensor sections are deployed by the sensor platoon leader with staff supervision exercised by the AD battalion S23. The S3 coordinates the selected map positions with the division A2C2 cell. In this method, the platoon leader retains control of the sections.
- Method B. Two sensor teams are attached to each firing battery. The firing battery recommends sensor positions to the ABMOC officer

in charge (OIC). The S3 coordinates these positions with the battalion S2 and division A2C2 cell. The S3 recommends approval or changes, and forwards the approved positions to the firing battery commander.

6-40. The AD battalion commander must consider certain deployment factors to determine which method to use. These factors include but are not limited to the following:

- mission
- deployment of supported forces
- deployment of fire units
- the enemy threat, both air and ground
- terrain
- electronic warfare environment