ATP 6-02.54

TECHNIQUES FOR SATELLITE COMMUNICATIONS

JUNE 2017

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Headquarters, Department of the Army

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Army Techniques Publication
No. 6-02.54

Headquarters
Department of the Army
Washington, DC, 5 June 2017

Techniques for Satellite Communications

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Preface

ATP 6-02.54 provides techniques for the Army satellite communications (SATCOM) community. The intent of this publication is to educate communicators on the multitude of options that are available utilizing SATCOM. This publication includes information for planning, establishing, and operating communications networks utilizing satellites.

The principal audience for ATP 6-02.54 is Army professionals and contractors whose duties involve designing, building, configuring, securing, operating, maintaining, and sustaining the SATCOM systems. This publication provides SATCOM information and guidance to commanders, staffs, operators, and maintainers that execute SATCOM for the Army. ATP 6-02.54 is a significant resource to Army SATCOM trainers and educators.

Commanders, staffs, and subordinates ensure their decisions and actions comply with applicable U.S., international, and, in certain cases, host-nation laws and regulations. Commanders at all levels ensure their Soldiers operate according to the law of war and the rules of engagement (see FM 27-10).

ATP 6-02.54 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. For definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition. This publication is not the proponent for any Army terms. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

ATP 6-02.54 applies to the Active Army, Army National Guard/Army National Guard of the United States, and U.S. Army Reserve unless otherwise stated.

The proponent of ATP 6-02.54 is the U.S. Army Cyber Center of Excellence. The preparing agency is the Cyber Center of Excellence Doctrine Division, U.S. Army Cyber Center of Excellence. Send comments and recommendations on a DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, U.S. Army Cyber Center of Excellence, ATTN: ATZH-ID (ATP 6-02.54), 506 Chamberlain Avenue, Fort Gordon, GA 30905-5735; by electronic mail to usarmy.gordon.cyber-coe.mbx.gord-fg-doctrine@mail.mil.

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Introduction

ATP 6-02.54, Techniques for Satellite Communications, identifies and explains the role of SATCOM as a part of the Army's transport layer for connection to Defense Information Systems Network (DISN) services. ATP 6-02.54 expands on the doctrinal foundations and tenets found in FM 6-02, *Signal Support to Operations*.

The vision for the Department of Defense Information Network-Army (DODIN-A) is the employment of an end-to-end network that provides assured global mission command and enables the Army to fight and win in a contested and congested operating environment. This network seamlessly integrates services and capabilities from strategic to tactical echelons and enables all warfighting functions. The network is a warfighting platform that enables the mission command system to integrate joint combined arms and all elements of combat power; support leaders' ability to understand, visualize, and describe the operational environment, problems, and approaches to solving them; support commanders' ability to make decisions and direct action toward a desired end state; assess understanding of the problem and adequacy of the operational approach and subsequent plans and level of progress.

The network is tailorable and will adapt based on phases of the operation to provide assured mission command in home station, en route, and in deployed environments. Deployed environments include training, exercises, security cooperation engagement, initial entry, and combined arms maneuver, which may employ minimal to robust force packages requiring the network to adjust to provide appropriate services at the point of need under all conditions. We will seek to provide services at point of need and, through home station mission command, reduce the deployed footprint and operational risk. The ability to predict the actions of enemies and adversaries enables proactive defense and assures access to critical data and the security of our networks and systems, which is essential to our mission success. The network must embrace common standards from a joint and multi-national perspective that allow the addition of capabilities and systems while reducing, not increasing complexity of the network. The network must provide an advantage and not a burden while providing enhanced speed and agility to our warfighting formations.

The SATCOM network capabilities provided by Signal Soldiers play a vital role in supporting Army operations by providing an information advantage. Today's Army demands the reliable network transport provided by SATCOM to receive information for situational understanding necessary to conduct Army operations. Network transport and information services is a core competency of the Signal Corps. Planners integrate satellite assets to support the commander and the operational mission plan. SATCOM capabilities are vital to increasing the Army's combat power and that of its joint, interorganizational, and multinational partners.

As the evolution of capabilities make our networks less complex and more defensible, we will evolve our doctrine to describe the current and effective employment of our networks and systems in a congested and contested operating environment. This publication will be updated as improvements and changes in Army capabilities occur or when there are changes in the operating environment in order to maintain the advantage in this challenging environment.

To apply the techniques contained in this document, readers should be familiar with the Army's capstone doctrine (ADP 1 and ADP 3-0), ADRP 1, and ADRP 3-0 to understand how the Army operates as part of a larger national effort characterized as unified action. Commanders and network planners should be familiar with, and apply, the military decision-making process in ADP 5-0 and ADRP 5-0 and the essentials of mission command found in ADP 6-0 and ADRP 6-0.

Procedures that cover each area of the three types of SATCOM (wideband, narrowband, and protected) are addressed by various governing commands. The nature of this ATP is to cover the various non-prescriptive techniques for SATCOM. For prescriptive procedures, the reader may access that information made available through the reference section of this publication.

ATP 6-02.54 chapters include—

Chapter 1 provides an overview of SATCOM. It discusses the three distinct segments of SATCOM: space, control, and terminal. This chapter covers wideband, narrowband, protected, and commercial SATCOM.

Chapter 2 describes the roles and responsibilities of the joint and Army elements involved with Army SATCOM.

Chapter 3 addresses tailoring Army SATCOM architecture to user requirements. This chapter discusses the requirements, objectives, and considerations about Army SATCOM architecture.

Chapter 4 addresses SATCOM mission planning. This chapter explains how an Army communicator develops a SATCOM plan from a concept.

Chapter 5 identifies units with unique SATCOM missions. This chapter addresses the deployment and employment of tailored signal units providing SATCOM support.

Appendix A identifies the equipment the Army uses to provide SATCOM support. It discusses the enterprise and tactical terminals that offer SATCOM support.

Appendix B addresses the application and functionality of the Global Positioning System.

Appendix C provides an overview of demand assigned multiple access and the integrated waveform (IW). It discusses the specifications of the two waveforms.

Chapter 1
Satellite Communications Overview

This chapter explains the fundamentals and various types of SATCOM. The inherent nature of SATCOM allows for service over the Polar Regions, the oceans, and the remote areas of the world. SATCOM provides global connectivity to widely dispersed small and mobile forces. The Army relies on SATCOM to support each of the warfighting functions. SATCOM acts as a network extension and provides long-haul communications to areas where terrestrial architecture may be insufficient or where line of sight equipment is inadequate.

FUNDAMENTALS

1-1. SATCOM provides advantages over terrestrial means of communications. These advantages include worldwide coverage and not being limited to line of sight connectivity. Army communication planners, maintainers, and operators should understand these fundamental SATCOM principles—

- SATCOM segments.
- Frequency.
- Bandwidth.
- The Department of Defense information network (DODIN).

SATCOM SEGMENTS

1-2. SATCOM has three segments—

- **Space Segment.** Military and leased commercial satellites and SATCOM payloads in orbit. This segment contains the military's ultrahigh frequency follow-on (UFO), Mobile User Objective System (MUOS), Defense Satellite Communications System (DSCS), Wideband Global Satellite Communications (WGS), the Global Broadcast Service (GBS), Milstar, advanced extremely high frequency (AEHF), Enhanced Polar System, and commercially leased SATCOM transponders/payloads such as Iridium and international maritime satellite (INMARSAT).
- **Control Segment.** All the ground facilities and antennas required to control the satellites and their SATCOM payloads in orbit. It incorporates the operational management planning hardware and software at a regional satellite communications support center (RSSC) and the satellite command and control centers used to perform satellite, payload, and transmissions control. Satellite control maintains the health and welfare of the satellite. Payload and transmissions control involve monitoring, operating, allocation of the satellites payload, signal power, antenna orientation, and link monitoring. The Army's wideband satellite communications operations center (WSOC) and the Navy Space Operations Center are examples of satellite command and control centers. The Air Force's 3d and 4th Space Operations Squadrons are satellite command and control centers that perform satellite movement and control.
- **Terminal Segment.** Fixed (strategic/enterprise) Department of Defense (DOD) gateways and the regional hub node (RHN), deployable (tactical) terminals, handheld, and portable tactical systems. As deployable terminals, this segment may include SATCOM assets used within the aerial layer, including satellite-equipped aircraft, manned or unmanned.

FREQUENCY

1-3. SATCOM uses the frequency range of 3 megahertz (MHz) to 300 gigahertz (GHz). Table 1-1 depicts the letter designations, frequency ranges, and frequency bands based on the Institute of Electrical and Electronics Engineers standards for frequency ranges.

Table 1-1. Radio frequency bands

Letter Designations	*Frequency Range*	*Frequency Band*
P	225–390 MHz	VHF/UHF
L	1–2 GHz	UHF
S	2–4 GHz	UHF/SHF
C	4–8 GHz	SHF
X	8–12 GHz	SHF
Ku	12–18 GHz	SHF
K	18–27 GHz	SHF
Ka	27–40 GHz	SHF/EHF
V	40–75 GHz	EHF
W	75–110 GHz	EHF

EHF - extremely high frequency	SHF - super-high frequency
GHz - gigahertz	UHF - ultrahigh frequency
MHz - megahertz	VHF - very high frequency

BANDWIDTH

1-4. Bandwidth is the width of a range of a frequency band, measured in hertz, used to transport data. In most cases as the bandwidth increases, throughput rates also increase. It is important to note that the amount of throughput using bandwidth is dependent on the efficiency of the SATCOM equipment used. The Army's use of new technologies drives requirements that demand greater amounts of bandwidth. Expanding requirements are partially responsible for the DOD's increased use of ultrahigh frequency (UHF), super-high frequency (SHF), and extremely high frequency (EHF) technology and leased commercial systems.

DEPARTMENT OF DEFENSE INFORMATION NETWORK

1-5. The *Department of Defense information network* (DODIN) is the set of information capabilities, and associated processes for collecting, processing, storing, disseminating, and managing information on-demand to warfighters, policy makers, and support personnel, whether interconnected or stand-alone, including owned and leased communications and computing systems and services, software (including applications), data, security services, other associated services, and national security systems (JP 6-0).

1-6. The DODIN provides communications services necessary to achieve information advantage. The DODIN is an integrated network that encompasses the Service-specific capabilities of the Army, Navy, and Air Force, combined with joint capabilities provided by the Defense Information Systems Agency (DISA). The Army DODIN operations mission is the responsibility of U.S. Army Cyber Command as primarily executed by U.S. Army Network Enterprise Technology Command (NETCOM). DODIN operations are the most important, most complex operation the Army performs on a daily basis. Commanders leverage the DODIN as a warfighting platform as it supports all other Army warfighting functions and capabilities, including mission command, intelligence, surveillance, and reconnaissance; precision fires; logistics; and telemedicine. The DODIN-A is an Army-operated enclave of the DODIN that encompasses all Army information capabilities that collect, process, store, display, disseminate, and protect information worldwide.

1-7. Commanders exercise command authority for DODIN operations in their portion of the network. The nature of this complex operation requires deliberate staff planning and coordination executed through the military decision making and operations processes to ensure the commander's intent is met. The staff will collaborate in the same manner as any other operation. Signal staff sections formulate DODIN operations plans and network operations security centers exercise technical control for all network transport missions.

1-8. To support the commander's intent SATCOM is a key means of network transport. During SATCOM planning the staff will consider what resources they need to request, required configurations, the monitoring of the satellite signals, and response to network anomalies.

1-9. Army-owned SATCOM terminals, both tactical and strategic, support Army network connection to the DODIN. Army strategic locations use SATCOM as the transport medium of choice to extend DISN services to all theaters of operation. For more information on DODIN and cyberspace operations, other than satellite transport, see Army doctrine for DODIN operations and FM 3-12.

THE INFORMATION ENVIRONMENT

1-10. U.S forces seek to dominate the information environment in order to maintain information advantage. The *information environment* is the aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information (JP 3-13). The information environment is one aspect of the overall operational environment. Effects in the information environment may affect other decisions and conditions in the operational environment.

Congested Environment

1-11. Gaining and maintaining control of the electromagnetic spectrum is a critical requirement for the commander. From satellite communications, to intelligence collection, to electronic warfare, all forces and supporting agencies depend on the electromagnetic spectrum to execute operations in the air, land, maritime, space, and cyberspace domains. Within the electromagnetic spectrum, joint forces contend with civil agencies, commercial entities, allied forces, and adversaries for use of a common electromagnetic spectrum resource (ATP 6-02.70). The competition for the finite available bandwidth sometimes results in an extremely congested spectrum, particularly when operating in developed nations where landing rights and host nation approval could affect availability.

Contested Environment

1-12. Enemies and adversaries may deliberately attempt to deny friendly use of the electromagnetic spectrum, space, cyberspace, and/or terrestrial systems. Due to heavy joint reliance on advanced communications systems, such an attack may be a central element of any enemy or adversary anti-access and area denial strategy, requiring a higher degree of protection for friendly command and control systems and planning for operations in a denied or degraded environment (JP 6-0).

1-13. U.S. forces dominated cyberspace and the electromagnetic spectrum in Afghanistan and Iraq against adversaries who lacked the technical capabilities to compel the coalition to contend with a contested environment. More recently, regional peers have demonstrated impressive capabilities in a hybrid operational environment that threaten the Army's dominance in cyberspace and the electromagnetic spectrum. Because mission command communications are a key enabler, U.S. military communications and information networks present a high-value target for enemies and adversaries. Technologically sophisticated adversaries understand the extent of U.S. forces' reliance on satellite communication systems. We should expect that in future conflicts enemies and adversaries will contest the information environment to deny operational access and diminish the effectiveness of U.S. and allied forces.

1-14. Degraded capabilities may result from hostile threat actions, but may also occur due to insufficient resources for all forces in the operational area. They may also result from a lack of coverage (such as inadequate communications satellite capacity) in the operational area or from electromagnetic interference, whether intentional (jamming) or unintentional.

1-15. Successfully integrating signal support with cyberspace, electronic warfare, and intelligence capabilities is the key to obtaining and maintaining freedom of action in cyberspace and the electromagnetic spectrum and the ability to deny the same to our adversaries. Synchronizing capabilities across multiple domains and warfighting functions maximizes the inherently complementary effects in and through cyberspace and the electromagnetic spectrum.

TYPES OF SATELLITE COMMUNICATIONS

1-16. Army SATCOM is a combination of military satellite communications (MILSATCOM) and commercial satellite communications (COMSATCOM) assets. These assets are either tactical or enterprise (strategic) systems. MILSATCOM is comprised of three separate bands (wide, protected, and narrow) examined in this chapter. Chapter 5 addresses COMSATCOM

WIDEBAND SATELLITE COMMUNICATIONS

1-17. The Army wideband SATCOM architecture largely provides range extension for the Army common user voice and data systems. Wideband SATCOM extends switched and network subscriber services to deployed forces. It provides reachback to the DODIN for sustaining base support, operational information, and DISN services. Wideband SATCOM provides the global connectivity needed to support Army operations. Wideband systems operate across the SHF spectrum of 3 to 30 GHz range, including the S, C, X, Ku, K, and Ka radio frequency bands.

1-18. Wideband SATCOM supports multichannel, secure voice, and high data rate communications for execution of mission command, crisis management, and intelligence data transfer. Wideband communications support a range of government, strategic, and tactical users including—the White House Communications Agency, all uniformed Services, the U.S. Department of State, the Joint Staff, all combatant commanders, joint task forces, multinational forces, and other government agencies. It provides common user information transport and allows the user global reachback to other portions of the DODIN. It supports DISN services including—Nonsecure Internet Protocol Router Network (NIPRNET), SECRET Internet Protocol Router Network (SIPRNET), Joint Worldwide Intelligence Communications System, and video teleconferencing.

The Defense Satellite Communications System

1-19. DSCS X band satellites operate with a 500 MHz uplink (7.9 GHz–8.4 GHz) and a 500 MHz downlink (7.25 GHz–7.75 GHz) bandwidth. The DSCS was the backbone of the U.S. MILSATCOM for decades and still supports Soldiers today. The DSCS constellation is now performing backup/residual wideband SATCOM roles. With its unique capabilities, the third generation DSCS satellites (DSCS III) augment the WGS and continue to support many of its strategic missions including the jam-resistant secure communications networks. The RSSC plans DSCS III missions and the WSOC executes payload and transmission control.

Wideband Global Satellite Communications Satellites

1-20. WGS supports more tactical users in any area of operations than DSCS. The WGS, through spatial frequency reuse, provides more than four times the X band bandwidth of a single DSCS III satellite. With the addition of the Ka band bandwidth, the WGS provides more than ten times the bandwidth capacity of a single DSCS III satellite, which helps the current congested environment. With higher power output, the WGS communications payload can support greater numbers of disadvantaged and tactical users. This additional power supports greater use of smaller tactical satellite (TACSAT) terminals with higher data rates than possible over the DSCS III. Another key aspect of the WGS is it is capable of supporting the cross-banding of X and Ka bands. What this means to the user is that any DSCS X band terminal can now communicate with the newer Ka band terminals without any upgrades. This increases flexibility to combatant commands and satellite planners for mission support. Figure 1-1 on page 1-5 shows the global coverage areas of the current WGS satellite constellation.

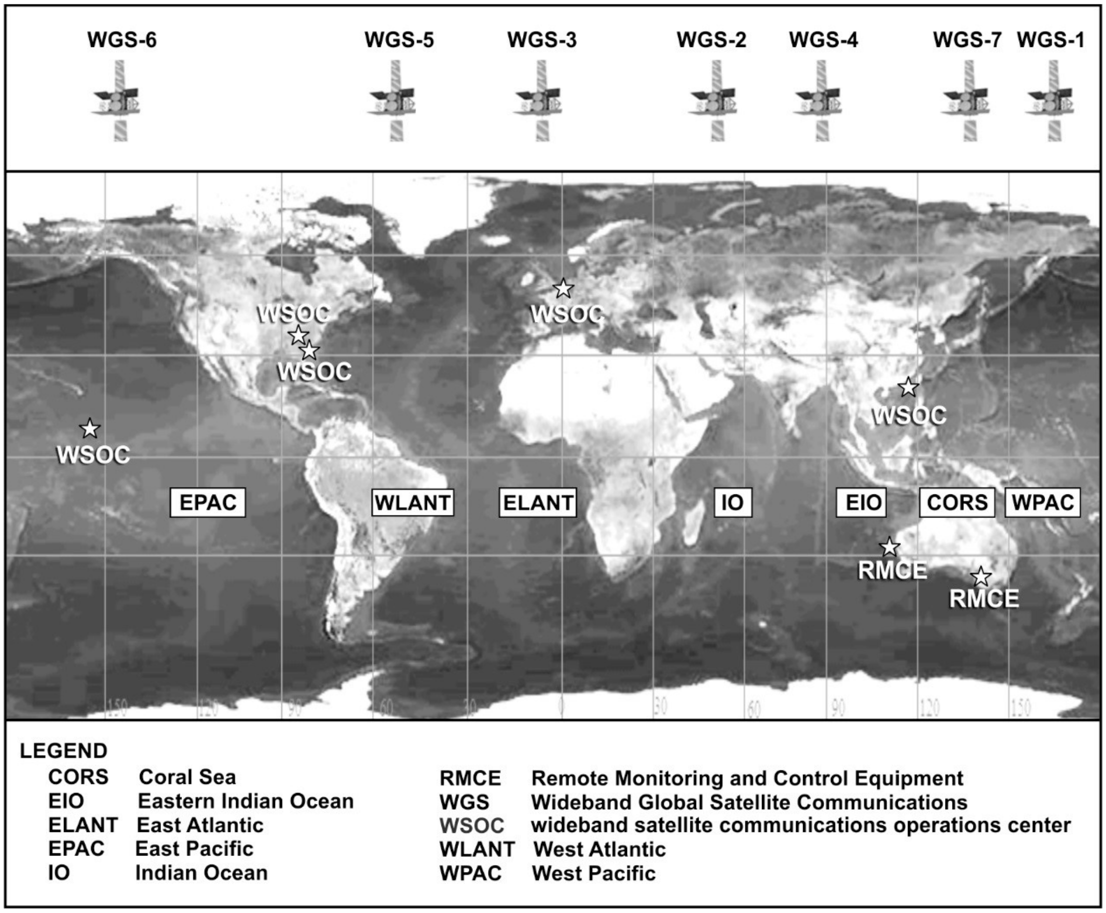

Figure 1-1. Wideband global satellite communications coverage areas

1-21. The WGS space segment is programmed to be a 10-satellite constellation. Each satellite has eight steerable and shapeable X band beams that give precise coverage over theaters, shipping lanes, and other broad areas of coverage. Each WGS has ten steerable Ka band dish antennas to provide Ka band coverage to areas of about 580 miles in diameter and can provide that coverage anywhere in the satellites field of view.

1-22. On the first three WGS satellites, two of the 10 beams are area coverage antennas, similar to GBS, providing links to an area of about 1750 miles in diameter; but due to the large area of coverage, users will experience much lower data rates. Each WGS also employs an X band uplink and a downlink earth coverage antenna. The first three satellites are designated WGS Block I satellites. Those satellites handle up to 35 individual 125 MHz channels, three 47 MHz channels, and a 50 MHz X band earth coverage channel.

1-23. The next three satellites that follow WGS 4, WGS 5, and WGS 6 are Block II; have the added ability of two 400 MHz channels that by-pass the main payload, called the channelizer. This allows EHF data rates to pass through the WGS satellites as required for selected airborne intelligence, surveillance, and reconnaissance assets.

1-24. The next block upgrade of satellites WGS 7 through 10 are designated as WGS Block IIA. The Block IIA satellites will not need the channelizer by-pass, as all channels going through the WGS channelizer upgrade are from 125 MHz channels to 500 MHz channels nearly doubling the available WGS bandwidth on a single satellite. Each listed channel is a sub-set of the available bandwidth of the satellite and not the spectral band in which it operates. These changes help mitigate the congested MILSATCOM availability.

Defense Satellite Communications System and Wideband Global Satellite Communications Control Segment

1-25. The Army portion of the control segment includes RSSCs and WSOCs. These centers give guidance and instruction to terminals using the DSCS and WGS constellations.

Regional Satellite Communications Support Center

1-26. U.S. Army Space & Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) operates four RSSCs per direction of U.S. Strategic Command (USSTRATCOM). Two RSSCs in the continental United States (CONUS), one in the Pacific Ocean area, and one in Europe (see figure 1-2). Combatant command (CCMD) communications staff validates unit requirements and sends the satellite access request (SAR) to RSSCs where SATCOM planners produce a satellite access authorization (SAA) for implementation by SATCOM users and WSOCs.

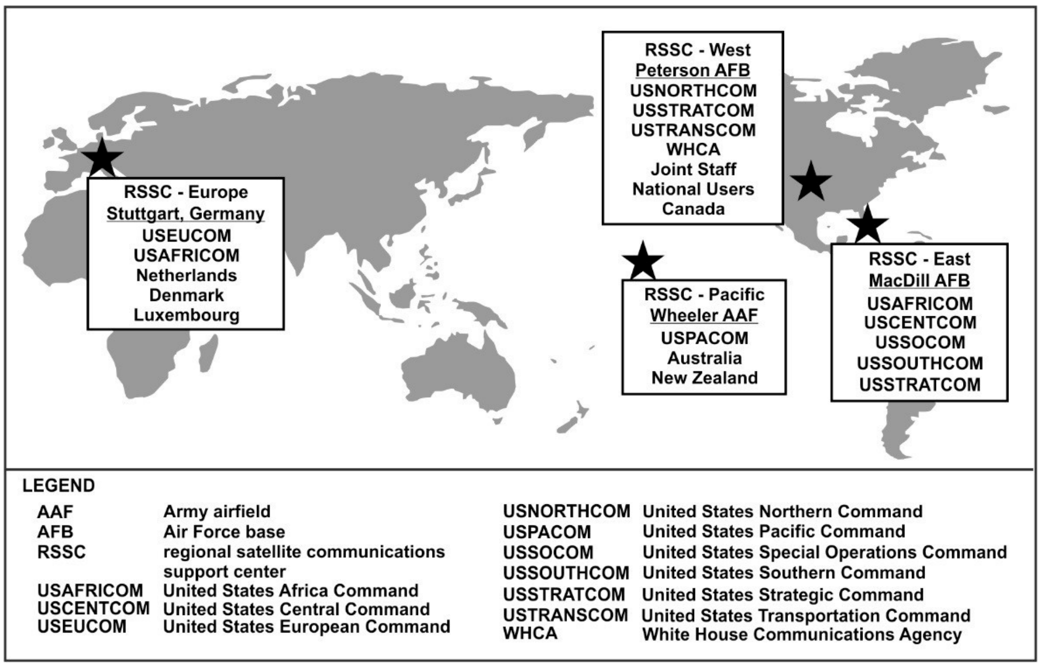

Figure 1-2. Regional satellite communications support center coverage

1-27. Users have an RSSC available for SATCOM planning, management, and access support. Generally, RSSCs support a combatant commander (CCDR) in routine, deliberate, and crisis action planning of SATCOM resources. RSSC personnel take part in planning conferences and meetings to identify theater SATCOM support requirements for mission tasks. RSSCs process user SARs and publish SAAs for approved missions.

Wideband Satellite Communications Operations Centers

1-28. There are five geographically dispersed WSOCs that provide transmissions monitoring and satellite payload control for the DSCS III and WGS constellations. This includes monitoring satellite telemetry to ensure the satellites health and status. In this congested environment each terminals transmissions are monitored from mission access until mission end for proper power, bandwidth, and spectral characteristics. WSOC personnel monitor the satellite’s payload for anomalies, electromagnetic interference, and help implement resolution actions. WSOC personnel record data and help identify equipment trends. WSOC personnel identify terminal segment issues through characterization of terminal transmissions and solve the problems. WSOCs perform payload control in response to wideband SAAs sent from the RSSCs.

1-29. The WSOCs command the satellite payload to create links, shape beams, point antennas, and provide power required to close the planned links. Each WSOC is at minimum, responsible for two satellites. As the

WGS constellation grows, WSOCs are responsible for more satellites. To accomplish this, additional antennas are available. The additional antennas, called Remote Monitoring and Control Equipment and are geographically in separate areas to support the growing numbers of WGS on orbit. The Joint Staff designated the Commander, United States Strategic Command (CDRUSSTRATCOM) as the SATCOM operational manager. USASMDC/ARSTRAT manages the RSSCs for CDRUSSTRATCOM. The Joint Functional Component Command for Space (JFCC-Space) has tactical control for the WSOCs. The 53d Signal Battalion (Satellite Control [SATCON]) performs the wideband SATCOM payload and transmissions control at the WSOCs and supports Commander, JFCC-Space in conducting SATCOM operations in coordination with USSTRATCOM and Commander, JFCC-Space. The USASMDC/ARSTRAT wideband consolidated satellite communications systems expert (C-SSE) provides technical direction and situational awareness to the WSOCs on behalf of JFCC-Space.

***Note*.** Refer to FM 3-14 for more information on RSSCs and WSOCs.

Global Broadcast Service

1-30. GBS ensures timely and secure net-centric capabilities supporting the DOD's full range of warfighting and intelligence missions. GBS is a broadcast service designed to meet the ever-increasing Soldier demand for large volume data. GBS provides high capacity smart-push and user-pull based broadcast capability for video, high quality imagery, data, and other information to the Soldier. GBS supports training and military exercises, special activities, crisis operations, battlefield awareness, weapons targeting, and intelligence, surveillance, and reconnaissance requirements. The transition to a DISA Defense Enterprise Computing Center (DECC)-centered architecture provides a centralized center for supporting worldwide, continuous operations, management, and control GBS assets.

1-31. GBS is predominantly a broadcast service that augments other communications systems. GBS can broadcast over two military satellite types—UFO and WGS. GBS provides joint operations with high-speed multimedia communication and information for deployed, in-transit, and garrisoned forces. GBS is a U.S. military system that supports operations with joint and multinational forces depending on security and cryptographic release restrictions.

1-32. The goal of the GBS program is to satisfy Soldier requirements for a high bandwidth broadcast capability for large volume information products. GBS' fundamental function is high capacity product dissemination for mission essential situational awareness. Examples include imagery, intelligence, training, tactical full motion video, large data files, 24-hour commercial news, and weather services. These products are available to deployed, at-the-halt, and garrison users. Figure 1-3 on page 1-8, shows the flow of data provided by GBS.

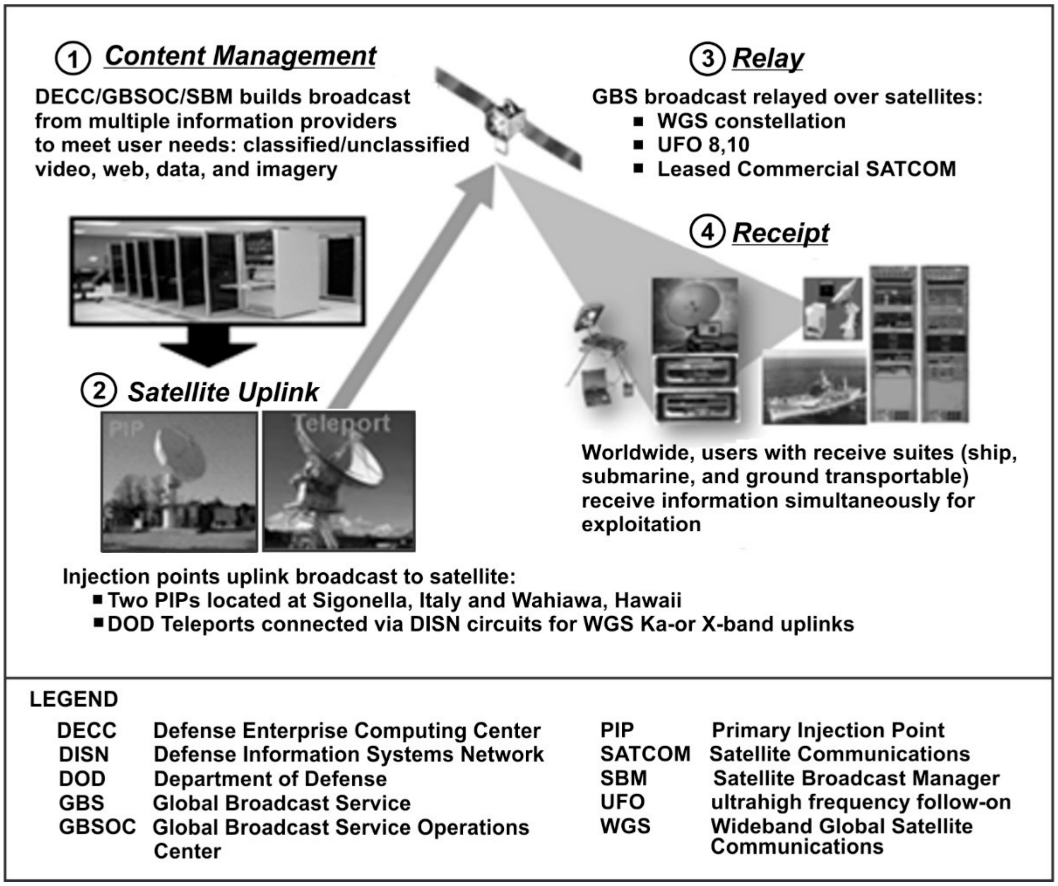

Figure 1-3. Global Broadcast Service broadcast route

GBS Attributes

1-33. GBS is a system of broadcast and content management including the management for requesting and coordinating the distribution of information products and high definition videos. The GBS facilitates terrestrial networks, uplink facilities, satellite bandwidth, and receiver terminals.

Uplink Facilities

1-34. The uplink facilities deliver the broadcast stream to satellites that support GBS operations. Broadcast streams are delivered to two UFO (UFO-8 and 10) satellites, the WGS constellation, and commercial satellites. GBS primary injection points are located at Sigonella, Italy, and Wahiawa, Hawaii. Primary injection points uplink the broadcast stream to UFO satellites or WGS satellites via the five gateway sites. The uplink terminals are connected to the DECC via robust and diverse DODIN connectivity from 3 megabits per second (Mbps) to 45 Mbps based on the authorized satellite transponder.

Space Segment

1-35. The space segment includes a hosted tertiary Ka band payload on two UFO satellites and WGS satellites operating in Ka band. Other U.S. and non-U.S. Ku and Ka band satellites can augment the space segment. The RSSCs plan and manage SATCOM resources for WGS and UFO satellites. The WSOC (WGS) and the Naval Satellite Operations Center (UFO) manage payload configurations.

1-36. Each UFO satellite used for GBS has four steerable downlink spot beams to support GBS users at 29.5 Mbps. Each WGS satellite has six steerable downlink spot beams, ability to fan-out the broadcast, and support GBS users at upwards of 45 Mbps. Figure 1-4 on page 1-9 provides an operational overview of the broadcast and space segments.

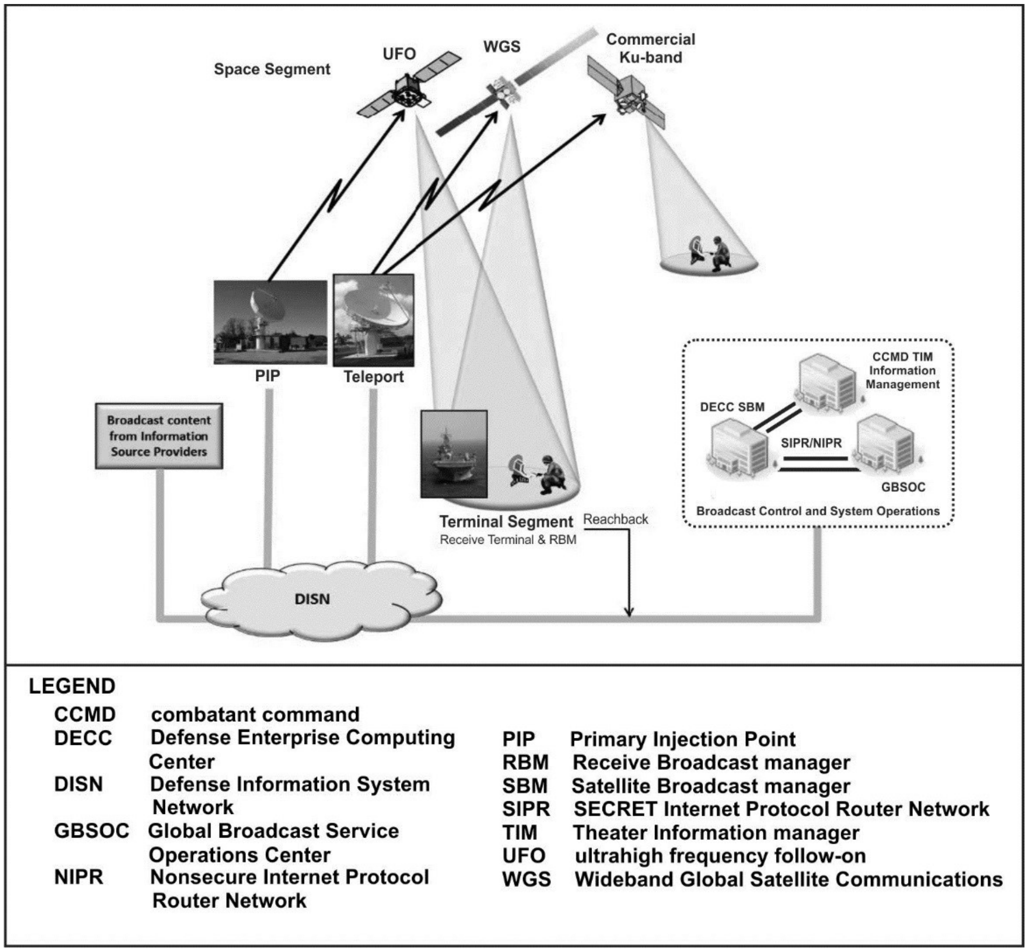

Figure 1-4. Global Broadcast Service operations overview

Note. GBS services will migrate from the UFO satellites to the WGS constellation.

1-37. In regions where MILSATCOM resources are not available, leased Ku band COMSATCOM satellites augment MILSATCOM to meet user requirements.

Broadcast Segment

1-38. The principal DECC satellite broadcast manager (SBM) is located in Oklahoma City, Oklahoma with the backup DECC SBM located in Mechanicsburg, Pennsylvania for continuity of operations. Data and streaming products are transmitted from sources to the GBS primary DECC SBM (videos are simultaneously transmitted to the continuity of operations DECC SBM), then across the DODIN to DOD Teleports, DOD gateways, and terminals for broadcast over the WGS satellites or to the primary injection point at Sigonella, Italy and Wahiawa, Hawaii for broadcast over UFO satellites.

1-39. The GBS architecture is a content priority based broadcast. This ensures the most essential information has priority. The internet protocol (IP) architecture allows higher content priority products to interrupt the broadcast of lower priority broadcasts after which the delivery of lower level priority content will resume. GBS does not have nuclear survivability or hardening features incorporated and is vulnerable to the same threats as most COMSATCOM systems. See chapter 5 for details of the receive segment.

Organizational Relationships

1-40. USSTRATCOM, through U.S. Cyber Command, directs cyberspace operations, including DODIN operations and defense. The responsibility for day-to-day execution of 24-hour operations for GBS is delegated to Headquarters Air Force Space Command and ultimately to the 50th Space Communications Squadron to support CCMDs, Services, and other government agencies. Headquarters Air Force Space Command is designated the lead command and systems manager for GBS, and is responsible for GBS operations, maintenance, and sustainment.

1-41. 50th Space Communications Squadron executes operations management for GBS. The 50th Space Communications Squadron Global Broadcast Service Operations Center (GBSOC) provides centralized GBS operations and a management. The GBSOC remotely manages the GBS broadcast content at the primary and continuity of operations DECC SBM. Each CCMD GBS theater information manager coordinates with the GBSOC operators for broadcast scheduling, resource allocation, product integration, and mission planning.

1-42. The CCMD GBS theater information manager is the validating authority for missions and products supported by GBS. Theater information manager functions include the collection and prioritization of requirements to direct GBS theater operations, coordination with the GBSOC and RSSCs on operational issues, the coordination of the broadcast schedules; management of allocated resources, and the identification of new products. The theater information manager also conducts audit user pull requests and designs, configures, maintains, and validates the user profile database.

1-43. Commander, USSTRATCOM directs JFCC Space to serve as the central focal point for all SATCOM operational issues and concerns. In this capacity, JFCC Space directs planning, allocation, asset management, configuration and control, and operations to deliver SATCOM capabilities to support U.S., allies, and international partners. JFCC Space will provide unified direction to the GBSOC for satisfaction of conflicting CCMD SATCOM requirements. JFCC Space will maintain situational awareness for the development of policies, adherence with regulations, outages affecting GBS, and resolution of user non-concurrence with GBS authorized service interruptions.

1-44. USASMDC/ARSTRAT conducts space and missile defense operations and provides planning, integration, control, and coordination of the Army and capabilities supporting USSTRATCOM missions. USASMDC/ARSTRAT provides oversight and management of the RSSC and is the wideband C-SSE, including DSCS, WGS, and the GBS SSEs. These roles provide technical, operational, and engineering support to USSTRATCOM, JFCC-Space, GBS Joint Program Office, and CCMDs.

1-45. GBSOC is responsible for monitoring and maintaining regional GBS SATCOM situational awareness supporting CCMD GBS theater information managers. The RSSCs operate around the clock to provide mission planning, constellation loading, and transmission utilization and optimization to worldwide SATCOM users. The RSSCs approve and provide SAAs. Within the RSSCs, the wideband operations cell monitors and maintains GBS SATCOM situational awareness and provides CCMD GBS theater information managers and other users with GBS SATCOM.

PROTECTED SATELLITE COMMUNICATIONS

1-46. Protected SATCOM characteristics, such as highly focused spot beams, the use of spread spectrum, and frequency hopping technology, provide capabilities of anti-jam (AJ), scintillation resistance, low probability of intercept, and low probability of detection. In a contested and hostile environment, wideband systems can be degraded. Protected SATCOM allows survivable communication at a reduced data rate. These unique capabilities make the use of the protected SATCOM frequency band ideal for the most critical strategic forces, and mission command systems.

1-47. The joint AEHF and Milstar system is a protected SATCOM asset. The system provides strategic, operational, and tactical support with highly secure and jam-resistant communications. It allows low data rate (LDR), medium data rate (MDR) and extended data rate (XDR) operation in the EHF and SHF bands. Protected band systems operate across the EHF uplink and SHF downlink frequency ranges. Protected SATCOM throughput is less than wideband SATCOM due to inherent features found in the Milstar and AEHF design.

Milstar

1-48. Milstar is a joint Service SATCOM system that provides secure, jam-resistant, worldwide communications to meet essential wartime requirements for high priority military users. The multi-satellite constellation links command authorities with a wide variety of resources, including ships, submarines, and aircraft and ground stations.

1-49. The Milstar satellite constellation is in geosynchronous orbit. Milstar provides interoperability among Army, Navy, Marine, Air Force, and other DOD users at the radio frequency level. Geographically dispersed user terminals can function as antenna controllers and communications controllers.

1-50. The Milstar constellation supports the Secure Mobile Anti-Jam Reliable Tactical-Terminal (SMART-T). The Army has upgraded all AN/TSC-154 SMART-Ts to function with AEHF satellites.

1-51. The Milstar constellation has five satellites. The first two (block I) satellites have LDR capability and can support up to four users on a single channel (Milstar LDR frame). The remaining three, (block II) satellites support both LDR and MDR capabilities, increasing the data rate to 1.544 Mbps.

1-52. Geographic usable coverage by the Milstar space segment is worldwide, between 65 degrees south and 65 degrees north. Crosslinks between the Milstar satellites permit worldwide communications without the use of ground stations. This is helpful in a jamming scenario. Milstar satellites employ the EHF band for the following reasons—

- Narrow antenna beams for low probability of intercept and low probability of detection, anti-jamming, and spatial diversity.
- Wide bandwidth for AJ processing.
- Combinations of Earth coverage and agile, wide, and narrow spot antennas provide appropriate power levels for each type of Earth terminal.

Milstar Capabilities

1-53. Milstar capabilities enable worldwide, secure, survivable, highly jam-resistant communication; satellite-to-satellite communications; autonomous operation; ability to reposition to meet theater requirements; and ability to directly support mobile forces. Milstar performs all communications processing and network routing onboard, thus eliminating the dependence on vulnerable land-based relay stations and reducing the chance of interception on the ground.

1-54. The Milstar constellation supports the Army's protected SATCOM architecture by using the MDR payload on the Milstar II satellites. The Milstar payloads have on-board computers that accomplish communications resource control. Once Milstar resources are allocated, users can reconfigure their terminals without submitting a new SAR as long as the terminal operates within the allocated resources identified in the users AEHF SAA. The MDR package provides higher throughput than LDR.

1-55. The MDR payload provides secure, jam-resistant communications services through onboard signal and data processing capabilities. The payload uses an EHF uplink and SHF downlink. Milstar processes link and service data received on the uplink, and retransmits it on appropriate downlink beam based on current terminal and service configurations allocated in the payload table. If necessary, it passes the data to another Milstar satellite via crosslink.

1-56. The nuller antennas resist jamming from within respective coverage areas by changing gain patterns when jamming occurs. The distributed user coverage antennas provide high-gain/low side lobes for users. The antennas can be individually steered to a desired latitude and longitude.

1-57. The Milstar frequency bands, waveforms, and signal processing algorithms are robust. Survivability and endurance in the design of the space and mission control segments ensures Milstar users maintain essential communications connectivity through specified levels of conflict using a number of terminals supporting strategic through tactical missions. Milstar flexibility allows communications services greater user configuration options.

Milstar Low Data Rate Payload

1-58. The Milstar LDR payload (block I) supports narrowband communications with various antennas and beams. There is one earth coverage antenna and an UHF antenna for transmit and receive signals. Milstar has nine EHF uplink coverage beams: one earth coverage, one wide spot beam, two narrow spot beams, and five agile beams. It has five SHF downlink beams: one earth coverage beam, one wide spot beam, two narrow spot beams, and one agile beam. The LDR operates at 75 bits per second (bps), 150 bps, 300 bps, 600 bps, 1.2 kilobits per second (kbps), and 2.4 kbps. The payload has the resources to cross-band from EHF to UHF, UHF to UHF, and EHF to SHF. The Milstar payloads provide onboard processing of incoming signals so that adding and subtracting user terminals does not require power and bandwidth balancing.

1-59. The LDR crosslinks consist of a classified number of 75 and 600 bps crosslink slots. If a service data rate is 75–300 bps, assignment of one to four 75 bps crosslink slots occurs. If a service data rate is 600 bps to 2.4 kbps, assignment of one to four 600 bps crosslink slots occurs. LDRs crosslinks are bi-directional between two or more satellites.

1-60. The LDR waveform, low frequency hopping, and high frequency hopping rates provide joint interoperability for Service terminals. The high frequency hopping rates provide sufficient processing gain to defeat jammers without a nulling antenna. The downlink agile beam provides increased power over the entire Earth coverage field of view. Spot beam coverage can be dynamically controlled by user privileged terminals throughout the Earth coverage footprint. Crosslinks join adjacent satellites, provide worldwide connectivity, and time the global constellation to permit instant call set-up, secure connectivity, secure telemetry, and tracking and command signals.

Milstar Medium Data Rate Payload

1-61. The Milstar MDR payload (block II) satellites extend the communications capabilities to higher data rates by adding a MDR payload. The MDR payload provides secure, jam-resistant communications services through onboard signal and data processing capabilities. It sends and receives individual voice, video and data services at individual service data rates up to 1.5 Mbps. The MDR payload processes link and service data received on the uplink, and retransmits it on appropriate downlink beam based on current terminal and service configurations allocated in the payload table. If necessary, it passes the data on to another satellite via crosslink.

1-62. Crosslinks provide rapid, ultra-secure communications by enabling the satellites to pass signals to one another worldwide while requiring only one ground station on friendly soil. The crosslink payload provides V band (60 GHz) communications for Milstar satellites, both the MDR and LDR payloads.

1-63. The MDR antenna payload consists of two nuller antennas and six distributed user coverage antennas. These eight antennas are mapped to onboard demodulators and can be programmed to different numbers of channel configurations if necessary. All are steerable spot beams with approximately 450 nautical mile footprints. The nuller antennas can attenuate the uplink received from specific portions of the footprint if off-key or off timed energy from adversarial jamming, effectively eliminating effect on the satellite and subscriber services. Milstar uplink beams are very narrow, limiting enemy the ability to detect and deny, degrade, or disrupt the signal with downlink or uplink jamming.

Advanced Extremely High Frequency MILSATCOM

1-64. The AEHF satellite system is a joint Service SATCOM system that provides global, secure, protected, jam-resistant MILSATCOM. AEHF users can operate at data rates ranging from 75 bps to 8 Mbps over the AEHF payload that encompasses the capabilities of both LDR and MDR payloads on Milstar block II satellites.

1-65. The AEHF constellation provides the same nulling antenna and crosslink capability as Milstar with greater throughput capacity. AEHF still uses an EHF uplink and SHF down but has many more steerable and reconfigurable beams have been added; all usable at the higher data rates required for the Army's tactical users: super high gain earth coverage (up to 160 beam locations); medium resolution coverage antenna (6 beams); beam shared medium resolution coverage area (6-24 beam locations). AEHF cryptographic design allows secure separation of U.S. and allied users.

1-66. AEHF expands protected interoperability from US joint forces to interoperability with our closest allies for coalition operations.

1-67. The AEHF system enhances the existing Milstar system for strategic and tactical military users, modernizing the protected MILSATCOM capability. The goal is coordinated space and information operations to meet both deterrent and decisive national security objectives.

1-68. The AEHF system is flexible enough to support communications for separate operational environments and is capable of reconfiguration to meet ever-changing operational requirements. It protects critical voice and data communications against jamming, interception, detection, and natural and nuclear effects at low, medium, and high data rates. The AEHF SATCOM system has three segments—

- Space segment.
- Control segment (mission control and associated communications links).
- Terminal segment.

AEHF Space Segment

1-69. The space segment is the integrated constellation of Milstar and AEHF satellites. This segment utilizes EHF uplink frequencies and SHF downlink frequencies to communicate with system users. AEHF satellites can crosslink AEHF and Milstar satellites using the V band. This enables worldwide communications over the constellation without using vulnerable ground relay sites.

1-70. The AEHF system can provide simultaneous coverage for multiple theaters. Theater coverage supports geographically concentrated tactical ground, air, and maritime forces. Theater coverage is further broken down into high-resolution and medium resolution coverage areas.

AEHF Control Segment

1-71. The control segment is comprised of four elements:

- **Mission control** (payload reconfiguration, satellite maintenance and relocation).
- **Mission planning** (planning networks and generating terminal images at the users/unit level on the Mission Planning Element/AN/PYQ-19).
- **Mission and operations support** (Mission planning assistance and resource allocation and monitor from Regional Space Support Centers).
- **Training and simulation** support training development throughout the evolution and life cycle of the control segment. Together these elements provide mission command capabilities supporting the space, control, and terminal segments.

AEHF Terminal Segment

1-72. The terminal segment is comprised of ground fixed, ground mobile, man-portable, transportable, airborne, submarine, and ship-borne configurations. The terminal segment is interoperable, joining the Services and networks using common voice, data, cryptographic, and data network devices. The AEHF terminal can pass communications over AEHF and Milstar networks.

1-73. AEHF terminals (including the Army SMART-T) can operate in both AEHF XDR and Milstar LDR or MDR modes, but not simultaneously. All legacy Milstar terminals remain compatible with Milstar, and may operate over AEHF satellites, but only if the AEHF satellite is configured for Milstar backward-compatible services.

Milstar to AEHF Transition

1-74. Before the first AEHF satellite was launched, the mission control segment was transitioned to support both Milstar and AEHF constellations. The first AEHF satellite was launched in 2010 and augmented Milstar in the backwards compatible mode with LDR and MDR services. The second AEHF satellite was launched in 2012 and AEHF 3 launched in September 2013. After an extensive testing period to determine operational effectiveness both the AEHF and Milstar satellites were moved to their operational locations in 2015. The newer AEHF satellites also carry the XDR payload and can process data rates up to 8.192 Mbps.

1-75. AEHF 4 has a planned launch in 2017 with two more AEHF satellites planned to provide overlapping worldwide coverage and on orbit redundancy. Figure 1-5 depicts the bandwidth available when employing the Milstar and AEHF satellite systems.

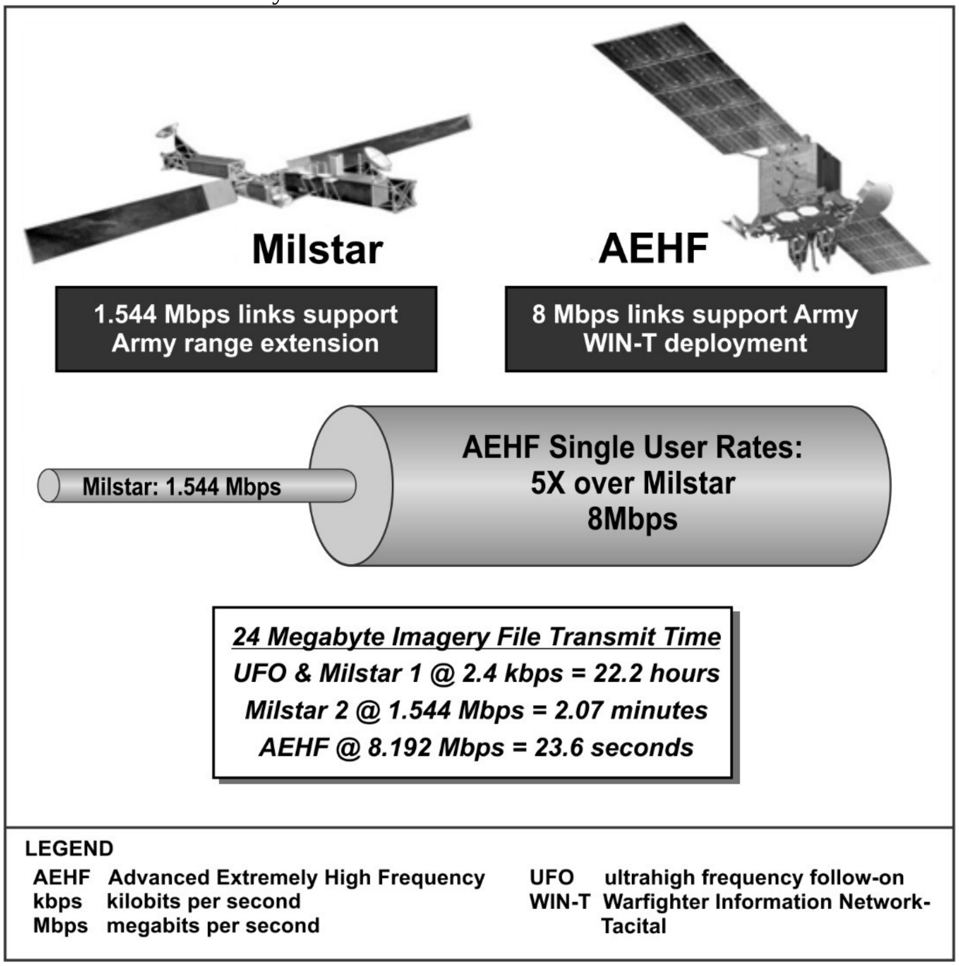

Figure 1-5. Milstar vs advanced extremely high frequency bandwidth

NARROWBAND SATELLITE COMMUNICATIONS

1-76. The narrowband SATCOM mission supports worldwide tactical communications, including en route contingency communications, in-theater communications, intelligence broadcast, and range extension for combat net radio. Narrowband SATCOM radios connect tactical operations centers across echelons, and support long-range surveillance units and Army special operations forces units separated from the main forces. Using small portable SATCOM terminals for long-haul communications reduces the probability of detection in a contested satellite environment. Narrowband systems operate across UHF in the 300 MHz to 3 GHz range and include military UHF, and commercial L and S radio frequency bands.

1-77. The advantages of using narrowband SATCOM are—

- Extended data communications to the tactical edge.
- Small terminals for maximum portability by dismounted forces.
- Terminals require less operator training (user owned and operated).

1-78. The disadvantages of using narrowband SATCOM are—

- Low data throughput.
- Transmissions are more susceptible to interference, scintillation, and jamming.

- Crowded spectrum.
- Limited access.

1-79. Narrowband SATCOM technology supports tactical forces. The Army uses narrowband SATCOM to provide beyond line of sight (BLOS) and long haul, worldwide communications coverage supporting emergency, tactical, and special forces operations. The UHF band supports the Army narrowband SATCOM mission.

1-80. Narrowband SATCOM is particularly important during contingency operations, crises, and training missions. The UHF band has low cost user terminals that are small, lightweight, and can operate with small portable antennas. Since narrowband SATCOM transmits and receives in the lower UHF spectrum, it provides more reliable communications while on-the-move, operating in adverse weather conditions, isolated locations, and in dense foliage. UHF is generally susceptible to both detection and jamming. Newer systems such as MUOS provide greater protection against these obstacles.

1-81. Narrowband SATCOM is ideal for highly mobile small tactical terminals such as manpack and handheld devices. The Army is the chief user of UHF SATCOM systems. The Navy is responsible for development, procurement, engineering support, and executive oversight of all DOD advanced UHF narrowband communications satellites and associated ground systems. The narrowband constellation of satellite has two fleet satellite communications satellites performing residual capabilities to augment UHF requirements. The Navy has seven UFO satellites on the geosynchronous performing mission support to keep the narrowband MILSATCOM constellation healthy. When a UFO satellite exceeds their design lifetime, referred to as an aging UFO, it is moved into a super-synchronous orbit (100-200 kilometers [km] above geosynchronous). The Navy's replacement for the aging UFO constellation is MUOS. MUOS uses the same bandwidth as its predecessors, providing backward compatibility for the standard 5- and 25-kilohertz (kHz) channels. However, it uses a new UHF cellular phone-like waveform to increase both capacity and user accesses nearly tenfold.

1-82. Narrowband MILSATCOM operates between 225 MHz and 400 MHz. MUOS satellites are equipped with two payloads—wideband code division multiple access-primary, and a legacy UHF payload as the migration to MUOS becomes available. Five MUOS satellites share the same orbital space with UFO satellites. MUOS provides a tenfold increase in narrowband communication capability.

Note. For detailed information on narrowband SATCOM see ATP 6-02.90.

UHF Follow-On System

1-83. The Navy sponsored UFO system, began replacing the aging fleet satellite system in the early 1990s. The UFO system is the dominant MILSATCOM constellation that supports tactical forces. Transponders on various space platforms support the Army's narrowband SATCOM mission. Both UFO and fleet satellite support the DOD UHF SATCOM mission. The UFO satellite constellation provides worldwide coverage. The coverage areas are close to those of the WGS constellation (see figure 1-6 on page 1-16). Fleet satellite is the main satellite system that provides two-way UHF communications for Air Force SATCOM. The DSCS provides an alternate UHF path for Air Force SATCOM.

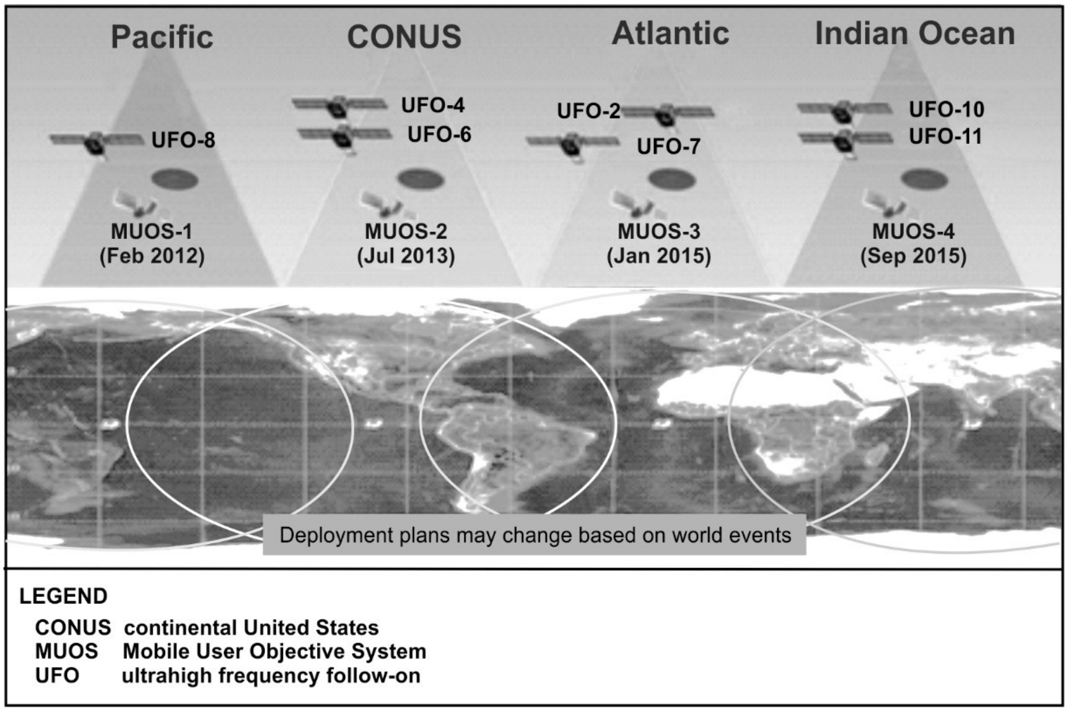

Figure 1-6. MUOS and ultrahigh frequency follow-on satellite constellation

Terminal Segment

1-84. Army narrowband satellite ground terminals operate in the UHF frequency range and are available in vehicle mounted and man-portable versions. They transmit and receive over two operating modes, narrowband (5 kHz) and wideband (25 kHz). The terminals' weight, availability, ease of use, and cryptographic systems make them suitable for the full range of military operations. Disadvantages of the terminals include difficulty in obtaining access on a UHF space segment, and the lack of AJ capability for threat mitigation.

Chapter 2

Roles and Responsibilities

SATCOM involves several commands, agencies, and individuals operating together to provide a reliable, robust network and secured services to Soldiers. Planners and technicians need to know who is responsible for the particular functions necessary to establish and operate SATCOM. This chapter addresses the roles and responsibilities of the joint and Army commands, agencies, and individuals essential to satellite missions.

JOINT AND DEPARTMENT OF DEFENSE

2-1. The following are key elements that influence joint and Army communications. This section covers joint SATCOM duties and responsibilities. For additional information on joint SATCOM operations, refer to CJCSI 6250.01E.

CHAIRMAN OF THE JOINT CHIEFS OF STAFF

2-2. The Chairman of the Joint Chiefs of Staff is the principal advisor for communications involving the President, the Secretary of Defense, and CCDRs. The Chairman of the Joint Chiefs of Staff exercises operational oversight over those portions of the DODIN utilized for communications via the National Military Command System, including SATCOM.

2-3. The Chairman of the Joint Chiefs of Staff establishes operational policies and procedures for the National Military Command System. In addition, the Chairman of the Joint Chiefs of Staff maintains oversight of operational SATCOM activities and resources supporting presidential and DOD requirements across the entire range of operations.

2-4. The Chairman of the Joint Chiefs of Staff directives and instructions drive the development of joint doctrine. JP 6-0 is the keystone joint doctrine publication that defines communications requirements. The Chairman of the Joint Chiefs of Staff provides operational policy, guidance, and procedures for SATCOM. The primary policy source for all DOD SATCOM is Chairman of the Joint Chiefs of Staff instructions and manuals.

DEPARTMENT OF DEFENSE CHIEF INFORMATION OFFICER

2-5. The DOD chief information officer (CIO) is the principal staff assistant for information management. The DOD CIO is the architect of the DODIN and is responsible for designing, maintaining, and enforcing compliance with the DODIN architecture (see DODD 5144.02).

2-6. The office of the DOD CIO is the lead for the establishment of SATCOM policy and other space-related activities and develops policies and procedures for planning, acquiring, and managing COMSATCOM services.

COMMUNICATIONS SYSTEM DIRECTORATE OF A JOINT STAFF

2-7. Duties and responsibilities of the communications system directorate of a joint staff (J-6) relevant to Army SATCOM operations include—

- Monitoring, coordinating, and formulating actions requiring the Chairman of the Joint Chiefs of Staff approval for SATCOM resources, developing a coordinating joint staff position on SATCOM issues having operational implications.

- Monitoring the health and operational status of SATCOM systems, and relevant connected networks as reported by USSTRATCOM.
- Managing the SATCOM requirements process, including contingency and wartime COMSATCOM assets.
- Helping in the resolution of international SATCOM interference issues.
- Operating the joint communications satellite center, the lead for monitoring, coordinating, and formulating actions to support the Chairman of the Joint Chiefs of Staff actions requiring SATCOM operation access.
- Directing the Chairman of the Joint Chiefs of Staff communications planners responsible for SATCOM access to support the nine mission essential functions.
- Staffing joint actions, as directed by Chairman of the Joint Chiefs of Staff.
- Delegating approval for final deployment and allocations of strategic SATCOM terminals to support validated USSTRATCOM requirements.
- Allocating authority of high-demand, limited-quantity, theater-deployable SATCOM assets.
- Directing resolution of electromagnetic interference with USSTRATCOM, Department of State, and host nations.
- Serving as final approval authority for satellite communications database (SDB) waiver requests to support satellite access.

2-8. The J-6 controls joint force systems and networks through a joint network operations control center or theater network operations control center. The joint network operations control center receives reports from systems control or network operations and security centers.

DIRECTOR, DEFENSE INFORMATION SYSTEMS AGENCY

2-9. The DISA is a DOD support agency responsible for planning, engineering, acquiring, fielding, and supporting global network-centric solutions to support the President, Vice President, the Secretary of Defense, and the other DOD agencies.

2-10. The DISA performs enterprise-wide system engineering for the DODIN. The Director, DISA exercises program management over DODIN activities and components. DISA prescribes policy, assigns responsibilities, and establishes guidelines for use of DOD SATCOM gateways.

2-11. The DISA serves as the C-SSE for designated USSTRATCOM systems (gateway and COMSATCOM). DISA provides technical, sustainment, and operational support to the SATCOM operational manager according to specific roles and responsibilities described in USSTRATCOM Strategic Instructions 714 series.

2-12. The DISA is the contract agent for COMSATCOM resources except as stipulated by the DOD CIO. The DISA helps CCDRs coordinate host nation approval for COMSATCOM services obtained through DISA contracts. In partnership with the General Services Administration, the DISA manages the future commercial satellite communications services acquisition (FCSA) contract for COMSATCOM arrangements. FCSA is the leading contract mechanism for all U.S. Government commercial satellite services. Through the FCSA contract structure, the DISA assists in areas of mutual concern to all users, such as cybersecurity, interference resolution and technical reporting to USSTRATCOM and other DOD offices. Users can obtain detailed information on satellite provisions from companies that participate in FCSA by searching the GSA web portal.

2-13. The DISA Contingency and Exercise Branch provides guidance, manages strategic resources, and coordinates usage of DISN services. The DISA Contingency and Exercise Branch processes gateway access request (GAR) and issues gateway access authorizations to extend pre-positioned DISN services, through DOD gateway sites to support global requirements.

Note**.** Refer to the DISA Website for more information.

MILITARY DEPARTMENTS

2-14. Each Service develops Service-level SATCOM operational concepts, procedures, and architectures and updates the SATCOM database. Each Service supports USSTRATCOM components tasked with SATCOM responsibilities, as appropriate. Under Title 10, U.S. Code, Section 3062, the Army has the responsibility to organize, train, and equip forces for prompt and sustained combat. In carrying out this responsibility, the Army employs MILSATCOM resources whenever they are available. When MILSATCOM resources are not available, the Army obtains COMSATCOM capabilities and manages them according to mission requirements and sound business practices. All COMSATCOM resources that are procured, including Service programs of record, follow the same process as MILSATCOM programs for SARs, when achievable or feasible. Further duties and responsibilities are in each Service's respective doctrine, instructions and manuals.

COMBATANT COMMANDS AND HEADS OF DEFENSE AGENCIES

2-15. DOD agencies and combatant commands coordinate prioritized MILSATCOM requirements with USSTRATCOM and the Joint Staff J-6. Agencies and commands validate and coordinate with the DISA for COMSATCOM requirements.

COMMANDER, UNITED STATES STRATEGIC COMMAND

2-16. CDRUSSTRATCOM has operational and configuration authority for on-orbit SATCOM, control systems, and SATCOM terminal infrastructure, including DOD gateway, deemed necessary for the effective and efficient operation of SATCOM resources. The commander directs the daily operational management of MILSATCOM resources and provides authorized users global SATCOM access.

2-17. CDRUSSTRATCOM performs SATCOM apportionment and arbitration, and directs positioning, repositioning, and disposition of MILSATCOM payloads and platforms.

> ***Note*.** The Army proponent for space and space-based capabilities is USASMDC/ARSTRAT.

2-18. Other USSTRATCOM responsibilities associated with Army SATCOM operations include—

- Maintaining the health, status, and surveillance of the MILSATCOM space segments.
- Conducting integrated, system-level planning, and coordination for SATCOM systems to support strategic and global operations, including intelligence, commercial, and multinational SATCOM resources.
- Developing, coordinating, and implementing operational management policies and procedures for SATCOM users.
- Synchronizing and planning for cyberspace operations through U.S. Cyber Command, including directing DOD information network operations and defense.

> ***Note*.** Refer to CJCSI 6250.01E for additional information on CDRUSSTRATCOM roles and responsibilities for Army SATCOM.

COORDINATING GROUPS

2-19. The following coordinating groups provide oversight for SATCOM systems. These organizations influence tactics, techniques, procedures, and policies that affect Army SATCOM operations—

- The Joint Requirements Oversight Council, Joint Capabilities Board, and the C4/Cyber Functional Capabilities Board review SATCOM capability requirements as they are defined in concepts of operations and capability development decision memoranda (acquisition documents); and make recommendations to the Secretary of Defense.
- The Military Communications-Electronics Board reviews matters, including those concerned with national security systems, referred by the Secretary of Defense, Chairman of the Joint Chiefs of

Staff, and the DOD CIO, and coordinates with DOD, other government agencies, and representatives of foreign nations on matters under Military Communications-Electronics Board jurisdiction.

- The Joint Space Acquisition Council is a forum established by the Services and the DISA to integrate and synchronize MILSATCOM.

***Note*.** Refer to CJCSI 6250.01E for more information on coordinating groups.

DEPARTMENT OF THE ARMY

2-20. The CIO/assistant chief of staff for communications (G-6), USASMDC/ARSTRAT, and NETCOM have defined SATCOM roles. Those roles include architecture, allocation and apportionment planning and management. Conducting strategic missile defense operations to include planning, integration, control, and coordination. Also to operate and defend the Army's enterprise level network transport capabilities.

CHIEF INFORMATION OFFICER/ASSISTANT CHIEF OF STAFF FOR COMMUNICATIONS, G-6

2-21. The CIO/G-6 provides architecture, governance, portfolio management, strategy, and communications systems and information technology acquisition oversight. The CIO/G-6 affords operational capabilities to enable joint expeditionary network-centric information advantage for the Army.

2-22. The CIO/G-6 chairs the CIO executive board. The board provides strategic direction on Army CIO/G-6 strategies, policies, actions, and guidance; with Army Commands, Army Service component commands, direct reporting units, and Headquarters Department of the Army. The executive board synchronizes initiatives and receives feedback on the management of information. It also reviews information technology capability requirements and concerns affecting the operating force. The office of the CIO/G-6 represents the Army at Defense Acquisition Boards, Defense Acquisition Executive Reviews, and on integrated product teams.

***Note*.** Refer to the CIO/G-6 Website for more information.

UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND/ARMY FORCES STRATEGIC COMMAND

2-23. USASMDC/ARSTRAT is an operational Army headquarters designated by the Secretary of the Army as the Army Service component command of USSTRATCOM. USASMDC/ARSTRAT exercises administrative control authority and responsibility on behalf of the Secretary of the Army and exercises operational control (OPCON) over Army forces, as delegated by the CDRUSSTRATCOM.

2-24. USASMDC/ARSTRAT conducts strategic deterrence, integrated missile defense, and space operations. They plan, integrate, control, and coordinate Army forces and capabilities to support USSTRATCOM missions.

2-25. USASMDC/ARSTRAT serves as the joint user representative, centralized manager, and integrator for the Global Missile Defense System and horizontally integrates air and missile defense systems. USASMDC/ARSTRAT executes C-SSE duties for wideband and narrowband MILSATCOM and satellite communications system expert (SSE) duties for WGS, DSCS, MUOS, and GBS. USASMDC/ARSTRAT roles and responsibilities related to SATCOM include—

- Direct support to Commander, JFCC-Space to support identification, characterization, geolocation, trend analysis, and reporting of SATCOM interference events.
- Plan and manage SATCOM supporting Commander, JFCC-Space, CCDRs, Services, governmental agencies, and international partners through RSCCs.

- Provide and sustain the infrastructure and resources necessary to plan, manage, configure, control, and provide situational awareness of wideband and narrowband SATCOM supporting Commander, JFCC-Space and CDRUSSTRATCOM.
- Provide facilities for RSSC Europe, RSSC Pacific, RSSC East to host the planning and allocation of all SATCOM systems and the necessary personnel and equipment from the other USSTRATCOM Service components and the DISA. Source personnel and equipment at RSSCs (including RSSC West) for planning and allocating SATCOM systems.
- Provide management structure for RSSCs to integrate operations as directed by Commander, JFCC-Space.
- Provide global payload resource management for wideband and narrowband SATCOM supporting Commander, JFCC-Space and CDRUSSTRATCOM.
- Enhance SATCOM delivery to DOD, in coordination with international partners.

Note. Refer to FM 3-14 for further information on space operations.

UNITED STATES ARMY NETWORK ENTERPRISE TECHNOLOGY COMMAND

2-26. NETCOM has the authority to operate, control, and defend the Army's enterprise level transport capabilities on behalf of U.S. Army Cyber Command. NETCOM exercises technical authority for all organizations that configure, secure, operate, maintain, and sustain portions of the DODIN-A.

2-27. NETCOM provides global communications capabilities to enable joint and multinational mission command. NETCOM provides backbone network transport to facilitate extension and reachback capabilities to the Soldier, while operating, engineering, transforming, and defending the Army enterprise. *Reachback* is the process of obtaining products, services, and applications, or forces, or equipment, or material from organizations that are not forward deployed (JP 3-30). NETCOM's responsibilities pertaining to SATCOM include—

- Providing protection of fixed-station communications facilities and the security of Army contractors.
- Operating the Army strategic communications facilities and circuitry as part of the DODIN.
- Exercising Army review, approval, and validation authority over telecommunication service requests.
- Validating requests for special access requirements to increase survivability and reliability.
- Operating, maintaining, and sustaining the Army's portion of MILSATCOM.
- Commissioning and decommissioning of Mobile Satellite Services (MSS) and Enhanced Mobile Satellite Services (EMSS).

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Chapter 3
Army Satellite Communications Architecture

This chapter addresses Army SATCOM architecture. SATCOM architecture conforms to the DISN architecture and user requirements. SATCOM architecture responds to situational and environmental factors. This chapter explains Army SATCOM architecture requirements, objectives, and considerations.

OVERVIEW

3-1. SATCOM architecture changes due to the national security posture, mission, user or force requirement changes, doctrinal changes associated with new equipment, policy or procedures changes, and changes associated with natural or manmade disasters. User requirements are the most important factor in constructing or modifying the Army SATCOM architecture (what, when, where, and how much does the user need). Those requirements drive SATCOM architecture for a given operation. SATCOM architecture includes constellations, terminals, planning and management systems, and networks, both military and commercial.

3-2. Publications covering the submission process for SATCOM outlines the procedures necessary to plan, manage, employ, and use DOD SATCOM resources. Following these procedures, Army users can receive SATCOM support. CJCSI 6250.01E establishes the joint approach to use finite SATCOM resources and to plan for future systems.

REQUIREMENTS

3-3. Requirements that drive architecture development—

- Extension of DISN services to the deployed Soldier.
- SATCOM capabilities at-the-halt and on-the-move.
- Bandwidth optimization.
- Reachback capability.
- Global Positioning System (GPS) mapping and imagery.
- Logistics and administrative support.

3-4. Military commands, agencies, and Services develop architectures for implementing solutions to operations, systems, and technical requirements that fall within their scope of responsibility. The DOD architecture framework applies to the DOD, ensuring appropriate operational, system, and technical linkage to the organizations enable interoperability.

3-5. At the Army enterprise level, the chief architect is the Director of the Army Architecture Information Center with the CIO/G-6 office of Architecture, Operations, Networks, and Space. An in-depth understanding of planning tools and the development process benefits commanders and planners. The roles and responsibilities of key players, and how these methods mesh with overall DOD architecture development, is essential to Army and joint missions, and the realization of long-term objectives.

3-6. The DISN architecture, developed by the DISA, represents a global network integrating Defense Collaboration Service assets, MILSATCOM, leased commercial services, dedicated DOD services, defense agency networks, and mobile or deployable networks. DISN services enable users to rapidly access networked information to conduct Army operations.

3-7. The three segments of the DISN architecture are—

- **Sustaining base.** Post, camp, and station facilities that remain behind during a deployment.

- **Deployed.** Facilities and equipment in a theater of operations supporting deployed units.
- **Long-haul.** Links between the deployed and sustaining base segments. MILSATCOM is a component of the long-haul segment of the DISN architecture.

OBJECTIVES

3-8. Commanders' objectives create requirements that dictate the architecture. The SATCOM architecture adapts to support a changing operation. Planners need know the commander's intent and resource availability to satisfy the intent. Objectives include—

- Interoperability.
- Connectivity and coverage.
- Cybersecurity.
- Operational management.
- Operational suitability.

INTEROPERABILITY

3-9. *Interoperability* is the condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users (JP 6-0). Information sharing promotes common interpretation and understanding of the operational environment and activities to ensure unity of effort and synchronization of actions.

3-10. The Army operates as a part of a joint force. Interoperability is essential to effectiveness. Doctrine, procedures, and training affect interoperability and facilitate the timely exchange of voice, data, and imagery information as dictated by the operational situation. SATCOM systems mesh seamlessly within and beyond theaters of operations by using a common architecture.

CONNECTIVITY AND COVERAGE

3-11. Connectivity provides the required amount of protected and unprotected communications services to the user. Connectivity encompasses coverage, capacity, and protection. Coverage refers to the portion of the Earth's surface to which a satellite can provide service. Coverage requirements are global, worldwide, theater, polar, or exoatmospheric. Global coverage provides service to the surface of the Earth and the airspace above it, including both poles. Worldwide coverage is the area in the middle of 65 degrees north and south latitudes. The North Polar Region is the area above 65 degrees north. The South Polar Region is the area below 65 degrees south latitude. Exoatmospheric coverage is that portion of space immediately around the Earth's surface ranging from about 50 km to 50,000 km or more.

3-12. The capacity of a SATCOM system is the type and amount of throughput available. Capacity determines the numbers of users that the system can support. Users may share the same bandwidth, as is the case with broadcast or networked applications.

3-13. SATCOM system protection is the system's ability to avoid, prevent, negate, or mitigate the degradation, disruption, denial, unauthorized access, or exploitation of communications services or system resources. SATCOM systems provide a degree of protection against disruption from environmental and atmospheric effects, physical destruction, and unwanted eavesdropping and intrusion.

CYBERSECURITY

3-14. *Cybersecurity* is the prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communications, and electronic communications, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation (DODI 8500.01).

Operational Management

3-15. Operational management is the oversight, planning, provisioning, management, and control of SATCOM, terminals, the electromagnetic spectrum, control systems, and the networks they support to enable access by authorized users. Operational management of satellite resources assists commanders in exercising mission command. Commanders maintain control and visibility over SATCOM assets in a congested and contested environment. Commanders and planners plan and manage access as stated in standing policies, operational requirements, and mission priorities.

3-16. Operational management requires SATCOM resources that can adapt to meet operational demands. Effective operational management provides the right resource to the right user at the right time. SATCOM managers must also have insight into threats, which would remove or negate those resources.

Operational Suitability

3-17. Operational suitability refers to the degree SATCOM systems can be fielded, deployed, operated, sustained, and function as required, while meeting prescribed performance parameters. SATCOM systems have to meet user requirements for system effectiveness in any operational environment.

OPERATIONAL CONSIDERATIONS

3-18. The Army must be capable of responding to crises with rapidly deployable, relevant forces against a wide range of threats and challenges. SATCOM operations have variables to consider. Operational considerations differ across strategic and tactical environments.

Strategic Considerations

3-19. Conducting operations in a fixed environment has its own set of variables leaders may not find familiar. The distribution of services is highly dependent on strategic terminals. Transporting the DODIN, procedures for leasing facilities, and dealing with foreign governments for landing rights are a few considerations.

The Global Backbone

3-20. Strategic SATCOM supports the global communications backbone with its extensive reach and tie-ins to terrestrial networks. The global backbone supports tactical DODIN operations with high capacity communications. Strategic SATCOM extends the DODIN to the deployed tactical network through its backbone architecture. The high capacity backbone connects the DODIN through networks tailored to the Soldier's area of operations. Air, sea, and mobile ground forces operational environments dictate the need for specialized communications in each domain. The high capacity backbone provides reachback to the sustaining base and extends DISN services to tactical systems.

Landing Rights

3-21. Landing rights are a set of agreements between a country and a satellite provider to accept satellite signals in that country. Landing rights do not include the right to own or operate a satellite earth terminal, nor do they convey the right to transmit in that country. Landing rights may not include authorization to bring a specific piece of equipment into a country. Army use of COMSATCOM systems may require specific approvals, particularly outside the continental United States (OCONUS). Host nations commonly require their express permission to operate any foreign-owned SATCOM terminal within their borders. When requesting satellite access, users should allow plenty of time to obtain landing rights. Some countries want multi-million dollar payments for landing rights for new satellite systems and impose annual licensing fees for ground terminals ranging from $1,000 to $10,000 per terminal.

Host Nation Approval

3-22. Host nation approval is permission given to operate, transport through, or locate in a foreign country. Obtaining permission may present a challenge. Some countries impose additional requirements that may include—fees for terminal licensing and or leasing, acquiring the ground terminals, or using the appropriate frequency clearances for the space segment. Obtaining host nation approval may take four months or longer, depending on the country and the expediency of the agency handling the paperwork.

3-23. Most countries require satellite earth terminals be authorized and licensed, though it is possible to have a terminal authorized but not licensed. Authorization usually involves location, the percentage of national ownership, and non-competition with the local postal, telephone, and telegraph companies. Licensing deals with parameters such as beam-width, transmission frequency clearance, fees, and permissions.

3-24. Host nation approval to operate SATCOM equipment and access resources depend upon the political climate and the personality of the negotiator. Offense, defense, stability, and defense support of civil authorities tasks require SATCOM services. Using a host nation’s airspace, ports, and electromagnetic spectrum requires coordination through host nation’s government channels.

TACTICAL CONSIDERATIONS

3-25. The Army is developing new technologies and more sophisticated networks to provide Soldiers and commanders greater situational understanding. The transformation of tactical communications technologies extends home station-level services to deployed locations. Improved connectivity leads to increased situational understanding, enabling better command decisions, faster targeting, and increased efficiency during tactical operations. Tactical considerations include—

- Communications mobility.
- Global access.

Communications Mobility

3-26. TACSAT contributes to mission success with proper planning and training. Commanders exercise mission command in fast-paced, highly mobile scenarios through a broad and sometimes noncontiguous area of operations. Mission command is possible on-the-move, en route to, entering into, operating in, or exiting an area of operations. TACSAT is available and accessible to the commander and his staff, enabling situational understanding.

Global Access

3-27. Long-range communications allow commanders to maintain situational understanding. Soldiers require continuous, reliable communications across the range of military operations. Long-range communications transmitted over satellite offer quick access to communication services when LOS communication is not possible. Voice and data communications, intelligence information, early warning, global positioning and navigation data, weather reports, and imagery can be extended anywhere on the globe via SATCOM.

Contested and Congested Operating Environment

3-28. In this joint, interorganizational, and multinational partner collaboration environment, satellite resources have become increasingly contested. In addition, the space domain is an increasingly congested environment with the availability of military, commercial and protected SATCOM. For this reason, managing satellite resources requires the consideration of cyberspace and electromagnetic vulnerabilities and actions.

3-29. SATCOM, space, electronic warfare, DODIN operations, and cyberspace operations missions share certain areas of overlap. Close collaboration and synchronization between these functions make all of them more effective. Shared awareness between signal, cyberspace operations, electronic warfare, and intelligence organizations improves situational understanding. Close coordination between satellite planners and electronic warfare units help eliminate the potential of interference between the two.

3-30. Since they have visibility of different indicators, sharing information between signal, cyberspace, electronic warfare, and intelligence elements is very important. This is particularly important when using satellite resources for operating against a peer or near-peer adversary. A technologically advanced enemy or adversary can locate a ground-based satellite system using radio frequency directional finding equipment. Once they determine the location, the enemy can direct lethal fires to destroy that satellite system. To counter this threat, the synchronization of signal and electronic warfare interference techniques coupled with current intelligence estimates can help mitigate an enemy or adversary's ability to find, fix, and attack satellite systems.

3-31. Some factors that should be considered include—

- Formulate SATCOM plans that will minimize the radio frequency footprint.
- Using low probability of detection/low probability of intercept modulation techniques.
- Accurately identifying real bandwidth requirements (lower data rates requires less radio frequency power).
- Emission control (limiting radio transmission).
- Primary, alternate, contingency, and emergency communications restoral procedures used to mitigate effects of a congested or contested environment.
- Transmit only when necessary (time division multiple access [TDMA] versus frequency division multiple access [FDMA]).
- Place satellite antennas as far from command posts as practical to mitigate collateral damage if destroyed.

Note. For more information about cyberspace operations, see JP 3-12 and FM 3-12. For more information about electronic warfare, see JP 3-13.1, FM 3-12, and ATP 3-36. For more information about spectrum management operations, see ATP 6-02.70.

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Chapter 4
Satellite Communications Planning

This chapter addresses the planning process for Army SATCOM systems. SATCOM planning is a complex process due to the many variables that affect satellite links. This chapter covers aspects of joint and Army SATCOM planning. This chapter describes planning for the four types of SATCOM (narrowband, wideband, protected, and commercial) and addresses planning associated with Warfighter Information Network-Tactical (WIN-T).

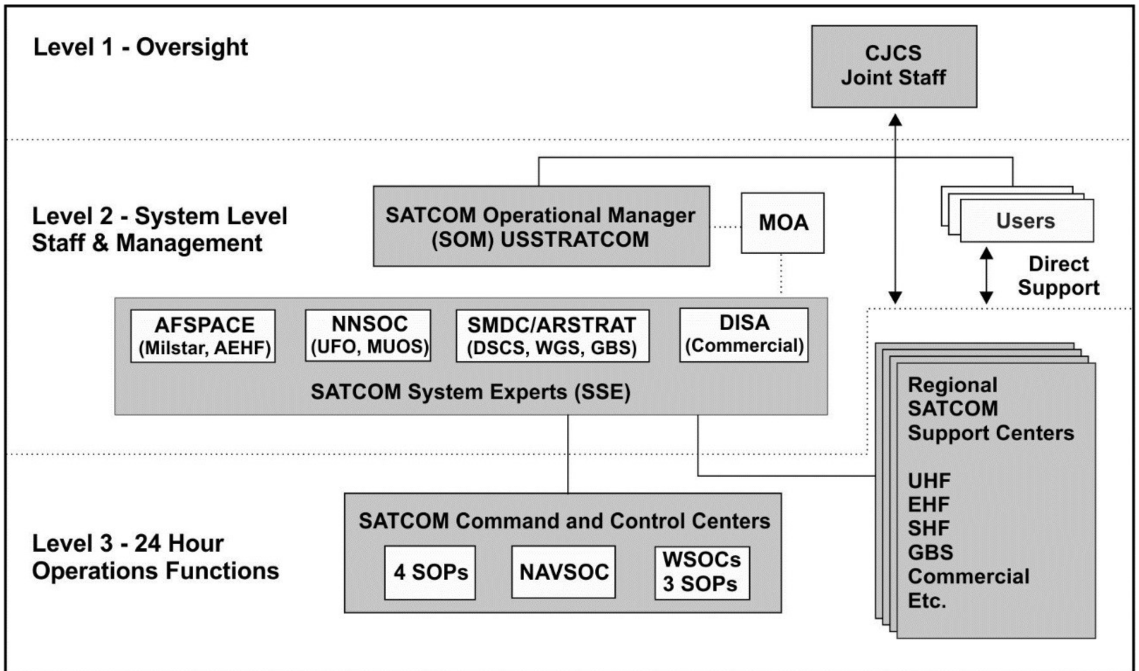
JOINT PLANNING

4-1. The CCDR provides communications system guidance and priorities to supporting commands through the J-6. This guidance goes through the joint cyberspace center. Subordinate to the theater network operations control center may be one or more joint network operations control centers (supporting joint task forces) or combinations of joint network operations control centers and Service-level network operations and security centers.

4-2. Communications systems planners at the joint cyberspace center, joint network operations control centers, Service-level network operations and security centers, joint task force Service components, and Army signal units receive training under J-6 oversight in the Joint Command, Control, Communications, and Computers (C4) Planner's Course taught by the U.S. Army Cyber Center and Fort Gordon. The course maximizes use of standard joint C4 planning tools to prepare graduates to plan operations in the joint environment within a joint task force J-6. Students also develop a strong foundation in joint C4 and cyberspace fundamentals, such as—joint operational planning process, Annex K, joint restricted frequency list, SAR, and GAR for planning a joint network.

4-3. There are three levels of operational command structure of SATCOM (Figure 4-1 on page 4-2 shows the relationship between the levels of management.)—

- Chairman of the Joint Chiefs of Staff oversight (level-1).
- System-level staff and management directed by USSTRATCOM, USASMDC/ARSTRAT and the other Service components (level-2).
- Operational functions of the SATCOM operations centers (level-3).



LEGEND

AEHF	advanced extremely high frequency
AFSPACE	United States Space Command Air Force
ARSTRAT	Army Forces Strategic Command
CJCS	Chairman of the Joint Chief of Staff
DISA	Defense Information Systems Agency
DSCS	Defense Satellite Communication System
EHF	extremely high frequency
GBS	Global Broadcast Service
MOA	Memorandum of Agreement
MILSTAR	military stratetic and tactical relay system
MUOS	Mobile User Objective System
NAVSOC	Naval Satellite Operations Center
NNSOC	Naval Network and Space Operations Command
SATCOM	Satellite Communications
SHF	super high frequency
SMDC	Space & Missile Defense Command
SOP	Space Operations Squadron
UFO	ultrahigh frequency follow-on
UHF	ultrahigh frequency
USSTRATCOM	United States Strategic Command
WGS	Wideband Global Satellite Communications
WSOC	Wideband Satellite Communications Operations Center

Figure 4-1. Joint satellite communications operations management

LEVEL 1: THE JOINT CHIEFS OF STAFF

4-4. The Chairman of the Joint Chiefs of Staff performs oversight of operational SATCOM activities and resources supporting Presidential and DOD SATCOM systems. Working for the Chairman of the Joint Chiefs of Staff, the Joint Staff J-6 monitors, coordinates, and formulates actions requiring Chairman of the Joint Chiefs of Staff approval for strategic, tactical, and contingency SATCOM operational accesses. The Joint Staff J-6 monitors the health and operational status of SATCOM systems and any relevant connected networks as reported by USSTRATCOM. The Chairman of the Joint Chiefs of Staff guidance on SATCOM planning, allocation, arbitration, adjudication, oversight, and assessment for daily systems management is in CJCSI 6250.01E and USSTRATCOM Strategic Instruction 714-04.

LEVEL 2: SYSTEM-LEVEL STAFF SUPPORT

4-5. The SATCOM operational manager (CDRUSSTRATCOM), with the help of SATCOM systems experts appointed via memorandum of agreement with supporting elements or external agencies, develops and implements policies, procedures, and standards for SATCOM systems. The SATCOM operational manager establishes global and regional operations centers to support CCDRs and other users. The SATCOM operational manager distributes guidance through USSTRATCOM Strategic Instruction 714-04 series publications. The Services reside at this level (see chapter 2). USASMDC/ARSTRAT provides guidance to all MILSATCOM planners.

LEVEL 3: 24-HOUR OPERATIONS CENTERS

4-6. The satellite command and control centers are the third level of SATCOM management. These control centers provide operations, support to authorized DODIN users, and are responsible for satellite control. The DISA Global Operations Command, operated by DISA, provides near real-time, situational awareness, and defense of the DODIN. A contingency operations section focuses on Soldier support for exercises and Army operations, with emphasis upon standardized tactical entry point (STEP) and Teleport missions.

ANNEX K AND THE JOINT NETWORK MANAGEMENT SYSTEM

4-7. The Joint Network Management System provides automated joint communications system management for CCMDs, and joint task forces. The Joint Network Management System is a package of hardware (transit cases, servers, and laptops) and software components that integrate several applications to plan and monitor deployed networks. The Joint Network Management System reporting subsystem, provides automated editing to produce Annex K of an operations order, and a schematic tool to create diagrams supporting Annex K. The reporting subsystem has a SAR and GAR editor to produce SAR and GAR messages for export. See CJCSM 6231.01E for more information on the Joint Network Management System.

ARMY SATELLITE COMMUNICATIONS PLANNING

4-8. Establishing SATCOM requires extensive pre-planning and coordination. Army SATCOM planners should be familiar with—

- The Satellite Communications Database.
- Requirements submission.
- Operating in degraded and denied environments.
- SARs.
- GARs.
- SATCOM access priorities.
- SATCOM apportionment.
- Access planning.
- Redundant communications procedures.
- Allocation process.
- After action reporting.
- Planner checklist.

THE SATELLITE COMMUNICATIONS DATABASE

4-9. The SDB is a comprehensive database of approved military and commercial SATCOM requirements. According to CJCSI 6250.01E, the Joint Staff owns and validates the SDB, while the DISA maintains it. The SDB provides valuable data input in scenario development and other analyses, and is available to DOD SATCOM planners, managers, and analysts worldwide. The SDB contains authorized requirements that are raw data and applies to an approved force structure or approved scenario to provide required satellite analyses.

4-10. The SDB categorizes SATCOM requirements based on begin dates and extend for two years. Current requirements meet operational missions and may have specific end-dates. These requirements specify a particular on-orbit satellite or frequency spectrum, based on operational limitations or equipment availability. The existing requirement entries of the SDB represent a comprehensive catalog of recent and near-term requirements for management and operational assessment of existing or future communications systems.

4-11. Future requirements are those requirements with begin dates beyond two years. The future requirement entries represent a catalog of long-term requirements to aid in architectural planning and system developments.

4-12. Many factors influence future requirements. These factors include— the introduction of new weapon systems, automated information systems, and technologies to support present requirements. Projected changes to the operational environment, evolving Service warfighting doctrine, and changes in Service force structures also influence these requirements. Future requirements may be new or may replace existing requirements, based on attribute changes as previously described.

4-13. Users establish and document valid requirements for SATCOM services before obtaining access to a satellite. Users submit requests for SATCOM service using the SDB management tool. These requirement requests capture information including—

- Begin date.
- End date.
- Classification of network.
- Network name.
- Concept of operations.
- Impact if the requirement is not satisfied.
- Media (X or Ka band military, EHF, C or Ku band commercial).
- Protection or survivability (if required).
- References.
- Types of services.
- User information.
  - Type of terminals and antennas.
  - Locations of terminals.
  - Link data rates.
- Point of contact.

4-14. Within CONUS users submit, SDB requirements to U.S. Army Forces Command (FORSCOM) for review and ultimately to the CCMD for submission to the SDB. OCONUS, the theater army (for example, U.S. Army Pacific Command or U.S. Army European Command) submits SDB requirements to their respective CCMD for validation and submission.

Requirement Submission

4-15. Using the SDB management tool, the CCMD forwards SATCOM requests to the joint satellite communications panel administrator (JSPA). The JSPA assigns an SDB number and forwards the requirement to USSTRATCOM. USSTRATCOM performs a comprehensive technical and operational assessment to determine supportability and returns their findings to the JSPA. The JSPA prepares the SDB requirements for presentation to the Joint SATCOM Panel for final review and approval. The Joint SATCOM Panel reviews requirements and the USSTRATCOM assessments, and either approves, holds in abeyance for more details, or returns the request to the CCMD for corrections. Final approval comes from the Joint Staff J-6. An approved requirement with an SDB number, does not guarantee access to SATCOM resources. However, an SDB number is required when a user submits a SAR.

Operating in Congested and Contested Environments

4-16. SATCOM planners must predict that our current adversaries are highly interested in degrading or denying our use of the congested and contested space domain. SATCOM resources are key targets for the growth in anti-access and areal denial capabilities from around the globe, the changing U.S. overseas defense posture, the emergence of more contested space and cyberspace, and the increasingly constrained EMS.

4-17. Due to heavy U.S. reliance on advanced satellite communications systems, such an attack may be a central focus of an enemy or adversary anti-access and areal denial strategy, requiring a higher degree of planning and situational awareness for redundant, auxiliary, and mitigation techniques.

SATELLITE ACCESS REQUESTS

4-18. When a unit has a validated SATCOM requirement and requires access, the communications planner, at the division G-6 or other operations cell submits a SAR through corps headquarters to the theater army for verification. Once the CCMD validates the requirement, the RSSC responsible for managing the SATCOM resources processes it. If sufficient satellite resources are available, the RSSC prepares an SAA after reviewing the approved SAR. If resources are not available, a SAR is denied or partially denied. If denied, the CCMD may request arbitration. Approved SAAs permit operational access. The RSSC issues them to the originating unit, disseminated to the controlling SATCOM Command Center on a secure website.

> ***Note*.** Per USSTRATCOM Policy Memorandum all SAR, GAR, and GBS Mission Request (GMR) for access for units that reside under USSTRATCOM have 45 days prior to mission access. For all SAR, GAR, and GMR access for other combatant commands those requests must be submitted to the supporting RSSC 30 days before mission access in accordance with USSTRATCOM (SI) 714-04.

GATEWAY ACCESS REQUESTS

4-19. GAR submission is similar to the SAR. Planners submit a GAR when there is need for DISN services. The DISA is the controlling organization for all approvals and access authorizations of a GAR. The GAR submission starts at the unit routes through the chain of command to the component command headquarters. If approved, the GAR is routed to the respective RSSC and DISA offices. If approved, the RSSC sends the request to DISA and the approved request is assigned a SDB number and priority.

SATCOM ACCESS PRIORITIES

4-20. The Chairman of the Joint Chiefs of Staff sets priorities for MILSATCOM systems. The Joint Staff J-6 collects, consolidates, assesses, and records requests and coordinates with the operations directorate of the Joint Staff to validate and prioritize them. MILSATCOM space segments are designated joint assets controlled by the Chairman of the Joint Chiefs of Staff.

4-21. The Chairman of the Joint Chiefs of Staff owns SATCOM assets and apportions them geographically to each CCDR, who temporarily controls those SATCOM assets within their area of responsibility. CCDRs apportion those resources to joint task forces or Service components, depending on operational requirements and national priorities.

4-22. Users should have an endorsed SDB requirement before submitting a SAR. Before submission to the RSSC, the division communications planner prioritizes the SARs based on mission priorities according to the priority tables in CJCSI 6250.01E. Table 4-1 outlines the access priorities.

Table 4-1. Satellite communications priorities

Priority	User Requirement	User Category
1	Strategic order (essential to national survival)	1A. System control orderwire 1B. Executive support 1C. Strategic and threat warning/intelligence 1D. National and strategic nuclear force direction requirements 1E. Secretary of Defense directed combatant command emergency operations authority (other than executive support)
2	Tasked plan execution (operation plan or concept plan)	2A. Chairman of the Joint Chiefs of Staff support 2B. Combatant commander operations 2C. Joint or multinational task force operations direct task force communications 2D. Component operations (theater forces) 2E. Tactical warning and intelligence
3	Essential operational support (operations not associated with an operation plan or concept plan)	3A. Humanitarian support or defense support of civil authorities 3B. Combatant commander operations 3C. Joint or multinational task force operations 3D. Component operations 3E. Intelligence and weather 3F. Diplomatic post support 3G. Space vehicle support 3H. Electromagnetic interference activity resolution 3I. Logistics (Department of Defense (DOD) routine material transit and processing)
4	Training	4A. Chairman of the Joint Chiefs of Staff directed exercise 4B. Pre-deployment exercise/training (30–45 days out) 4C. Combatant command-sponsored (homeland security and defense) 4D. Major command 4E. Joint forces training (multiple categories) 4F. Unit-sponsored, unit level training
5	Very important person support	5A. Service secretaries 5B. Service chiefs 5C. Combatant commander travel 5D. Other travel
6	Research, development, testing, and evaluation	6A. Electromagnetic interference activity testing 6B. DOD sponsored testing 6C. DOD sponsored demonstrations 6D. DOD administrative support 6E. DOD quality of life initiative
7	Miscellaneous	7A. DOD support to law enforcement (non-joint task force support) 7B. Civil non-federal agency support 7C. Non-U.S. support (as approved) 7D. Other

SATCOM APPORTIONMENT

4-23. Apportionment is the distribution of a block of SATCOM resources to CCDRs and other authorized users for contingency and crisis planning. The SATCOM apportionment process begins before deployment with the development of contingency plans directed by the Joint Strategic Capabilities Plan. The force planning construct, based on strategic planning guidance, outlines SATCOM resources apportionment. This construct considers operational situations, threat conditions, and operational requirements.

4-24. Operational and mission variables can affect SATCOM apportionment. Resources may require reassignment to meet urgent operational needs. CCDRs cannot draft detailed communication plans without knowing SATCOM apportionment.

ACCESS PLANNING

4-25. To use their apportioned SATCOM resources, CCDRs need permission to access a satellite. To obtain this permission to access, CCDRs follow the Joint Operational Planning and Execution System. The Joint Strategic Capabilities Plan tasking contains the development of time-phased force and deployment data or an Annex K (communications annex) for the contingency or crisis plan. If time-phased force and deployment data is not required, CCDRs may initiate production of a SATCOM requirements summary.

4-26. Approval recommendation for CCDRs' communications plans rests with the USSTRATCOM J-6. The USSTRATCOM J-6 determines if SATCOM support is feasible and resources are available.

ALLOCATION PROCESS

4-27. Allocation is the authorization of SATCOM resources to support authenticated requirements. The allocation process provides or denies SATCOM access to the requestor. Denial of service due to insufficient resources can go through the USSTRATCOM arbitration process defined in Strategic Instruction 714-04.

4-28. The allocation process starts with a SAR, as outlined in approved communications plans. If the unit requires gateway access to DISN services, they submit a GAR concurrently with the SAR. USSTRATCOM requires SARs for training missions 30–45 days in advance.

4-29. The RSSC processes and certifies SARs. The DISA Contingency and Exercise Branch processes GARs. The RSSC issues SAAs to allocate SATCOM resources. The DISA Contingency and Exercise Branch issues gateway access authorizations for pre-positioned DISN services to support a mission.

4-30. Processing times differ according to the priority of the SAR and GAR. The allocation process schedules satellite access according to system limitations, equipment constraints, and validated priorities. Processing times include—

- Crisis or contingency SAR—within 24 hours if a solution exits.
- Routine requirements—usually 9 days before mission or exercise start, or 21 days after SAR submission.
- Procedures for submitting waivers rejected for SARs or GARs are outlined in CJCSI 6250.01E.

SATELLITE AND GATEWAY ACCESS REQUEST GUIDELINES

4-31. Each SAR and GAR includes a SDB reference number, appropriate mission priority number, and must meet CJCSI 6250.01E requirements. Failing to meet the requirements results in denial of satellite or gateway access.

4-32. Units plan SARs and GARs via automated (preferred) or manual systems. Planners should submit requests as early as possible. Additional time may be necessary to coordinate frequency conflicts within the organization. Procedures may vary depending upon the type of SATCOM access required (narrowband, wideband, protected, or commercial). To submit a SAR or GAR. the requesting unit should follow these four-steps—

- Signal or operations staff planners prepare a SAR and GAR (coordination with the supporting RSSC is encouraged).
- Unit forwards SAR and GAR to supported theater army SATCOM manager for validation (CONUS units submit to FORSCOM).
- Theater army or FORSCOM submits to CCDR for mission approval.
- CCDR forwards validated SARs and GARs to supporting RSSC.

After Action Reviews

4-33. The after action review documents system and personnel performance, it identifies procedural or technical conflicts, and records outstanding or substandard mission performance. The after action review also provides historical information to identify trends, lessons learned, and potential systemic problems associated with satellite missions. The data collected during after action reviews can serve as a roadmap to improve future operations.

4-34. Upon request from the user, CCMD, controller, planner, or manager, all entities involved with a SATCOM mission complete an after action review within 10 working days of the request. After action review submission follows the same channels as listed in paragraph 4-31 for SARs and GARs.

Satellite Communications Planning Checklist

4-35. The SATCOM planning checklist helps planners understand SATCOM requirements. The checklist helps a planner in determining SATCOM links.

- Are we in the communications planning meetings for this operation?
- What is our mission?
- What is our deployment timeline?
- When specifically does the mission begin and end?
- Who is our supporting headquarters and what information do they require from us?
- Whom do we support and what services do they require?
- If the operation is OCONUS, are host nation agreements and landing rights approved?
- What is the area of operations communications infrastructure?
- Can we leverage off the communications infrastructure?
- What types of terrain may be present in the area of operations that will interfere with SATCOM access or terminal placement?
- What is the threat environment?
- Do we have justified SATCOM requirements to support the mission?
- Do we have to submit requests for SDB numbers?
- Do we require expedited approvals?
- How long will SATCOM services be required?
- What are the types of circuits and data rates required?
- Where do we obtain required frequencies?
- Are the GPS frequencies incorporated in the unit frequency plans to preclude interference from tactical communications equipment?
- Do we have adequate communications security devices and keying material to support our networks?
- What is our plan for emergency destruction of classified material in the terminals?
- What multinational systems support or connect to the network?
- Do we have or foresee any interoperability issues with allies or other services?
- What type of traffic requires protected SATCOM links and what traffic can use commercial SATCOM?
- What are the SATCOM priorities for individual links?
- What terminals are required to support the mission?
- Are the terminals on hand or do we obtain them from another unit?
- Where will the terminals be located?
- What is the phasing of the operation and what type of SATCOM support is necessary for each phase?
- What equipment and troops will we deploy?
- Do we have qualified SATCOM equipment operators/maintainers? What training will be required before movement?

- What types of backup communications is necessary?
- Are SATCOM units and personnel prioritized and included in the time-phased force and deployment data?
- Have we established and disseminated clear policies for use of personal GPS receivers, handheld commercial radios, cell phones, and morale calls using SATCOM?
- Is there a heavy dependence on any one means of communications during the operation?
- Have SATCOM requirements for the operation been evaluated to ensure proper use of limited assets?
- Can any of the networks combine or time-share based upon evaluation of usage patterns?
- Should we plan for and establish provisions for a changeover of tactical SATCOM with commercial SATCOM at the earliest opportunity?

NARROWBAND SATELLITE COMMUNICATIONS

4-36. Narrowband (UHF) SATCOM supports tactical forces. Planners should submit a SAR 30–45 days before the mission to allow adequate time for processing. Planners use the Joint Integrated Satellite Communications Tool (JIST) on SIPRNET to prepare and submit narrowband SATCOM SARs.

4-37. UHF networks use the UFO satellite constellation, fleet satellite, certain Air Force systems, MUOS, and multinational systems Skynet and North Atlantic Treaty Organization (NATO) IV, when necessary. UHF satellites have limited available bandwidth. Other means of communication are recommended for routine traffic.

Note. For a complete description of narrowband SATCOM planning, see ATP 6-02.90. For narrowband SATCOM policy, guidance, and procedures, see CJCSI 6251.01D.

WIDEBAND SATELLITE COMMUNICATIONS

4-38. The primary purpose of wideband SATCOM is to extend the range of DISN services. WGS, along with the remaining DSCS satellites provide global backbone connection. Wideband SATCOM enables efficient use of the spectrum. The use of wideband frequencies adds flexibility to routed traffic between users in different scenarios. Wideband improves performance for disadvantaged users, and provides legacy compatibility with existing users. Wideband architecture is supported by both tactical and enterprise systems including on-the-move users.

WIDEBAND PLANNING

4-39. For wideband SATCOM development, planners rely on ARSTRAT circulars. These circulars cover the use of the DSCS and WGS constellations and GBS. It applies to Army, Marine Corps, Navy, and Air Force users requesting access to wideband SATCOM systems.

WIDEBAND ACCESS REQUESTS AND AUTHORIZATIONS

4-40. Wideband satellites are a limited and shared resource. The CCMD J-6 staff analyzes the communication requirements to support the command and subordinate commands within their area of operations. The J-6 staff collects requirements and develops their communications plan (Annex K) supporting mission command requirements at all echelons. The J-6 plan takes into account the characteristics (equipment type, data rate, and connectivity) of wideband SATCOM links required to support the mission. J-6 planners coordinate with the wideband SATCOM manager from the servicing RSSC to identify shortfalls and resource availability.

4-41. Communications planners submit an Army service request (ASR) or SAR through their operational chain of command to the supporting RSSC to request satellite access and a GAR to DISA requesting DISN services for a wideband SATCOM mission. Planners should allow should submit requests 30–45 days before the mission start date to allow adequate time for wideband access request—

- ASR or SAR for Army COMSATCOM Ku band and RHN enterprise service support via Army Centralized Army Service Request System-NIPRNET.
- ASR for RHN enterprise service support via the Army Centralized Army Service Request System-SIPRNET.
- ASR for WGS (Ka or X band) mission support via the Army Centralized Army Service Request System-SIPRNET.
- SAR for WGS SATCOM via JIST.

4-42. The supporting RSSC uses the SAR to produce SAAs once they adjudicate any conflicting requirements.

4-43. The GAR is a DISA document engineered to request and grant services via the DOD gateways, STEPs, and Teleports. The GAR allocates and distributes enterprise services and is specifically engineered for the Army's RHNs. The unit submits a GAR to the DISA Contingency and Exercise Branch for missions requiring DOD gateway connectivity. DISA Contingency and Exercise Branch schedules and authorizes DODIN access based on DISN service availability and satellite supportability. The resulting GAR identifies the DOD gateway site to support the mission support.

4-44. RSSCs grant satellite access based on satellite resource availability, mission priority, and the SDB characteristics. SAAs provide operating parameters, interim tactical orderwire system parameters, and interim tactical orderwire system-controlled FDMA network operating parameters. SAAs are transmitted via the JIST to the originator of the SAR, the primary and alternate WSOC, the STEP site (if applicable).

PROTECTED SATELLITE COMMUNICATIONS

4-45. Milstar and AEHF provide protected SATCOM capabilities. EHF and AEHF are resistant to jamming, interception, and detection making EHF and AEHF communications survivable and flexible. Protected SATCOM missions require—

- Planning.
- EHF and AEHF access request and authorization.
- Terminal image generation.
- Management of protected access.
- EHF and AEHF tactical reporting.

PROTECTED SATELLITE COMMUNICATIONS PLANNING

4-46. User requirements determine the satellite and terminal connectivity necessary. Coordination with management and controlling organizations for protected SATCOM is necessary for network planning, antenna control, communications control, and resource monitoring. Combatant commands consolidate and approve unit-level mission requirements. EHF and AEHF mission implementation is a complex process due to the amount of information required to prepare the satellite terminals for EHF and AEHF access.

4-47. Planners submit SARs via JIST. Planners should allow a processing time of 30–45 days following submission of a SAR for EHF and AEHF services.

PROTECTED SATELLITE COMMUNICATIONS ACCESS AND AUTHORIZATION

4-48. Accessing a protected SATCOM payload requires a SAR and terminal image data. Planners identify mission requirements and submit a SAR for EHF to the theater army SATCOM manager. The theater army communications planning staff verifies the mission and forwards requirements to the CCMD for validation and mission approval. The RSSC implements the requirements.

4-49. The RSSC verifies Milstar and AEHF can support the mission using the Mission Planning Element. Additionally, the RSSC verifies the UHF Follow-on can support EHF LDR missions using the UFO or EHF Communications Support Tool. Depending on the EHF or AEHF satellite used, the RSSC coordinates the mission with the theater Army and CCMD communications planning staff.

4-50. The RSSC develops and issues the SAA, authorizes the protected mission, and issues an action copy to the requesting unit. The RSSC provides information copies to the theater army communications planning staff, the CCMD communications planning staff, the Milstar Satellite Operations Center, and the Naval Satellite Operations Center.

TERMINAL IMAGE GENERATION

4-51. System constellation, payload, service, terminal configuration data, satellite ephemeris data (orbit information), and transmission and communications security keys for the EHF and AEHF mission are the data elements needed to form the terminal image. The service terminal controller consolidates, develops, and distributes the terminal image data required to the users of terminals associated with the mission for loading.

MANAGEMENT OF PROTECTED ACCESS

4-52. The CCMD manages allocated and apportioned resources according to warfighting requirements. Milstar and AEHF enable centralized management and decentralized execution. The CCMD can sub-apportion resources to the theater army and other Service components. Units can use the resources in any configuration. Activation of EHF and AEHF services is the responsibility of the force allocated assets. The designated network control station or communications controller monitors services during the mission. For Milstar network operations planning see CJCSM 6254.01.

EHF TACTICAL REPORTING

4-53. Accurate EHF operations reporting is essential to managing protected tactical communications. The EHF after action review provides information to identify trends, lessons learned, and problems with tactical EHF missions and improve future operations for the EHF management and user community.

4-54. The tactical environment is always fluid. SMART-T and single-channel anti-jam man-portable terminals provide echelons corps and below with the means to extend tactical communications to BLOS ranges. Terminals move frequently, de-accessing and re-accessing the satellite, and are subject to preemption due to low precedence. The nature of tactical communications makes it difficult to document each problem.

4-55. Unit standard operating procedures dictate additional reporting requirements. Terminal operators report to the network control station/communications controller and communications planner during troubleshooting. Communications planners report conflicts to the RSSC promptly to ensure the resolution of system problems.

4-56. At the end of a protected SATCOM operation mission, participants provide feedback to the communications planner. The communications planner compiles comments for the after action review and submits these comments through the JIST.

4-57. The after action review process, documents EHF and AEHF terminal mission operations. Army units maintain a master station log to track mission information. Department of Army Form 1594 (Daily Staff Journal or Duty Officers Log) and Department of Defense Form 1753 (Master Station Log) are master station log examples. Terminal operators can take advantage of the SMART-T data export features to save (or print) history, fault, and fault isolation logs. The logs assist in after action review development.

COMMERCIAL SATELLITE COMMUNICATIONS

4-58. The COMSATCOM industry has a small number of multinational commercial satellite owner-operators and a larger number of vendors, who resell SATCOM bandwidth and services. COMSATCOM resources play a vital role in satisfying DOD requirements for SATCOM support and are an integral component to the DOD's warfighting capability. When military requirements exceed MILSATCOM capabilities, commercial satellites augment military wideband and narrowband applications.

4-59. The DISA manages the contracts for COMSATCOM bandwidth. Combatant commands must obtain COMSATCOM support or a waiver through the DISA. The increased use of COMSATCOM coupled with its reliability has made it a cost effective solution for MILSATCOM. In the next several years, the demand for COMSATCOM will increase, in the absence of any new external variables affecting requirements, to meet the MILSATCOM requirements.

Army Use of Commercial Satellite Communications

4-60. The Army employs MILSATCOM whenever it is available. In some cases the available MILSATCOM resources are insufficient to support ongoing operations. COMSATCOM are leveraged to provide the required additional bandwidth. In a few cases, the Army mission does not have sufficient high priority to receive consistent MILSATCOM access. In other cases, the technical design and/or the deployment schedule of the MILSATCOM network cannot fulfill Army mission requirements. In these cases, the Army employs a disciplined process of mission analysis, solution analysis, and resource analysis to obtain COMSATCOM services.

4-61. Several Army organizations provide, operate, and manage commercial SATCOM networks that augment MILSATCOM for Army and DOD missions. These organizations include U.S. Army Intelligence and Security Command (operational manager of the TROJAN Special Purpose Integrated Remote Intelligence Terminal network); Program Manager Defense Wide Transmission Systems (operational manager of the logistics SATCOM network); FORSCOM (operational manager of the commercial SATCOM network for WIN-T training in CONUS); and Program Manager Mission Command (operational manager of the friendly force tracking network). These systems and networks comply with Chairman of the Joint Chiefs of Staff Instructions for SATCOM.

4-62. The DISA records the SDB and transmission plan for each lease annually, and reports to USSTRATCOM. COMSATCOM access also goes through the SAR and SAA process.

Planning for COMSATCOM Fixed Satellite Services Access

4-63. Army SATCOM networks require SDB numbers in accordance with CJCSI 6250.01E. The SDB entry for each network identifies whether COMSATCOM is the primary or the alternate means of communication. To support CCMD missions, units submit the requirement to the supported CCMD before submitting to DISA. COMSATCOM resource access is requested in a similar manner to request for MILSATCOM access. All SARs, GARs, telecommunications service requests, statements of work, and commercial satellite service surveys should be submitted to the theater army spectrum manager (OCONUS) or FORSCOM SATCOM manager (CONUS) 30–45 days before the requested access start date.

4-64. Army units with WIN-T systems in CONUS request MILSATCOM (WGS) or COMSATCOM access based on unit training goals. For MILSATCOM access for WIN-T systems, Army units request access through the Joint Integrated SATCOM Tool. FORSCOM processes the SAR for submission to USSTRATCOM. FORSCOM manages COMSATCOM access supporting WIN-T training. NETCOM operates the RHNs to provide DISN services for these missions. Units request access by submitting a SAR and a GAR through the Army Centralized Army Service Request System portal. Requests should comply with CJCSI 6250.01E, including the use of an appropriate SDB reference priority designator (usually within Priority 4B–4F). FORSCOM assesses the request and adjudicates the schedule and capacity based on overall collective training missions for the Army. USSTRATCOM receives a copy of the SAR for validation. Most commercial SATCOM missions for training in CONUS use the WIN-T RHNs at Camp Roberts, California and Fort Bragg, North Carolina for reachback.

Management for COMSATCOM

4-65. USSTRATCOM is the main DOD element for engagement with the COMSATCOM industry. The DOD and the telecommunications industry share common interests in reducing the threat of orbital debris and collisions; awareness of scheduled launches; analysis of intentional or unintentional interference; and so on. USSTRATCOM actively engages with the Satellite Industry Association for collaborative analysis of these strategic factors. The Army participates in many working groups USSTRATCOM organizes with Satellite Industry Association member companies.

4-66. The DISA Operations Directorate has two divisions that assist with management of COMSATCOM. The Operate and Assure Division directs, coordinates, and synchronizes acquisition for COMSATCOM. The

Gateway Operations Division is the C-SSE for DOD gateways, manages COMSATCOM networks, and provides monitoring and control.

MOBILE SATELLITE SERVICES

4-67. An MSS is a portable satellite telephone that enables phone service anywhere on the earth. The Army defines MSS as satellite-based services (digital voice, data, paging, and facsimile) provided by existing and emerging commercial communications providers through mobile terminals. MSS systems support Army missions and operations by augmenting military terrestrial and satellite networks and providing BLOS communications capabilities. MSS systems are commercial enterprises; the Army does not exercise oversight in development, fielding, or operation of these systems. The Army relies on vendor-provided information to determine MSS systems are applicable for military use.

4-68. The only MSS systems the Army can use without a DISA waiver are Iridium and INMARSAT. A telephone connection using MSS is similar to a cellular telephone link, except the repeaters are orbiting the Earth, rather than on the surface. Those MSS repeaters are on geostationary, medium Earth orbit, or low Earth orbit satellites. If the system uses satellites properly positioned around the globe, MSS can link any two wireless telephone sets at any time, regardless of location. MSS systems interoperate with land-based cellular and land line telephone networks.

4-69. The DISA is the SATCOM system expert for MSS. The DISA MSS office—

- Provides planning and technical functions to support operational management of the Inmarsat satellite constellation and responds to operational requirements of DOD and non-DOD customers.
- Maintains a management structure that integrates MSS with the DODIN.
- Obtains, configures, operates, maintains, and provides status of fixed and transportable MSS gateways.
- Establishes procedures for reporting status and service interruptions.
- Establishes centralized contracts to procure MSS terminals and services.
- Provides MSS resources to meet the CCDRs' operational requirements.
- Maintains classified telephone directories for MSS.
- Establishes procedures for reporting status and service interruptions of the Iridium constellation.
- Coordinates connection approvals, based on host nation regulations and standards.

Enhanced Mobile Satellite Services

4-70. EMSS is a satellite-based telephone and data communication service, utilizing a commercial satellite infrastructure to provide voice and LDR services from a mobile, lightweight terminal through a dedicated gateway to access the DODIN. It can provide type-1 secure voice service and non-secure access to commercial and Defense Switched Network (DSN) telephone services.

4-71. Modifications to the commercial system provide compatibility with type-1 voice encryption and protection of sensitive user information. The DOD's EMSS gateway provides remote access to the DSN, commercial long distance, commercial international long distance, and other DISN services. EMSS features include—

- Global coverage. Polar Regions (90 degrees North to 90 degrees South), ocean areas (no gaps), airborne service, and secure global handheld communications.
- Encryption. End-to-end, type-1 voice, and non-secure data capability.
- Signaling. Protection of sensitive user information.
- Access. U.S. Government control, denial of service protection, DSN multilevel precedence, and preemption access.
- Paging.
- Short burst data.

4-72. The EMSS provides the following special features:

- Broadcast service.

- Protected paging.
- Short burst messaging.
- Conference calling.
- NIPRNET and SIPRNET connectivity.

4-73. The EMSS is available as a service offering through the DISA to the DOD, other federal departments and agencies, state and local governments, and Joint Staff approved multinational users. Specific value-added manufacturers approved by the DISA can offer Iridium-based solutions compatible with the DOD Iridium architecture. These value added manufacturers have to comply with provisions for positive control of access to the DOD EMSS network; control of user information; reports to DISA; and other factors.

The Iridium System

4-74. The Iridium system is the first commercially available, crosslinked, pole-to-pole, global EMSS. Iridium provides mobile (on-the-move) telephone and other services (paging, messaging, facsimile, and LDR) to small handsets anywhere on the globe, including the poles, around the clock.

4-75. The Iridium satellite constellation facilitates continuous coverage of every region on the globe by at least one satellite. Each satellite acts as a digital relay, crosslinked to four other satellites: two satellites in the same orbital plane and two in an adjacent plane, delivering essential communications services to and from remote areas on the Earth where terrestrial communications may not be available.

4-76. This system is very attractive to Army users because it provides complete Earth coverage. Iridium ground support involves the system control segment and gateways, which connect to the terrestrial telephone system. The system control segment is the central management component for Iridium. It provides global operational support and control services for the satellite constellation, delivers satellite-tracking data to the gateways, and performs the termination control function of messaging services. The DOD Iridium gateway in Wahiawa, Hawaii handles Iridium military traffic for security and billing.

4-77. Iridium handsets and associated hardware are available through the DISA Direct Order Entry ordering process. Various vendors offer third-party solutions. The DISA Direct Order Entry process ensures the solutions comply with the DOD Iridium architecture. The National Security Agency has approved and certified a security appliqué called the Iridium Security Module. This module provides users a secure method to coordinate with RSSCs for access and engineering purposes. The Iridium architecture depends on LOS access to the satellite. Customers inside buildings, under dense foliage, or in steep terrain like high mountains or urban areas with tall buildings may experience difficulty acquiring a satellite signal.

International Maritime Satellite

4-78. INMARSAT was established in 1979 to serve the maritime industry by developing SATCOM for ship management and distress and safety applications. It has since expanded to land and aeronautical communications, so that users now include thousands of civilians who live or work in remote areas without reliable terrestrial networks, or travelers anywhere. Besides maritime customers, typical users include journalists and broadcasters; health teams and disaster relief workers; ground transport fleet operators; airlines, airline passengers, and air traffic controllers; government workers, national emergency, and civil defense agencies; and heads of state.

4-79. INMARSAT has many functions. It is important for an Army planner to know these capabilities to better develop their communications solutions. INMARSAT features include—

- Standard voice communications.
- Streaming (predetermined quality of service) and standard (shared data connection) internet protocol services at speeds up to 432 kbps.
- Integrated Services Digital Network services supporting voice and data communications.
- Text messaging.
- Cybersecurity.
- Network usage and fault monitoring and reporting.
- Customer support services.

4-80. One of the major differences in the Iridium and INMARSAT constellations is the orbits the satellites use. INMARSAT operates in a geosynchronous orbit. INMARSAT has the same advantages and disadvantages as other geosynchronous satellite constellations. INMARSAT does not offer polar coverage.

WARFIGHTER INFORMATION NETWORK-TACTICAL EQUIPPED SATELLITE COMMUNICATIONS PLANNING

4-81. Each WIN-T equipped Soldier requires an authorization to operate certification from the responsible designated approval authority before submitting a SAR or ASR. The fielded WIN-T assemblages' are type accredited. Accreditation is part of the authorization to operate submission.

ACCESS REQUEST AND AUTHORIZATION

4-82. Tactical units operate as part of a joint force. The CCMD adjudicates and validates resource requirements. The following organizational references only identify parent organization relationships. The process for SAR and ASR access and authorization includes—

- The unit submits a SAR or ASR, statement of work, commercial satellite service survey, network diagram, and air tasking order/interim authorization to operate to the theater army (OCONUS) or FORSCOM (CONUS).
- The unit coordinates with corps or division when developing and submitting the SAR, statement of work, commercial satellite service survey, ASR, network diagram, and air tasking order.
- The corps verifies the submission paperwork and forwards it to theater army or FORSCOM.
- The theater army or FORSCOM verifies the request, assigns mission priority and—
  - Coordinates with the signal command (theater) [SC(T)] and the RHN operations section to ensure resources are available to support mission requirements.
  - Coordinates requirements with the CCMD if it funds the space segment or supports a joint mission, or an arbitration of resources is necessary for competing joint mission requirements.
- If the approval authority disapproves a request, they return it to the requesting unit noting disapproval. The theater army, SC(T), and the affected unit identify alternative courses of action (for example, out-of-theater RHN or Teleport access).
- The theater army submits an SAR or commercial satellite team service survey to the RSSC planner, for further processing. The SC(T) or NETCOM incorporates the mission requirement into the SATCOM access schedule. The organization, theater army and/or CCMD arbitrate resource conflicts for Army or joint missions.
- The SC(T) or NETCOM forwards the SAR or commercial satellite service survey to the RSSC, who—
  - Submits the package to the FCSA at the DISA.
  - The FCSA contractor develops a transmission plan and coordinates licensing, landing rights, and frequency clearance.
  - Assigns a mission number and develops the SAA.
- The SAA and transmission plan go back to SC(T) or NETCOM. The RSSC manager disseminates the SAA and transmission plan for joint missions (exercise and operational) to the CCMD J-6 for theater space segment utilization and frequency management. The COMSATCOM manager—
  - Submits the package to the DISN Satellite Transmission Service-Global contractors who develops a transmission plan and coordinates licensing, landing rights, and frequency clearance.
  - Assigns a mission number and develops the SAA.
  - Reviews the interim authorization to operate or air tasking order and authorizes connectivity.
  - Coordinates with the RHN operations section to identify equipment to support missions.
- The SC(T) develops the Army service authorization from the ASR and incorporates the mission number from the SAA in to the Army service authorization.

- The SC(T) or NETCOM provides the authorization to connect, Army service authorization, SAA, and transmission plan to the tactical unit and RHN operations section.
- The RHN operations section and tactical unit implement crew assignment sheets, prepare systems and implement equipment configurations for operation according to the SAA, Army service authorization, and transmission plan, and coordinate with the RHN operations section for access to satellite and baseband services.

4-83. In establishing services, the WIN-T equipped unit works with the RHN and its network service center to initiate and troubleshoot service as required. The RHN and network service center coordinate with commercial satellite operations centers.

MANAGING DISN SERVICE ACCESS

4-84. The WIN-T equipped unit submits an ASR to the theater army through the SC(T) to request RHN access and DISN services. The WIN-T equipped unit's ASR is internal to the Army because it uses pre-provisioned connectivity to DISN services.

4-85. The unit follows the standard GAR process to request DISN service access via the DOD gateway. The SC(T) and RHN operations sections assist the unit with provisioning and extending services via the hub node.

4-86. If the RHN cannot fulfill a mission requirement due to competing or higher priority missions (special circuits or user-requested STEP circuits), the deployed user, with support from the SC(T), submits a GAR through the CCMD to the DISA Contingency and Exercise Branch for validation.

Chapter 5
Satellite Communications Enablers

There are specific organizations within DOD are responsible for the use of military and commercial SATCOM. These organizations help the SATCOM community support Army operations. Clear guidance and readily available assistance are essential for SATCOM efficiency. The units monitor SATCOM transmissions and ensure compliance with technical and regulatory guidance. This chapter discusses USSTRATCOM, USASMDC/ARSTRAT, NETCOM, and distribution of signal units.

UNITED STATES STRATEGIC COMMAND

5-1. At the strategic level, CDRUSSTRATCOM provides SATCOM support to geographic combatant commanders. Regarding SATCOM, CDRUSSTRATCOM links the Joint Staff, DOD elements, and the President to the operational theater.

5-2. USSTRATCOM and its Service components oversee worldwide space operations, including SATCOM. As the SATCOM operational manager, CDRUSSTRATCOM directs day to day, 24-hour support to the force.

UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND/ARMY FORCES STRATEGIC COMMAND

5-3. USASMDC/ARSTRAT is the Army Service component command supporting USSTRATCOM. USASMDC/ARSTRAT executes space operations, ensuring joint and Army forces maintain an information advantage through access to space assets. To accomplish its mission, USASMDC/ARSTRAT has OPCON over a number of elements positioned worldwide.

5-4. CDRUSSTRATCOM designates C-SSEs and satellite communications system experts (SSEs) to serve as subject matter experts for their systems and portfolios. USSTRATCOM requires an integrated management approach that combines the efforts of the various SSEs and provides recommendations through a fully integrated analysis. C-SSEs for military UHF, SHF, and EHF, COMSATCOM, and DOD gateways coordinate and integrate SATCOM community of interest and cross-system inputs from SSEs. The SSEs support the C-SSEs, with an integrated SATCOM management framework, which supports USSTRATCOM's efforts to plan, assess, analyze, and integrate SATCOM.

5-5. SSEs are experts on their SATCOM system(s) and have a general knowledge of all SATCOM systems. SSEs provide technical, operational, and engineering support to USSTRATCOM, C-SSEs, electromagnetic interference managers, acquisition (future SATCOM) activities, and other USSTRATCOM organizations. USSTRATCOM may task SSEs to support other commands and agencies as required. SSEs can respond to operational emergency requests 24 hours a day. USSTRATCOM will task non-component SSEs directly for required support. The C-SSE will integrate non-component SSE input to an integrated product for USSTRATCOM use.

5-6. CDRUSTRATCOM designated USASMDC/ARSTRAT the C-SSE for military UHF (narrowband) and SHF (wideband) SATCOM. It is also the designated SSE for MUOS, WGS, DSCS, and GBS. USASMDC/ARSTRAT maintains 24-hour wideband and narrowband SATCOM assistance line.

1ST SPACE BRIGADE

5-7. The 1st Space Brigade provides existing and emerging space capabilities that enable the President and Secretary of Defense, U.S. forces, and allies to deliver decisive combat power. The space brigade exercises mission command over its subordinate space battalions and the 53d Signal Battalion (SATCON).

53D SIGNAL BATTALION (SATELLITE CONTROL)

5-8. The 53d Signal Battalion (SATCON) provides satellite transmission, payload control, and electromagnetic interference detection for DSCS and WGS constellations for the President of the United States the Secretary of Defense, joint commands, multinational forces, and international partners. They operate and maintain the WSOCs, providing worldwide long-haul support.

5-9. The Soldiers of this battalion manage payload control of both DSCS and WGS systems. Using spectral monitoring of the communications across the satellite, the controllers can instantly detect, monitor, and mitigate satellite anomalies and electromagnetic interference for their designated satellite.

5-10. The battalion manages six geographically dispersed companies. Five companies operate the WSOCs, while the sixth is responsible for the DSCS Certification Facility and the battalion staff. They provide global operations to ensure freedom of action in space to support USSTRATCOM's ability to ensure access to DOD and leased commercial satellite transmission paths of interest.

UNITED STATES ARMY NETWORK ENTERPRISE TECHNOLOGY COMMAND

5-11. At the Army enterprise level, NETCOM design, builds, configures, secures, operates, maintains, and sustains the DODIN-A. NETCOM provides staff assistance for Army units that provide SATCOM support to operations. NETCOM is responsible for the Army Enterprise Infostructure. Refer to FM 6-02 and AR 10-87 for more information on NETCOM.

5-12. NETCOM executes its global mission through the SC(T)s. The SC(T) is the highest level organization in charge of the DODIN-A in a theater of operations. The SC(T)s are subordinate commands of NETCOM and function under OPCON of a supported theater army. The SC(T), builds, configures, secures, and sustains the DODIN-A within the DODIN. It enables mission command over strategic and limited tactical organizations, visual information resources, wire and cable and commercial infrastructures, and theater signal maintenance. Total force composition under the mission command of the SC(T) depends on the operational variables and CCDR requirements.

SIGNAL COMMAND (THEATER)

5-13. A SC(T) provides signal support to the theater army including missions to support large scale combat operations. The SC(T) exercises mission command over the theater tactical signal brigade and its assigned signal support elements. It also exercises mission command over a tailored theater strategic signal brigade, which provides mission support that enables access to the DODIN-A through enterprise services.

5-14. The commander of the SC(T) may serve as the theater army G-6. The SC(T) commander receives mission orders from the theater army commander. The SC(T) performs network management through staff or technical channels via NETCOM, the geographic combatant commander J-6, and USSTRATCOM for service and enterprise management, technical compliance, and network defense. The SC(T) responsibilities regarding Army SATCOM operations include—

- Provide mission command for subordinate units.
- Provide a staff component for various operational commands including joint task force J-6, joint force land component command G-6, Army forces G-6, and corps and division G-6.
- Provide operational management of signal assets that build, configure, secure, operate, maintain and sustain the DODIN-A in theater (centralized management of voice, data, facsimile, messaging, and video teleconferencing capabilities).
- Provide oversight to the regional cyber center.

- Provide planning and staff management of the ground mobile force (GMF)/TACSAT Theater SATCOM Monitoring Center and Army GMF in the theater of operations.
- Coordinate with the DISA and theater army G-6 concerning DISN matters.
- Coordinate with the DISA and theater army G-6 and host nation communications organizations for scheduling and using commercial and host nation assets within theater.
- Provide theater visual information units supporting the theater army.

5-15. If the SC(T) deploys forward elements it will request communications support from either a theater-committed or rotational signal unit in the global force pool. It will operate in a manner to support Army network requirements in theater, whether as a forward element, operating in sanctuary, or from a power projection platform. Ideally, the SC(T) center of mass will locate where the commander can best exercise mission command over signal assets, influence theater network schemes and architectures, and optimize network management supporting the theater army commander or joint forces commander.

302D SIGNAL BATTALION

5-16. The 302d Signal Battalion executes Army enterprise (strategic) SATCOM operations. This battalion runs the day-to-day operations involving Army enterprise (strategic) SATCOM. The 302d Signal Battalion is part of the 21st Signal Brigade, whose mission is to provide global information services to enable mission command from the President of the United States down to the Soldier, and other federal agencies. Army terminals and technical control facilities in CONUS are the responsibility of the 302d Signal Battalion, except for the auxiliary satellite control terminal at the WSOC.

DISTRIBUTION OF SIGNAL UNITS

5-17. The Army's force structure allows tailored signal assets to meet mission requirements when deployed. Expeditionary signal elements operate with common skills and capabilities at all tactical echelons. These elements include organic assets in the brigade combat team (BCT) signal company and pooled assets in the expeditionary signal battalion to support additional requirements.

BRIGADE LEVEL

5-18. The BCT signal company provides continuous operations to sustain the brigade communications networks. It designs, builds, configures, secures, operates, and maintains automated information systems and networks to support brigade operations and integrate with higher and adjacent units and theater networks. The BCT signal company extends DISN services to subordinate elements through LOS and satellite transport capabilities. The brigade signal company reports to the signal staff officer.

5-19. Communications assets not organic to the brigade signal company, but which are organic to the BCT, may still fall under the signal company's responsibility to configure and install. Other signal assets, such as the very small aperture terminal and TROJAN Special Purpose Integrated Remote Intelligence Terminal, fall under the responsibility of the user to coordinate with the S-6 and integrate with the BCT network.

5-20. Multifunctional support brigades are another substitutable formation type, based on operational specialty. Examples of support brigades are—

- Field artillery.
- Combat aviation.
- Maneuver enhancement.
- Sustainment.

5-21. The expeditionary signal battalion provides communications support to those units without organic signal assets at the theater army, corps, division, and brigade levels. They can also augment units when their communications requirements exceed organic capabilities.

Brigade Combat Team

5-22. SATCOM extends the range of the BCT communications network and provides an internal brigade network down to the maneuver company level. SATCOM support to the brigade includes—

- Milstar EHF MILSATCOM.
- Point-to-point data links to SMART-Ts.
- UHF MILSATCOM data links to Spitfire MILSATCOM terminals fitted on command vehicles.
- TROJAN Special Purpose Integrated Remote Intelligence Terminal point-to-point data links on commercial SATCOM systems.

5-23. The BCT relies on WIN-T for wide-area network support. WIN-T's wideband TACSAT terminals provide transmission for high bandwidth, voice (telephone), battlefield video teleconferencing, data applications, and collaborative planning while at-the-halt or on-the-move.

Expeditionary Signal Battalions

5-24. The expeditionary signal battalion (ESB) provides pooled network provisioning capabilities that support echelons above corps, but they also have smaller teams to support units within a BCT, or when needed to provide network support for natural disaster relief efforts or other emergencies around the world. ESBs build, configure, secure, operate, and maintain their portion of the DODIN-A. Units requiring ESB support gain approval through FORSCOM using the request for forces process (see Army doctrine for signal support).

5-25. ESBs can deploy a tailored capability or an entire battalion, depending on mission requirements. Units with no organic signal capabilities may receive dedicated support from an ESB, or they may be located at a site that permits sharing of existing network support. The ESB structure has multifunctional elements, each containing all of the switching equipment, transmission systems, data network management systems, and network management resources that comprise a complete signal node.

Deployment and Employment of Units

5-26. A robust network of satellites, radios, and tactical communications systems enables the tailored Army unit to connect to the DODIN regardless of their location. These unique capabilities enable the expeditionary joint forces commander to perform missions that are interdependent, globally dispersed, and network-centric.

Pre-deployment

5-27. Signal planners prepare detailed signal plans, which include the SAA, frequency clearance, deployment orders, deployment instructions, and communications cut-sheets. They obtain CCMD J-6 approval before the satellite access phase of any wideband SATCOM mission. Upon receiving the SAA the communications planner—

- Obtains frequency clearance by coordinating with the area or local frequency agencies and authorities.
- Prepares terminal deployment orders and cut-sheets that reflect the approved communications parameters for wideband SATCOM terminal and gateway terminal operators involved in the mission.

5-28. The WSOC updates the control communications subsystem identified in the SAA for positive control. It is the responsibility of the wideband SATCOM network terminal's unit commander to ensure terminals deploy with properly maintained equipment and qualified operators. The wideband SATCOM network terminal operator is the terminal operator and the individual sub-network controller, network controller, and the network terminal operator's leadership.

Deployment

5-29. The wideband SATCOM terminal operator deploys, builds, configures, operates, monitors, and maintains the terminal equipment. The terminal operator reconfigures and adjusts operating parameters in response to WSOC direction to support various tactical missions. The wideband SATCOM network terminal operator responsibilities include—

- Implement and comply with the access and operating procedures found in USASMDC/ARSTRAT Wideband Satellite Communications Operating Procedures V1.0 and other applicable operational documentation.
- Thoroughly review and understand the terminal SAA and/or deployment orders. Configure the terminal with no deviation from the SAA, deployment orders, cut-sheets, and technical manuals.
- Establish and maintain contact with the WSOC via the Replacement Frequency Modulated Orderwire or other dedicated means of communications before accessing the satellite. Immediately establish an alternate means of control communications to maintain positive control, when necessary.
- Establish and maintain user communications according to the SAA and deployment orders and ensure transmissions to the satellite are.
- Make sure qualified personnel staff the terminal and they can promptly comply with WSOC directives.
- Report equipment problems (user communications outages, loss of positive control, and terminal outage problems) promptly.
- Submit Wideband SATCOM 8-hour report information to the WSOC.
- Help the WSOC report, analyze, and resolve persistent, recurring interference incidents affecting communications.
- Prepare a joint spectrum interference resolution report as found in CJCSM 3320.02D and applicable service guidelines.
- Coordinate with the WSOC to resolve network communications disruptions, implement changes in service during a mission, and disseminate control directives or other communications between the WSOC and other network terminal operators.
- Redeploy the network terminal, as required by the local commander or the communications systems managing element, coordinate the move with the WSOC and communications systems planning element, and re-access the satellite.

POSITIVE CONTROL

5-30. *Positive control* the continuous ability to oversee SATCOM access and coordinate necessary changes in the frequency/channel, power level, or network via users assuring terminal(s) use alternative communication means (e.g. radio, telephone, or orderwire, etc.) to coordinate adjusting power levels, frequency, and user terminal modem settings with RSSC or WSOC guidance to prevent interference with adjacent satellite channels and users. All SATCOM access must be under positive control at all times. Access will be denied/terminated to links that lack positive control. As the technology built into systems allow, positive control through automated methods (USSTRATCOM Strategic Instruction 714-04).

5-31. Positive control ensures terminals operate under the established parameters of an SAA according to USSTRATCOM Strategic Instruction 714-04. Wideband SATCOM terminals access only under the conditions of positive control.

5-32. The wideband SATCOM terminal must have a means to contact the WSOC to satisfy the positive control requirement. If positive control is lost, the WSOC can terminate access after coordination with the Wideband C-SSE.

5-33. The WSOC monitors signals transmitted by a wideband SATCOM terminal over a given satellite, communicates with the terminal operators to establish network communications matching the SAA, and maintains orderly network operation. This includes verifying terminal type, location, transmit and receive frequency, data rate, coding, and spectral shape of each carrier. The WSOC can de-access a network terminal if the terminal causes unauthorized access or jamming. If changes in connectivity are necessary during a mission, the WSOC can coordinate the change with the appropriate organizations.

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Appendix A
The Terminal Segment

The terminal segment supports both the Army and joint forces. Global networks extend through DOD gateways to the Soldier operating a ground terminal. This chapter discusses global networks, DOD gateways, and the ground terminals that comprise the terminal segment.

GLOBAL NETWORKS

A-1. SATCOM capabilities enable Soldiers in theater to access local, tactical, and global networks. The DSCS and WGS constellations, and their associated worldwide ground-segment network of control stations, support wideband SATCOM activity for DOD, non-DOD, and international partners. CDRUSSTRATCOM is the DOD SATCOM manager who exercises combatant command authority of on-orbit SATCOM systems. USASMDC/ARSTRAT, as the satellite communications systems expert, provides engineering expertise for DSCS, WGS, GBS, MUOS, AEHF, and Milstar.

A-2. Through its network of WSOCs and RSSCs, USASMDC/ARSTRAT supports USSTRATCOM with control of wideband MILSATCOM assets.

A-3. DOD gateways and RHNs provide access to wideband MILSATCOM and COMSATCOM satellites. The DOD gateways, STEP, Teleports, and RHN interface with the enterprise network for services. The hub nodes extend enterprise services to the tactical network. The remaining global SATCOM constellations are the Milstar, AEHF, UFO, MUOS, and COMSATCOM assets.

DEPARTMENT OF DEFENSE GATEWAYS

A-4. DOD gateways are the sites formerly called the STEP, the upgraded STEP, and the Teleport. DOD gateways connect the tactical world to the enterprise world. This gives tactical terminals access to DISN services and the benefits of an enterprise site. The difference between a STEP and a Teleport is the frequency bands in which they operate. The STEP site operates in the X band. The upgraded Teleport can function in multiple frequency bands. DOD gateways are located across the globe to offer gateway entry points close to warfighters, regardless of where they operate (see figure A-1 on page A-2). For more information on DOD gateways, refer to JP 6-0.

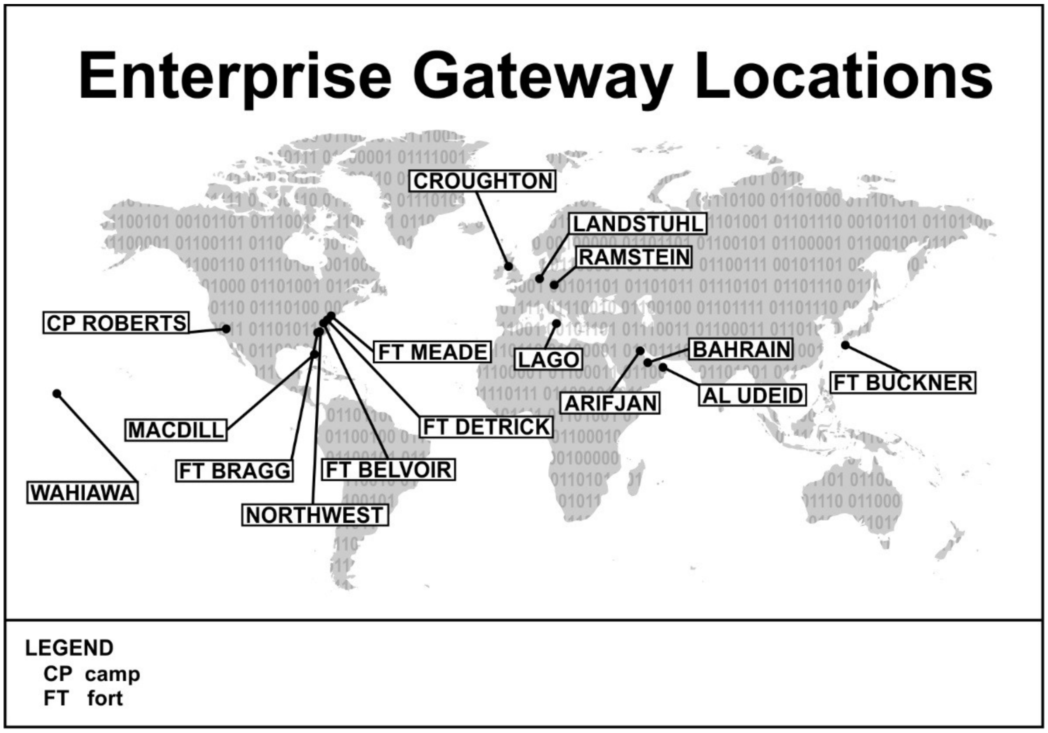


Figure A-1. Department of Defense gateway locations

DOD Gateway Benefits

A-5. DOD gateway access is granted according to established priorities. The following is a list of the operational benefits afforded to users via gateway access—

- On-demand, pre-positioned links to the DSN, Defense Red Switched Network, NIPRNET, SIPRNET, Joint Worldwide Intelligence Communications System, and video teleconferencing.
- Automatic routing and information transfer to Soldiers over the most effective SATCOM network.
- Cross-banding, a means to communicate despite being on different SATCOM systems (C band, X band, Ku band, and Ka band).
- Multi-hop linkages between satellites, to connect fixed and deployed forces using the same frequency band. This extends the range of SATCOM systems that lack crosslink capability.
- Receipt, pass-through, and re-routing of bulk-encrypted information as a normal function.
- Interface with the WSOCs, and other network management facilities to allow remote systems monitoring and management.

Standardized Tactical Entry Point

A-6. STEPs are strategically located, fixed enterprise facilities that provide deployed forces reachback to DISN services. They support multiple contingencies simultaneously, to support the requirements of CCDRs and operational exercises. STEP capabilities are available to CCDRs and the Services on a priority basis. STEPs are joint assets under the OPCON of the Joint Chiefs of Staff through USSTRATCOM.

Single and Dual Standard Tactical Entry Point Sites

A-7. A single STEP site utilizes a single Earth terminal that views only one satellite. A dual STEP site utilizes two or more collocated Earth terminals that view multiple satellites. Both the single and dual STEP sites use a common suite of baseband equipment; however, the dual step requires more equipment and DISN service capacity to satisfy user requirements. Both STEP sites provide the following pre-positioned services:

- DSN.

- Multilevel Secure Voice.
- SIPRNET.
- NIPRNET.
- Joint Worldwide Intelligence Communications System.
- Video teleconferencing.

A-8. Mobile SATCOM terminals access a STEP via wideband SATCOM or COMSATCOM. Baseband equipment within each STEP site links DISN services to tactical users in a theater of operations. Once there, the users can request the services as needed.

TELEPORTS

A-9. The DOD Teleport program expanded a number of the STEP sites providing more connections to DISN services and greater satellite connectivity via L, C, X, Ku, and Ka band, and EHF and UHF satellites. Teleports integrate and expand STEP, Naval Computer and Telecommunications Area Master Stations, and commercial satellite functions into a reliable, accessible, and interoperable system. Teleports support high throughput multiband and multimedia telecommunications services for deployed forces of Services in operational scenarios.

A-10. Teleports provide 24-hour operations, using both military and commercial SATCOM terminals and associated baseband equipment to provide global access. The Teleport (see figure A-2) provides a connection to the DISN infrastructure on military and commercial SATCOM frequency bands used by Soldiers.

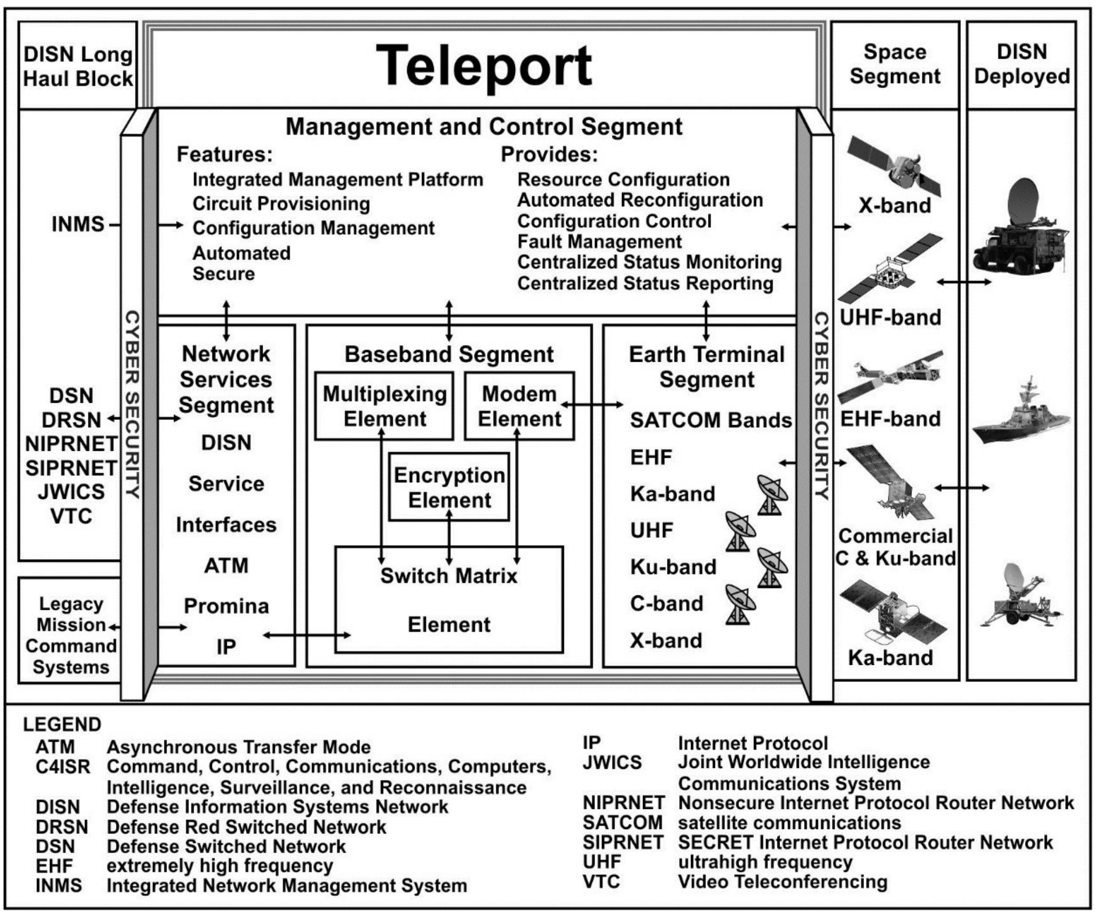


Figure A-2. Teleport program

GROUND TERMINALS

A-11. Ground terminals serve to connect satellite constellations in the communications architecture. Ground terminals offer rapid support often resulting in economies in maintenance, supply, training, and other logistics while conserving the radio frequency spectrum. The terrestrial segment has ground terminals programmed to provide direct transmission of signals to and from interoperable systems, or for access to the satellites for relaying signals over long distances.

ENTERPRISE TERMINALS

A-12. Enterprise terminals are fixed-station, heavy, or medium expeditionary terminals that provide international SATCOM trunking for the Defense Communications System. Enterprise terminals are interoperable with tactical terminals. The following paragraphs provide an overview of Army enterprise SATCOM terminals.

AN/FSC-78(V)

A-13. The AN/FSC-78(V) is a fixed SHF SATCOM heavy terminal (see figure A-3 on page A-5) capable of providing many (actual number is dependent on site equipment) transmit and receive carriers for both voice and high data rate traffic. Transmit frequency is from 7.9–8.4 GHz and the receive frequency is from 7.25–7.75 GHz. This terminal system comprises six subsystems: antenna, antenna tracking servo, transmitter, receiver, frequency generator, and control and monitoring. The AN/FSC-78(V) terminal has redundant subsystems with automatic switchover and fault isolation capability. The antenna for the AN/FSC-78(V) is a 60-foot diameter, high-efficiency, parabolic reflector mounted on a specially configured pedestal providing an antenna gain-to-noise temperature ratio of 39 decibel/K (18–27 GHz).

Figure A-3. AN/FSC-78 terminal

AN/GSC-39(V)

A-14. The AN/GSC-39(V) has a 38-foot diameter, high efficiency reflector and a pedestal housing the drive mechanism. The steerable, rear-fed antenna provides high quality, intermodulation-free SHF transport. The AN/GSC-39(V) features wideband access at 70 and 700 MHz intermediate frequency to accommodate both analog and digital interfaces. The AN/GSC-39(V) is the same as the AN/FSC-78, except for the size of the antenna.

A-15. AN/GSC-39 has two versions: V1 is fixed and V2 is transportable Major components are interchangeable between versions. (See figure A-4 on page A-6.)

Figure A-4. AN/GSC-39(V1) terminal

AN/GSC-52(V)

A-16. The AN/GSC-52(V) is a high capacity, SHF, medium SATCOM terminal designed to operate with DSCS, WGS, and NATO satellites. It is capable of either attended or unattended operation. The AN/GSC-52(V) has 12 upconverters and 12 downconverters, capable of expanding to 18 each. The AN/GSC-52(V) transmits from 7.9 to 8.4 GHz and receives at 7.25 to 7.75 GHz. The terminal design allows placement in a government furnished electronic equipment building or in modified vans. The antenna is a parabolic, 38-foot diameter, OE-371/G. (See figure A-5 on page A-7.)

Figure A-5. AN/GSC-52(V) terminal

Ka band Satellite Transmit and Receive System

A-17. The Ka band Satellite Transmit and Receive System (Ka-STARS) provides wideband communications to meet user operational requirements while leveraging the WGS system. Ka-STARS alleviates X band spectrum saturation. Ka-STARS terminals provide additional terminals for mission support, increasing the pool of resources (power, bandwidth, DODIN access). The Ka-STARS provides connectivity from early warning, sensor sites, and intelligence agencies to command centers and information processing centers. The operational objective of the Ka-STARS is to provide continuous high-quality communications.

A-18. The Ka-STARS design complies with the joint technical architecture used in the WGS system, Ka band, and other commercial satellites. It is in a fixed configuration, but is capable of relocation. The Ka-STARS control, monitor, and alarm subsystem allows for local or remote operation and integration with WSOC network control facilities.

Modernization of Enterprise Terminals

A-19. The modernization of enterprise terminals acquisition program is replacing aging, bandwidth-limited infrastructure (Ka-STARS terminals AN/GSC-52, -39, -70 and AN/FSC-78 terminals). Along with the new antennas (4.8 m-7.2 m-12.2 m), the modernization program upgrades associated SATCOM equipment including control, monitor, and alarm; performance measurement and testing; frequency and time standard; and transmit and receive subsystems. These new terminals come in various models from fixed, high-altitude electromagnetic pulse hardened, to mobile configurations. (See figure A-6 on page A-8.) Nomenclature for each system changes to AN/GSC-52B(V) x, where x identifies the capability of the terminal. Unique characteristics of these terminals are—

- Communicate with WGS, DSCS X band, and commercial satellites.
- Transmit and receive X and Ka frequency bands.

- Perform dual-polarization operations in Ka frequency band.
- Control, monitor, and alarm up to six modernization of enterprise terminals from a single console

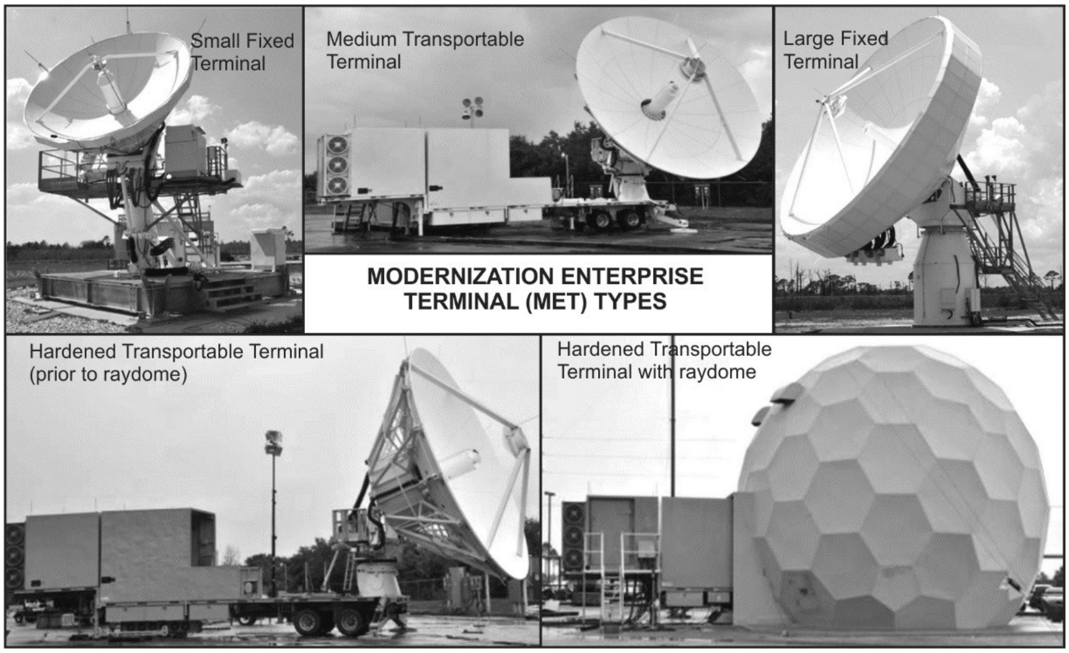


Figure A-6. Family of modernization enterprise terminals

WIDEBAND TACTICAL TERMINALS

A-20. Army wideband tactical terminals provide tactical satellite (TACSAT) ground and commercial terminal services that enhance efficiency of deployment and mobility. Wideband tactical terminals operate over C, Ku, Ka, and X frequencies. They provide commanders with reliable communications across the globe and provide flexibility in integrating the joint communications network. Wideband terminals enable the geographic combatant commander to execute multiple missions simultaneously. All these terminals conform to established standards and protocols for the network, interfacing with and/or replacing equipment in legacy and interim forces.

AN/TSC-86

A-21. The AN/TSC-86 is a contingency SATCOM terminal and has been modified and upgraded several times. The AN/TSC-86A terminal is a mobile configuration, the AN/TSC-86C is a fixed version. This terminal can simultaneously communicate with up to four other terminals. The AN/TSC-86 performs modulation and demodulation, multiplexing, and signal conditioning to process voice and digital data signals.

A-22. This terminal transmits at 7.9–8.4 GHz and receives at 7.25–7.75 GHz. Power comes from two palletized 30 kW generators that deploy with the terminal. The terminal uses either an 8-foot (AS-3036) or 20-foot diameter (AS-3199) antenna. (See figure A-7 on page A-9.)

Figure A-7. AN/TSC-86A terminal

AN/TSC-93E(V)1 (Lynx) Terminal

A-23. The AN/TSC-93E TACSAT terminal (Lynx) is a multichannel SHF terminal that receives, transmits, and processes low, medium, and high-capacity multiplexed voice and digital signals over DSCS and WGS satellites. The AN/TSC-93E operates as a point-to-point or multi-point trunking facility. As a spoke terminal, it can communicate with one other GMF terminal, providing circuit and range extension data rates up to 52 Mbps in FDMA mode, and 3 Mbps uplink and 18 Mbps downlink in TDMA mode.

A-24. The AN/TSC-93E provides one secure link plus orderwire and overhead via the use of a tactical satellite signal processor (hub-spoke). The terminal carries a first level multiplexer and can interface directly with 70 MHz intermediate frequency sources. The terminal typically operates with an integral AS-3036A 8-foot ground mounted dish antenna. Additional upgrades include L-band ports added to the signal entry panel. This upgrade allows the terminal to support additional antenna types other than the AS-3036A antenna. The terminal does not have redundancy, but some variants carry on-board hot spares. The terminal is in one S-250 shelter and operated by a crew of three 25S Soldiers. There are AN/TSC-93 terminals in expeditionary signal battalions in lieu of Phoenix terminals.

A-25. The S-250 shelter mounted on a Silver Eagle Tactical Trailer meets the Army's up-armor requirements by distributing the weight of the Lynx shelter over the axle allowing the vehicle to tow significantly more weight. The 8-foot antenna is in a purpose built pallet carried by a second heavy high mobility multipurpose wheeled vehicle with two generators and a power synchronization switch. The generator trailer has a built-in fuel cell with the capacity to shift fuel system usage when fuel is low for more than 40 hours of continuous operation. The terminal can also operate using commercial three phase power sources. Setup time is approximately 30 minutes using a three-person crew. The AN/TSC-93E can rol1-on/rol1-off of C-130, C-141, and C-17 aircraft. (See figure A-8 on page A-10.)

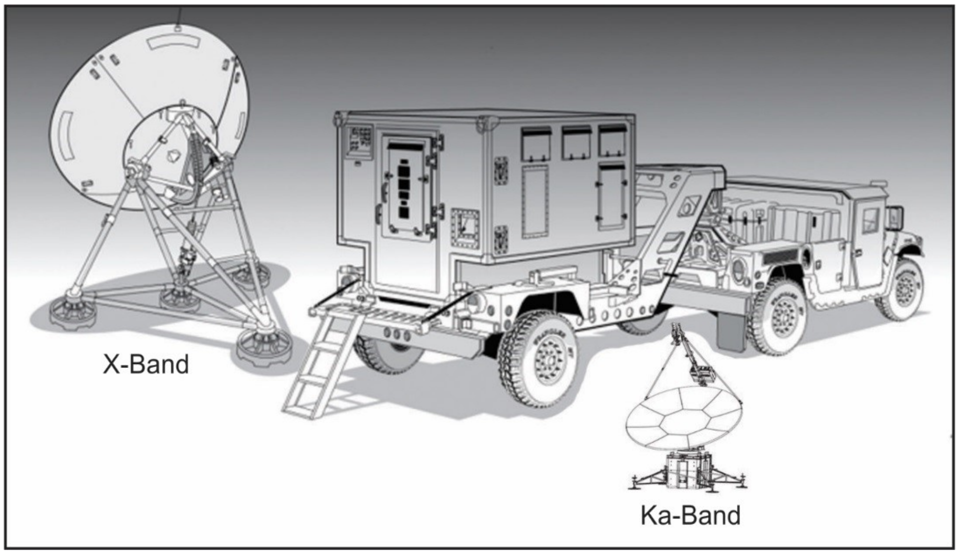


Figure A-8. AN/TSC-93E Lynx terminal

AN/TSC-156 (Phoenix) Terminal

A-26. The Phoenix terminal is a transportable wideband TACSAT terminal operating in the C, X, Ku, and Ka bands. It provides flexible, mobile, high capacity, range extension through military and commercial satellites. The Phoenix can interface with strategic networks using the replacement frequency modulation orderwire. Phoenix terminals replaced all AN/TSC-85 terminals in designated signal units. Current upgrades have added TDMA and IP interfaces to make the Phoenix interoperable with the WIN-T network.

A-27. A Phoenix terminal has an integrated assemblage of non-developmental items, commercial off-the-shelf and government furnished equipment, and those items adapted for Army use to meet the military specified requirements. Phoenix terminals are backward-compatible with legacy GMF satellite terminals (X band only) to the second level multiplexer and will support up to four full-duplex links deployed in hub-spoke, hybrid mesh, or point-to-point configurations.

A-28. Phoenix terminals operate over either military or commercial satellites, and provide high capacity communications links to support voice and data up to 52Mbps via two carriers. A Phoenix terminal may interface with other strategic networks via STEP or strategic assets. It can also operate with the light-weight high gain X-band antenna to provide connectivity at the edge of satellite footprints, or to reduce satellite gain requirements. In commercial bands, Phoenix terminals can use standard commercial gateways or DOD gateways. (See figure A-9 on page A-11.)

Figure A-9. AN/TSC-156 Phoenix terminal

AN/TSC-154A Secure Mobile Anti-Jam Reliable Tactical Terminal

A-29. The AN/TSC 154A SMART-T is a transportable, multichannel protected (anti-jam) SATCOM terminal (see figure A-10 on page A-12) that operates in the EHF range. The SMART-T provides protected range extension for tactical command posts at corps, division, BCT, fires and combat aviation brigades, and expeditionary signal battalions (ESB) to provide protected SATCOM as needed. The SMART-T operates over the LDR and MDR EHF payloads on Milstar satellites, and the XDR payload on AEHF satellites. The SMART-T provides a protected link for critical mission command traffic for forward deployed enclaves. This will ensure and defend communications so commanders can execute mission command during a jamming event.

A-30. The SMART-T processes data and voice communications services up to 8.192 Mbps in the XDR mode over AEHF. It can also provide both LDR (up to 2.4 kbps) and MDR (up to 1544 kbps) services simultaneously on Milstar or over AEHF in the Milstar backwards compatible mode if AEHF resources are not available. The SMART-T uses fiber, conditioned diphase interface, and non-return to zero serial interfaces. Application of an Internet Protocol interface upgrade is programmed for FY18. The SMART-T also accommodates non-WIN-T baseband configurations used by joint Services, and is fully interoperable with all Joint EHF (Milstar) and AEHF TACSAT terminals. This provides the flexibility for a SMART-T to connect to, and draw services from, a Teleport site using a Navy EHF terminal, when required.

A-31. SMART-Ts have different role definitions assigned by the privilege level associated with the terminal identification number. Terminals can simultaneously fill roles as a net member terminal, network or communications controller, and or an antenna controller. The SMART-T can log on to the satellite and use authorized resources, join and exit services as required (SMART-Ts receive Milstar or AEHF keys over-the-air once logged on to the satellite). They can also send and receive over-the-air-data-distribution transfers from other terminals, monitor satellite resources, add or delete net members from services, and or move satellite antenna beams, if required and authorized by terminal role and privilege.

A-32. The SMART-T can support up to four digital transmission paths for use as protected WIN-T inter nodal links. Additionally, the SMART-T can support other voice and data network and point-to-point services simultaneously. AEHF SMART-T communications capacity is a function of data rate and uplink modulation mode for each user link and service. It can support a mix of networks and services simultaneously, as long as the data rates do not exceed the aggregate AEHF threshold of 8.192 Mbps.

A-33. The SMART-T is a HMMWV mounted palletized system. It can be set-up and torn down in less than 30 minutes. It is C-130 roll-on and roll-off capable and CH-47 and UH-60 sling-loadable. The SMART-T has a remote control capability, allowing unmanned monitoring and operating. However, it must remain within the manned security perimeter of the command post. SMART-T provides a flexible and highly reliable protected capability for the warfighter.

Figure A-10. Secure Mobile Anti-Jam Reliable Tactical Terminal

Global Broadcast Service Receive Suites

A-34. The receive segment consists of various Service-specific receive suites. Those include receive broadcast manager and associated terminal equipment to receive and process broadcast products for distribution to end users. Receive suites can operate in either the military Ka band or commercial Ku band, but not simultaneously in both bands.

A-35. The location of the receive suite is network dependent. If located with units that have access to high bandwidth, the receive suite may be found with the S-6 or G-6 for management. Any SIPRNET traffic required would be passed down to the G-2. For units with limited bandwidth allocations, the receive suite would be found in the G-2 secured area for management and access.

Global Broadcast Service Tactical Receive Suite

A-36. The standard GBS receive suite designed for fixed tactical locations is the same across the Services. The Army uses the AN/TSR-8 and the AN/TSR-11, the Marine Corps and Navy use the AN/TSR-9, and the Air Force uses the AN/TSR-10. Figure A-11 shows the major components of the tactical receive suite.

A-37. The next generation receive terminal is a transportable earth station receiving antenna, consisting of a five-piece segmented circular center fed reflector, gimbaled pedestal, integrated electronics with tracking receiver and controller, and light weight tripod. In addition, the next generation receive terminal suite comes with a laptop computer, referred to as the Server. The next generation receive terminal suite is stored in two transit cases— one for the reflector, and the other for the controller and grounding kit. The next generation receive terminal broadcast manager, crypto device, and other associated equipment are housed in a separate transit case.

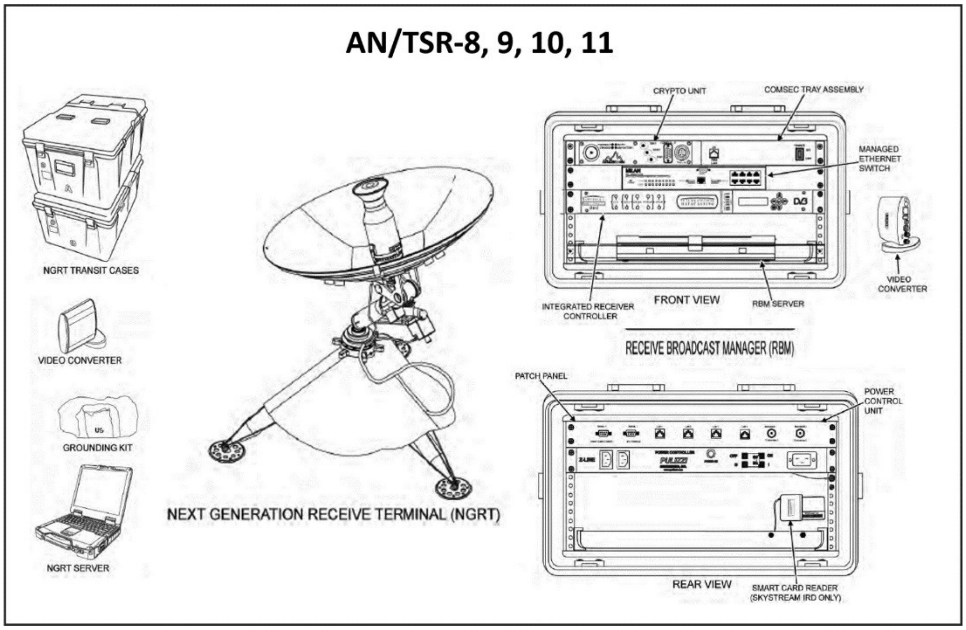


Figure A-11. Global Broadcast Service tactical receive suite

Global Broadcast Service Portable Receive Suite

A-38. Two variants of the GBS receive suite designed for special mission users requiring a lightweight suitcase or man portable models are the AN/PRC-11 (suitcase) and the AN/PRC-12 (rucksack). Both versions operate over the UFO or WGS satellites and meet military standard 810G requirements. These versions have incorporated high-assurance IP encryption devices, allowing reception of up to top secret/sensitive compartmented information data. (See figure A-12 on page A-14.)

A-39. These portable GBS receivers allow users to access unmanned aircraft imagery including forward-looking infrared imagery as well as terrain, geospatial, mapping information, and large full motion video. For improved signal reception when signal attenuation to weather effect or edge of beam conditions require additional signal gain, an optional 60 cm parabolic dish can be used.

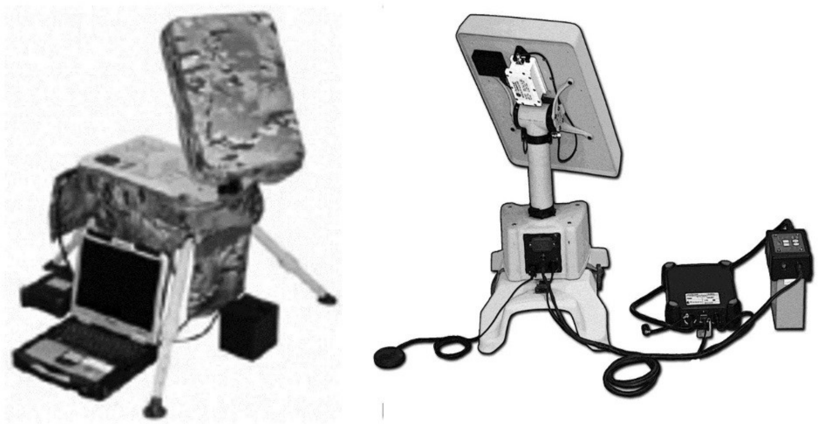


Figure A-12. Global Broadcast Service portable receive suite

Global Broadcast Service Access procedures

A-40. A GMR starts, stops, drops or changes services. Users submit requests 14 days before viewing date to the theater injection manager. The theater injection manager reviews the GMR and passes it to the satellite broadcast manager for final approval. Once approved, the user receives a mission data sheet with all information needed to configure equipment to receive the requested data. Select the access to approved service from a single channel guide for news, multimedia sources, imagery, intelligence and full motion video. For users without access to JIST, utilize the Global Broadcast Service (GBS) Mission Request (GMR) Template located at the DISA GBS Satellite Broadcast Manager website.

AN/USC-60

A-41. The AN/USC-60 flyaway tri-band satellite terminal is a commercial off-the-shelf terminal supporting deployed communications and special user requirements. The terminal can operate in C, X, and Ku bands. It has a 2.4-meter antenna that unfolds. These specifications make the AN/USC-60 highly transportable.

A-42. The flyaway tri-band satellite terminal operates from, and is transportable in, ruggedized transit cases. The transit case units are commercial airline checkable for ease of deployment. The terminal is also transportable by pallets by military aircraft. Terminal set-up and satellite acquisition takes less than 60 minutes. The flyaway tri-band satellite terminal provides worldwide SATCOM operating over any of the following satellite systems—

- DSCS III.
- NATO IV.
- WGS.
- UFO.
- C and Ku band commercial satellites.

A-43. The flexible architecture of the AN/USC-60 terminals easily accommodates expansions for digital video, digital voice or facsimile transmission, secure communications, and network control (see figure A-13).

Figure A-13. AN/USC-60 flyaway tri-band satellite terminal

SIPRNET/NIPRNET Access Point

A-44. Like the AN/USC-60, the SIPRNET/NIPRNET Access Point terminals (see figure A-14 on page A-16), are commercial off-the-shelf, user-operated TACSAT terminals. It is a component of WIN-T program of record. It is designed to provide BLOS, voice, video and data communications and network capability down to the company, platoon and, team level.

A-45. The SIPRNET/NIPRNET Access Point has two variations, the 1.2-meter and 2.2-meter terminal. The variants support access to X and Ka band satellites based on the unit's mission. The transit case design allows rapid deployment and operation over either DSCS or WGS satellites.

A-46. The SIPRNET/NIPRNET Access Point has a custom outdoor equipment enclosure, which houses an integrated spectrum analyzer and an auxiliary control unit for auto-acquisition. It has a built in uninterruptible power supply. This design allows for an operational readiness in under 30 minutes.

Figure A-14. SIPRNET/NIPRNET Access Point

AN/GSR-42A

A-47. The AN/GSR-42A tactical single channel transponder receives emergency action messages transmitted over DSCS-III satellites. The tactical single channel transponder receiver can receive, demodulate, and extract near real-time messages from the DSCS beacon. The downlink frequency can be fixed or hopping over a wideband or narrowband frequency range. After messages complete tail parity checks, they transfer to the thermal printer for hard copy. For the tactical single channel transponder receiver installed in a building, the demodulator, access controller, power control unit, battery backup and transmission security group (KI-36) are collocated in the equipment room, and the printer can be up to 1,500 feet away in the operations center.

NARROWBAND TACTICAL TERMINALS

A-48. This section addresses the space and ground terminal segments of the Army military narrowband UHF (single channel) SATCOM architecture. Narrowband terminals transmit and receive over 5 kHz and 25 kHz channels. Narrowband UHF SATCOM provides vital BLOS communications capabilities for emergencies, tactical operations, and special forces operations. It supports battlefield voice and data range extension requirements. Narrowband terminals are preferred for initial communications contingency situations, since the terminals are small, light, and very mobile. Disadvantages of narrowband terminals are difficulty in obtaining access to the UHF space segment and the lack of AJ capability for threat mitigation. For more information on UHF SATCOM radios see ATP 6-05.90.

AN/ARC-210 Terminal

A-49. The AN/ARC-210 series of radios are mainly for aircraft. The radios are multiband very high frequency (VHF) and UHF, and have AJ capabilities. The unit weighs only 12 pounds, and can transmit 23 watts in certain modes. Mounted and outfitted with a low-high angle UHF SATCOM antenna, the AN/ARC-210 is SATCOM capable.

AN/ARC-231 (Skyfire) Terminal

A-50. The Skyfire terminal is the airborne-capable version of the AN/PSC-5D multiband, multimode radio. The Skyfire is a VHF, UHF, LOS, and SATCOM, demand assigned multiple access (DAMA) radio. It supports Army requirements for airborne, multiband, multi-mission, secure, AJ voice, data, and imagery. It uses military standard software and waveforms so it is interoperable across Services and in joint operation.

AN/PRC-117G Multiband Manpack Radio

A-51. This radio is software-defined, and has the capabilities to provide wideband data performance and legacy narrowband interoperability operating from 30 MHz to 2 GHz. The AN/PRC-117G is compatible with broadband area global network terminals. It can store multiple mission fill files and has an embedded selective availability anti-spoofing module GPS receiver to display position information, which it can report on situational awareness applications. It can hold up to 300 communications security keys. It has a removable front plate for ease of remote operations in manpack or mounted configuration.

AN/PRC-152

A-52. The AN/PRC-152 provides SATCOM support while moving or in a fixed configuration. To communicate over the satellite, the radio is equipped with either a UHF high gain or UHF SATCOM antenna. The radio uses UHF and VHF LOS waveform programming. The radio uses 5 kHz (presets 9-128) and 25 kHz channels (presets 129-239) over UHF satellite constellation. When operating in SATCOM mode, the radio operates in high power (5 watts).

AN/PRC-155

A-53. The AN/PRC-155 is man-portable, vehicle-mounted, or fixed site configurable. It becomes SATCOM capable when configured with the SATCOM, UHF high gain, or vehicle mounted antennas. GPS functionality is built-in to the radio, providing the means to interface with other GPS units. The AN/PRC-155 can provide secure SATCOM utilizing the UFO or MUOS constellation. The radio has two half-duplex channels. The two channels give the radio the ability to cross-band a user. The radio can receive a VHF user on one channel, and retransmit over UHF SATCOM on the other channel.

AN/PSC-5 Terminal

A-54. The AN/PSC-5 (Spitfire) terminal provides wideband and narrowband range extension for voice and data in manpack configurations. The Spitfire radio replaced the existing inventory of single channel SATCOM radios, adding embedded communications security and DAMA capabilities.

AN/PSC-5C Terminal

A-55. The Shadowfire terminal has upgrades over the Spitfire including—

- Improved voice encryption.
- Noise canceling and frequency hopping capabilities.
- Maritime capability.
- HAVE QUICK and HAVE QUICK II capabilities in airborne operations.
- Expanded frequency range.

AN/PSC-5D Multiband, Multi-Mission Radio

A-56. The multiband, multi-mission radio has the capabilities found in the AN/PSC-5 series terminals, and additional capabilities—

- Extended UHF frequency range to 512 MHz.
- Black key database (up to 500 additional communications security keys).
- Fully programmable software.

Combat Survivor Evader Locator Radio

A-57. The combat survivor evader locator system is an end-to-end rescue recovery system with three segments. The combat survivor evader locator radio is useful for special forces operating in or near enemy territory. It consists of a terminal segment that has a handheld radio, a UHF space segment, and a control segment. The control segment consisting of multiple command, control, and communications workstations is located in joint search and rescue centers.

A-58. The combat survivor evader locator radio supports rapid recovery operations. The radio provides the location of an isolated Soldier using geo-positioning to facilitate rescue or recovery operations. The combat survivor evader locator encrypts transmissions and has a 10-day battery life. The radio enables a Soldier to send pre-programmed messages or text messages to describe situations.

A-59. Before a mission, the combat survivor evader locator radio is loaded with operation-specific information including maps, personal data, GPS coordinates, and encryption keys. If a Soldier requires extraction, the radio signals a UHF satellite. The signal is sent via SIPRNET to one of the four joint search and rescue centers. An acknowledgment message goes back to the Soldier. The Soldier authenticates his identity and responds to questions with yes and no answers in text format. Messages continue while the rescue center attempts to determine the user's location. When the recovery team is ready for the extraction, the Soldier can shift to VHF mode so they can talk directly to the recovery aircraft.

WARFIGHTER INFORMATION NETWORK-TACTICAL SATELLITE COMMUNICATIONS

A-60. WIN-T is the program of record for acquisition of the evolving system of systems geared to provide Soldiers with seamless, anytime access to the DODIN in a deployed environment. WIN-T provides the network transport and information services that allow commanders to execute mission command on-the-move or at-the-halt. WIN-T is a collection of transportable communication equipment that integrates hardware and software with high-band networking waveform LOS and network centric waveform SATCOM. WIN-T enables collaboration from the division to the company level.

A-61. WIN-T's self-forming and self-healing network architecture helps mitigate adversary effects when operating in a contested environment. The communications-in-depth architecture includes redundant network transport capabilities to dynamically recover and reestablish network connectivity if either line of sight or the satellite communications link is disrupted. Because WIN-T uses internet protocol routing, removing one node (even a key node) from the network does not interfere with the rest of the network's ability to communicate.

A-62. WIN-T increases capabilities incrementally—

- Increment 1. Networking at-the-halt capability down to the battalion level, referred to as WIN-T.
- Increment 1a. Extended networking at-the-halt. Upgraded to Lot 10 and added Ka band capability.
- Increment 1b. Enhanced networking at-the-halt. Introduced the NCW modem.
- Increment 2.Initial networking on-the-move capability down to company level.
- Increment 3. Provides enhanced DODIN operations upgrades; waveform management for NCW and HNW.

A-63. The WIN-T architecture has several systems capable of SATCOM located from division to company. Table A-1 on page A-19 outlines assets available at each echelon. For more information on WIN-T, see ATP 6-02.60.

Table A-1. Mobile Warfighter Information Network-Tactical satellite communications capabilities

Echelon	*Tactical Hub Node*	*Tactical Communications Node*	*Satellite Transportable Terminal*	*Point of Presence*	*Soldier Network Extension*
Division	X	X	X	X	
Brigade		X	X	X	
Battalion		X	X	X	
Company					X

REGIONAL HUB NODE

A-64. The *regional hub node* is a component of the network service center, which provides a transport connection between the Warfighter Information Network-Tactical and the wider Department of Defense information network (ATP 6-02.60). The RHN allows pre-positioned satellite, voice, and data services to support deploying forces in a theater of operation and connect Soldiers to the DISN. RHN locations provide near global coverage, while the tactical hub node is available to service units deployed outside RHN coverage. The RHN consists of three 9.2 meter antennas and ancillary communications equipment that can operate over either Ku or Ka band. They can support up to 3 Army divisions and 12 separate enclaves, or up to 56 discrete missions. RHN access allows forces to mobilize without having to develop transport and network access solutions. The theater strategic signal brigade operates network service centers that support the geographic combatant commanders.

A-65. Army airborne command and control and mounted situational awareness applications on-the-move are available through the RHN and WIN-T. These capabilities allow commanders to remain mobile without a decrease in situational understanding. For more information on the RHN see ATP 6-02.60.

TACTICAL HUB NODE

A-66. The tactical hub node uses the AN/TSC-187 unit hub SATCOM truck to support the organic WIN-T systems of one division. It merges the TDMA and FDMA satellite network architectures. It provides end-to-end network transport to extend DISN services to the deployed tactical network. The tactical hub node consists of three major subsystems—one baseband shelter and two TDMA and FDMA capable SATCOM shelters. The SATCOM shelters provide master network timing for TDMA networks.

A-67. Both TDMA and FDMA equipment shelters reside on a 5-ton family of medium tactical vehicle. Each truck has a mounted 6.3 meter Ku, Ka, or X band antenna. Each of the satellite equipment shelters houses a master reference terminal for all the TDMA subnets (one subnet per BCT, brigade, and division).

TACTICAL COMMUNICATIONS NODE

A-68. The Tactical Communications Node (see figure A-15 on page A-20) utilizes the M20 antenna for SATCOM. This 20-inch antenna can provide SATCOM connectivity while on-the-move or at-the-halt. The AN/MRC-82 can use the larger Satellite Transportable Terminal (STT) series of antennas while at-the-halt. The Tactical Communications Node can also use a Phoenix or SMART-T to provide communications, as mission dictates. The STT series allows Ku and Ka band communications. The M20 is upgradeable to multiband capability and the model with the Tactical Communications Node can communicate in Ku and Ka bands. A typical brigade has eight Tactical Communications Nodes.

Figure A-15. Tactical communications node

SATELLITE TRANSPORTABLE TERMINAL

A-69. The STT has evolved during the WIN-T increment process. All versions can operate over Ku or Ka frequency bands. The various differences and techniques used by each are discussed below.

AN/TSC 167A (V) Satellite Transportable Terminal

A-70. The AN/TSC-167A(V) STT system (see figure A-17) is a lightweight, compact, 2.4 meter Ku antenna that has integrating foldable panels for transportation. The system has a Ku band equipment rack that houses the antenna control and radio frequency equipment. The AN/TSC-167A (V)1 supports both TDMA and FDMA SATCOM. The AN/TSC-167A(V)2 supports the Command Post Node, and only provides TDMA SATCOM.

AN/TSC-185 Satellite Transportable Terminal

A-71. The AN/TSC-185 STT system (see figure A-17) is a durable, trailer-mounted terminal. Originally fielded as part of the Joint Network Node, the terminals were part of the evolution to WIN-T. The terminals have high throughput (20 Mbps standard and 50 Mbps optional), multiband (Ku, Ka) capability. The STT uses a 2.4 meter satellite antenna. Several versions of this terminal exist.

- AN/TSC-185(V)1 is FDMA and TDMA capable.
- AN/TSC-185(V)2 is TDMA only, and is found in Inc. 1 Command Post Nodes.
- AN/TSC-185(V)3 or STT+ is found in initial WIN-T Inc. 2 units TDMA network. The upgrade includes the addition of the Distributed Computing Element for node management and the Network Centric Waveform modem.

AN/TSC-202 High Power (HP) and AN/TSC-208 Satellite Transportable Terminal

A-72. The AN/TSC-202 and AN/TSC-208 (see figure A-16 on page A-21) are similar to the AN/TSC-185 with minor differences. Those include a round 2.5 meter antenna, a tri-leg stabilized trailer platform, and a 400 Watt high power amplifier for both Ku and Ka band operation. The one upgrade the AN/TSC-208 has over the AN/TSC-202 is a reduced size communications and equipment enclosure, which allows full front and rear equipment access.

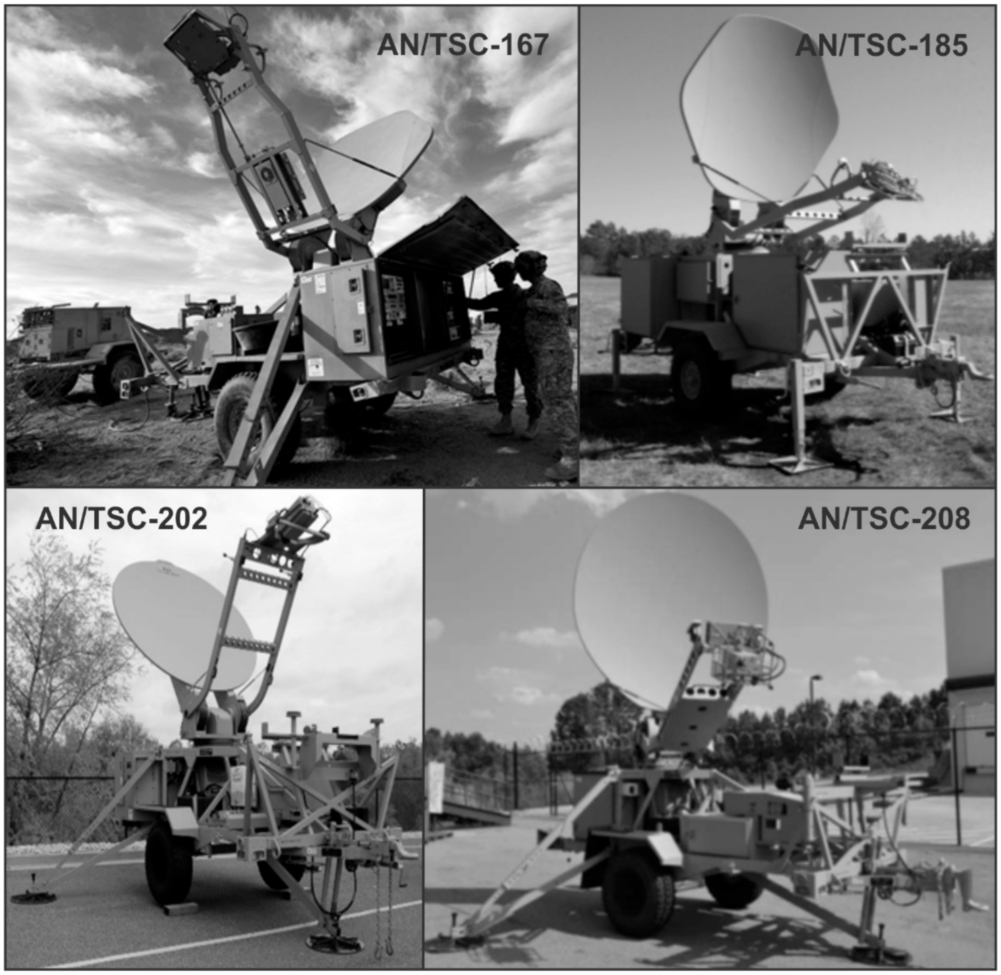


Figure A-16. Satellite transportable terminal

POINT OF PRESENCE

A-73. The Point of Presence uses the Highband Radio Frequency Unit and associated Baseband Processing Unit to provide self-forming, self-healing LOS links with associated neighbors. The AN/MRC-150 is equipped with the M20 parabolic SATCOM antenna using either Ku or Ka band. This and the network centric waveform modem provide a backup BLOS communication link with other members of the network. This lighter and more agile unit provides division, brigade, and battalion commanders a satellite interface in remote areas not possible with LOS radios. It is capable of communications on-the-move or at-the-halt. A typical brigade has seven Point of Presence vehicles. One version is shown mounted on a high mobility multipurpose-wheeled vehicle. (See figure A-17 on page A-22.) The terminal can also mount on a mine-resistant ambush protected tactical vehicle or a Stryker, based on the unit's mission.

Figure A-17. Point of Presence

SOLDIER NETWORK EXTENSION

A-74. The Soldier Network Extension uses an 18-inch Daytron Fixed parabolic antenna. Like the M20, this antenna can communicate on-the-move (<60 miles per hour) or at-the-halt in Ku and Ka bands. This extends the network to the company level for the first time. The AN/MRC-149 does this by using the Combat Network Radio gateway that converts the unit's analog radio signal into internet protocol format for processing through its satellite communications link. Figure A-18 shows the Soldier Network Extension mounted on a mine-resistant ambush protected vehicle. The Soldier Network Extension can also mount on a high mobility multipurpose-wheeled vehicle or a Stryker, based on the unit's mission.

Figure A-18. Soldier network extension

Appendix B
Global Positioning System

The DOD developed the GPS in the 1970s, it is a space-based, all weather, and continuous-operation radio navigation system. It is a multi-use DOD owned and operated, satellite-based navigation system. The Army relies on the use of the GPS in all of its SATCOM systems. The use of GPS technology in commercial industry has grown rapidly. This appendix covers how the military uses GPS, how GPS works, and the GPS system segments.

GLOBAL POSITIONING SYSTEM ROLE IN THE MILITARY

B-1. The GPS' common-datum, common-grid, and common-time capabilities aid across the range of military operations. GPS establishes an unambiguous correlation in four dimensions (altitude, latitude, longitude, and time) between a target and a dynamic weapon system aimed at that target. This provides increased probability of kill for any particular weapon, increased force employment efficiency for military mission planners, and lower risk for the military members and units executing the missions. GPS improves the odds of hitting the target compared to other targeting technologies.

B-2. GPS requires no electronic transmissions for access. It enables safe, efficient, precise operations in situations where complete radio silence is required. Its functionality integrates with most DOD warfighting and support systems, including communications and automated information systems. The military uses GPS for—

- Air operations.
- Naval operations.
- Land operations.
- Space operations.
- Weapons delivery.
- Targeting.
- Special operations.
- Mine clearing and explosive ordnance disposal.
- Search and rescue.
- Communications.
- Intelligence, surveillance, and reconnaissance.
- Network-centric operations.
- Operational awareness.

AIR OPERATIONS

B-3. The GPS enables precision in manned and unmanned air operations. It permits point-to-point air navigation anywhere in the world without relying on ground-based navigation aids or ground control through all phases of flight, up to precision approach and landing. GPS works best in aircraft applications combined with inertial navigation. GPS allows lower cost inertial systems than would otherwise be required if the inertial navigation system were stand-alone.

B-4. The GPS positions relayed across Joint Tactical Information Distribution System communications networks, affording air commanders continuous precise positional information for air assets. Aircraft and guided munitions both employ GPS.

Maritime Operations

B-5. A GPS receiver enables seamless, global maritime navigation on the open ocean, littoral waters, harbors, and inland waterways. It improves safety of close proximity operations at night and under limited visibility.

Land Operations

B-6. GPS enables efficient and safe land operations globally. With properly gridded maps, GPS enables ground forces to conduct coordinated operations in featureless terrain. Combined with laser rangefinders, it can precisely determine target coordinates from a distance for attack by guided munitions. Integrated with tactical secure communications devices, GPS gives commanders continuous awareness of force location and movement for more effective operations and to mitigate fratricide. Forests, mountainous terrain, and urban areas may interfere with GPS reception.

Space Operations

B-7. The GPS constellation orbits at an altitude of about 11,000 miles. It enables highly precise and continuous determination of satellite orbits out to about 22,000 miles (35,405 km). For satellites orbiting below 4,000 miles, continuous point positioning is possible, as with aircraft navigation. Satellites at or above medium Earth orbit use serial data collection techniques for orbit determination.

Weapons Delivery

B-8. GPS enables all-weather, day or night precision weapons delivery. It improves employment, efficiency, and accuracy of guided bombs, missiles and artillery systems, and aircrew safety by enabling weapon release farther from targets. It also improves safety for forces in close contact with adversaries by enabling precise guided bombing or artillery fires against GPS-designated target coordinates.

Targeting

B-9. Target location error is the single largest contributor to total system error when employing GPS guided munitions against fixed targets. GPS enhances the precision of targeting, works with laser range finders used by ground forces and forward air controllers, and determines the relative positions of the target and the aircraft.

Special Operations

B-10. GPS enables covert and precise day/night rendezvous on land, sea, and air under any weather condition. Precise position and timing information makes it possible to rendezvous without radio transmissions or other displays that might attract unwanted attention.

Mine Clearing/Explosive Ordinance Disposal

B-11. GPS, combined with other navigation techniques, enables precise charting of minefields on land or in the water to construct safe lanes and improve safety of explosive ordinance disposal operations. This charting enables a vehicle, ship, or Soldier to navigate suspected mined areas.

Search and Rescue

B-12. GPS enables precise location of downed aircrew members and improves the probability of rescue. Combat survivor evader locator handsets combine GPS with low probability of intercept and low probability of detection over-the horizon direct communications.

Communications

B-13. GPS provides timing and frequency synchronization for wired and wireless communications and data networks. Synchronization is necessary for encrypted communications, data transmissions, and for maintaining efficient throughput at connection nodes between networks. The U.S. Naval Observatory is the official timekeeper for the DOD. As a part of its mission, the Naval Observatory maintains its alternate master clock at the GPS master control station and provides the data necessary to steer GPS time directly to the Naval Observatory standard. The timing signal from the GPS satellite constellation is the transmitted version of Naval Observatory time and is the official time source for military operations.

INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE

B-14. GPS enables increased efficiency in geo-referencing intelligence, surveillance, and reconnaissance data and provides the precise timing information used in intelligence, surveillance, and reconnaissance systems. Information gathered from drone aircraft for reconnaissance missions would not provide the required accuracy without GPS availability.

NETWORK-CENTRIC OPERATIONS

B-15. GPS provides the timing and synchronization necessary for network-centric operations. GPS is a common factor that allows intra- and inter-Service collaboration. Reliance on GPS for network-centric operations could come at a cost. Since GPS provides precise position, navigations and timing, the absence of that would gravely affect all network-centric operations.

SITUATIONAL AWARENESS

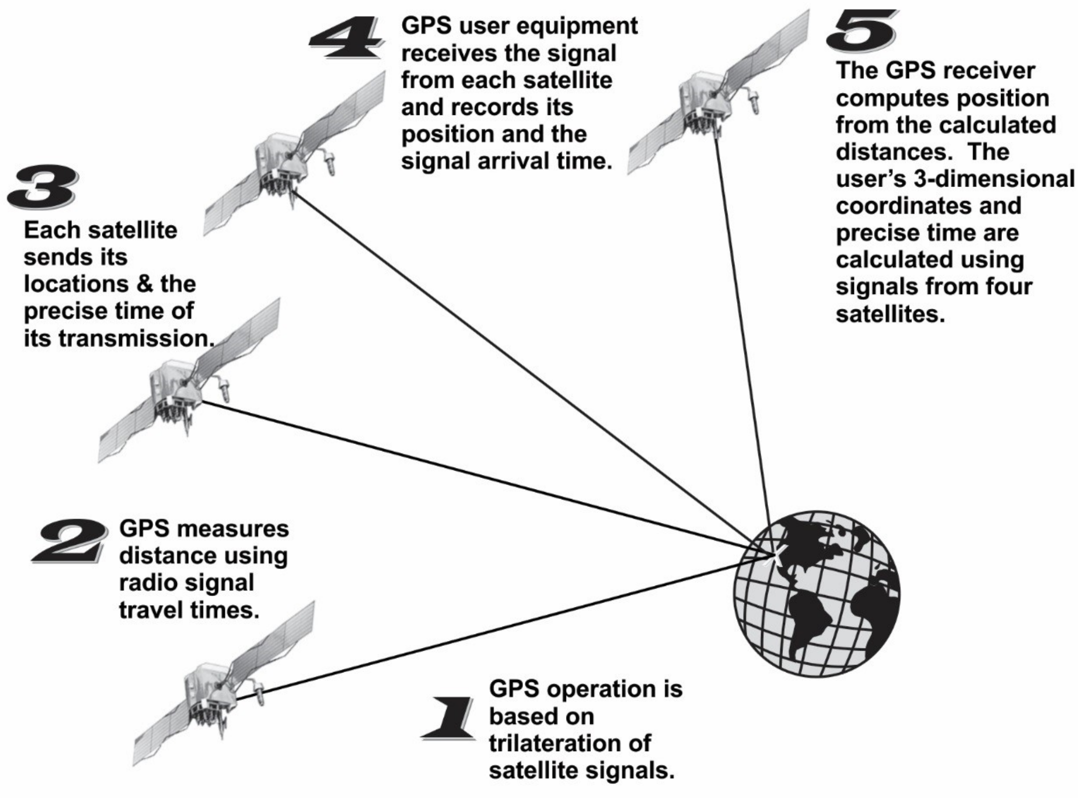
B-16. GPS enables position information and communications to support situational awareness. Precise position and timing information are important for friendly force tracking and Joint Friendly Force Situational Awareness capabilities that contribute to reduced fratricide and coordinated operations. Friendly force tracking improves situational awareness by providing the location and movement of force assets equipped with devices that transmit their position information. The LOS or BLOS SATCOM systems transmit friendly force tracking data between devices and systems. Friendly force tracking devices use an embedded GPS receiver to establish location. The device repackages the date, time, and location information, and transmits it to a data processing node using established communications infrastructure. The information routes from the data processing node through the friendly force tracking mission management center for further processing and dissemination or directly to a common operating picture.

B-17. GPS provides military, civil, and commercial users highly accurate, worldwide, three-dimensional, common-grid location data. GPS allows the measurement and display of precise velocity and time. GPS can calculate and display a position on the Earth anytime, in any weather, and at any location to an accuracy within 30 feet. A GPS receiver at a known, fixed location can obtain greater accuracy (within 3 feet), potentially saving the life of a Soldier. Use fixed location for the GPS receiver whenever possible.

HOW THE GLOBAL POSITIONING SYSTEM WORKS

B-18. GPS uses trilateration (see figure B-1 on page B-4). The GPS receivers measure signals generated by the GPS satellites and use geometry to calculate an exact location on the Earth. A GPS receiver requires a signal from at least three satellites (x, y, and z-axis or the term, acquired a 3D fix) to triangulate the location of the receiver. The receivers calculate the distance to each satellite and the distance between satellites. The receiver extrapolates exact location from the satellite signals.

B-19. The pseudorandom code is a fundamental part of GPS. This pseudorandom code is very complicated and resembles random electrical noise. The complexity is necessary to make sure that the receiver does not accidentally synchronize with other unrelated signals. The patterns are so complex that it is highly unlikely that a stray signal will have exactly the same shape. Each GPS satellite has its own pseudorandom code; the satellites can use the same frequency without jamming each other. The accuracy of GPS does not degrade over time or distance, as does the accuracy of inertial or Doppler navigation aids.



LEGEND
GPS Global Positioning System

Figure B-1. How the global positioning system works

GLOBAL POSITIONING SYSTEM SEGMENTS

B-20. The space, control, and user segments make up the GPS. Each segment is dependent on the functions and support of the others to accomplish its function.

GLOBAL POSITIONING SYSTEM SPACE SEGMENT

B-21. The GPS satellites operate in six circular orbital planes with an inclination of 55 degrees at 11,000 miles (17,702.7 km) altitude. This provides global coverage. Each GPS satellite takes about twelve hours to orbit the Earth once. Ground receivers can receive signals from six GPS satellites nearly 100 percent of the time from any point on Earth. Six signals provide the most accurate position information.

B-22. Each GPS satellite has atomic clocks on board to maintain accurate time to within three nanoseconds (0.000000003 or three billionths of a second). This precision timing is important because the receiver must determine exactly how long it takes signals to travel from each GPS satellite. The receiver uses this information to calculate its position.

B-23. On-orbit spares and the periodic launch of new satellites to replace aging ones maintain the GPS constellation. The lifecycle of a typical satellite is approximately seven years. Some satellites have continued to function for more than ten years.

B-24. The GPS constellation consists of Block II/IIA, Block IIR, and Block IIR-M. GPS Block IIR satellites began replacing the older GPS Block II/IIA satellites in 1997. The GPS Block IIR satellites boast dramatic improvement over the previous blocks with reprogrammable satellite processors to enable fixes and upgrades in flight. GPS Block IIR-M satellite improvements are a new military signal (M-Code) on both the L1 and L2 channels, and a more robust civil signal second channel, on the L2 channel.

B-25. GPS Block IIF satellites are the latest generation of GPS space vehicles. The GPS Block IIF satellites provide the capabilities of the previous blocks with additional benefits (an extended design life of 12 years, faster processors with more memory, a new civil signal on a third frequency [L5], and no selective availability hardware).

Global Positioning System Control Segment

B-26. The 50th Space Wing (Air Force Space Command), 2d Space Operations Squadron, Schriever Air Force Base, Colorado operates the GPS control segment. The GPS SATCON system uses six monitor stations and four ground antennas around the globe. The monitor stations use high fidelity GPS receivers to track the satellites' navigation signals.

B-27. The master control station processes information from the monitor stations. Operators in the master control station calculate the satellites ephemeris and clock data. The master control station uploads the data to each satellite for inclusion in the navigation message. This maintains the desired system accuracy. The GPS control segment monitors the status and accuracy of the atomic clocks. Controllers send corrections to the satellite whenever necessary to keep the system within specification.

Global Positioning System User Receiver/Terminal Segment

B-28. The user receiver/terminal segment of GPS includes all military and civilian users, both U.S. and foreign, and the receiver equipment configured for handheld, ground, aircraft, and watercraft applications. The typical handheld receiver is about the size of a cellular telephone, and the newer models are even smaller. The GPS Joint Program Office, located at Los Angeles Air Force Base, California, manages the development and acquisition of GPS receivers for military users. Personnel from the Army, Marine Corps, Navy, Air Force, Coast Guard, and representatives from the Defense Mapping Agency and NATO countries staff the GPS Joint Program Office. The GPS Joint Program Office provides information to manufacturers of civilian GPS receivers and processors.

B-29. GPS receivers come in many variations. Each meets the requirements of a specific group of users. The electronics (hardware) and programs (software) stored in the receiver determine the responsiveness and accuracy of GPS receivers. The number of channels in a receiver determines the number of satellites from which it can receive signals simultaneously. GPS receivers used in the Army include—

- **Defense Advanced GPS Receiver** replaces the precise lightweight GPS receiver. The defense advanced GPS receiver provides precision lightweight GPS receiver functionality, plus new features, in a smaller package. It is a key element in position reporting for the electronic battlefield. The defense advanced GPS receiver features the selective availability and anti-spoofing module. This chip allows the processing of a pseudorandom encrypted code (P[Y] code) embedded in all DOD GPS receivers.
- **GPS/Inertial Navigation System** is a tightly coupled, secure GPS receiver and a miniature inertial navigation unit. It provides a low-cost, synergistic vehicle navigation solution.
- **GPS Receiver Application Module** is a GPS on a card. With the full functionality of a precision GPS receiver on a standard-bus card, the GPS customer can embed a standard, approved GPS module within another host application system, saving space and weight. Open architecture allows future upgrades by simply replacing the GPS receiver application module card. GPS receiver application module is actually a family of products with varying physical configurations and functionality. Planning calls for a minimum of three configurations: Versa Module Eurocard bus, Standard Electronic Modules Format-size E for avionics applications, and Personal Computer Memory Card International Association for ground-based vehicle applications.
- **Selective Availability and Anti-Spoofing Module** takes the next logical step after GPS receiver application module to put GPS on a single, large chip. By putting the essential navigation and cryptographic functions on a tamper-resistant chip, a selective availability anti-spoofing module minimizes the risk of compromise of the critical algorithms and functions that provide maximum

accuracy and reduce threats. GPS-augmented aircraft navigation systems incorporate selective availability anti-spoofing module technology and other capabilities required for compliance with Federal Aviation Administration directives to control flight in national airspace.

- **Combat Survivor Evader Locator** is a handheld combination radio and GPS receiver that reports the location of a downed pilot over a secure radio link to recovery forces. The combat survivor evader locator provides downed aircrew members or isolated personnel with a secure, digital, two-way, over-the-horizon communications capability.

THE GLOBAL POSITIONING SYSTEM GROUND RECEIVER

B-30. To calculate its position, a GPS receiver calculates the delay between signal transmission and the time received on the ground. The time indicates the distance between the GPS receiver and the satellite. The difference between the transmission time from the satellite and the reception time by the ground receiver, multiplied by the speed of light, enables the receiver to calculate the distance to the satellite. Using distance measurements from at least three satellites, the receiver can determine the position of the user and display it on a screen. To get the accuracy required for military applications a fourth satellite helps calculate a timing and location correction from the first three GPS satellite the receiver acquires.

B-31. A GPS receiver does more than acquire and track signals from the GPS satellites. The receiver collects data from the navigational message and makes pseudo-range and comparative velocity measurements. From this information, the receiver can calculate the GPS time, its position, and its velocity. The screen then displays the results.

B-32. GPS receivers do not transmit any signals, so they are not electronically detectable. Because they only receive signals, there is no limit to the number of simultaneous GPS users.

Appendix C
Demand Assigned Multiple Access and Integrated Waveform

Demand assigned multiple access and the IW are techniques used to increase the number of users that can possibly use a limited pool of satellite transponder space. DAMA multiplexes several users on one UHF satellite channel, at either 5 or 25 kHz. This adds more satellite users per channel to the UHF SATCOM systems and reduces satellite resource underutilization. This appendix is an introduction to DAMA and the IW. This appendix describes the structure of the waveforms, the advantages and disadvantages of the 5 and 25 kHz waveforms, and a comparison of the two.

INTRODUCTION TO DEMAND ASSIGNED MULTIPLE ACCESS

C-1. DAMA enables greater flexibility when managing available bandwidth. Most users do not need constant bandwidth, so DAMA allows bandwidth sharing. DAMA systems quickly and transparently assign communication links or circuits to a network control system based on requests received from user terminals. Inactive channels provide bandwidth for others to use. DAMA allows multiple subscribers, using a fraction of the satellite resources required by dedicated, point-to-point signal-channel carrier networks, thus reducing the costs of satellite networking.

C-2. User demand dictates access allocation. DAMA multiplexing channels allow dedicated access portions of the channel without interference and through TDMA, enables more networks to access the channel. TDMA occurs when network controller station transmits control signals that establish precisely recurring intervals of time (frames). A frame is one or more seconds in duration. Each frame is subdivided (time-division) into precise time-slots. Certain slots in each frame are for the controller station to receive user station service requests, or to send control signals via the satellite. Other time-slots are available for user stations to transmit signal bursts to others via the satellite. User nets have slots within the frames on a given channel. This allows multiple nets to access the same channel simultaneously.

ADVANTAGES AND DISADVANTAGES OF DEMAND ASSIGNED MULTIPLE ACCESS

C-3. Army ground terminal radios using DAMA require both hardware and software changes before implementation. DAMA terminals use channel power and bandwidth efficiently through the automatic transponder resource control (a function of DAMA) because it does not correspond to fixed channel assignments. Additionally, the cost of sustaining systems timing and maintenance by network controllers is not nearly as much as having to launch the quantity of satellites needed to provide equivalent service in a non-DAMA environment.

C-4. Figure C-1 on page C-2 is an example of information throughput without DAMA. Each radio network occupies an entire SATCOM channel continuously.

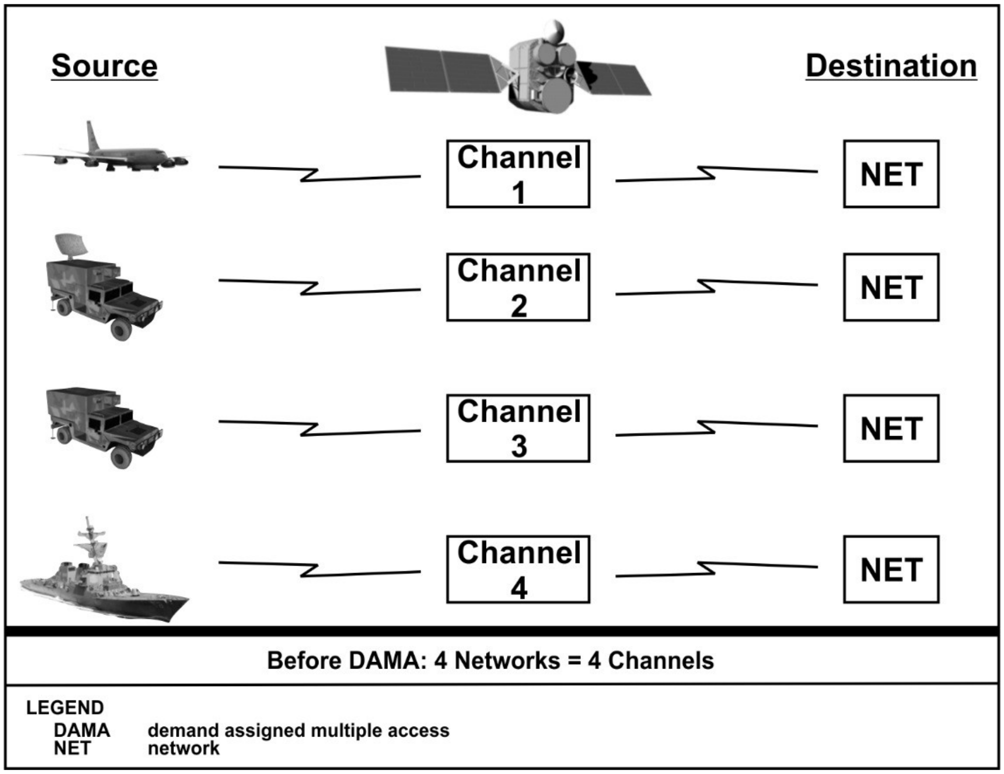


Figure C-1. Information throughput without demand assigned multiple access

C-5. Figure C-2 on page C-3 is an example of information throughput with DAMA-capable terminals. DAMA terminals are time synchronized with the network and are permitted access when and where bandwidth is available. Each network user shares the channel(s), thus reducing dedicated channels. This increases effective channel capacity and information throughput. For example, there is approximately a five-fold increase in voice accesses using DAMA as opposed to non-DAMA systems.

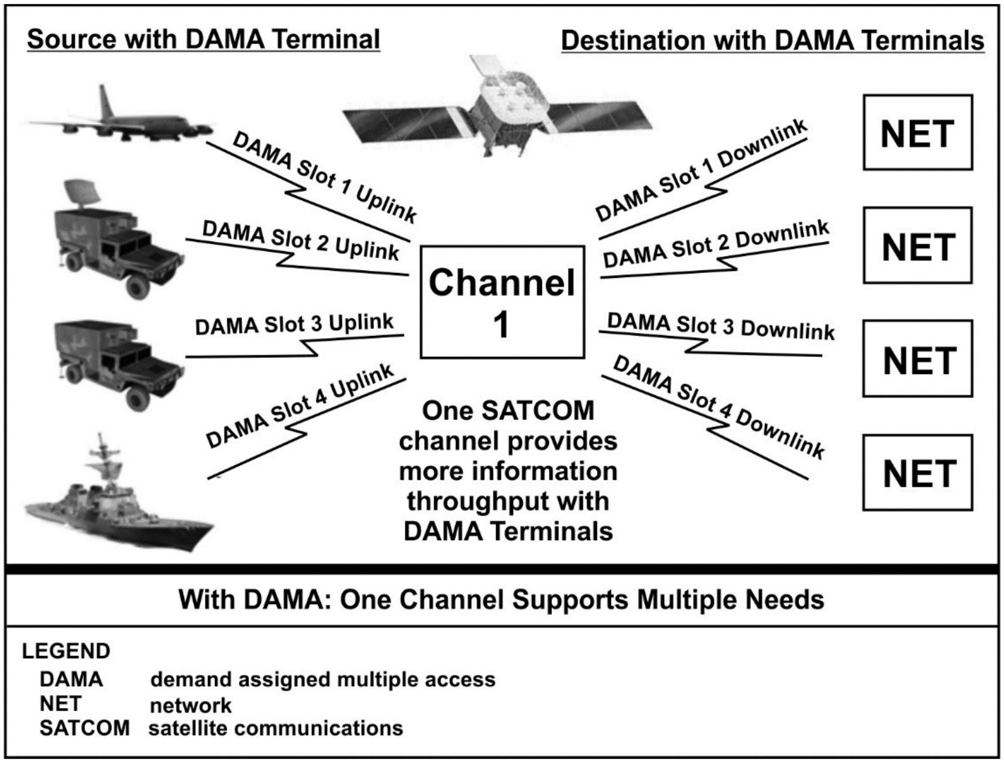


Figure C-2. Demand assigned multiple access capable terminals

DEMAND ASSIGNED MULTIPLE ACCESS WAVEFORM

C-6. UHF SATCOM DAMA uses two distinct DAMA waveforms: the 5 kHz waveform and 25 kHz waveform. The two waveforms differ in the size of the channels, how much data each supports, and the controller of the channels demand assigned single access.

C-7. Demand assigned single access allows the user to request a dedicated channel and the DAMA control station assigns the user to a satellite channel with no DAMA control signals. With DAMA, a user terminal requests access through the DAMA control station and then communicates within DAMA time slots.

C-8. Demand assigned single access channel assignments are temporary time allocations. If a user wishes to create a temporary secure voice connection, but requires a turnaround time faster than offered by 5 kHz DAMA, one of the user terminals requests a channel assignment. The channel assignment request indicates the desired receiving terminal or radio net and a time span for the conversation. The DAMA control station processes the request and assigns a channel for the allowed time based on available resources, network rank, and loading on the system.

C-9. The Joint Staff mandates all users of non-processed narrowband transponders to own equipment that is interoperable with either the TDMA-1 distributed control mode using the approved 25 kHz standard or in the DAMA mode using the approved 5 kHz standard due to the associated time delay using 5 kHz DAMA.

INTRODUCTION TO THE INTEGRATED WAVEFORM

C-10. DAMA greatly improved access to UHF SATCOM resources. As time and technology have advanced, the need for an even better technique became clear. The improved technique is the IW. Like DAMA, the idea is to support as many users using the least SATCOM resources possible. Experience has taught that DAMA has many unacceptable limitations. Complicated user procedures, significant time delays, and voice quality issues prompted the need for IW. The demand for UHF services leveraged against an aging UHF satellite is more than double its available subscribed requirement when using DAMA. Significant upgrades, enhancements, and resources have been devoted to using the IW throughout the DOD because of unchanging demands.

BENEFITS OF INTEGRATED WAVEFORM

C-11. IW replaces DAMA. The IW has some advantages and improvements versus DAMA. The benefits of IW include—

- Greatly simplified operating procedures.
- Carrier phase modulation to allow more access on the same channel.
- Reduced time delays.
- Better link closure.
- Improved voice quality.
- 2.5 times as many users can use the same frame.
- Older terminals can be upgraded to use IW.
- Data rates up to 19.2 kbps.

***Note*.** For a detailed explanation of DAMA and IW, refer to ATP 6.02.90.

HOW THE INTEGRATED WAVEFORM WORKS

C-12. IW is being developed as a two-phased upgrade for fielded legacy terminals approved by the Naval Communications Functional Capabilities Board for the following radios—

- AN/ARC-210 Gen 4 and 5.
- AN/ARC-231.
- MD-1324B.
- AN/PRC-5C (Shadowfire).
- AN/PRC-117F.
- AN/PRC-148 Joint Tactical Radio System Enhanced Multiband Inter/Intra Team Radio.
- AN/USC-61 Digital Modular Radio.
- AN/USC-62 Joint Tactical Radio.
- RT-1828/9.
- System access channel controller.

C-13. Other terminals scheduled to receive the IW upgrade are the AN/PRC-117G and AN/PRC-152.

C-14. In phase I of the upgrade, IW it supports single access (one radio net per channel using military standard (MIL-STD)-188-181 series) and multiple access on MIL-STD-188-183 series. Phase I only supports pre-assigned services. Pre-assigned services include—

- Preplanning user networks.
- Assigning a service number.
- Activating and deactivating by the control system and not by the user terminals via orderwire messages.

C-15. All active pre-assigned services are broadcast over a system orderwire every 15–20 seconds. User terminals monitor the system orderwire and connect to the service selected by the terminal operator.

C-16. All control segments are interoperable and support operations for terminals operating in single channel and DAMA modes over 5 kHz and 25 kHz channels. Those control segments identified for the IW upgrade must be interoperable and support operations in the IW mode. Control segments, including control terminals, must be fully interoperable and operationally compliant using MIL-STD-188-185A(1) and the channel control interoperability requirements for channel control of MIL-STD-188-181C(3), MIL-STD-188-182B(3), and MIL-STD-188-183B(3).

C-17. Terminals and controllers are certified to the required military standard using the Joint Interoperability Test Command system standard conformance test certification. All program offices developing terminals/controllers failing to comply with this policy are required to submit a waiver via their respective combatant command, service, or agency to the Joint Staff J-6. Before deploying terminals, users must obtain certification of spectrum support as required. This certification process applies during experimental testing, developmental testing, or operation of satellite terminals in the United States and its possessions or in any foreign country in which the terminal is intended to operate.

C-18. All IW capable terminals operate using IW to the largest extent possible. Increased use of the IW capability is necessary to increase the number of UHF accesses on orbit per available channel and to use available UHF resources (see figure C-3).

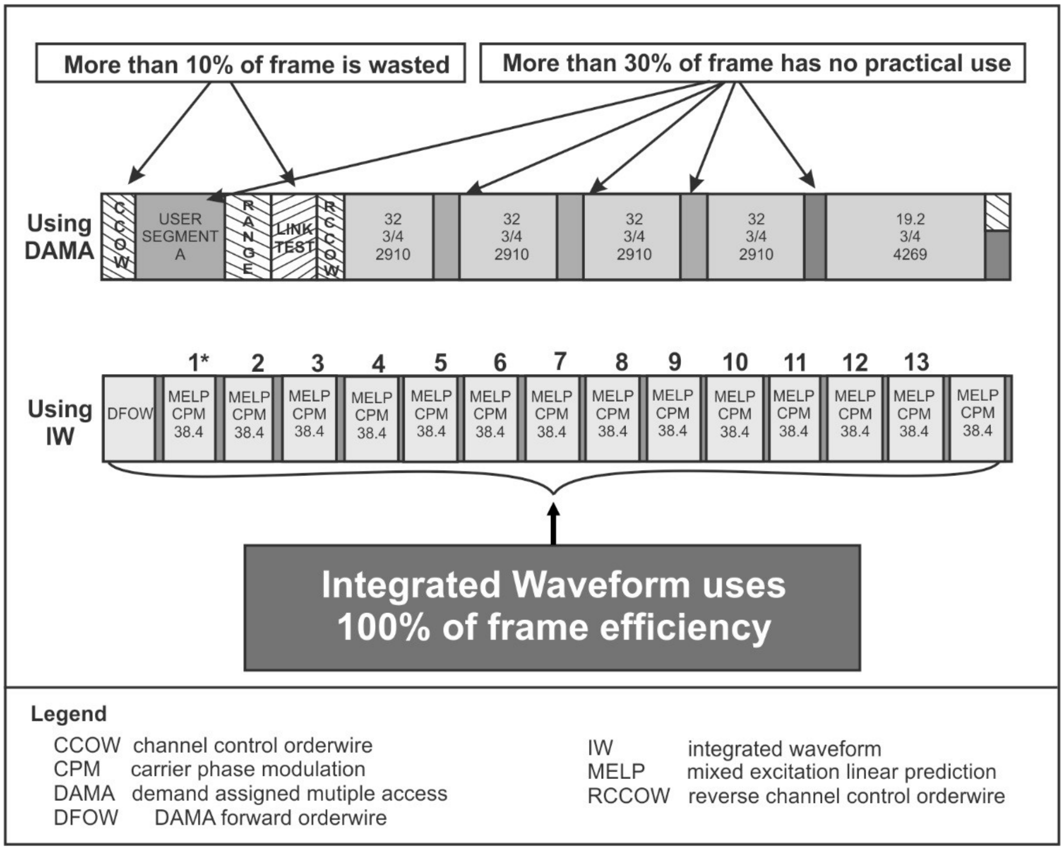


Figure C-3. Comparison of a 25 kbps demand assigned multiple access vs. integrated waveform frame

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Glossary

The glossary lists acronyms and terms with Army, multi-service, or joint definitions, and other selected terms. Where Army and joint definitions are different, (Army) follows the term. The proponent for other terms is listed in parentheses after the definition.

SECTION I – ACRONYMS AND ABBREVIATIONS

AEHF	advanced extremely high frequency
AJ	anti-jam
BCT	brigade combat team
BLOS	beyond line of sight
C-SSE	consolidated satellite communications system expert
CCDR	combatant commander
CCMD	combatant command
CDRUSSTRATCOM	Commander, United States Strategic Command
CIO	chief information officer
COMSATCOM	commerical satellite communications
CONUS	continental United States
DAMA	demand assigned multiple access
DECC	Defense Enterprise Computing Center
DISA	Defense Information Systems Agency
DISN	Defense Information Systems Network
DOD	Department of Defense
DODIN	Department of Defense information network
DODIN-A	Department of Defense information network-Army
DSCS	Defense Satellite Communications System
DSN	Defense Switched Network
EHF	extremely high frequency
EMSS	Enhanced Mobile Satellite Services
FDMA	frequency division multiple access
FORSCOM	United States Army Forces Command
FCSA	future commercial satellite communications services acquisition
G-6	assistant chief of staff for communications
GAR	gateway access request
GBS	Global Broadcast Service
GBSOC	Global Broadcast Service Operations Center
GMF	ground mobile force
GMR	GBS Mission Request

GHz	gigahertz
GPS	Global Positioning System
INMARSAT	international maritime satellite
IW	integrated waveform
J-6	communications system directorate of a joint staff
JFCC-Space	Joint Functional Component Command for Space
Ka-STARS	Ka band Satellite Transmit and Receive System
kHz	kilohertz
LDR	low data rate
MHz	megahertz
MDR	medium data rate
MILSATCOM	military satellite communications
MSS	Mobile Satellite Services
MUOS	Mobile User Objective System
NATO	North Atlantic Treaty Organization
NETCOM	United States Army Network Enterprise Technology Command
NIPRNET	Nonsecure Internet Protocol Router Network
OCONUS	outside the continental United States
OPCON	operational control
RSSC	regional satellite communications support center
SAA	satellite access authorization
SAR	satellite access request
SATCOM	satellite communications
SATCON	satellite control
SBM	satellite broadcast manager
SC(T)	signal command (theater)
SDB	satellite communications database
SHF	super-high frequency
SIPRNET	SECRET Internet Protocol Router Network
SMART-T	Secure Mobile Anti-Jam Reliable Tactical-Terminal
SSE	satellite communications system expert
STEP	standardized tactical entry point
STT	Satellite Transportable Terminal
TACSAT	tactical satellite
TDMA	time division multiple access
UFO	ultrahigh frequency follow-on
UHF	ultrahigh frequency
USASMDC/ ARSTRAT	United States Army Space and Missile Defense Command/Army Forces Strategic Command
USSTRATCOM	United States Strategic Command
VHF	very high frequency

WGS	Wideband Global Satellite Communications
WIN-T	Warfighter Information Network-Tactical
WSOC	wideband satellite communications operations center
XDR	extended data rate

SECTION II – TERMS

cybersecurity

Prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communications, and electronic communications, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation. Deparment of Defense Instructions (DODI) 8500.01

Department of Defense information network

The set of information capabilities, and associated processes for collecting, processing, storing, disseminating, and managing information on-demand to warfighters, policy makers, and support personnel, whether interconnected or stand-alone, including owned and leased communications and computing systems and services, software (including applications), data, security services, other associated services, and national security systems Also called DODIN. (JP 6-0)

information environment

The aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information. (JP 3-13)

interoperability

The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. (JP 6-0)

positive control

The continuous ability to oversee SATCOM access and coordinate necessary changes in the frequency/channel, power level, or network via users assuring terminal(s) use alternative communication means (e.g. radio, telephone, orderwire etc.) to coordinate adjusting power levels, frequency, and user terminal modem settings with RSSC or WSOC guidance to prevent interference with adjacent satellite channels and users. All SATCOM access must be under positive control at all times. Access will be denied/terminated to links that lack positive control. As the technology built into systems allw, positive control includes automated methods. (USSTRATCOM Instruction 714-04)

reachback

The process of obtaining products, services, and applications, or forces, or equipment, or material from organizations that are not forward deployed. (JP 3-30)

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References

REQUIRED PUBLICATIONS

These documents must be available to the intended users of this publication.

ADRP 1-02. *Terms and Military Symbols*. 16 November 2016.

DOD Dictionary of Military and Associated Terms. March 2017.

RELATED PUBLICATIONS

These documents contain relevant supplemental information

JOINT PUBLICATIONS

Most joint publications are available online: http://www.dtic.mil/doctrine/new_pubs/jointpub.htm.

DODI 8420.02. *DOD Satellite Communications (SATCOM)*. 15 September 2016.

DODI 8500.01. *Cybersecurity*. 14 March 2014.

JP 3-12[R]. *Cyberspace Operations*. 5 February 2013.

JP 3-13. *Information Operations.* 27 November 2012.

JP 3-13.1. *Electronic Warfare*. 8 February 2012.

JP 3-30. *Command and Control for Joint Air Operations*. 10 February 2014.

JP 6-0. *Joint Communications System*. 10 June 2015.

ARMY PUBLICATIONS

Most Army doctrinal publications are available online: http://www.apd.army.mil.

ADP 1. *The Army*. 17 September 2012.

ADP 3-0. *Operations*. 11 November 2016.

ADP 5-0. *The Operations Process*. 17 May 2012.

ADP 6-0. *Mission Command*. 17 May 2012.

ADRP 1. *The Army Profession*. 14 June 2015.

ADRP 3-0. *Operations*. 11 November 2016.

ADRP 5-0. *The Operations Process*. 17 May 2012.

ADRP 6-0. *Mission Command*. 17 May 2012.

AR 10-87. *Army Commands, Army Service Component Commands, and Direct Reporting Units*. 4 September 2007.

ATP 3-36. *Electronic Warfare Techniques*. 16 December 2014.

ATP 6-02.60. *Techniques for Warfighter Information Network-Tactical*. 3 February 2016.

ATP 6-02.70. *Techniques for Spectrum Management Operations*. 31 December 2015.

ATP 6-02.90/MCRP 3-40.3G/NTTP 6-02.9/AFTTP(I) 3-2.53. *Multi-Service Tactics, Techniques, and Procedures for Ultrahigh Frequency Military Satellite Communications*. 9 August 2013.

FM 3-12. *Cyberspace and Electronic Warfare Operations*. 11 April 2017.

FM 3-14. *Army Space Operations*. 19 August 2014.

FM 6-02. *Signal Support to Operations*. 22 January 2014.

FM 27-10. *The Law of Land Warfare*. 18 July 1956.

OTHER PUBLICATIONS

Air Force Space Command Instruction 10-1204. *Satellite Operations*. 15 May 2014.

http://static.e-publishing.af.mil/production/1/afspc/publication/afspci10-1204/afspci10-1204.pdf.

Chairman of the Joint Chiefs of Staff issuances are available online: http://www.dtic.mil/doctrine/doctrine/cjcs.htm.

CJCSI 6250.01E. *Satellite Communications*. 14 March 2013. https://intelshare.intelink.sgov.gov/sites/space/jfccspace/satcom/ssed/rssceast/rssc-ewideband/widebanddocumentsexternal/cjcsi625001e.pdf restricted access via SIPR.

CJCSI 6251.01D. *Narrowband Satellite Communication Requirements*. 30 November 2012.

CJCSI 6510.01. *Information Assurance (IA) and Support to Computer Network Defense (CND)*. 9 February 2011.

CJCSM 3320.02D. *Joint Spectrum Interference Resolution (JSIR) Procedures*. 3 June 2013.

CJCSM 6231.01E. *Manual for Employing Joint Tactical Communications*. 6 February 2015. https://jsportal.sp.pentagon.mil/sites/Matrix/DEL/CJCSJS%20Directives%20Limited/CJCSM%206231.01E.pdf limited access via CJCS Directives .mil/.gov only.

CJCSM 6254.01. (U) *Milstar Network Operating Procedures*. 16 January 2015. https://intelshare.intelink.sgov.gov/sites/space/jfccspace/satcom/ssed/rssceast/rssc-ewideband/widebanddocumentsexternal/cjcsm625401g.pdf restricted access via SIPR.

DODD 5144.02. *DOD Chief Information Officer*. 21 November 2014. http://dtic.mil/whs/directives/corres/pdf/514402p.pdf.

MIL-STD-188-181C(3). Interoperability Standard for Access to 5-kHz and 25-kHz UHF Satellite Communications Channels. 07 May 2014.

MIL-STD-188-182B(3). Interoperability Standard for UHF SATCOM DAMA Orderwire Messages and Protocols. 07 May 2014.

MIL-STD-188-183B(3). Interoperability Standard for Multiple-Access 5-kHz and 25-kHz UHF Satellite Communications Channels. 07 May 2014.

MIL-STD-188-185A(1). Interoperability Standard for UHF MISALTCOM DAMA Control System. 07 May 2014.

USSTRATCOM Strategic Instructions (SI) (Requires DOD-approved e-mail certificate login and a validated USSTRATCOM user account.) stratcom.offutt.j64.mbx.service-desk@mail.mil

Strategic Instruction 714-04. *Satellite Communications*. 14 October 2014.

https://vela.stratcom.mil/sites/publications/Pubs/SIs/714-04.pdf

Strategic Instruction 714-06. *Satellite Communications (SATCOM) Facility Configuration Management (CM) Policies and Procedures*. 2 October 2012.

https://vela.stratcom.mil/sites/publications/Pubs/SIs/714-06.pdf

USSTRATCOM Strategic Policy Memorandum 66001-15. *Policy on the Satellite Access/Gateway Access/Global Broadcast Service Mission Requests for all USSTRATCOM Spectrum Bands.* 20 July 2015. https://vela.stratcom.mil/sites/jointsatcom/SATOPS/Documents/USSTRATCOM_J66_SAR_GAR_GMR_Policy_Memo_20150720_opt.pdf

UNITED STATES LAW

Most acts and public laws are available at http://thomas.loc.gov/home/thomas.php

Title 10, United States Code. *Armed Forces*.

PRESCRIBED FORMS

None

REFERENCED FORMS

Unless otherwise indicated, Department of the Army forms are available on the Army Publishing Directorate (APD) Website: http://www.apd.army.mil.

DA Form 1594. *Daily Staff Journal or Duty Officer's Log*.

DA Form 2028. *Recommended Changes to Publications and Blank Forms*.

DD Forms are available on the Office of the Secretary of Defense Web site: www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm.

DD Form 1753. *Master Station Log*.

WEBSITES

These are the Websites quoted or paraphrased in this publication.

Army Centralized Army Service Request System: https://acas.army.mil/

Department of the Army CIO/G-6 Website: http://ciog6.army.mil/

Defense Information Systems Agency Website: www.disa.mil.

Global Broadcast Service (GBS) Mission Request (GMR) Template

https://gbs.csd.disa.mil/portal-files/Forms/User%20Forms/GMR/GMRTemplate.docx

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ATP 6-02.54

5 June 2017

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