# ATP 6-02.54

# TECHNIQUES FOR SATELLITE COMMUNICATIONS

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**Distribution Restriction:** Approved for public release; distribution is unlimited.

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# Techniques for Satellite Communications

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# Preface

The purpose of ATP 6-02.54 is to educate communicators on the options available when using beyond line of sight satellite communications. This publication includes information for planning, establishing, and operating communications networks with satellites.

The principal audience for ATP 6-02.54 is Army professionals and contractors whose duties involve planning, installing, operating, and maintaining satellite communications systems and networks. Satellite communications trainers and educators throughout the Army will also use this publication. To apply this doctrine correctly, readers should be familiar with the capstone Army Doctrine (ADP 1 and ADP 3-0), FM 3-0, and FM 6-02.

Commanders, staff, and subordinates ensure their decisions and actions comply with applicable U.S., international, and, in some 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 6-27). Commanders also adhere to the Army Ethic as described in ADP 6-22.

ATP 6-02.54 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. 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 United States Army Reserve unless otherwise stated.

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

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# Introduction

ATP 6-02.54 expands on the doctrinal foundations and tenets found in FM 6-02. This publication identifies and explains the role of satellite communications as a part of the transport layer of the Department of Defense information network-Army.

The vision for the Department of Defense Information Network-Army is the employment of an end-to-end network that provides assured global command and control 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 commanders 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; and assess understanding of the problem and adequacy of the operational approach and subsequent plans and level of progress.

The network is tailorable and adapts based on phases of the operation to support command and control at the home station, en-route, and in deployed environments. Deployed environments include training, exercises, theater security cooperation, initial entry, and combined arms maneuver. Deployments may use minimal to robust force packages, requiring the network to adjust to provide appropriate services at the point of need. Use of the home station mission command center can reduce the deployed footprint and operational risk. The network must embrace common joint and multinational standards that allow the addition of capabilities and systems while reducing, not increasing the 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 satellite communications capabilities provided by signal Soldiers play a vital role in supporting Army operations by enabling information advantage. Planners integrate satellite communications assets to support the commander's intent and the operation plan.

This publication presents non-prescriptive techniques for satellite communications. Procedures that cover wideband, narrowband, protected, and commercial satellite communications are addressed in various governing policy publications.

ATP 6-02.54 chapters include—

**Chapter 1** provides an overview of satellite communications. This chapter covers wideband, narrowband, protected, and commercial satellite communications.

**Chapter 2** describes the roles and responsibilities of the joint and Army elements involved with Army satellite communications.

**Chapter 3** discusses the requirements, objectives, and considerations of the Army satellite communications architecture.

**Chapter 4** addresses satellite communications mission planning. This chapter explains how planners develop a satellite communications plan from a concept.

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

**Appendix A** discusses the satellite communications ground segment. It identifies the equipment the Army uses to provide satellite communications support. It discusses the enterprise and tactical terminals that offer satellite communications support.

**Appendix B** provides information about demand assigned multiple access, integrated waveform, and the wideband code division multiple access waveforms. It discusses the specifications of the three waveforms.

**Appendix C** provides details about the Global Broadcast System, including roles, attributes, uplink facilities, space segment, and broadcast segment.

**Appendix D** provides information about protected satellite communications capabilities, including Milstar and advanced extremely high frequency.

# Chapter 1

# Satellite Communications Overview

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

## THE INFORMATION ENVIRONMENT

1-1. U.S. forces seek to dominate the information environment 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 just one aspect of the operational environment. Effects in the information environment may affect other decisions and conditions in the operational environment.

### CONGESTED ENVIRONMENT

1-2. Gaining and maintaining control of the electromagnetic spectrum is a critical requirement for the commander. From satellite communications (SATCOM), to information collection, to electromagnetic 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. Competition for the limited available bandwidth results in a congested electromagnetic spectrum, particularly when operating in developed nations where landing rights and host nation approval could affect availability. The proliferation of commercial cube satellites contributes to the physical congestion in space.

### CHALLENGES FOR SATELLITE COMMUNICATIONS

1-3. The space domain is an increasingly contested environment with the availability of military, commercial and protected SATCOM. For this reason, managing satellite resources requires the consideration of electromagnetic spectrum vulnerabilities. Enemies and adversaries may deliberately attempt to deny the use of the electromagnetic spectrum, in either space-based or terrestrial communications systems. Due to heavy 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 command and control systems and planning for operations in a denied or degraded environment.

1-4. U.S. forces dominated the electromagnetic spectrum in Afghanistan and Iraq against adversaries who lacked the technical capabilities to challenge the coalition in a contested and congested electromagnetic operational environment. More recently, regional peers have demonstrated capabilities in a hybrid operational environment that threaten the Army's dominance in the electromagnetic spectrum. Because communications are a key command and control 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 space-based navigation and SATCOM systems. We should expect that in future conflicts enemies and adversaries will contest use of these capabilities to deny operational access and diminish the effectiveness of U.S. and allied forces.

1-5. A technologically advanced enemy or adversary can locate a ground-based satellite system using radio frequency direction-finding equipment. The enemy can then direct lethal fires to destroy the located satellite system. Synchronization of signal and electromagnetic protection techniques, coupled with current intelligence estimates, can help mitigate an enemy or adversary's ability to find and attack satellite systems.

1-6. While enemy action might cause a degraded environment, degraded capabilities may also occur because of insufficient resources to support all communications requirements. For example, inadequate communications satellite capacity in an operational area cause congestion and network latency. Jamming or unintentional electromagnetic interference may also cause degradation. The architecture of the tactical network implements redundant communications means to improve reliability in a degraded environment (FM 6-02).

1-7. Successfully integrating signal support with electromagnetic warfare and intelligence capabilities is essential to obtaining and maintaining freedom of action in the electromagnetic spectrum while denying the same to our adversaries. Synchronizing capabilities across multiple domains and warfighting functions maximizes the inherently complementary effects in and through the electromagnetic spectrum.

### DEPARTMENT OF DEFENSE INFORMATION NETWORK

1-8. 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).

1-9. 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 United States Army Cyber Command as primarily executed by United States Army Network Enterprise Technology Command (NETCOM). DODIN operations are the most important, most complex operations the Army performs daily. Commanders leverage the DODIN as a warfighting platform to support all Army warfighting functions and capabilities, including command and control; intelligence, surveillance, and reconnaissance; fires; logistics; and telemedicine. The *Department of Defense information network-Army* (DODIN-A) is an Army-operated enclave of the Department of Defense information network that encompasses all Army information capabilities that collect, process, store, display, disseminate, and protect information worldwide (ATP 6-02.71).

1-10. SATCOM is a primary means of network transport for the DODIN-A. During SATCOM planning, the staff will consider what SATCOM resources to request, required configurations, the monitoring of the satellite signals, and response to-electromagnetic interference.

1-11. Army-owned SATCOM terminals, support Army network connection to Defense Information Systems Network (DISN) services. Army strategic locations use SATCOM as the transport medium of choice to extend DISN services to all theaters of operation.

## SATELLITE COMMUNICATIONS FUNDAMENTALS

1-12. SATCOM provides advantages over terrestrial means of communication. These advantages include worldwide coverage and beyond line of sight connectivity. Army communication planners, maintainers, and operators should understand these fundamental SATCOM principles—

- SATCOM segments.
- Frequency.
- Bandwidth.

## SATELLITE COMMUNICATIONS SEGMENTS

1-13. SATCOM has three segments—

- **Space Segment.** The space segment consists of military and commercial satellites and SATCOM payloads in orbit. The space segment includes the military's Ultrahigh Frequency Follow-On (UFO), Mobile User Objective System (MUOS), Defense Satellite Communications System (DSCS), Wideband Global Satellite Communications (WGS), Milstar, Advanced Extremely High Frequency (AEHF), Enhanced Polar System, and commercially leased SATCOM transponders and payloads.
- **Link Segment.** The link segment connects the ground and space segments together through the electromagnetic spectrum. This includes telemetry, tracking, and command signals necessary to control the spacecraft. The link segment includes satellite payload signals such as the SATCOM signal, enabling communication between points on the ground, or the positioning, navigation, and timing signals that enable navigation.
- **Ground Segment.** The ground segment consists of the ground facilities and antennas required to control the satellites and all terminals. The ground segment 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. The Army's wideband satellite communications operations center (WSOC) and the Navy Space Operations Center are examples of satellite control centers.

## FREQUENCY

1-14. SATCOM uses the frequency range of 3 megahertz (MHz) to 300 gigahertz (GHz). Table 1-1 depicts the radio frequency bands used for military SATCOM.

**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 |

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

## BANDWIDTH

1-15. Bandwidth is a range of radio frequencies which is occupied by a modulated carrier wave, which is assigned to a service, or over which a device can operate measured in hertz. In most cases as the bandwidth increases, data rates may also increase. It is important to note that the amount of bandwidth available is dependent on the SATCOM equipment system used. The Army's use of new technologies drives requirements that demand greater amounts of bandwidth. Expanding requirements are partially responsible for the increased use of ultrahigh frequency (UHF), super high frequency (SHF), and extremely high frequency (EHF) technology and leased commercial systems.

# TYPES OF SATELLITE COMMUNICATIONS

1-16. Army SATCOM is a combination of military and commercial SATCOM resources. These resources are either tactical, or strategic small or large gateways. Military SATCOM is comprised of three separate bands (narrowband, protected, and wideband) examined in this chapter. Chapter 5 addresses commercial SATCOM.

## WIDEBAND SATELLITE COMMUNICATIONS

1-17. Wideband SATCOM extends DISN services, including—Non-classified Internet Protocol Router Network (NIPRNET), SECRET Internet Protocol Router Network (SIPRNET), Joint Worldwide Intelligence Communications System, and video teleconferencing to deployed forces. Wideband SATCOM provides the global connectivity needed to support Army operations. Wideband systems operate in the C, Ku, K, Ka, S, and X radio frequency bands.

1-18. Wideband SATCOM supports high data rate communications for the execution of command and control, crisis management, and intelligence data transfer. Wideband SATCOM supports a range of government, strategic, and tactical users including—

- The White House Communications Agency.
- The military Services.
- The Department of State.
- The Joint Staff.
- Geographic combatant commanders.
- Joint task forces.
- Multinational forces.
- Other government agencies.

1-19. Wideband SATCOM provides common user information transport and allows the user global reachback to other portions of the DODIN.

### The Defense Satellite Communications System

1-20. The 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 military SATCOM for decades and still supports Soldiers today. The six-satellite DSCS constellation is now performing backup and residual wideband SATCOM roles. The DSCS constellation augments the WGS and continues to support many of its strategic missions, including the jam-resistant secure communications networks. The RSSCs plan DSCS missions, and the WSOCs execute payload and transmission control.

### Wideband Global Satellite Communications

1-21. WGS supports more tactical users in any area of operations than the DSCS. Each WGS satellite provides more than four times the available X band bandwidth of a single DSCS satellite. With the addition of Ka band capabilities, each WGS satellite provides more than ten times the bandwidth capacity of a single DSCS 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 terminals with higher data rates than possible over the DSCS constellation. WGS satellites support cross-banding of X and Ka bands. What this means to the user is that any DSCS X band terminal can communicate with the newer Ka band terminals without equipment upgrades. This increases flexibility to geographic combatant commands and satellite planners for mission support. Changes to the WGS constellation are based on mission requirements and geographic combatant commander priorities and managed by the consolidated satellite communications systems expert (C-SSE) for optimization of the constellation. Figure 1-1 on page 1-5 shows an example of orbital locations for WGS satellites.

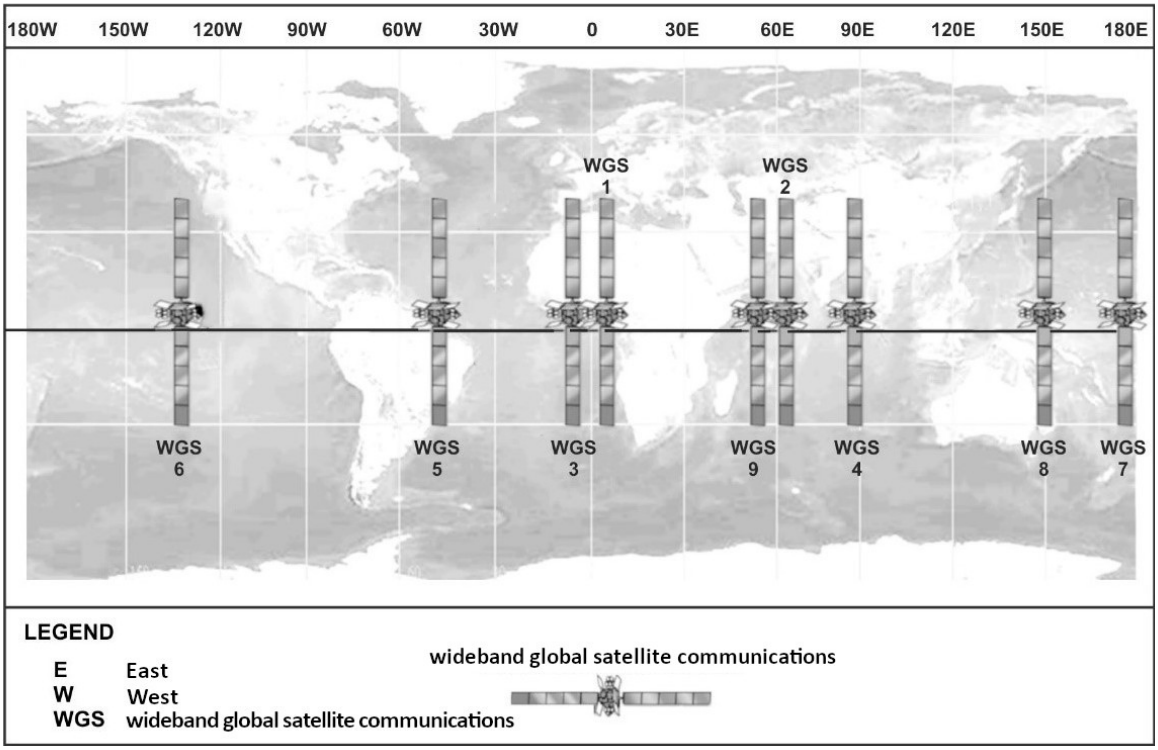



**Figure 1-1. Example orbital locations for Wideband Global Satellite Communications satellites**

1-22. Each WGS 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 satellite has ten steerable Ka band dish antennas that provide coverage to areas about 580 miles in diameter anywhere in the satellite's coverage area.

1-23. On the first three WGS satellites, two of the 10 beams are area coverage antennas, providing links to an area about 1,750 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 one 78 MHz X band earth coverage channel.

1-24. WGS-4, WGS-5, and WGS-6 are block II. Block II satellites have the added ability of two 400 MHz channels that bypass the main payload, called the channelizer. This allows higher data rates to pass through the block II satellites.

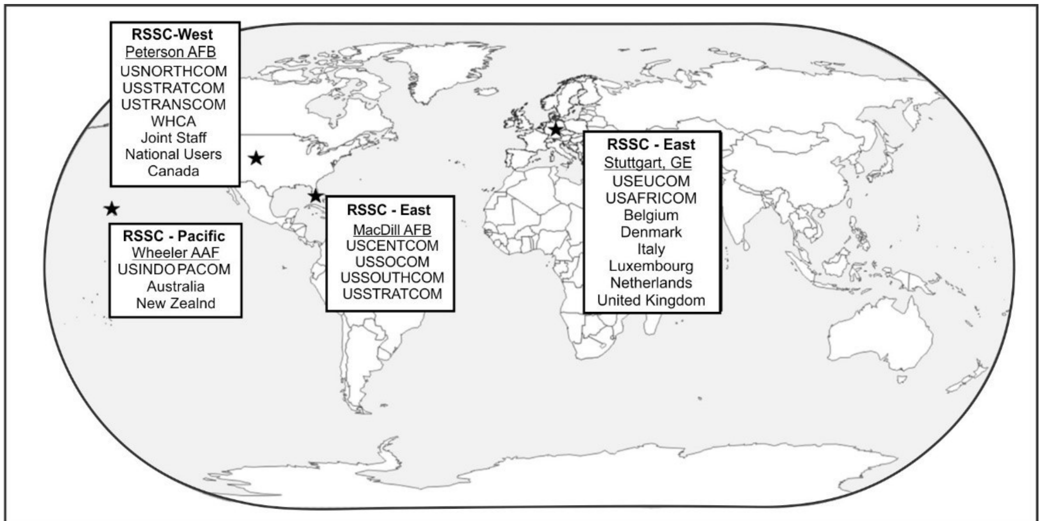
1-25. WGS-7 through WGS-10 are referred to as block II follow-on. The technical capabilities of WGS-7 are more in line with WGS 4–6 than WGS 8–10. WGS-7 retains 125 MHz channelization and provides additional channels compared to WGS 4–6. The WGS-7 spacecraft channelizer with redundant port activation provides 46 primary and 10 redundant channels. WGS 8–10 are equipped with a modified frequency conversion system and a newer wideband digital channelizer, which allows for 500 MHz channelization and helps mitigate congested military SATCOM availability.

## Defense Satellite Communications System and Wideband Global Satellite Communications Ground Segment

1-26. The Army portion of the ground segment includes RSSCs and WSOCs. These centers control the satellite payload and network access. RSSC and WSOC personnel provide guidance and instruction to terminal personnel using the DSCS and WGS constellations. Other centers maintain the satellites in their assigned orbital position and orientation.

### *Regional Satellite Communications Support Center*

1-27. The United States Army Satellite Operations Brigade operates four RSSCs, two in the continental United States, one in the Pacific region, and one in Europe (see figure 1-2). Geographic combatant command communications staffs validate unit requirements and send satellite access requests to the supporting RSSC where SATCOM planners produce a satellite access authorization for implementation by SATCOM users and WSOCs.




**LEGEND**

| | | | |
|---|---|---|---|
| AAF | Army airfield | USINDOPACOM | United States Indo-Pacific Command |
| AFB | Air Force base | USNORTHCOM | United States Northern Command |
| CJCS | Chairman of the Joint Chiefs of Staff | USOUTHCOM | United States Southern Command |
| RSSC | regional satellite communications support center | USSOCOM | United States Special Operations Command |
| USAFRICOM | United States Africa Command | USSTRATCOM | United States Strategic Command |
| USCENTCOM | United States Central Command | USTRANSCOM | United States Transportation Command |
| USEUCOM | United States European Command | WHCA | White House Communications Activity |

**Figure 1-2. Regional satellite communications support center coverage**

1-28. RSSCs may assist users in SATCOM planning and management. The RSSCs—

- Support the geographic combatant commanders in routine, deliberate, and crisis action planning for SATCOM resources.
- Take part in planning conferences and meetings to identify theater SATCOM support requirements.
- Process satellite access requests and publish satellite access authorizations for approved missions.

### *Wideband Satellite Communications Operations Center*

1-29. Five geographically dispersed WSOCs provide transmission monitoring and satellite payload control for the DSCS and WGS constellations. The WSOC continuously monitors the operational condition and status of satellites. WSOC personnel—

- Monitor every terminal's transmissions for proper power, bandwidth, and spectral characteristics from the start of the mission until mission completion.
- Monitor the satellite payload for anomalies and electromagnetic interference and help implement resolution actions.
- Record data and help identify equipment trends.
- Identify and solve terminal segment issues through the characterization of terminal transmissions.
- Perform satellite payload control in response to wideband satellite access authorizations sent from the RSSCs.

1-30. The WSOCs control the satellite payload to create links, shape beams, point antennas, and provide the power required to close the planned links. Each WSOC manages at least two satellites. As the WGS constellation grows, WSOCs may assume responsibility for more satellites.

1-31. The Joint Staff designated the Commander of the United States Space Command (USSPACECOM) as the SATCOM operational manager. United States Army Space and Missile Defense Command (USASMDC) manages the RSSCs. The Combined Force Space Component Command (CFSCC) exercises tactical control over the WSOCs. The 53d Signal Battalion performs wideband SATCOM payload and transmission control at the WSOCs and supports Commander, CFSCC in conducting SATCOM operations, in coordination with USSPACECOM and Commander, CFSCC. The USASMDC wideband C-SSE provides technical direction and situational awareness to the WSOCs on behalf of CFSCC.

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

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### Global Broadcast System

1-32. Global Broadcast System (GBS) ensures timely and secure net-centric capabilities supporting the full range of DOD warfighting and intelligence missions. GBS provides a broadcast service designed to meet the ever-increasing demand for a large volume of data. GBS provides high capacity smart-push and user-pull broadcast capability for video, high-resolution imagery, data, and other information. GBS supports training; military exercises; special activities; crisis operations; situational awareness; targeting; and intelligence, surveillance, and reconnaissance requirements.

1-33. GBS augments other communications systems. GBS broadcasts use WGS satellites for transport. GBS provides high-speed multimedia communication and information for deployed, in-transit, and garrisoned forces. GBS supports operations with joint and multinational mission partners, depending on security classification and communications security release restrictions. See appendix C for more information about the Global Broadcast System.

## PROTECTED SATELLITE COMMUNICATIONS

1-34. The joint Milstar and AEHF constellations are protected SATCOM resources. These satellite constellations provide highly secure and jam-resistant communications at the strategic, operational, and tactical levels. The satellites allow for low data rate, medium data rate, and extended data rate operation in the EHF and SHF bands. Protected SATCOM systems operate across the EHF uplink and SHF downlink frequency ranges. Protected SATCOM throughput is less than wideband SATCOM due to anti-jamming modulation techniques used in the Milstar and AEHF designs.

### Milstar

1-35. Milstar is a joint SATCOM system that provides secure, jam-resistant, worldwide communications to meet essential wartime operations for higher priority military forces. The multi-satellite constellation links commands with a wide variety of resources, including ships, submarines, aircraft, and ground stations. The Milstar constellation provides interoperability for all Services and supports the Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T).

### Advanced Extremely High Frequency

1-36. The AEHF satellite system is a joint SATCOM system that provides global, secure, protected, jam-resistant communications. AEHF users can operate at data rates ranging from 75 bps–8 megabits per second (Mbps) over the AEHF payload; this encompasses the capabilities of both the low data rate and medium data rate payloads on Milstar block II satellites. The cryptographic design of the AEHF satellites allows secure separation of U.S. users and multinational mission partners.

1-37. The AEHF system is flexible enough to support communications for separate operational environments and configurable to meet ever-changing operational requirements. The AEHF system protects critical voice and data communications against jamming, interception, detection, and natural and nuclear effects at low, medium, and high data rates. See appendix D for more information about protected SATCOM.

## NARROWBAND SATELLITE COMMUNICATIONS

1-38. Narrowband SATCOM supports worldwide tactical communications, including en route contingency communications, in-theater communications, intelligence broadcast, and range extension for combat net radios. 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 beyond line of sight communications reduces the probability of detection in a contested environment. Narrowband systems operate in the 300 MHz–3 GHz UHF range and include military UHF and commercial L and S radio frequency bands.

1-39. Narrowband SATCOM is particularly important during contingency operations, crises, and training missions. UHF user terminals are small, lightweight, low cost, and can operate with small portable antennas. Since narrowband SATCOM transmits and receives in the lower UHF range, it provides more reliable communications while on-the-move, in adverse weather conditions, in remote locations, and in dense foliage. UHF is generally susceptible to detection, direction finding, and jamming.

1-40. Narrowband SATCOM is ideal for highly mobile small tactical terminals such as manpack and handheld devices. The Army is the primary user of UHF SATCOM systems. The Navy develops, procures, provides engineering support for, and exercises executive oversight of all DOD advanced UHF narrowband communications satellites and associated ground systems. The narrowband satellite constellation has one fleet satellite communications satellite performing residual capabilities to support UHF requirements.

### UHF Follow-On

1-41. The Navy sponsored UFO system, began replacing the aging fleet satellite system. The UFO system is the dominant UHF constellation supporting tactical forces. Transponders on various space platforms support the Army's narrowband SATCOM mission. Both UFO and fleet satellite support UHF SATCOM. The UFO satellites provide worldwide coverage. The coverage areas are close to those of the WGS constellation (see figure 1-3 on page 1-9). Fleet satellite provides two-way UHF communications for Air Force SATCOM.

1-42. The Navy has five UFO satellites in geosynchronous orbit. When a UFO satellite exceeds its designed service life, it is moved into a super-synchronous orbit (100–200 kilometers above geosynchronous). The Navy's replacement for the aging UFO constellation is the MUOS.

### Mobile User Objective System

1-43. The MUOS uses the same frequency range as its predecessors, providing backward compatibility for the standard 5- and 25-kilohertz (kHz) channels. However, it uses a new waveform to increase both capacity and user availability nearly tenfold.

1-44. Narrowband SATCOM operates from 225 MHz–400 MHz. MUOS satellites have two payloads—wideband code division multiple access (WCDMA)-primary, and a legacy UHF payload as the migration to WCDMA over MUOS becomes available. The MUOS constellation consists of five satellites and shares the same orbital space with the UFO satellites. The fifth MUOS satellite is an on-orbit spare

**Note**. Refer to ATP 6-02.53 for more information on narrowband SATCOM radios.

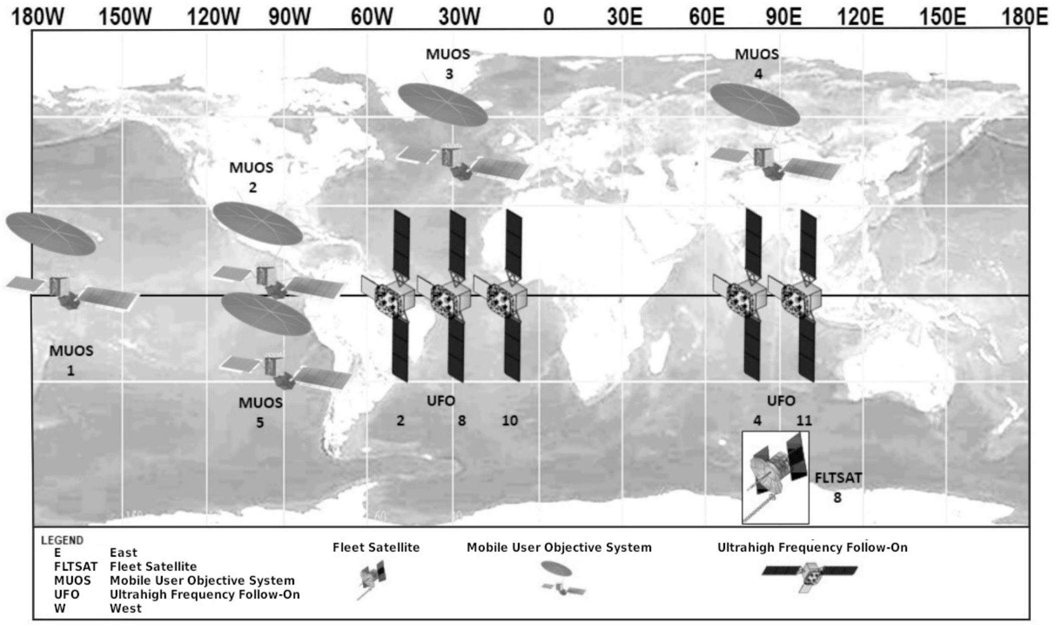


**Figure 1-3. Narrowband satellite constellation**

## Terminal Segment

1-45. Army narrowband satellite ground terminals operate in the UHF frequency range and are available in vehicle-mounted and man-portable versions. The terminals 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 UHF satellite access and the lack of anti-jamming capability.

1-46. The new modulation scheme used in the terminal segment is WCDMA. The WCDMA waveform is like the commercial 3G cellular waveform. The MUOS satellites replace cellular towers to provide worldwide coverage. This technology allows legacy UHF users to talk to WCDMA users through the MUOS to legacy UHF Gateway Component ground station.

## Ground Segment

1-47. The MUOS program has four locations in the ground segment which combine the technology of smartphone-like communications to augment the space and terminal segments. The ground segment locations are in Chesapeake, VA, Wahiawa, HI, Geraldton, Australia, and Niscemi, Italy. There is one primary satellite control facility in Point Mugu, California, and a backup at Schriever Airforce Base, Colorado. Army units preparing for deployment should coordinate host-nation approval for MUOS-capable radios before movement.

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# Chapter 2

# Roles and Responsibilities

Satellite communications involve several commands, agencies, and individuals operating together to provide a reliable, robust network and secured services. Planners and technicians need to know who is responsible for the functions necessary to establish and operate satellite communications systems. 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. Refer to CJCSI 6250.01F for more information on joint SATCOM operations.

### DEPARTMENT OF DEFENSE CHIEF INFORMATION OFFICER

2-2. The DOD chief information officer (CIO) is the principal staff assistant for information management to the DOD. The DOD CIO is the architect of the DODIN and provides policies, oversight, guidance, architecture, and strategic approaches for all communications and information network programs and initiatives on an DOD-wide basis. The DOD CIO ensures military SATCOM systems and resources support the DODIN architecture (refer to DODD 5144.02).

2-3. The office of the DOD CIO coordinates with the Chairman of the Joint Chiefs of Staff, United States Cyber Command, and USSPACECOM on any activities affecting SATCOM resource management, including resource allocation and service management.

### CHAIRMAN OF THE JOINT CHIEFS OF STAFF

2-4. The Chairman of the Joint Chiefs of Staff is the principal military adviser to the President, Secretary of Defense, and the geographic combatant commanders. The Chairman of the Joint Chiefs of Staff exercises operational oversight over those portions of the DODIN utilized for communications using the National Military Command System, including SATCOM.

2-5. The Chairman of the Joint Chiefs of Staff adjudicates allocation conflicts involving DOD SATCOM users that remain unresolved through USSPACECOM arbitration process. The Chairman of the Joint Chiefs of Staff provides contingency planning guidance to geographic combatant commanders and mission partners for the use of DOD SATCOM resources.

2-6. The Chairman of the Joint Chiefs of Staff provides operational policy, guidance, and procedures for SATCOM. The primary policy sources for all DOD SATCOM are the Chairman of the Joint Chiefs of Staff issuances.

### 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 SATCOM 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 USSPACECOM.
- Managing the SATCOM requirements process, including contingency and wartime commercial SATCOM assets.
- Helping resolve international SATCOM interference issues.
- Operating the joint communications satellite center, the lead for monitoring, coordinating, and formulating actions to support Chairman of the Joint Chiefs of Staff actions requiring SATCOM operation access.
- Directing 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 USSPACECOM requirements.
- Acting as the allocating authority for high-demand, limited-quantity, theater-deployable SATCOM assets.
- Directing resolution of electromagnetic interference with USSPACECOM, Department of State, and host nations.
- Serving as final approval authority for satellite communications database waiver requests to support satellite access.

2-8. The J-6 controls joint force communications systems and networks through a joint network operations control center at a joint task force or theater network operations control center at a geographic combatant command. The joint network operations control center receives reports from Service systems control or network operations and security centers. Refer to ATP 6-02.71 for more information about the joint network operations control center and theater network operations control center.

## Commander, United States Space Command

2-9. Commander, USSPACECOM is the operational and configuration authority for on-orbit SATCOM, satellite control systems, and SATCOM terminal infrastructure, including DOD gateways. Commander, USSPACECOM directs the operational management of military SATCOM resources and provides authorized users global access to SATCOM capabilities.

2-10. Commander, USSPACECOM performs SATCOM apportionment and arbitration and directs positioning, repositioning, and disposition of military satellite payloads and platforms.

2-11. Other USSPACECOM SATCOM responsibilities include—

- Maintaining the health, status, and surveillance of the military space segment.
- 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 United States Cyber Command.

***Note.*** Refer to CJCSI 6250.01F for additional information on Commander, USSPACECOM roles and responsibilities for SATCOM.

## Defense Information Systems Agency

2-12. 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 other DOD agencies.

2-13. The DISA performs enterprise-wide system engineering for the DODIN. The Director, DISA exercises program management over DODIN activities and components. The DISA prescribes policy, assigns responsibilities, and establishes guidelines for the use of DOD gateways.

2-14. The DISA serves as the C-SSE for DOD gateway sites. The DISA provides technical, sustainment, and operational support to the SATCOM operational manager, according to the roles and responsibilities outlined in United States Strategic Command Strategic Instructions 714 series.

2-15. The DISA manages the future commercial SATCOM services acquisition contract for commercial arrangements in partnership with the General Services Administration. The future commercial SATCOM services acquisition is the leading contract mechanism for U.S. Government commercial satellite services. Through the future commercial SATCOM services acquisition contract structure, the United States Space Force assists in areas of mutual concern to all users, such as cybersecurity, interference resolution, and technical reporting to USSPACECOM and other DOD offices. Users can obtain detailed information on commercial satellite communications services from companies participating in the future commercial SATCOM services acquisition contract by searching the General Services Administration Satellite Services Website.

2-16. 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 requests and issues gateway access authorizations to extend pre-positioned DISN services through DOD gateway sites to support global requirements.

2-17. The DISA performs assessments of satellite communications database submissions, engineering analyses, and performance-related studies of current and future SATCOM systems. The performance assessment and certification of all terminals are conducted by the DISA Joint Interoperability Test Command.

***Note.*** Refer to the DISA Website for more information DISA services and products.

### MILITARY DEPARTMENTS

2-18. The Army employs military SATCOM resources whenever they are available. When military resources are not available, the Army contracts commercial capabilities and manages them according to mission requirements and sound business practices. All commercial SATCOM resources procured, including Service programs of record, follow the same process as military SATCOM programs for satellite access requests when achievable or feasible. Further duties and responsibilities are in each Service’s respective doctrine and policy publications.

### GEOGRAPHIC COMBATANT COMMANDS AND HEADS OF DEFENSE AGENCIES

2-19. DOD agencies and geographic combatant commands coordinate prioritized SATCOM requirements with USSPACECOM and the Joint Staff J-6. DOD agencies and commands validate and coordinate commercial requirements the DISA.

## ARMY

2-20. USASMDC and NETCOM have defined SATCOM roles for the Army. Those roles include architecture, allocation and apportionment, planning, and management.

### UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND

2-21. USASMDC is the Army Service component command to USSPACECOM. USASMDC exercises administrative control for Space and Missile Defense and operational control over Army space forces, as delegated by Commander, USSPACECOM. USASMDC is the Army proponent for space and space-based capabilities.

2-22. USASMDC executes C-SSE duties for wideband and narrowband military SATCOM and satellite communications system expert (SSE) duties for DSCS, GBS, MUOS, and WGS. USASMDC's SATCOM roles and responsibilities include—

- Directly supporting Commander, CFSCC to support identification, characterization, geolocation, trend analysis, and reporting of SATCOM interference events.
- Planning and managing SATCOM supporting Commander, CFSCC, geographic combatant commanders, Services, other U.S. Government agencies, and multinational partners through the RSCCs.
- Providing and sustaining the infrastructure and resources necessary to plan, manage, configure, control, and provide situational awareness of wideband and narrowband SATCOM assets supporting Commander, CFSCC and Commander, USSPACECOM.
- Providing facilities for RSSC Europe, RSSC Pacific, and RSSC East to host the planning and allocation of all SATCOM systems and the necessary personnel and equipment from the other USSPACECOM Service components and the DISA.
- Sourcing personnel and equipment at the RSSCs for planning and allocating SATCOM systems.
- Providing the management structure for RSSCs to integrate operations as directed by Commander, CFSCC.
- Providing payload resource management for wideband and narrowband SATCOM assets supporting Commander, CFSCC and Commander, USSPACECOM.
- Enhancing SATCOM delivery to the DOD, in coordination with multinational partners.

## UNITED STATES ARMY NETWORK ENTERPRISE TECHNOLOGY COMMAND

2-23. NETCOM has the authority to operate, control, and secure the Army's enterprise-level transport capabilities on behalf of United States Army Cyber Command. NETCOM exercises technical control over all organizations that install, operate, maintain, and secure portions of the DODIN-A.

2-24. NETCOM provides global communications capabilities to enable joint and multinational command and control. NETCOM provides backbone network transport to facilitate extension and reachback capabilities while engineering, installing, operating, and securing the DODIN-A. *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 SATCOM responsibilities 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 DISN long-haul segment.
- Exercising Army review, approval, and validation authority over telecommunications service requests.
- Validating requests for special access requirements to increase survivability and reliability.
- Operating, maintaining, and sustaining the Army SATCOM resources.
- Commissioning and decommissioning of Mobile Satellite Services and Enhanced Mobile Satellite Services.

# Chapter 3
# Satellite Communications Architecture

This chapter provides an overview of the satellite communications architecture. The satellite communications architecture conforms to the Defense Information Systems Network architecture and user requirements. The satellite communications architecture responds to situational and environmental factors. This chapter explains Army architecture requirements, objectives, and considerations.

## OVERVIEW

3-1. The SATCOM architecture includes constellations, terminals, planning, management systems, and networks, both military and commercial. The SATCOM architecture is subject to change based on 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 drive the SATCOM architecture for a given operation.

3-2. CJCSI 6250.01F establishes joint policies for the use of DOD SATCOM resources and to plan for future systems. Following the procedures outlined in CJCSI 6250.01F, Army users can receive DOD SATCOM support

## REQUIREMENTS

3-3. Requirements that drive architecture development include—

- Extension of DISN services to deployed units.
- SATCOM capabilities at-the-halt and on-the-move.
- Bandwidth optimization.
- Connectivity between echelons.
- Reachback capability.
- Logistics and administrative support.

3-4. At the Army enterprise level, the chief architect is the Director of the Army Architecture Information Center with the CIO/assistant chief of staff for communications (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.

## OBJECTIVES

3-5. Commanders' objectives create requirements that dictate the architecture. The SATCOM architecture adapts to support a changing operation. Planners need to know the commander's intent and resource availability to satisfy the intent. Objectives include—

- Interoperability.
- Connectivity—
  - Coverage.
  - Capacity.
  - Protection.

- Cybersecurity.
- Operational management.
- Operational suitability.

## INTEROPERABILITY

3-6. *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 understanding of the operational environment and promotes ensure unity of effort and synchronization of actions.

3-7. Interoperability is essential to effectiveness. The Army depends on the interoperability of communications systems when operating as a part of a joint force. Using a common SATCOM architecture enables forward deployed forces to more efficiently integrate into operations.

## CONNECTIVITY

3-8. SATCOM connectivity provides the required amount of protected and unprotected communications services. Connectivity encompasses coverage, capacity, and protection.

### Coverage

3-9. 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 between 65 degrees north and south latitudes. The North Polar Region is the area above 65 degrees north, and 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 kilometers to 50,000 kilometers or more.

### Capacity

3-10. The capacity of a SATCOM system is the type and amount of throughput available. Capacity determines the number of users that the system can support. Users may share the same bandwidth, as is the case with broadcast or networked applications.

### Protection

3-11. 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

3-12. *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).

3-13. Space-based assets can be rendered useless through physical attacks with anti-satellite weapons. These assets may also come under attack through electronic means such as jamming or spoofing. These methods of attack interfere with the transmission of radio frequency signals and cause communications systems outages. Peer threats may use physical or electronic means to disrupt space-based systems to render ground-based weapons and communications systems ineffective, creating uncertainty and confusion.

3-14. Threat activities in cyberspace continue to pose significant challenges to each of the different segments in spaced-based systems. Cyberattacks use a different approach from the traditional forms of aggression by targeting communications systems to degrade or disrupt information and services. Peer threats may inject false signals to compromise the system without the knowledge of the intended recipient.

### 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 supported to enable access by authorized users. Operational management of satellite resources assists commanders in exercising global command and control. Commanders maintain control and visibility over SATCOM assets in a congested and contested environment. Commanders and staffs 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, whose activities could deny, degrade, or disrupt 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 must meet user requirements for system effectiveness in any operational environment.

## PLANNING 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. Planning 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 be familiar with these variables. The distribution of services is highly dependent on strategic terminals. Long-haul network transport, procedures for leasing facilities, and negotiating with host nations for frequency use and landing rights are a few considerations.

#### The Global Backbone

3-20. Strategic SATCOM supports the global communications backbone with extensive reach and tie-ins to terrestrial networks. Deployed air, land, and maritime forces operational environments dictate the need for specialized communications in each domain. The global backbone supports the deployed network with high capacity communications for reachback to the sustaining base and extends DISN services to tactical command and control applications and systems. The high capacity backbone connects the DODIN through networks tailored to the Soldier’s area of operations.

#### Interoperability With Other Services

3-21. Integration with other Services during joint operations requires communications interoperability. The standardized DOD SATCOM architecture ensures that all Services’ SATCOM systems are interoperable.

### OPERATIONAL CONSIDERATIONS

3-22. There are specific operational-level SATCOM considerations that enable SATCOM at the tactical level. Most negotiation for landing rights, and host-nation approval take place at the operational level.

#### Landing Rights

3-23. 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 and operate a satellite earth terminal or 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 commercial satellite systems may require specific approvals, particularly outside the continental United States.

3-24. Host nations commonly require express permission to operate any foreign-owned SATCOM terminal within their borders. When requesting satellite access, users should allow plenty of time to negotiate 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. Refer to ATP 6-02.70 for more information about landing rights.

### Host-Nation Approval

3-25. 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.
- Using the appropriate frequency clearances for the space segment.

3-26. Obtaining host nation approval may take four months or longer, depending on the country and the expediency of the agency handling the paperwork. Most countries require satellite earth terminals to 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 agreements may include parameters such as beamwidth, transmission frequency clearance, fees, and permissions.

3-27. Host nation approval to operate SATCOM equipment and access resources depends upon the political climate and the personality of the negotiator. Using a host nation's airspace, ports, and electromagnetic spectrum requires coordination through the host nation's government channels.

## TACTICAL CONSIDERATIONS

3-28. Tactical communications systems extend home station-level services to deployed locations. Improved connectivity leads to increased situational understanding to enable better command decisions, faster targeting, and increased efficiency during tactical operations. Tactical considerations include—

- Communications mobility.
- Survivability
- Global access.

### Communications Mobility

3-29. Tactical satellite communications contribute to mission success with proper planning and training. Commanders exercise command and control in fast-paced, highly mobile scenarios across broad and sometimes non-contiguous areas of operations. Command and control is possible on-the-move, en-route to, entering into, operating in, or exiting an area of operations. Tactical satellite communications capabilities are available and accessible to the commander and staff, enabling communications on the move for better situational awareness and understanding. Tactical satellite communications provide the commander with global access to DISN services if planned according to the mission requirements.

### Survivability

3-30. Satellite communications systems provide command post support and command and control with both fixed and on-the-move capabilities. Signal planners should consider the operating characteristics, limitations, and effective planning distance for each available SATCOM communications asset. As planners define communications requirements, one consideration should include the survivability of both personnel and equipment. Survivable SATCOM networks result from techniques such as separation of key facilities, redundant communications nodes, or a combination of these techniques necessary for the physical protection of personnel and protection of transmission equipment and infrastructure. While it is not practical to make all elements of a system equally survivable, the assets which enable command and control need protection equal to the survivability requirements of the associated command post.

## Global Access

3-31. Long-range communications allow commanders global access to information and services increasing their awareness to the current or developing situation. Soldiers require continuous, reliable communications across the range of military operations. Long-range communications transmitted over satellite provide quick global access to communication services extends voice and data communications, information and intelligence, early warning, weather reports, and imagery anywhere on the globe.

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# Chapter 4

# Satellite Communications Planning

This chapter addresses the planning process for Army satellite communications. Satellite communications planning is a complex process due to the many variables that affect satellite links. This chapter describes planning for narrowband, wideband, protected, and commercial satellite communications and addresses planning associated with Warfighter Information Network-Tactical.

## JOINT

4-1. The geographic combatant commander provides communications system guidance and priorities to supporting commands through the J-6 to the joint cyberspace center. This guidance is provided to subordinate theater network operations control centers, joint network operations control centers, and Service-level network operations and security centers.

4-2. There are three levels of SATCOM operational command structure—

- Level 1: Chairman of the Joint Chiefs of Staff oversight.
- Level 2: System-level staff and management directed by USSPACECOM, USASMDC, and the other Service components.
- Level 3: 24-hour SATCOM command and control centers.

### LEVEL 1: CHAIRMAN OF THE JOINT CHIEFS OF STAFF

4-3. The Chairman of the Joint Chiefs of Staff exercises oversight of operational SATCOM activities and resources supporting presidential and DOD SATCOM systems. 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 access. The Joint Staff J-6 monitors the health and operational status of SATCOM systems and any relevant connected networks, as reported by USSPACECOM. Refer to CJCSI 6250.01F and United States Strategic Command Strategic Instruction 714-04 for Chairman of the Joint Chiefs of Staff guidance on SATCOM planning, allocation, arbitration, adjudication, oversight, and assessment for daily systems management.

### LEVEL 2: SYSTEM-LEVEL STAFF AND MANAGEMENT

4-4. Commander, USSPACECOM develops and implements policies, procedures, and standards for SATCOM systems with input from designated SSEs. As the SATCOM operational manager, Commander, USSPACECOM establishes global and regional operations centers to support geographic combatant commanders and other users. Commander, USSPACECOM distributes guidance through United States Strategic Command Strategic Instruction 714-04. The Service components also operate at this level (see chapter 2). USASMDC provides guidance to all SATCOM planners.

### LEVEL 3: 24-HOUR SATELLITE COMMAND AND CONTROL CENTERS

4-5. The satellite command and control centers are the third level of SATCOM management. These command and control centers provide operations support to authorized users and are responsible for satellite control. The DISA Global Operations Command, operated by the DISA, provides near real-time, situational awareness and defense of the DODIN. A contingency operations section focuses on support for exercises and current operations, with emphasis on standardized tactical entry point (STEP) and teleport missions.

### ANNEX K AND THE JOINT NETWORK MANAGEMENT SYSTEM

4-6. The Joint Network Management System provides automated joint communications system management for geographic combatant commands and joint task forces. The Joint Network Management System is a package of hardware 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 a joint operation order and a schematic tool to create network diagrams supporting Annex K. The reporting subsystem provides an editor to produce and export the satellite access request and gateway access request. Refer to CJCSM 6231.01E for more information on the Joint Network Management System.

## ARMY

4-7. Establishing satellite links 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.
- Satellite access requests.
- Gateway access requests.
- Access priorities.
- Apportionment.
- Access planning.
- Redundant communications procedures.
- Allocation process.
- After action reporting.
- Planning checklist.

### THE SATELLITE COMMUNICATIONS DATABASE

4-8. The satellite communications database is a comprehensive database of approved military and commercial SATCOM requirements. The Joint Staff owns and validates the satellite communications database, while the DISA maintains it. The satellite communications database provides valuable data input for scenario development and other analyses and is available to SATCOM planners, managers, and analysts worldwide. The satellite communications database contains authorized requirements and applies to approved force structures or scenarios to facilitate required satellite analyses.

4-9. The satellite communications database categorizes SATCOM requirements based on begin dates and extends for two years. Current requirements meet operational missions and may have specific end dates. These requirements specify a particular on-orbit satellite or frequency range based on operational limitations or equipment availability. The existing requirement entries of the satellite communications database represent a comprehensive catalog of recent and near-term requirements for management and operational assessment of SATCOM systems.

4-10. 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.

4-11. 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 doctrine.
- Changes in Service force structures.

4-12. Future requirements may be new or may replace existing requirements based on changes as previously described. Program managers responsible for current or proposed systems that rely on SATCOM resources must ensure their requirements are documented in the Satellite Communications Database Management Tool.

4-13. Users establish and document valid service requirements in the Satellite Communications Database Management Tool before requesting satellite access in the Joint Integrated Satellite Communications Tool. Users submit connectivity requirements using the Satellite Communications Database Management Tool. These requirement entry captures information including—

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

4-14. Within the continental United States, users submit satellite communications database requirements to United States Army Forces Command (FORSCOM) for review and the geographic combatant command for submission to the satellite communications database. Outside the continental United States, the theater army submits satellite communications database requirements to their geographic combatant command for validation and submission.

## REQUIREMENTS SUBMISSION

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

## OPERATING IN DEGRADED AND DENIED ENVIRONMENTS

4-16. Understanding threat capabilities is critical to hardening the deployed SATCOM network against enemy electromagnetic warfare and signals intelligence. If an enemy cannot detect command posts and communications sites, it cannot target the sites with electromagnetic attack or lethal fires. Enemy attacks on friendly command nodes may combine electromagnetic attack, other information warfare effects, or lethal fires to deny friendly forces the use of spectrum-dependent systems. Threat forces gather technical and combat information about their enemies to accomplish this. Refer to ATP 6-02.60 for more information regarding techniques in tactical SATCOM deployments.

4-17. 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 critical targets for the growth in anti-access and aerial 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 electromagnetic spectrum. 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 aerial denial strategy, requiring a higher degree of planning and situational awareness for redundant, auxiliary, and mitigation techniques.

4-18. Techniques to consider include —

- Formulate satellite communications plans that minimize the radio frequency footprint.
- Use modulation techniques which provide a low probability of signal detection or interception.
- Identify bandwidth requirements (lower data rates require less radio frequency power).
- Emission control (limiting radio transmission).

4-19. SATCOM users must also be proactive and take appropriate actions to minimize the impacts of interference and adversary attacks. Users should assess threat risks and the capabilities and vulnerabilities of terminals to plan and implement appropriate primary, alternate, contingency, and emergency communication plans to assure communications and the ability to restore lost communications in operationally relevant timeframes. They should also bring all necessary equipment to support the primary, alternate, contingency, and emergency communication plan; protect information sent over SATCOM; routinely check terminal performance; report degradation to operations centers identified in their satellite access authorizations; and be prepared to change terminal settings to mitigate interference and attacks when directed by an operations center.

4-20. Factors to consider include—

- Primary, alternate, contingency, and emergency communication plans to mitigate the effects of a congested or contested environment.
- Locating SATCOM antennas away from command posts to mitigate collateral damage if communications systems are destroyed.

## Satellite Access Requests

4-21. When a unit has a validated requirement for SATCOM access, the communications planner at the division G-6 or other operations cell submits a satellite access request through corps headquarters to the theater army for verification. Once the geographic combatant command validates the requirement, the RSSC responsible for managing the SATCOM resources processes it. If sufficient satellite resources are available, the RSSC prepares a satellite access authorization after reviewing the approved satellite access request. If resources are not available, a satellite access request is denied or partially denied. If denied, the geographic combatant command may request arbitration. Approved satellite access authorizations permit operational access. The RSSC issues them to the originating unit, disseminated to the controlling SATCOM command center on a secure website.

4-22. Planners should provide flexibility in the satellite access request by including all frequency bands their multi-band terminals can use. Doing so reduces the chance of denials or partial denials and increases the effectiveness of restoral by enabling planners to leverage multiple communication paths for multi-band terminals. Often, power restrictions or capacity limitations in one band do not carry over to other bands, so the user can get much better throughput and support if they are flexible and transparent.

### Satellite Access Request Guidelines

4-23. Each satellite access request must meet CJCSI 6250.01F requirements. Failing to meet the requirements results in denial of satellite or gateway access.

4-24. Units generate satellite access requests using 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 (narrowband, wideband, protected, or commercial) required. When submitting a satellite access request or gateway access request, the requesting unit should follow these steps:

- Signal or operations staff planners prepare a satellite access request.
- Unit forwards satellite access request to supported theater army SATCOM manager for validation; units in the continental United States submit requests to FORSCOM.
- Theater army or FORSCOM submits request to the geographic combatant commander for mission approval.
- The geographic combatant commander forwards validated satellite access requests and gateway access requests to the supporting RSSC.

***Note.*** In accordance with United States Strategic Command Strategic Instruction 714-1, the validation authority (geographic combatant command or FORSCOM) submits satellite access requests to the supporting RSSC at least 30 days before the requested access date. Validation authorities may require verification authorities or authorized users to submit a satellite access request and gateway access request well in advance of the 30-day minimum to meet applicable timeline requirements. Therefore, the geographic combatant commands and FORSCOM requires users to submit their request 51 days before the requested access date. The validation authority requires an exception to policy to justify the late submission signed by the first O-6 in the chain of command for requests not submitted 51 days in advance. If the requesting unit fails to submit 30 days before mission access or the RSSC determines a pattern of systemically late requests the RSSC may request an O-6 level engagement with the validation authority, along with a letter of lateness submitted by an O-6 sponsoring the requesting unit.

## GATEWAY ACCESS REQUESTS

4-25. The gateway access request submission is similar to the satellite access request. Planners submit a gateway access request to request DISN services. The DISA reviews and approves gateway access requests. The gateway access request submission starts with the unit and routes through the chain of command to the theater army. If approved, the gateway access request routes through the respective RSSC and DISA offices. If approved, the RSSC sends the request to DISA, and the authorization is assigned a satellite communications database number and priority.

## ACCESS PRIORITIES

4-26. The Chairman of the Joint Chiefs of Staff sets priorities for military SATCOM 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.

4-27. The Chairman of the Joint Chiefs of Staff owns SATCOM assets and apportions them to each geographic combatant commander, who temporarily controls SATCOM assets within their area of responsibility. Geographic combatant commanders apportion resources to joint task forces or Service components, depending on operational requirements and national priorities.

4-28. Users should have an endorsed satellite communications database requirement before submitting a satellite access request. Before submission to the RSSC, the division communications planner prioritizes satellite access requests based on mission priorities according to the priority tables in CJCSI 6250.01F. Table 4-1 on page 4-6 outlines satellite communications priorities.

**Table 4-1. Satellite communications priorities**

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

## APPORTIONMENT

4-29. Apportionment is the distribution of a block of SATCOM resources to geographic combatant commanders and other authorized users for contingency and crisis planning. The force planning construct outlines resource apportionment based on strategic planning guidance. This construct considers operational situations, threat conditions, and operational requirements. The apportionment process begins before deployment with the development of contingency plans directed in the Joint Strategic Capabilities Plan.

4-30. Operational and mission variables can affect SATCOM apportionment; satellite resources may require reassignment to meet urgent operational needs. Geographic combatant commanders cannot draft detailed communication plans without knowing the SATCOM apportionment.

## ACCESS PLANNING

4-31. To use their apportioned SATCOM resources, geographic combatant commanders need permission to access a satellite. To obtain this permission to access, geographic combatant commanders 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, geographic combatant commanders may initiate the production of a SATCOM requirements summary.

4-32. Approval recommendation for geographic combatant commanders' communications plans rests with the USSPACECOM J-6. The USSPACECOM J-6 determines if SATCOM support is feasible and resources are available.

## ALLOCATION PROCESS

4-33. Allocation is the authorization of SATCOM resources to support authenticated requirements. The allocation process provides or denies the requestor access to satellite resources. Denial of service due to insufficient resources can go through the USSPACECOM arbitration process defined in United States Strategic Command Strategic Instruction 714-04.

4-34. The allocation process starts with a satellite access request, as outlined in approved communications plans. If the unit requires gateway access to DISN services, the unit submits a gateway access request concurrently with the satellite access request. USSPACECOM requires the validation authority to submit satellite access requests for training missions to the supporting RSSC at least 30 days before the mission. Validation authorities may require verification authorities or authorized users to submit satellite access requests and gateway access requests more than 30 days in advance to meet applicable timeline requirements.

4-35. The RSSC processes and certifies satellite access requests and issues satellite access authorizations to allocate SATCOM resources. The DISA Contingency and Exercise Branch processes gateway access requests and issues gateway access authorizations for pre-positioned DISN services.

4-36. Processing times differ according to the priority of the satellite access request and gateway access request. The allocation process schedules satellite access according to system limitations, equipment constraints, and validated priorities. Processing times include—

- Crisis or contingency satellite access request—within 24 hours if a solution exists.
- Routine requirements—usually 30 days before mission or exercise start, or 21 days after satellite access request submission.

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***Note.*** CJCSI 6250.01F outlines procedures for submitting waivers requests for rejected satellite access requests or gateway access requests.

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## AFTER ACTION REVIEWS

4-37. The after action review documents system and personnel performance, identifies procedural or technical conflicts, and records outstanding or substandard mission performance. The after action review 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.

4-38. Upon request from the user, geographic combatant commander, controller, planner, or manager, all entities involved with a SATCOM mission complete an after action review within 10 working days of the request. The after action review submission follows the same channels as listed in paragraph 4-31 for satellite and gateway access requests.

## PLANNING CHECKLIST

4-39. The SATCOM planning checklist helps planners understand SATCOM requirements. The checklist helps a planner in defining SATCOM requirements. The planning checklist requires the planner to answer the following questions:

- 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 outside the continental United States, are host-nation agreements and landing rights approved?
- What is the area of operations communications infrastructure?
- Can we leverage the existing communications infrastructure?
- What types of terrain may be present in the area of operations that may interfere with SATCOM access or terminal placement?
- What is the threat environment?
- Do we have justified SATCOM requirements to support the mission?
- Do we need to submit requests for satellite communications database 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 the required frequencies?
- Are the Global Positioning System 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 the 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 multinational partners or other Services?
- What type of traffic requires protected SATCOM links and what traffic can use commercial SATCOM?
- What are the 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 which troops will deploy?
- Do we have qualified SATCOM equipment operator-maintainers? What training is required before movement?
- What types of backup communications are 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 the use of personal Global Positioning System receivers, handheld commercial radios, cell phones, and morale calls using SATCOM?

- Is there a heavy dependence on one means of communications during the operation?
- Have SATCOM requirements for the operation been evaluated to ensure the proper use of limited assets?
- Can any of the networks combine or time-share based on 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

4-40. Narrowband (UHF) SATCOM supports tactical forces. Planners should submit a satellite access request to the validation authority at least 30 days before the mission date to meet applicable timeline requirements. The validation authority submits the validated satellite access request to the supporting RSSC 30 days before the requested access date, unless the validation authority identifies a satellite access request as an exception to policy, crisis, or contingency satellite access request. Planners use the Joint Integrated Satellite Communications Tool application on SIPRNET to prepare and submit narrowband SATCOM satellite access requests.

4-41. UHF satellites have limited available bandwidth. Routine traffic should use other means of communication.

***Note.*** Refer to ATP 6-02.53 for more information on narrowband SATCOM planning. Refer to CJCSI 6251.01F for narrowband SATCOM policy guidance and procedures.

# WIDEBAND SATELLITE COMMUNICATIONS

4-42. The primary purpose of wideband SATCOM is to extend the range of DISN services. WGS and DSCS satellites provide global backbone connections. Wideband SATCOM enables efficient use of the spectrum. The use of wideband frequencies adds flexibility to routed traffic between users in different scenarios. Wideband SATCOM improves performance for disadvantaged users and provides legacy compatibility with existing users. Both tactical and enterprise systems support wideband SATCOM, which is increasingly interoperable with commercial SATCOM infrastructure to maximize performance and flexibility.

## WIDEBAND PLANNING

4-43. For wideband SATCOM development, planners rely on wideband satellite operations procedures. These procedures cover the use of the DSCS and WGS constellations and GBS. Wideband satellite operations procedures apply to all Services, agencies, and multinational mission partners requesting access to the DSCS and WGS constellations.

## WIDEBAND SATELLITE AND GATEWAY ACCESS REQUEST

4-44. Wideband satellites are a limited and shared resource. The geographic combatant command J-6 staff analyzes communications 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 command and control requirements at all echelons. The J-6 plan considers the equipment type, data rate, and connectivity characteristics of wideband SATCOM links required. J-6 planners coordinate with the wideband SATCOM manager from the servicing RSSC to identify shortfalls and resource availability.

4-45. Communications planners submit an Army service request or satellite access request through their chain of command to the supporting RSSC to request satellite access for a wideband SATCOM mission. Planners should submit requests 30–45 days before the mission start date to allow adequate time for processing. The supporting RSSC adjudicates conflicting requirements before approving a satellite access authorization. The requests processes include—

- Army service request or satellite access request for commercial Ku band.

- Army service request for WGS (Ka or X band) support using the Army Centralized Army Service Request System on SIPRNET.
- Satellite access request for WGS SATCOM using the Joint Integrated Satellite Communications Tool application.

4-46. The unit submits a gateway access through the Army Centralized Army Service Request system portal. When submitting a gateway access request, the planner includes the appropriate satellite communications database priority designator. FORSCOM validates and adjudicates the unit’s gateway access request against the collective mission of the Army, and provides a copy of the satellite or gateway access to USSPACECOM.

4-47. RSSCs plan and authorize satellite access based on satellite resource availability, mission priority, and satellite communications database characteristics. Satellite access authorizations provide operating parameters, interim tactical orderwire system parameters, and interim tactical orderwire system-controlled frequency division multiple access network operating parameters. The Joint Integrated Satellite Communications Tool application transmits satellite access authorizations to the originator of the satellite access request, the primary and alternate WSOC, and the DOD gateway site (if applicable).

# PROTECTED SATELLITE COMMUNICATIONS

4-48. 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. Protected SATCOM missions require—

- Planning.
- Access and authorization.
- Terminal image generation.
- Management of protected access.
- Tactical reporting.

## PLANNING

4-49. Geographic 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. Planners submit satellite access requests over the Joint Integrated Satellite Communications Tool application. Planners should submit request early enough to allow 30–45 days processing time for EHF and AEHF services.

## ACCESS AND AUTHORIZATION

4-50. Accessing a protected SATCOM payload requires a satellite access authorization and terminal image data. Planners identify mission requirements and submit a satellite access request for EHF to the theater army SATCOM manager. The theater army G-6 verifies the mission and forwards requirements to the geographic combatant command for validation and mission approval. The RSSC implements the requirements.

4-51. The RSSC verifies Milstar and AEHF can support the mission using the Tactical Mission Planning Subsystem. The RSSC verifies UHF Follow-On can support EHF low data rate 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 G-6 and geographic combatant command J-6 staff.

4-52. The RSSC develops and issues the satellite access authorization, authorizes the protected mission, and issues an action copy to the requesting unit. The RSSC provides information copies to the theater army G-6, the geographic combatant command J-6, the Milstar Satellite Operations Center, and the Naval Satellite Operations Center.

## TERMINAL IMAGE GENERATION

4-53. System constellation, payload, service, terminal configuration data, satellite ephemeris data, and transmission security and communications security keys for the EHF and AEHF mission form the terminal image. The service terminal controller consolidates, develops, and distributes the terminal image data for loading by terminal operators.

### MANAGEMENT OF PROTECTED ACCESS

4-54. The geographic combatant command manages allocated and apportioned resources according to warfighting requirements and can sub-apportion resources to the theater army and other Service components. The designated network control station or communications controller monitors services during the mission. Milstar and AEHF enable centralized management and decentralized execution. Refer to CJCSM 6254.01H for more information about Milstar network planning.

### TACTICAL REPORTING

4-55. Accurate tactical reporting is essential to managing protected SATCOM. The EHF after action review documents information to identify trends, lessons learned, and problems with tactical EHF missions and improve future operations for the EHF management and user community.

4-56. The tactical environment is always fluid. SMART-T and single-channel anti-jam man-portable terminals extend tactical communications to beyond line-of-sight ranges at echelons corps through brigade. Terminals frequently move, de-access and re-access the satellite, and are subject to preemption due to low precedence.

4-57. Unit standard operating procedures dictate additional reporting requirements. Terminal operators report to the network control station or communications controller and communications planner during troubleshooting. Communications planners report conflicts to the RSSC to help resolve system problems.

4-58. At the end of a protected SATCOM mission, participants provide feedback to the communications planner. The communications planner compiles comments for the after action review and submits these comments through the Joint Integrated Satellite Communications Tool for inclusion in the DOD satellite database.

4-59. The after action review documents EHF and AEHF mission performance. Army units maintain a master station log to track mission information. DA Form 1594 (*Daily Staff Journal or Duty Officers Log*) is a master station log example. Terminal operators can use the SMART-T data export feature to save or print history, fault, and fault isolation logs. The logs assist in after action review development.

## COMMERCIAL SATELLITE COMMUNICATIONS

4-60. The commercial satellite industry has a small number of multinational commercial satellite owner-operators and a greater number of vendors who resell satellite bandwidth and services. Commercial resources play a vital role in satisfying military SATCOM requirements. When operational requirements exceed military capabilities, or can be met more efficiently or effectively using commercial services, commercial satellites augment military wideband and narrowband capabilities.

4-61. United States Air Force Space Command manages commercial SATCOM contracts. Planners route requests for commercial satellite support through United States Air Force Space Command or obtain a waiver through the DOD CIO. The increased use of and reliability of commercial satellite services make them a cost-effective solution for military use. In coming years, the demand for commercial capabilities to meet military SATCOM requirements is expected to continue to increase.

### ARMY USE OF COMMERCIAL SATELLITE COMMUNICATIONS

4-62. The Army employs military SATCOM capabilities when they are available and the most effective or efficient asset for a particular mission. When available military resources are insufficient to support operations, units can request commercial satellite resources to provide the required additional bandwidth. In a few cases, the Army mission does not have a sufficiently high priority to receive consistent military SATCOM access. In other cases, the technical design or the deployment schedule of the military satellite constellations cannot fulfill mission requirements. In these cases, the Army employs a disciplined process of mission analysis, solution analysis, and resource analysis to provision commercial services.

4-63. Several Army organizations provide, operate, and manage commercial SATCOM networks to augment military capabilities for Army and DOD missions. These organizations include—

- Program Manager-Defense Wide Transmission Systems—operational manager of the logistics SATCOM network.
- FORSCOM—operational manager of the commercial SATCOM network for Warfighter Information Network-Tactical (WIN-T) training in the continental United States.
- Program Manager-Mission Command—operational manager of the friendly force tracking network.

4-64. Commercial satellite access also goes through the satellite access request and satellite access authorization process. United States Air Force Space Command records the satellite communications database and transmission plan for each lease annually, and reports to USSPACECOM.

## PLANNING FOR COMMERCIAL SATELLITE COMMUNICATIONS FIXED SATELLITE SERVICES

4-65. Army SATCOM networks require satellite communications database numbers in accordance with CJCSI 6250.01F. The satellite communications database entry for each network identifies whether commercial capabilities are the primary or alternate means of communication. Units submit their requirements through the supported geographic combatant command. Commercial satellite access requests follow similar procedures to requests for military SATCOM access. Planners should submit satellite access requests, gateway access requests, telecommunications service requests, statements of work, and commercial satellite service surveys to the theater army spectrum manager (outside the continental United States) or the FORSCOM SATCOM manager (in the continental United States) 30–45 days before the requested access date.

4-66. Army units employing WIN-T systems in the continental United States request military or commercial satellite access based on unit training goals. Army units request access to military satellites using the Joint Integrated Satellite Communications Tool. FORSCOM processes the satellite access request for submission to USSPACECOM. FORSCOM manages commercial access to support WIN-T training. NETCOM operates the regional hub nodes to provide gateway access and a connection to DISN services for these missions. Units request access by submitting a satellite access request and a gateway access request using the Army Centralized Army Service Request System Portal. Requests should include the satellite communications database priority designator. FORSCOM validates the request and adjudicates the schedule and capacity based on overall collective training missions for the Army. USSPACECOM receives a copy of the satellite access request for validation. Most commercial SATCOM missions for training in the continental United States use the WIN-T regional hub nodes at Camp Roberts, California, and Fort Bragg, North Carolina for DISN access.

## COMMERCIAL SATELLITE COMMUNICATIONS MANAGEMENT

4-67. USSPACECOM is the main DOD element for engagement with the commercial satellite industry. The Army participates in many working groups USSPACECOM organizes with Satellite Industry Association member companies.

4-68. United States Air Force Space Command has two divisions that assist with managing commercial SATCOM. The Operate and Assure Division directs, coordinates, and synchronizes acquisition for commercial SATCOM. The Gateway Operations Division is the C-SSE for DOD gateways, manages the use of commercial satellite networks, and provides monitoring and control.

## MOBILE SATELLITE SERVICES

4-69. Mobile satellite service is a portable satellite telephone that enables phone service anywhere on the earth. Mobile satellite service systems support Army missions and operations by augmenting military terrestrial and satellite networks and providing beyond line of sight communications capabilities. Mobile satellite service systems are commercial products; the Army does not exercise oversight in the development, fielding, or operation of these systems. The Army relies on vendor-provided information to determine the suitability of mobile satellite service systems for military use.

4-70. The only mobile satellite service systems the Army can use without a waiver are Iridium and international maritime satellite (INMARSAT). A mobile satellite service link is similar to a cellular telephone link, except the repeaters are orbiting the Earth, rather than on the surface. Those mobile satellite service repeaters are on geostationary, medium Earth orbit, or low Earth orbit satellites. If the system has enough satellites to provide global coverage, a mobile satellite service can link any two compatible handsets at any time, regardless of location. Mobile satellite service systems interoperate with land-based cellular and landline telephone networks.

4-71. The DISA is the SSE for mobile satellite services. The DISA mobile satellite service office—

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

## Enhanced Mobile Satellite Service

4-72. Enhanced Mobile Satellite Service is a satellite-based telephone and data communication service that uses commercial satellite infrastructure to provide voice and low rate data services from a mobile, lightweight terminal through a dedicated gateway to access the DODIN. Enhanced mobile satellite service can provide type-1 secure voice service and non-secure access to commercial and Defense Switched Network telephone services.

4-73. Modifications to the commercial system provide compatibility with type-1 voice encryption and protection of sensitive user information. The Enhanced Mobile Satellite Service gateway provides remote access to the Defense Switched Network, commercial long-distance, commercial international long distance, and other DISN services. Enhanced Mobile Satellite Service features include—

- Global coverage—Polar Regions (90 degrees north to 90 degrees south), ocean areas with 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, Defense Switched Network multilevel precedence and preemption.
- Paging.
- Short-burst data.

4-74. The Enhanced Mobile Satellite Service provides the following special features:

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

4-75. The Enhanced Mobile Satellite Service is offered through the DISA to DOD users, other U.S. Government 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 must comply with provisions for positive access control to the DOD Enhanced Mobile Satellite Service network, control of user information, and reports to the DISA.

### Iridium

4-76. The Iridium system is the first commercially available, cross-linked, pole-to-pole, global enhanced mobile satellite service. Iridium provides mobile, 24-hour telephone, paging, messaging, facsimile, and low data rate services to small handsets anywhere on the globe, including the polar regions.

4-77. The Iridium constellation provides continuous coverage of every region on the globe by at least one satellite. Each satellite acts as a digital relay, cross-linked to four other satellites—two satellites in the same orbital plane and two in an adjacent plane—to deliver communications services to remote areas on the Earth where terrestrial communications may not be available.

4-78. Iridium 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.

4-79. 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 the Iridium Security Module. The Iridium security module provides users a secure method to coordinate with RSSCs for access and engineering purposes. The Iridium architecture depends on a clear line of sight to the satellite. Customers inside buildings, under dense foliage, or in steep terrain, such as high mountains or urban areas with tall buildings, may experience difficulty acquiring a satellite signal.

### International Maritime Satellite

4-80. INMARSAT supports maritime, land, and aerial communications. Army planners should understand INMARSAT capabilities to better develop their communications solutions. INMARSAT capabilities include—

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

4-81. One of the major differences between the Iridium and INMARSAT constellations is the orbits the satellites use. Because INMARSAT operates in a geosynchronous orbit, it cannot offer polar coverage. INMARSAT shares the same advantages and disadvantages as other geosynchronous satellite constellations.

## WARFIGHTER INFORMATION NETWORK-TACTICAL PLANNING

4-82. Each WIN-T SATCOM assemblage requires an authorization to operate from the designated approval authority before submitting a satellite access request or Army service request. The fielded WIN-T assemblages are type-accredited. Accreditation is part of the authorization to operate submission.

## ACCESS REQUEST AND AUTHORIZATION

4-83. The geographic combatant command adjudicates and validates resource requirements. The following organizational references only identify parent organization relationships. The satellite access request and Army service request process includes—

- The unit submits a satellite access request or Army service request, statement of work, commercial satellite service survey, network diagram, and air tasking order or interim authorization to operate through their chain of command to the theater army outside the continental United States or FORSCOM in the continental United States.
- The unit coordinates with the corps or division when developing and submitting the satellite access request, statement of work, commercial satellite service survey, Army service request, 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 validates the request, assigns mission priority and—
  - Coordinates with the signal command (theater) [SC(T)] and the regional hub node operations section to ensure resources are available to support mission requirements.
  - Coordinates requirements with the geographic combatant command if it funds the space segment or supports a joint mission or if arbitration of resources is necessary for competing joint mission requirements.
- If the approval authority disapproves a request, the authority returns 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 regional hub node or teleport access.
- The theater army submits a satellite access request 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 theater army and geographic combatant command arbitrate resource conflicts for Army or joint missions.
- The SC(T) or NETCOM forwards the satellite access request or commercial satellite service survey to the RSSC, who—
  - Submits the package to the future commercial SATCOM services acquisition office at the DISA. The future commercial satellite communications services acquisition contractor develops a transmission plan and coordinates licensing, landing rights, and frequency clearance.
  - Assigns a mission number and develops the satellite access authorization.
- The satellite access authorization and transmission plan go back to SC(T) or NETCOM. The RSSC manager disseminates the satellite access authorization and transmission plan for joint missions to the geographic combatant command J-6 for theater space segment utilization and frequency management. The commercial SATCOM manager—
  - Submits the package to the DISN Satellite Transmission Service-Global who develop a transmission plan and coordinate licensing, landing rights, and frequency clearance.
  - Assigns a mission number and develops the satellite access authorization.
  - Reviews the interim authorization to operate or air tasking order and authorizes connectivity.
  - Coordinates with the regional hub node operations section to identify equipment to support missions.
- The SC(T) develops the Army service authorization from the Army service request and incorporates the mission number from the satellite access authorization into the Army service request authorization.
- The SC(T) or NETCOM provides the authorization to connect, Army service authorization, satellite access authorization, and transmission plan to the tactical unit and regional hub node operations section.
- The regional hub node operations section and tactical unit implement crew assignment sheets, prepare systems, and implement equipment configurations for operation according to the satellite

access authorization, Army service authorization, and transmission plan, and coordinate with the regional hub node operations section for access to satellite and baseband services.

4-84. In establishing services, the WIN-T equipped unit works with the regional hub node to initiate and troubleshoot services, as required. Regional hub node personnel coordinate with commercial satellite operations centers.

## MANAGING DEFENSE INFORMATION SYSTEMS NETWORK SERVICE ACCESS

4-85. The WIN-T equipped unit submits an Army service request to the theater army through the SC(T) to request regional hub node access and DISN services. The WIN-T equipped unit's Army service request is internal to the Army because it uses Army pre-provisioned connectivity to DISN services. The unit follows the standard gateway access request process to request DISN service access over the DOD gateway.

4-86. The SC(T) and regional hub node operations sections assist the unit with provisioning and extending services through the regional hub node. If the regional hub node cannot fulfill a mission requirement due to competing or higher priority missions, the deployed user, with support from the SC(T), submits a gateway access request through the geographic combatant command to the DISA Contingency and Exercise Branch for validation.

# Chapter 5

# Satellite Communications Enablers

There are specific organizations within DOD responsible for the use of military and commercial satellite communications. These organizations help the satellite communications community support Army operations. Clear guidance and readily available assistance are essential for satellite communications efficiency. The units monitor satellite transmissions and ensure compliance with technical and regulatory guidance. This chapter discusses the various commands that enable satellite communications and the distribution of signal units.

## UNITED STATES SPACE COMMAND

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

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

5-3. Commander, USSPACECOM designates C-SSEs and SSEs to serve as subject matter experts for their systems and portfolios. USSPACECOM 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, commercial SATCOM, and DOD gateways coordinate and integrate inputs from the SATCOM community of interest and cross-system inputs from SSEs. The SSEs support the C-SSEs with an integrated SATCOM management framework to support USSPACECOM's efforts to plan, assess, analyze, and integrate SATCOM.

5-4. SSEs are experts on their specific SATCOM systems and have a general knowledge of other SATCOM systems. SSEs provide technical, operational, and engineering support to USSPACECOM, C-SSEs, electromagnetic interference managers, acquisition activities, and other USSPACECOM organizations. USSPACECOM may task SSEs to support other commands and agencies as required. SSEs respond to operational emergency requests 24 hours a day. USSPACECOM tasks non-component SSEs directly for required support. The C-SSE integrates non-component SSE input into a complete product for USSPACECOM use.

## UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND

5-5. USASMDC executes space operations, ensuring joint and Army forces maintain an information advantage through access to space assets. To accomplish its mission, USASMDC exercises operational control over elements positioned worldwide.

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

### United States Army Satellite Operations Brigade

5-7. The United States Army Satellite Operations Brigade provides existing and emerging space capabilities that enable the President, Secretary of Defense, U.S. forces, and allies to deliver decisive combat power. The brigade conducts continuous space force enhancement, space support, and space control operations. The United States Army Satellite Operations Brigade exercises command and control over its four subordinate space battalions, one being the 53d Signal Battalion.

### 53d Signal Battalion (Satellite Control)

5-8. The 53d Signal Battalion (Satellite Control) executes the RSSCs satellite access authorizations for WGS and DSCS satellites. The battalion conducts satellite payload and transmission control, telemetry, network monitoring, and electromagnetic interference detection for the WGS and DSCS constellations for the President, the Secretary of Defense, the Department of Defense, geographic combatant commanders, and multinational partners.

5-9. The 53d Signal Battalion authorizes wideband SATCOM terminal access, maintains the satellite communications database, and manages power of communications links. Using spectral monitoring of the communications across the satellite, the controllers can detect, monitor, and mitigate satellite anomalies and electromagnetic interference for their designated satellite.

5-10. The 53d Signal Battalion manages six geographically dispersed companies. Five of the companies operate the WSOCs; the sixth is a headquarters and headquarters company responsible for the health, morale, welfare, training, discipline, conduct, and combat readiness for all assigned Soldiers and the battalion staff. Two companies have the additional task of managing the jam-resistant secure communication mission. Both companies provide global operations to ensure freedom of action in space to support USSPACECOM's ability to ensure access to military and leased commercial satellite transmission paths of interest.

## UNITED STATES ARMY NETWORK ENTERPRISE TECHNOLOGY COMMAND

5-11. NETCOM oversees the installation, operation, maintenance, and security of the DODIN-A. NETCOM provides staff assistance for Army units that provide SATCOM support. NETCOM is responsible for the Army Enterprise Infostructure. NETCOM executes its global mission through the SC(T)s. Refer to FM 6-02 and AR 10-87 for more information on NETCOM.

### Signal Command (Theater)

5-12. The SC(T) is the highest-level signal organization in a theater of operations. The SC(T)s are subordinate commands of NETCOM and function under the operational control of their supported theater army. The SC(T) provides oversight for units installing, operating, maintaining, and securing elements of the DODIN-A in theater. The SC(T) exercises command and control over strategic and limited tactical organizations, visual information resources, wire and cable, commercial infrastructure, and theater signal maintenance.

5-13. An SC(T) provides signal support to the theater army, including missions to support large-scale combat operations. The SC(T) exercises technical control over the theater tactical signal brigade and its assigned signal support elements. It also exercises command and control over the strategic signal brigade.

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 through NETCOM, the geographic combatant command J-6, and USSPACECOM for service and enterprise management, technical compliance, and cybersecurity. The SC(T)'s SATCOM responsibilities include—

- Exercising command and control over subordinate units.
- Providing a staff component for various operational commands, including joint task force J-6, joint force land component command G-6, Army forces G-6, corps G-6, and division G-6.
- Operationally managing signal assets in theater.
- Providing oversight to the regional cyber center.
- Providing planning and staff management of the ground mobile force tactical satellite Theater SATCOM Monitoring Center and Army ground mobile force terminals in theater.
- Coordinating with the DISA and theater army G-6 concerning DISN matters.
- Coordinating with the DISA, theater frequency manager, and host-nation spectrum and communications authorities for scheduling and using commercial and host-nation assets in theater.
- Providing visual information assets to support the theater army.

5-15. The SC(T) supports 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 locates where the commander can best exercise technical control over signal assets, influence theater network schemes and architectures, and optimize network management in support of the theater army commander or joint force commander.

### 302D SIGNAL BATTALION

5-16. The 302d Signal Battalion executes Army enterprise (strategic) SATCOM operations in the continental United States. The 302d Signal Battalion is part of the 21st Signal Brigade, whose mission is to provide global information services for command and control for the President, Secretary of Defense, geographic combatant commands, and other federal agencies. Army fixed station earth terminals and technical control facilities in the continental United States are the responsibility of the 302d Signal Battalion, except for the auxiliary satellite control terminals at the WSOCs.

## 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 from corps to brigade combat team and the pooled assets of the expeditionary signal battalion (ESB) to support echelons above corps and downward reinforcing missions.

### BRIGADE LEVEL

5-18. Brigade-level elements receive their network support either using their organic signal capabilities or by requesting the pooled signal capabilities of the ESB. Refer to FM 6-02 for more information about defining signal requirements and requesting support.

#### Brigade Combat Team

5-19. The organic signal assets of the brigade combat team support continuous operations to sustain the brigade communications networks. Brigade combat team signal elements install, operate, maintain, and secure automated information systems and networks to support brigade operations and integrate with higher and adjacent units and theater networks. Brigade combat team signal elements extend DISN services to subordinate elements through line of sight and satellite transport capabilities. The brigade signal company reports to the brigade signal staff officer.

5-20. Communications assets not organic to brigade combat team signal elements, but which are organic to the brigade combat team, may still fall under the signal company's responsibility to configure and install. Other signal assets, such as the very small aperture terminal, are the responsibility of the user to coordinate with the signal staff and integrate into the brigade combat team network.

5-21. SATCOM extends the range of the brigade combat team communications network beyond line of sight and provides an internal brigade network down to the battalion level. SATCOM support to the brigade includes—

- Milstar and AEHF.
- Point-to-point data links to SMART-Ts.
- UHF links to Spitfire terminals fitted on command vehicles.
- WIN-T network

5-22. The brigade combat team relies on WIN-T for wide-area network transport. WIN-T's wideband tactical satellite terminals provide transmission for high bandwidth, voice, battlefield video teleconferencing, data applications, and collaborative planning while at-the-halt or on-the-move. Refer to ATP 6-02.60 for more information about WIN-T SATCOM transport.

### Support Brigade

5-23. Multifunctional and functional support brigades are another substitutable formation type, based on operational specialty. Examples of support brigades are—

- Multifunctional:
  - Field artillery.
  - Combat aviation.
  - Maneuver enhancement.
  - Sustainment.
- Functional:
  - Expeditionary military intelligence.
  - Military police.

5-24. Multifunctional support brigades have some organic signal assets but may require augmentation to support their deployed mission. Functional support brigades have no organic network capabilities. The S-6 identifies and requests support through the request for forces process. Refer to FM 6-02 for more information about the request for forces process.

## Expeditionary Signal Battalion

5-25. The ESB generally provides pooled network capabilities to support echelons above corps. The ESB also has smaller teams to support units within a brigade combat team, or when needed to provide network support for natural disaster relief efforts or other contingencies around the world. ESBs install, operate, maintain, and secure their portions of the DODIN-A.

5-26. 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 co-locate with a unit at a site that permits sharing of existing network support. The ESB structure has multifunctional elements, each containing the switching equipment, transmission systems, data network management systems, and network management resources that comprise a complete signal node.

## Deployment and Employment of Units

5-27. A robust network of satellites, radios, and tactical communications systems enables units to connect to the DODIN-A regardless of their location. These unique capabilities enable the joint force commander to perform missions that are interdependent, globally dispersed, and network-centric.

### Pre-Deployment

5-28. Signal planners prepare detailed signal plans, which include the satellite access request, frequency clearance, landing rights, deployment orders, deployment instructions, and equipment cut-sheets. Planners obtain geographic combatant command J-6 approval before the satellite access phase of any wideband SATCOM mission. Upon receiving the satellite access authorization, the communications planner—

- Obtains frequency clearance by coordinating with the theater or host-nation spectrum 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.

5-29. The WSOC updates the control communications subsystem identified in the satellite access authorization for positive control. The wideband SATCOM network terminal's unit commander ensures terminals deploy with properly maintained equipment and qualified operators.

### Deployment

5-30. The wideband SATCOM terminal operator deploys, installs, operates, and maintains the terminal equipment. The terminal operator reconfigures and adjusts operating parameters at WSOC direction to support various tactical missions. The wideband SATCOM network terminal operator responsibilities include—

- Implementing and complying with the access and operating procedures found in USASMDC Wideband Satellite Communications Operating Procedures.
- Reviewing and understanding the terminal's satellite access authorization and deployment orders.
- Configuring the terminal according to the satellite access authorization, deployment orders, cut-sheets, and technical manuals.
- Establishing and maintaining contact with the WSOC using the terminal's orderwire or other dedicated means of communications before accessing the satellite.
- Establishing an alternate means of control communications to maintain positive control, if the orderwire is not available.
- Establishing and maintaining user communications according to the satellite access authorization and deployment orders.
- Ensuring qualified personnel staff the terminal and can promptly comply with WSOC directives.
- Reporting equipment problems—communications outages, loss of positive control, and terminal outage problems—promptly.
- Submitting 8-hour status reports to the WSOC.
- Helping the WSOC report, analyze, and resolve persistent or recurring interference incidents.
- Preparing a joint spectrum interference resolution report as found in CJCSM 3320.02D and applicable Service guidelines in the case of unidentified electromagnetic interference.
- Coordinating 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.
- Displacing the network terminal as required by the commander or the communications systems managing element, coordinating the move with the WSOC and communications systems planning element, and re-accessing the satellite, as necessary.

## POSITIVE CONTROL

5-31. *Positive control* is the continuous ability to oversee satellite communications access and coordinate necessary changes in the frequency/channel, power level, or network settings. Coordination of access can use alternative communication means (e.g. radio, telephone, or orderwire, etc.) to help in the adjustment of power levels, frequency, and user modem settings with RSSC or WSOC guidance. All satellite communications access must be under positive control, if positive control is lost, the WSOC may terminate terminal access after coordination with the wideband C-SSE. As the technology built into systems allow, positive control through automated methods will be used (CJCSI 6250.01F). Wideband SATCOM terminals may access a satellite only under the conditions of positive control.

5-32. 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 satellite access authorization, and maintains orderly network operation. Monitoring includes verifying terminal type, location, transmit and receive frequency, data rate, coding, and spectral shape of each carrier. The WSOC may terminate network terminal access if the terminal causes unauthorized access or jamming. If changes in connectivity are necessary during a mission, the WSOC coordinates the change with the appropriate organizations.

## Appendix A

# Satellite Communications Ground Segment

This appendix discusses global networks, Department of Defense gateways, and the ground terminals that comprise the ground segment. The ground segment supports joint forces, Army forces, and global networks, extended through the Department of Defense gateways to deployed ground terminals.

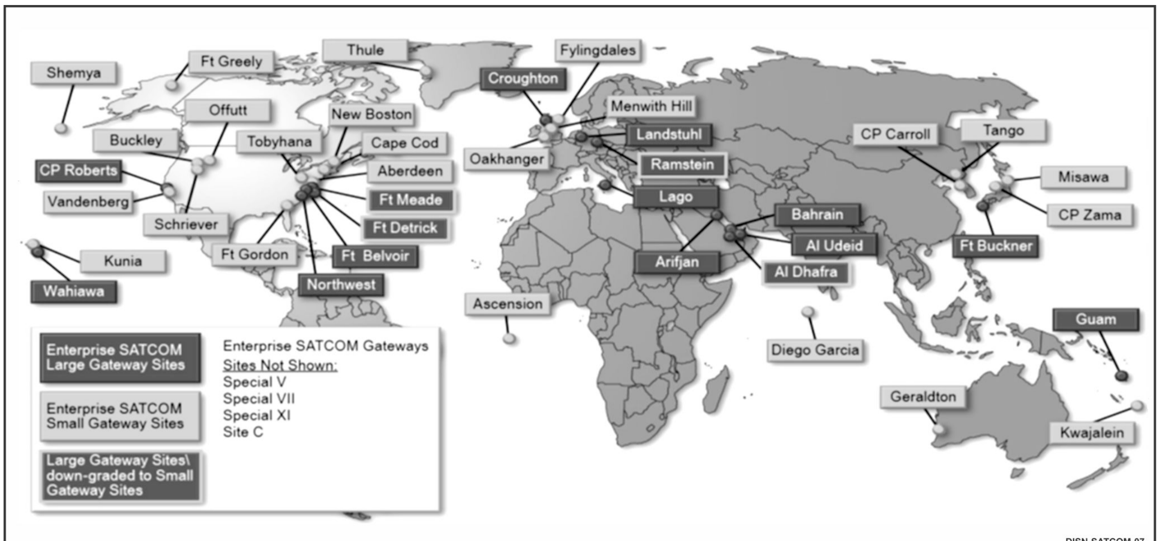
## GLOBAL NETWORK

A-1. SATCOM capabilities enable Soldiers in theater to access global networks. The DSCS and WGS constellations and their associated worldwide ground-segment network of control stations support wideband SATCOM activity for the DOD, other governmental and nongovernmental agencies, and multinational mission partners.

A-2. Through the ground segment network the remaining global SATCOM constellations of Milstar, AEHF, UFO, MUOS, and commercial satellites provide access to wideband military and commercial satellite assets.

## DEPARTMENT OF DEFENSE GATEWAYS

A-3. DOD gateways provide long-haul network transport and connections from the deployed tactical network to the strategic infrastructure. Gateways give tactical terminals access to DISN services regardless of their deployment location. DOD gateways are located across the globe to offer gateway entry points close to warfighters in all theaters. Figure A-1 shows the DOD gateway terminal locations. Refer to JP 6-0 for more information on DOD gateways.




**LEGEND**

Cp Camp
Ft Fort
SATCOM satellite communications

**Figure A-1. Department of Defense gateway locations**

## BENEFITS

A-4. DOD gateway access is granted according to established priorities. The following is a list of the operational benefits afforded to users using gateway access—

- On-demand, pre-positioned links to DISN services.
- Automatic routing and information transfer over the most effective SATCOM network.
- Cross-banding for communications between dissimilar SATCOM systems and frequency bands (C band, X band, Ku band, and Ka band).
- Multi-hop links to connect fixed and deployed forces using the same frequency band over multiple satellites. This extends the range of SATCOM systems that lack cross-link 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-5. STEP sites are joint assets under the operational control of the Joint Chiefs of Staff through USSPACECOM. STEP sites are strategically located, fixed enterprise facilities that provide deployed forces reachback connection to DISN services. STEP sites provide multi-band terminals to support simultaneous contingencies for the requirements of geographic combatant commanders and operational exercises. STEP capabilities are available to geographic combatant commanders and the Services on a priority basis.

A-6. A single STEP site utilizes a single Earth terminal that views only one satellite. A dual STEP site utilizes two or more co-located 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 greater DISN service capacity to satisfy user requirements. STEP sites provide pre-positioned DISN services, including—

- Defense Switched Network.
- Multilevel secure voice.
- SIPRNET.
- NIPRNET.
- Joint Worldwide Intelligence Communications System.
- Video teleconferencing.

A-7. Mobile SATCOM terminals access a STEP site through wideband military or commercial SATCOM. Baseband equipment at a STEP provides a connection to DISN services for deployed tactical users.

## TELEPORT

A-8. The DOD teleport program expanded some STEP sites, providing more connections to DISN services and more satellite connectivity using C, X, Ku, and Ka band SHF, and EHF and UHF satellites. Teleports integrate and expand STEP and commercial satellite functions into a reliable, accessible, and interoperable system and support high-throughput multiband and multimedia telecommunications services for deployed forces.

A-9. Teleports provide 24-hour operations, using both military and commercial SATCOM terminals and associated baseband equipment to provide global access. The teleport (figure A-2 on page A-3) provides a connection to the DISN infrastructure on military and commercial SATCOM frequency bands.

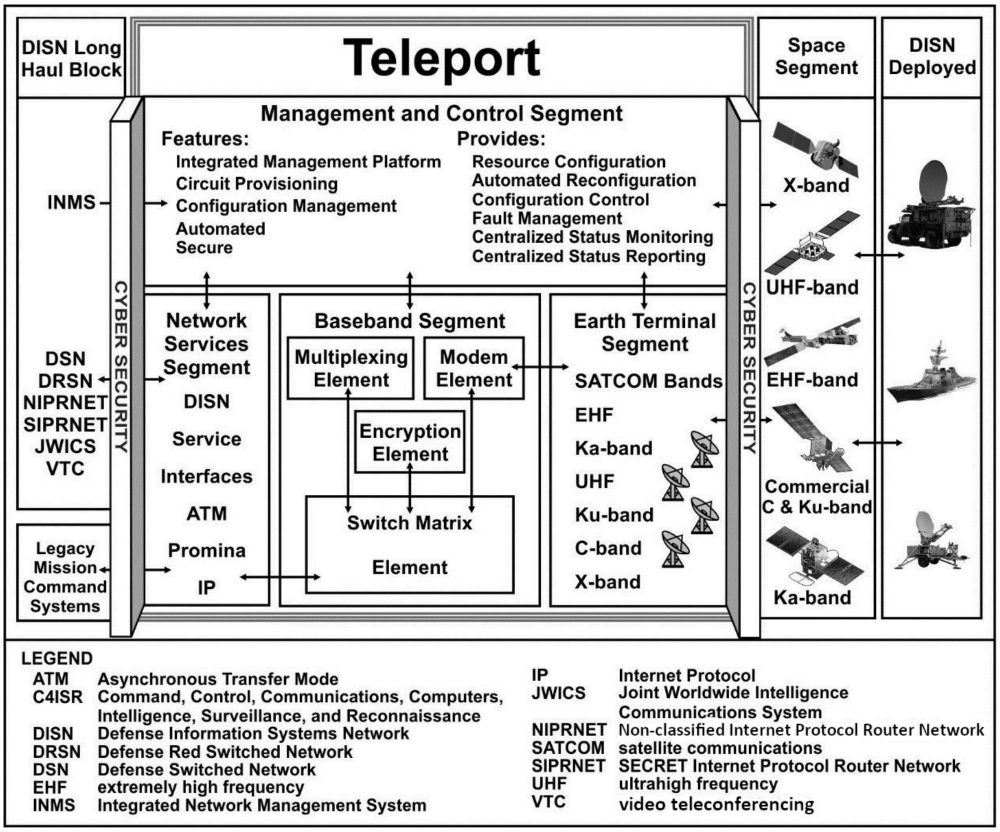



**Figure A-2. Teleport program**

# GROUND TERMINALS

A-10. Ground terminals are located on the surface of the Earth and communicate over satellites using radio waves in the super high frequency or extremely high frequency bands. Ground terminals may be fixed or mounted on a mobile platform. The ground terminals are controlled and managed to provide direct transmission paths for signals to and from interoperable systems, or for access to the satellites for relaying signals over long distances.

## ENTERPRISE TERMINALS

A-11. Enterprise terminals are fixed-station, heavy, or medium expeditionary terminals that provide long-haul backbone transport for the DISN. Enterprise terminals are interoperable with tactical terminals.

### AN/FSC-78(V)

A-12. The AN/FSC-78(V) is a fixed SHF SATCOM heavy terminal capable of providing many (the actual number depends 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 consists of six subsystems:

- Antenna.
- Antenna tracking servo.
- Transmitter.
- Receiver.
- Frequency generator.
- Control and monitoring.

A-13. The AN/FSC-78(V) terminal (see figure A-3) 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 decibels/Kelvin (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 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. The AN/GSC-39 has two versions: V1 is fixed and V2 is transportable. All major components are interchangeable between versions (see figure A-4 on page A-5).

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

## AN/GSC-52B(V)

A-16. The AN/GSC-52B(V)is a high-capacity medium SHF SATCOM terminal designed to operate with DSCS, WGS, and North Atlantic Treaty Organization satellites. It is capable of either attended or unattended operation. The AN/GSC-52B(V) has 12 upconverters and 12 downconverters, capable of expanding to 18 each. The AN/GSC-52B(V) transmits from 7.9–8.4 GHz and receives at 7.25–7.75 GHz. The terminal design allows placement in a government-furnished electronic equipment building or modified vans. The antenna is a parabolic, 38-foot diameter, OE-371/G (see figure A-5 on page A-6).

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

## Ka band Satellite Transmit and Receive System

A-17. The Ka Band Satellite Transmit and Receive System (Ka-STARS) provides wideband communications over the WGS constellation. Ka-STARS alleviates X band spectrum saturation. Ka-STARS terminals provide additional terminals for mission support. 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 WGS, 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 WSOCs.

## Modernization of Enterprise Terminals

A-19. The modernization of enterprise terminals program (see figure A-6 on page A-7) replaces aging, bandwidth-limited infrastructure (Ka-STARS, AN/GSC-52B(V), -39, -70, and AN/FSC-78 terminals). Along with the new antennas, 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. 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 over WGS, DSCS X band, and commercial satellites.
- Transmit and receive X and Ka frequency bands.
- Perform dual-polarization operations in the Ka frequency band.

- Control, monitor, and alarm up to six modernization of enterprise terminals from a single console.

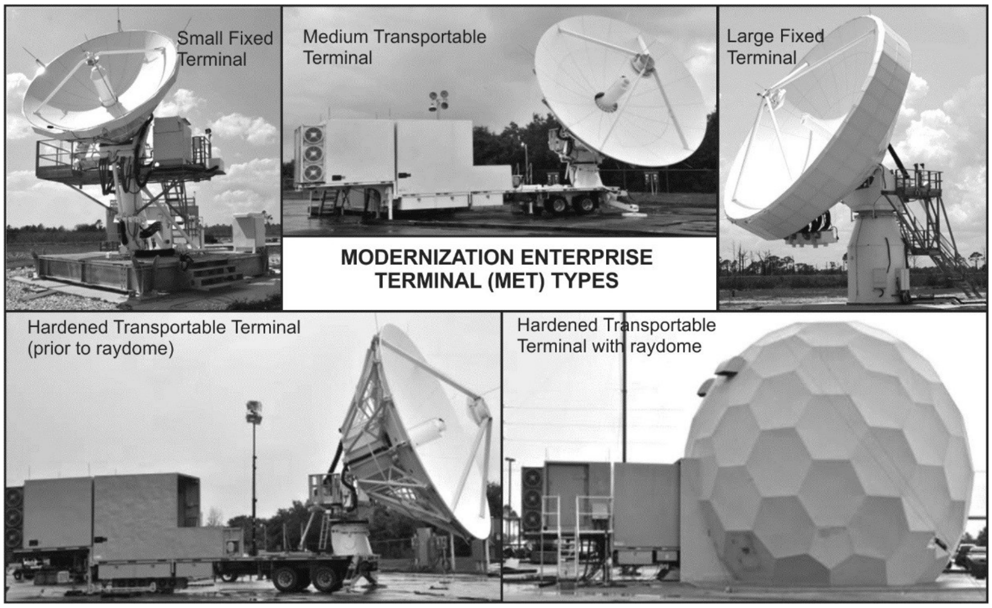



**Figure A-6. Family of modernization of enterprise terminals**

## WIDEBAND TACTICAL TERMINALS

A-20. Army wideband tactical terminals provide tactical satellite ground and commercial terminal services that enhance the efficiency of deployment and mobility. Wideband tactical terminals operate over C, Ku, Ka, and X frequency bands. These terminals provide commanders with reliable communications across the globe and flexibility in integrating into joint network. Wideband terminals enable the geographic combatant commander to execute multiple missions simultaneously.

### AN/TSC-86

A-21. The AN/TSC-86 is a contingency SATCOM terminal. 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 kilowatt 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-8).

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

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

A-23. The AN/TSC-93E tactical satellite 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 ground mobile force terminal. The Lynx provides circuit and range extension data rates up to 52 Mbps in frequency division multiple access mode, and 3 Mbps uplink and 18 Mbps downlink in time division multiple access mode.

A-24. The AN/TSC-93E provides one secure link plus orderwire and overhead using 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. ESBs use AN/TSC-93 terminals instead 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. A second heavy high mobility multipurpose wheeled vehicle with two generators and a power synchronization switch also carries the 8-foot antenna. 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 is rol1-on/rol1-off capable on C-130, C-141, and C-17 aircraft (see figure A-8).

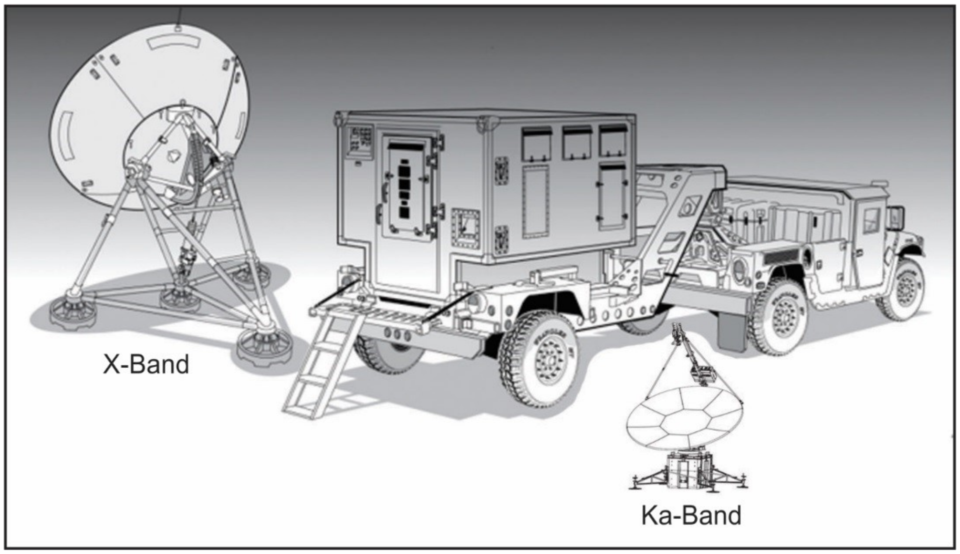



**Figure A-8. AN/TSC-93E Lynx terminal**

## AN/TSC-156 (Phoenix) Terminal

A-26. The Phoenix terminal is a transportable wideband tactical satellite 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. Current upgrades have added time division multiple access and internet protocol 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 items adapted for Army use to meet military specifications. Phoenix terminals are backward-compatible with legacy ground mobile force satellite terminals (X band only) to the second level multiplexer. Phoenix terminals can 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 52 Mbps between two carriers. A Phoenix terminal may interface with other strategic networks through a 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-10).

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 (see figure A-10 on page A-11) is a transportable, multichannel, anti-jam SATCOM terminal that operates in the EHF frequency range. The SMART-T provides protected range extension for tactical command posts at corps, division, brigade combat team, field artillery brigade, combat aviation brigade, and ESB. The SMART-T operates over the low data rate and medium data rate EHF payloads on Milstar satellites, and the extended data rate payload on AEHF satellites. The SMART-T provides a protected link for critical communications for forward-deployed enclaves. Protected links provide assured communications so commanders can continue to exercise command and control during a jamming event.

A-30. The SMART-T processes data and voice communications services up to 8.192 Mbps in the extended data rate mode over AEHF. It can also provide both low data rate (up to 2.4 kbps) and medium data rate (up to 1.544 Mbps) services simultaneously on Milstar or over AEHF in the Milstar backward-compatible mode if AEHF resources are not available. The SMART-T uses fiber, conditioned diphase, and non-return to zero serial and internet protocol interfaces. The SMART-T also accommodates non-WIN-T baseband configurations used by other Services and is fully interoperable with all joint EHF (Milstar) and AEHF tactical satellite terminals. This interoperability 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 controller, communications controller, or 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. SMART-Ts can send and receive over-the-air-data-distribution transfers from other terminals and modify services by removing or adding members, 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. 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, if the data rates do not exceed the aggregate AEHF threshold of 8.192 Mbps.

A-33. The SMART-T is a vehicle-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 operation.


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

## Transportable Tactical Command Communications

A-34. The Transportable Tactical Command Communications terminal provides tactical communications for early entry and secure forces deployed in a forward-deployed region. The transportable tactical command communications terminals provide scalable SATCOM capabilities using the AN/TSC-232 or AN/TSC-233 to support small or large command posts.

A-35. The Transportable Tactical Command Communications equipment provides—

- AN/TSC-232—
  - 1.2 meter inflatable antenna.
  - Transmission over X, Ku, or Ka-band.
  - Time-division multiple access.
  - NIPRNET, SIPRNET, and colorless enclaves.
  - Three user access ports per user enclave.
- AN/TSC-233—
  - 2.4 meter inflatable antenna.
  - Transmission over, X, Ku, or Ka-band.
  - Time-division multiple access.

- NIPRNET, SIPRNET, and colorless enclaves.
- 16 user access ports per user enclave.

## Global Broadcast System Receive Suites

A-36. The GBS receive suites include the 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.

A-37. The location of the receive suite is network-dependent. If located with units that have access to high bandwidth, the S-6 or G-6 manages the receive suite. Any SIPRNET traffic required passes down to the G-2. For units with limited bandwidth allocations, the receive suite locates in the G-2 secured area for management and access.

### *Global Broadcast System Transportable Ground Receive Suite*

A-38. The standard GBS receive suite for tactical locations is the AN/TSR-11. Figure A-11 shows the major components of the transportable ground receive suite.

A-39. 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 lightweight tripod. 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. A separate transit case houses the next generation receive terminal broadcast manager, cryptographic device, and other associated equipment.

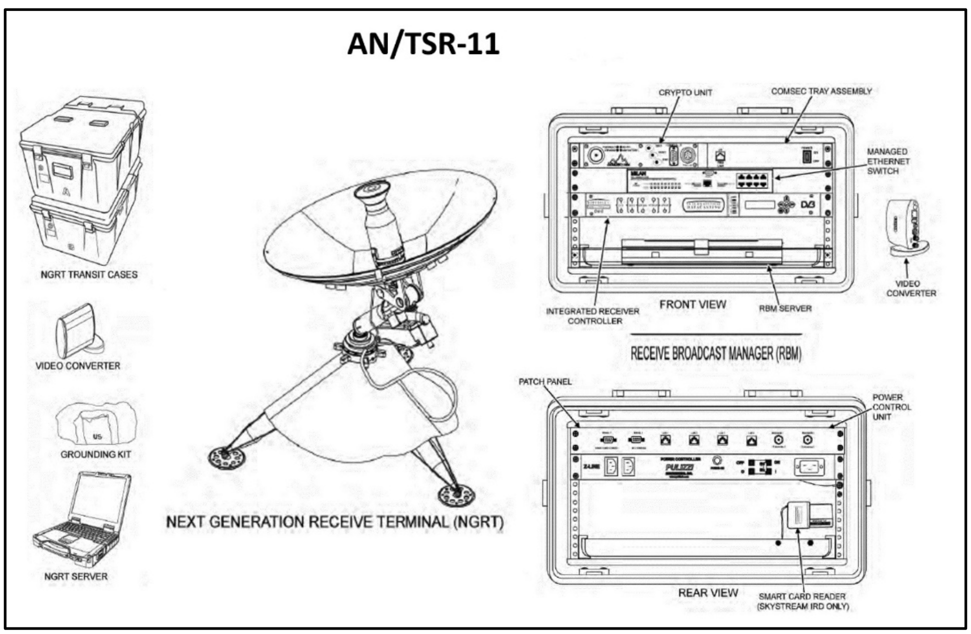



**Figure A-11. Global Broadcast System tactical receive suite**

### *Global Broadcast System Portable Receive Suite*

A-40. The AN/PRS-11 (suitcase) and the AN/PRS-12 (rucksack) GBS receive suites support special mission users requiring a lightweight suitcase or man-portable terminal. Both versions operate over the WGS satellites (see figure A-12 on page A-13).

A-41. Portable receive suites allow users to access unmanned aircraft system imagery, including forward-looking infrared; terrain, geospatial, and mapping information; and full-motion video. Operators may use the optional 60 cm parabolic dish to improve signal reception when weather effects or edge of beam conditions attenuate the signal.

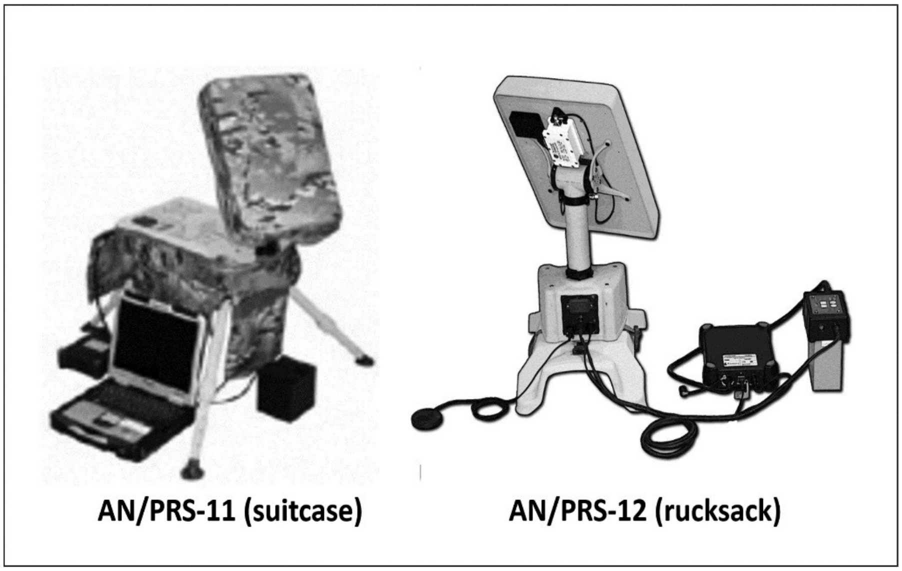



**Figure A-12. Global Broadcast Service portable receive suite**

***Global Broadcast System Access Procedures***

A-42. A GBS mission request starts, stops, drops, or changes services. Users submit requests 51 days before viewing date to the theater injection manager. The theater information manager reviews the global broadcast system mission request 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 approved data services. Users without Joint Integrated Satellite Communications Tool application access should use the GBS mission request template located at the DISA GBS Satellite Broadcast Manager Website.

## AN/USC-60

A-43. 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, or Ku band. It has a 2.4-meter antenna that unfolds. These specifications make the AN/USC-60 highly transportable.

A-44. 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 on pallets by military aircraft. The terminal is capable of setup and satellite acquisition in under 60 minutes. The flyaway tri-band satellite terminal provides worldwide communications over any of the following satellite constellations—

- DSCS.
- North Atlantic Treaty Organization IV.
- UFO.
- WGS.
- C and Ku band commercial satellites.

A-45. 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.

## SIPRNET/NIPRNET Access Point

A-46. Like the AN/USC-60, the SIPRNET/NIPRNET Access Point terminals (see figure A-13 on page A-14), are commercial off-the-shelf, user-operated tactical satellite terminals. These terminals provide beyond line of sight voice, video, and data communications and network capability down to the company, platoon, and team level.

A-47. The SIPRNET/NIPRNET Access Point has two variations, the 1.2-meter, and the 2.2-meter terminal. The variants support access to X and Ka band satellites, based on authorizations and the unit's mission. The transit case design allows rapid deployment and operation over either DSCS or WGS satellites.

A-48. The SIPRNET/NIPRNET Access Point has a custom outdoor equipment enclosure, which houses an integrated spectrum analyzer and an auxiliary control unit for the auto-acquisition of satellites. It has a built-in uninterruptible power supply. This design allows for operational readiness in under 30 minutes.

**Figure A-13. SIPRNET/NIPRNET Access Point**

## AN/GSR-42A

A-49. The AN/GSR-42A tactical single-channel transponder receives emergency action messages transmitted over DSCS 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, the message goes to the thermal printer for hardcopy. 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 all in the equipment room; the printer may be up to 1,500 feet away in the operations center.

## Narrowband Tactical Terminals

A-50. Narrowband tactical terminals transmit and receive over 5 kHz and 25 kHz channels. Narrowband UHF SATCOM provides vital beyond line of sight communications capabilities for emergencies, tactical operations, and special operations. It supports battlefield voice and data range extension requirements. Narrowband terminals are preferred for initial entry communications in contingency operations because 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 anti-jamming capability for threat mitigation. Refer to ATP 6-02.53 for more information on UHF SATCOM radios.

## AN/ARC-231 Skyfire Terminal

A-51. The airborne-capable version of the AN/PSC-5D multiband, multimode radio is a very high frequency (VHF), UHF, line of sight, and SATCOM, demand assigned multiple access (DAMA) radio. It supports Army requirements for airborne, multiband, multi-mission, secure, anti-jam voice, data, and imagery. It uses military standard software and waveforms, so it is interoperable across Services.

## AN/PRC-117G Multiband Manpack Radio

A-52. The PRC-117G is a software-defined radio and can provide wideband data performance and legacy narrowband interoperability operating from 30 MHz–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 Global Positioning System 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 man pack or mounted configuration.

## AN/PRC-152

A-53. The AN/PRC-152 provides SATCOM support while moving or in a fixed configuration. The radio uses either a UHF high gain or UHF SATCOM antenna. The radio uses UHF and VHF line of sight 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-54. 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 antenna. Global Positioning System functionality is built-in to the radio, providing the means to interface with other Global Positioning System 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/PRC-158

A-55. The AN/PRC-158 is a modular two-channel man pack radio that covers the full range from 30 MHz–2.5 GHz. Each channel can transmit and receive in duplex, half-duplex, and simplex modes. The radio can connect to different networks and sub-networks for both voice and data, using the embedded routing and cross-banding capabilities. The radio provides the following waveforms:

- Type 1.
- Type 2.
- Soldier radio waveform.
- MUOS.
- SINCGARS.
- SATCOM.

## AN/PRC-162

A-56. The AN/PRC-162 is a two-channel software defined radio. It can operate in both the narrowband and wideband frequency ranges and can use the MUOS waveform. Like the AN/PRC-158, the AN/PRC-162 provides the same routing and cross-banding features and capability.

## AN/PSC-5 Spitfire Terminal

A-57. The AN/PSC-5 (Spitfire) terminal provides wideband and narrowband range extension for voice and data in man pack configurations. The Spitfire radio replaced the existing inventory of single-channel

SATCOM radios, adding embedded communications security and DAMA capabilities on top of the SINCGARS family of radios. The radio can span two satellite footprints using the beyond line of sight mode.

### AN/PSC-5C Shadowfire Terminal

A-58. 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-59. 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 software programmable.

### Combat Survivor Evader Locator Radio

A-60. The Combat Survivor Evader Locator system is an end-to-end rescue recovery system. The Combat Survivor Evader Locator radio is useful for special operations forces operating in or near enemy territory. The UHF space segment supports two-way messaging and geo-position information. The ground segment, consisting of multiple command, control, and communications workstations, is located in joint search and rescue centers. The terminal segment includes the handheld radio and a planning computer.

A-61. 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 radio enables a Soldier to send encrypted pre-programmed messages or text messages to describe situations. The Combat Survivor Evader Locator has a battery life of 10 days.

A-62. The load data for the Combat Survivor Evader Locator radio includes operation-specific information including maps, personal data, Global Positioning System coordinates, and encryption keys. If a Soldier requires extraction, the radio sends a SIPRNET message to one of the four joint search and rescue centers over a UHF satellite. The search and rescue center sends an acknowledgment message back to the Soldier. The Soldier authenticates identity and responds to yes and no questions 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 to talk directly to the recovery aircraft crew.

## Warfighter Information Network-Tactical Satellite Communications

A-63. WIN-T provides network transport and information services that enable command and control on-the-move or at-the-halt. WIN-T is a collection of transportable communications equipment that integrates hardware and software with high-band networking waveform line of sight and network centric waveform SATCOM. WIN-T enables collaboration from the division to the battalion level.

A-64. 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 disruptions occur with either the line of sight or the SATCOM links. 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-65. The WIN-T architecture has several SATCOM-capable systems employed from corps to battalion. Table A-1 on page A-17 outlines assets available at each echelon. Refer to ATP 6-02.60 for more information about WIN-T.

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

| *Echelon* | *Tactical Hub Node* | *Tactical Communications Node* | *Satellite Transportable Terminal* | *Point of Presence* |
|---|---|---|---|---|
| Corps | | | X | |
| Division | X | X | X | X |
| Brigade | | X | X | X |
| Battalion | | X | X | X |

## Regional Hub Node

A-66. The *regional hub node* is the gateway transport node for the Warfighter Information Network-Tactical and the transport medium for theater-based network service centers (ATP 6-02.60). The regional hub node allows pre-positioned DISN services to support deploying forces in a theater of operation. Regional hub node locations provide near-global coverage. The regional hub node consists of three 9.2-meter antennas and ancillary communications equipment that operates over either Ku or Ka band. A typical regional hub node can support up to 3 Army divisions and 12 separate enclaves, or up to 56 discrete missions. Access to the regional hub node allows forces to deploy without first developing network transport and network access solutions.

A-67. Army airborne command and control and mounted on-the-move situational awareness applications are available through the regional hub node and WIN-T. These capabilities allow commanders to remain mobile without a decrease in situational awareness. Refer to ATP 6-02.60 for more information about the regional hub node.

## Tactical Hub Node

A-68. For divisions deployed outside the coverage area of a regional hub node, the tactical hub node is available to provide network coverage. 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 time division multiple access and frequency division multiple access 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 time division multiple access and frequency division multiple access-capable SATCOM shelters. The SATCOM shelters provide master network timing for time division multiple access networks.

A-69. Both time division multiple access and frequency division multiple access equipment shelters reside on a 5-ton family of medium tactical vehicles. 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 time division multiple access subnets—one subnet per brigade combat team, multifunctional support brigade, and division).

## Tactical Communications Node

A-70. The Tactical Communications Node AN/MSC-82 (see figure A-14 on page A-18) uses a small aperture 20-inch antenna for SATCOM connectivity while on-the-move or at-the-halt. The 20-inch antenna is upgradeable to either Ku or Ka band. The AN/MSC-82 can connect to the Satellite Transportable Terminal at-the-halt for increased throughput. The Tactical Communications Node can connect to either a Phoenix or SMART-T to provide an alternate means network transport. The Satellite Transportable Terminal allows for Ku and Ka band transport. A typical brigade combat team has eight Tactical Communications Nodes.

Figure A-14. AN/MSC-82 Tactical Communications Node

## Satellite Transportable Terminal

A-71. The Satellite Transportable Terminal has evolved during the WIN-T increment process. All versions of the Satellite Transportable Terminal can operate over Ku or Ka frequency bands.

### *AN/TSC 167A (V) Satellite Transportable Terminal*

A-72. The AN/TSC-167A(V) Satellite Transportable Terminal (see figure A-15 on page A-19) 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 time division multiple access and frequency division multiple access SATCOM. The AN/TSC-167A(V)2 supports the Command Post Node or Single Shelter Switch and only supports time division multiple access.

### *AN/TSC-185 Satellite Transportable Terminal*

A-73. The AN/TSC-185 Satellite Transportable Terminal system (see figure A-15 on page A-19) uses a durable 2.4-meter satellite antenna on a trailer-mounted terminal. The terminals provide increased throughput (20 Mbps standard and 50 Mbps optional), and Ku or Ka band operation. Several versions of this terminal exist:

- AN/TSC-185(V)1 is time division multiple access and frequency division multiple access-capable.
- AN/TSC-185(V)2 is time division multiple access-only to support WIN-T increment 1b Command Post Nodes.
- AN/TSC-185(V)3 Satellite Transportable Terminal+, adds the Distributed Computing Element for node management and the network centric waveform modem to support WIN-T increment 2 units' time division multiple access networks.

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

A-74. The AN/TSC-202 and AN/TSC-208 (see figure A-15) include a 2.5-meter antenna, tri-leg stabilized trailer platform, and a 400-watt high power amplifier for both Ku and Ka band operation. The AN/TSC-208 has a smaller communications and equipment enclosure, which allows full front and rear equipment access.

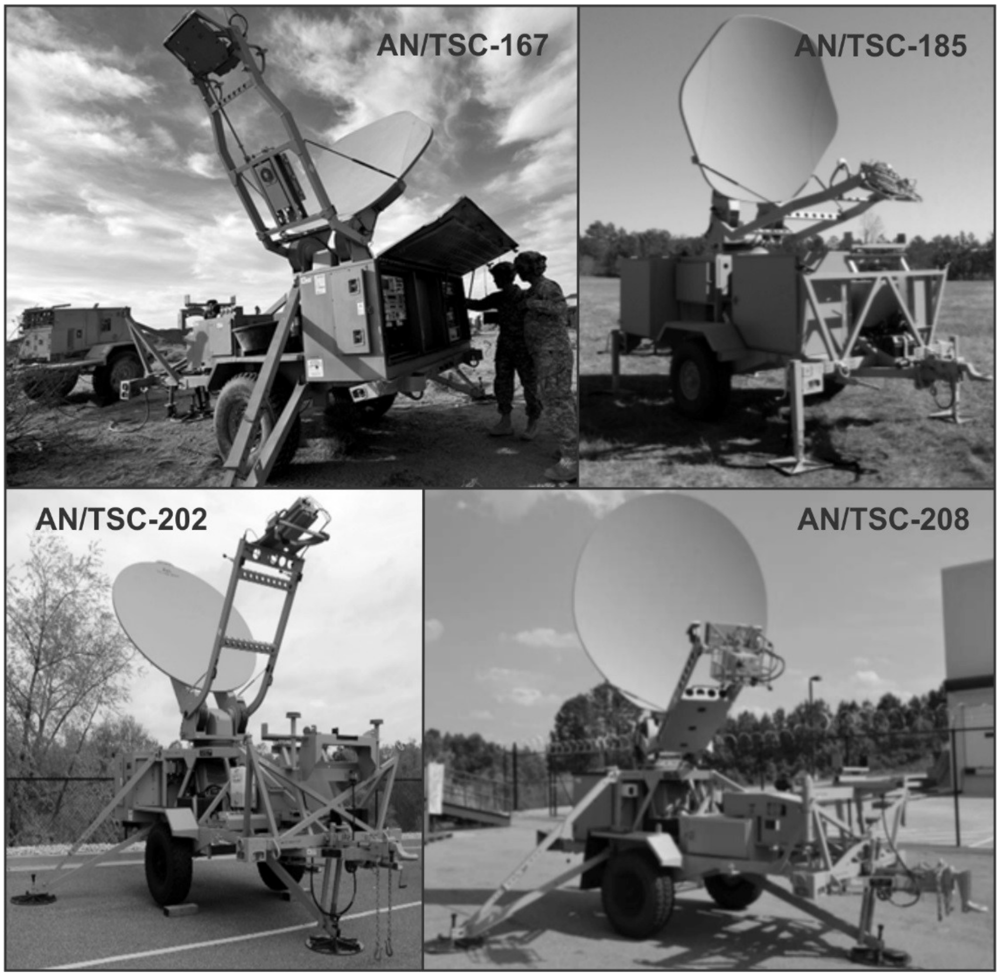



**Figure A-15. Satellite Transportable Terminal**

## Point of Presence

A-75. The Point of Presence provides SIPRNET service on-the-move or at-the-halt. The Highband Radio Frequency Unit and Baseband Processing Unit provide self-forming, line of sight connectivity with associated neighbors. The Point of Presence uses the M20 parabolic SATCOM antenna over either Ku or Ka band. The Point of Presence and the network centric waveform modem provide a beyond line of sight communications link with other members of the network. This lighter and more agile unit provides division, brigade combat team, and battalion commanders satellite access in remote areas. A typical brigade combat team has seven Point of Presence terminals. The Point of Presence satellite communications B-kit can mount on different tactical vehicles, based on the unit’s mission. Figure A-16 on page A-20 shows a Point of Presence mounted on a High Mobility Multipurpose Wheeled Vehicle.

**Figure A-16. Point of Presence**

## Appendix B

# Demand Assigned Multiple Access, Integrated Waveform, and Wideband Code Division Multiple Access

Demand assigned multiple access, integrated waveform, and wideband code division multiple access are techniques used to increase the number of users supportable by the limited pool of satellite transponder space. Demand assigned multiple access adds more satellite users per channel to the UHF systems and reduces satellite resource underutilization.

## INTRODUCTION TO DEMAND ASSIGNED MULTIPLE ACCESS

B-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 for dedicated point-to-point signal-channel networks, thus reducing the costs of satellite networking.

B-2. User demand dictates access allocation. DAMA multiplexing channels allow dedicated access portions of the channel without interference, and through time division multiple access enables more networks to access the channel. Time division multiple access occurs when the 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. Specific slots in each frame are for the controller station to receive user station service requests, or to send control signals over the satellite. Other slots are available for user stations to transmit signal bursts to other stations over 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

B-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.

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

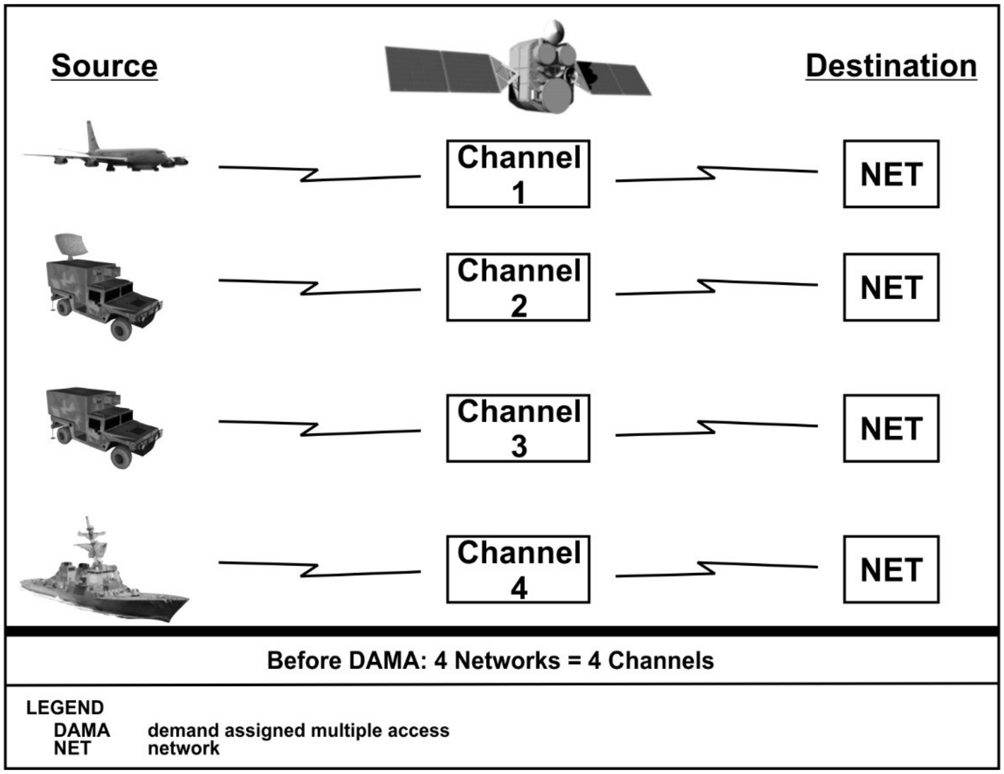



**Figure B-1. Information throughput without demand assigned multiple access**

B-5. Figure B-2 on page B-3 is an example of information throughput with DAMA-capable terminals. DAMA terminals are time synchronized with the network and permitted access when and where bandwidth is available. Each network user shares the channel(s), effectively increasing 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.

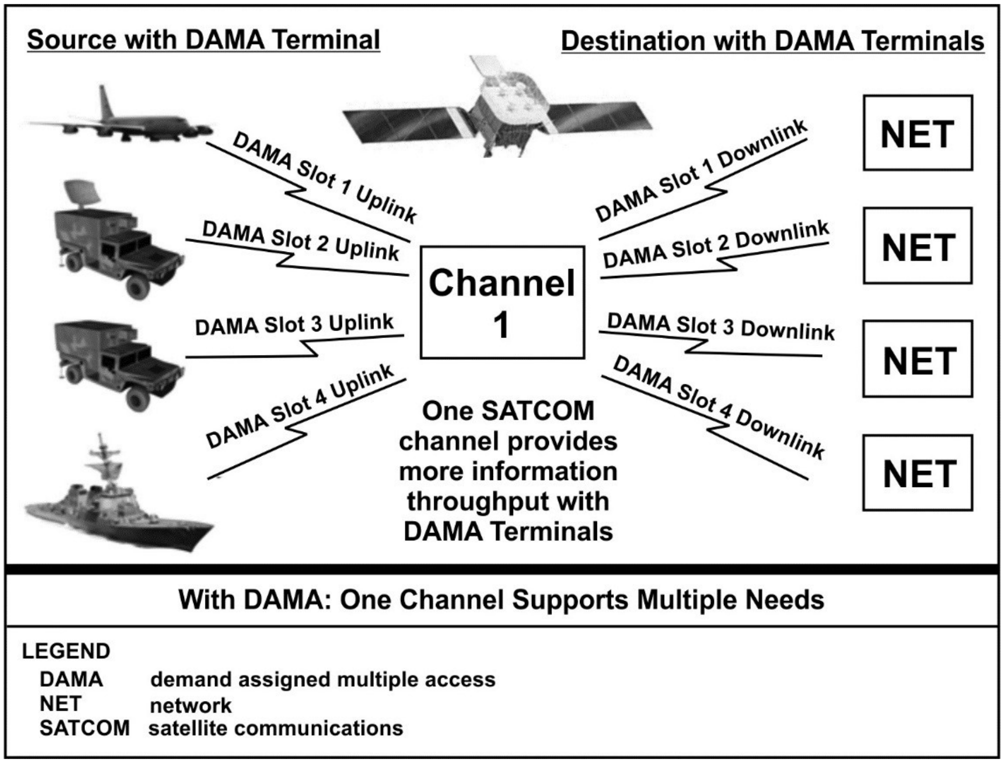



**Figure B-2. Demand assigned multiple access capable terminals**

### DEMAND ASSIGNED MULTIPLE ACCESS

B-6. UHF SATCOM uses two distinct DAMA waveforms—the 5 kHz waveform and the 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.

B-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.

B-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 start time for the conversation. The DAMA control station processes the request and temporarily assigns a channel based on available resources, network rank, and loading on the system.

## INTRODUCTION TO THE INTEGRATED WAVEFORM

B-9. Like DAMA, the integrated waveform supports many users with the least SATCOM resources possible. Experience has shown that DAMA has limitations. Complicated user procedures, significant time delays, and voice quality issues prompted the need for an integrated waveform.

### BENEFITS OF INTEGRATED WAVEFORM

B-10. The integrated waveform replaces DAMA. The integrated waveform has some advantages and improvements versus DAMA. The benefits of integrated waveform include—

- Greatly simplified operating procedures.
- Carrier phase modulation to allow more access using 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 are upgradable to use integrated waveform.
- Data rates up to 19.2 kbps.

## HOW THE INTEGRATED WAVEFORM WORKS

B-11. The integrated waveform is a two-phased upgrade for legacy terminals approved by the Naval Communications Functional Capabilities Board for the following radios—

- 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.

B-12. Other terminals scheduled to receive the integrated waveform upgrade are the AN/PRC-117G and AN/PRC-152.

B-13. In phase I of the upgrade, integrated waveform supports single access (one radio net per channel) and multiple access. 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 using orderwire messages.

B-14. 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.

B-15. 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.

B-16. All integrated waveform-capable terminals operate using integrated waveform as much as possible. Increased use of the integrated waveform capability is necessary to increase the number of UHF accesses per available channel and to use available UHF resources (see figure B-3).

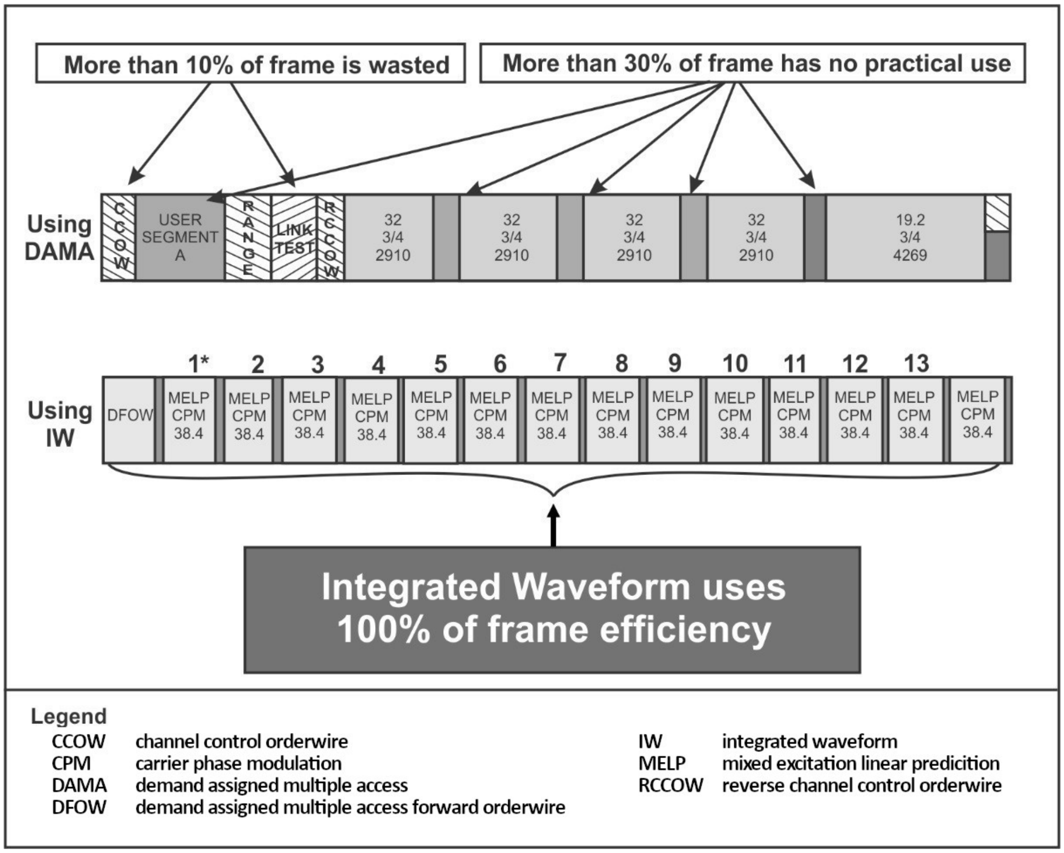



**Figure B-3. Comparison of a 25-kbps demand assigned multiple access versus integrated waveform frame**

# INTRODUCTION TO WIDEBAND CODE DIVISION MULTIPLE ACCESS

B-17. The MUOS system uses geosynchronous satellites in conjunction with ground stations to provide military users with secure voice and internet protocol data connectivity. The Navy's communications satellite program office has overall responsibility for the MUOS space segment and ground stations.

## ADVANTAGES OF WIDEBAND CODE DIVISION MULTIPLE ACCESS

B-18. The MUOS waveform—spectrally adaptive WCDMA—is based on 3G cellular technology. Design features include rake receivers, advanced turbo coding, and state-of-the-art interference-mitigation techniques on both the downlink and uplink signal.

B-19. Because the MUOS waveform functions like current cell phone technology, it allows radio operators to communicate on-the-move. The waveform mimics a roaming feature by seeking out signals as the Soldier moves from one location to another to improve reliability in dense vegetation and urban environments that challenge legacy SATCOM.

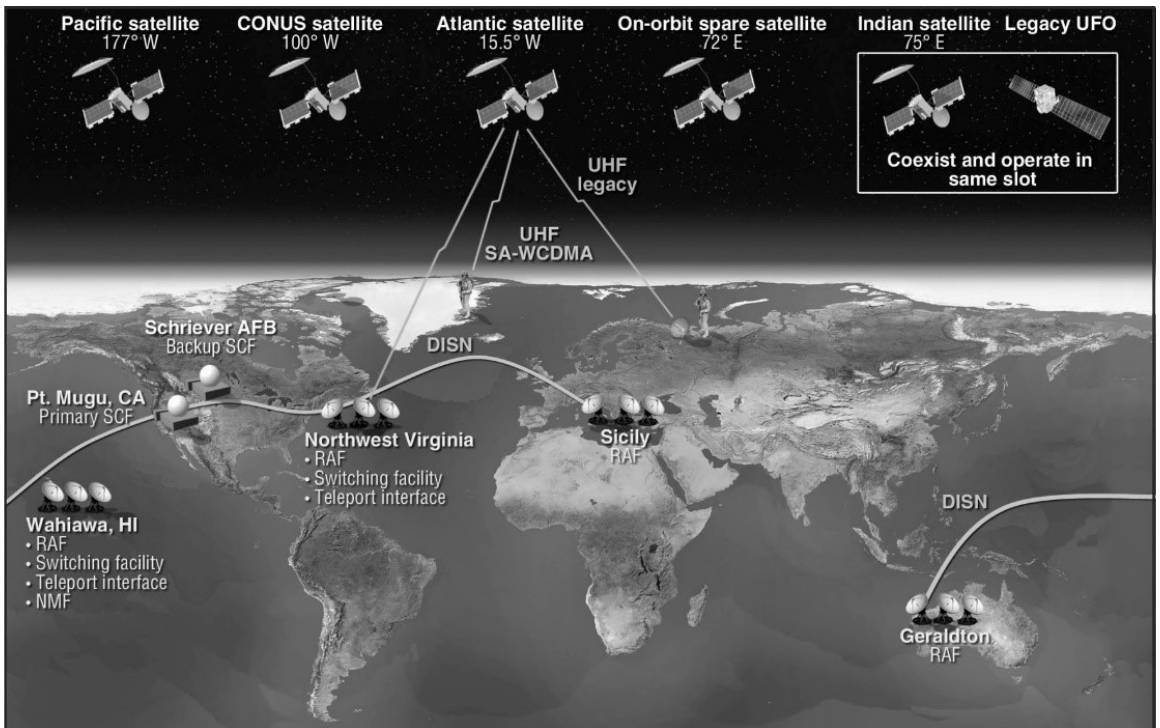
B-20. The radios are considered two-channel radios that can send and receive a SINCGARS or Soldier radio waveform signal on one channel and the MUOS or WCDMA waveform on the second. The radio can internally bridge voice or data between the two waveforms to enable interconnectivity between disparate networks.

B-21. The manpack radios use an omnidirectional antenna that enables communications on-the-move without having to stop and point the antenna toward a satellite. This a key advantage over legacy tactical satellite communications.

## How Wideband Code Division Multiple Access Works

B-22. There are four MUOS to legacy UHF gateway component ground stations (Hawaii, Norfolk, Sicily, and Australia) and two MUOS voice gateways co-located with the two MUOS radio access facilities at the Hawaii and Virginia locations to provide worldwide coverage. The MUOS voice gateways contain the switching and network management equipment for access to DISN services.

B-23. Transmission of data using WCDMA is different than a legacy DAMA or integrated waveform, which used the MUOS satellite as a bent pipe for users in the same satellite coverage area. With WCDMA, the signal transmits to a MUOS satellite then back to a radio switching facility. The radio switching facilities connect through a fiber optic terrestrial network. Information destined for a radio outside the local footprint uplinks to a different MUOS satellite and back down to the user at that location. Figure B-4 illustrates the wideband code division multiple access network architecture.




**Legend:**

| | | | |
|---|---|---|---|
| AFB | Air Force base | SA-WCDMA | spectrally adaptive wideband code division multiple access |
| DISN | Defense Information Systems Network | SCF | satellite control facility |
| NMF | network management facility | UHF | ultrahigh frequency |
| Pt | point | UFO | Ultrahigh Frequency Follow-on |
| RAF | radio access facility | | |

**Figure B-4. Wideband code division multiple access network architecture**

# Appendix C
# Global Broadcast System

The goal of the Global Broadcast System program is to satisfy requirements for high bandwidth broadcast of high volume information products. The primary function of GBS is to provide high capacity product dissemination for mission-essential situational awareness. Examples include imagery, intelligence, training, full-motion video, large data files, 24-hour commercial news, and weather services.

## GLOBAL BROADCAST SYSTEM ROLES

C-1. Headquarters, Air Force Space Command, and the 50th Space Communications Squadron execute day-to-day operations of the GBS to support geographic combatant commands, Services, and agencies. Headquarters, Air Force Space Command is the lead agent and systems manager for the GBS and operates, maintains, and sustains the GBS.

C-2. The 50th Space Communications Squadron manages the GBS. The GBS Operations Center provides centralized management of GBS operations. The GBS Operations Center remotely manages the GBS broadcast content and continuity of operations defense enterprise computing center satellite broadcast manager. Each geographic combatant command GBS theater information manager coordinates with the GBS Operations Center for broadcast scheduling, resource allocation, product integration, and mission planning.

C-3. CFSCC provides the unified direction to the GBS Operations Center to deconflict geographic combatant command SATCOM requirements. CFSCC maintains situational awareness for the development of policies, adherence with regulations, outages affecting GBS, and resolution of user non-concurrence with GBS authorized service interruptions.

C-4. The geographic combat command GBS theater information manager is the validating authority for GBS missions and products. The theater information manager validates geographic combatant command requirements and establishes GBS plans, policies, procedures, and information flow. The theater information manager coordinates and works closely with users, information providers, and the GBS Operations Center. Theater information manager functions include—

- Coordinating beam plans.
- Processing GBS mission requests.
- Initiating or validating satellite access requests.
- Validating users.
- Verifying mission priorities.
- Maintaining user profiles within the geographic combatant commander's area of responsibility

C-5. The theater information manager collects and prioritizes requirements to direct GBS theater operations and coordinates with the GBS Operations Center and RSSCs on operational issues, broadcast schedules, resource allocation and management, and the identification of new products. The theater information manager also audits user pull requests and designs, configures, maintains, and validates the user profile database.

C-6. The GBS Operations Center monitors and maintains regional GBS SATCOM situational awareness. GBS theater information managers and the RSSCs provide 24-hour mission planning, constellation loading, and transmission utilization and optimization to worldwide SATCOM users. The RSSCs process satellite access requests and approve satellite access authorizations. Within the RSSCs, the wideband operations cell maintains GBS situational awareness and provides GBS capabilities to theater information managers and other users.

# GLOBAL BROADCAST SYSTEM ATTRIBUTES

C-7. The GBS is a system of broadcast and content management to coordinate the distribution of information products and high definition videos from the Defense Enterprise Computing Center. The GBS consists of terrestrial networks and uplink facilities. GBS broadcast streams originate from the five primary gateway sites to the WGS satellites.

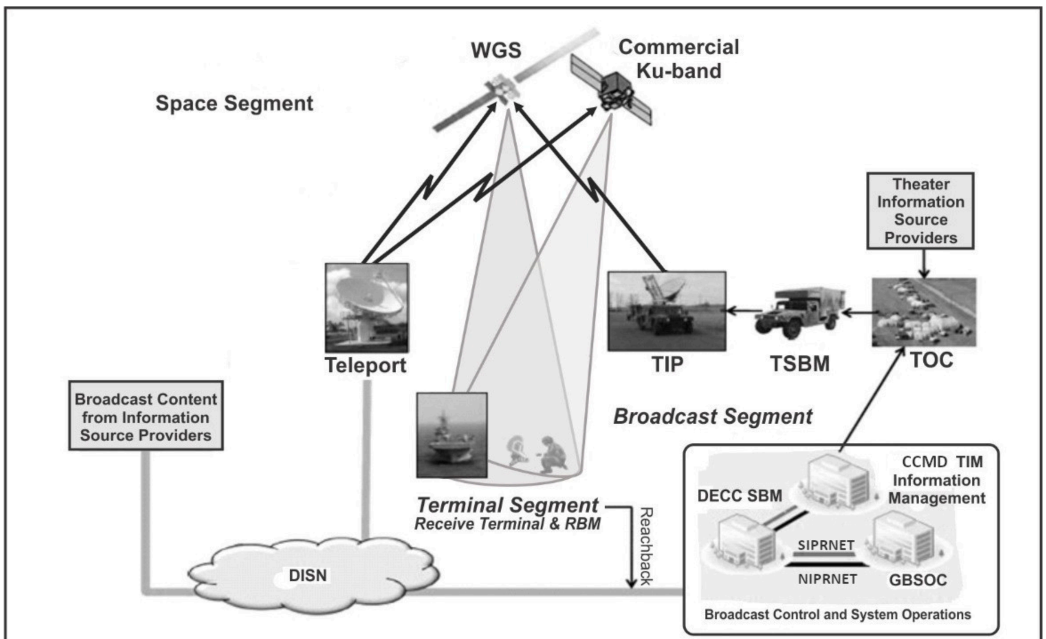
## UPLINK FACILITIES

C-8. Uplink facilities deliver requested products using WGS satellites. The uplink terminals connect to the Defense Enterprise Computing Center.

## SPACE SEGMENT

C-9. The space segment consists of the WGS satellites operating in the Ka band. Other U.S. and non-U.S. Ku and Ka band satellites can augment the space segment. Each WGS satellite can support GBS broadcast streams over 45 Mbps.

C-10. In regions where military SATCOM resources are not available, leased Ku band commercial satellites can support user requirements. Figure C-1 provides an operational overview of the broadcast and space segments.




**LEGEND**

| | | | |
|---|---|---|---|
| CCMD | combatant command | TIM | theater information manager |
| DECC | Defense Enterprise Computing Center | TIP | theater injection point |
| DISN | Defense Information Systems Network | TOC | tactical operation center |
| GBSOC | Global Broadcast System Operations Center | TSBM | transportable satellite broadcast manager |
| NIPRNET | Non-classified Internet Protocol Router Network | WGS | Wideband Global Satellite Communications |
| RBM | receive broadcast manager | | |
| SIPRNET | Secret Internet Protocol Router Network | | |

**Figure C-1. Global Broadcast System broadcast and space segments**

## BROADCAST SEGMENT

C-11. The primary Defense Enterprise Computing Center satellite broadcast manager is in Oklahoma City, Oklahoma. The backup satellite broadcast manager is in Mechanicsburg, Pennsylvania for continuity of operations. Data and streaming products are transmitted from their sources to the satellite broadcast manager (videos are simultaneously transmitted to the backup satellite broadcast manager), then across DISA backbone transport to DOD teleports, DOD gateways, and terminals for broadcast over the WGS satellites.

C-12. The GBS architecture is a content priority-based broadcast. This architecture prioritizes essential information. The internet protocol architecture allows higher priority products to override the broadcast of lower priority broadcasts, after which the delivery of lower-level priority content resumes. GBS does not have nuclear survivability or hardening features and is vulnerable to the same threats as most commercial SATCOM systems.

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## Appendix D

# Protected Satellite Communications

Protected satellite communications allow survivable communication at a reduced data rate. These unique capabilities make the use of the protected satellite communications frequency band ideal for the most critical strategic forces, and command and control systems.

## OVERVIEW

D-1. Protected SATCOM features highly-focused spot beams, spread spectrum modulation, and frequency hopping technology to provide anti-jamming, scintillation resistance, low probability of intercept, and low probability of detection.

## MILSTAR

D-2. The Milstar constellation has five satellites. The first two (block I) satellites have low data rate capability and can support up to four users on one channel (Milstar low data rate frame). The remaining three (block II) satellites support both low data rate and medium data rate capabilities, increasing the data rate to 1.544 Mbps.

D-3. The Milstar space segment provides worldwide coverage, between 65 degrees south and 65 degrees north. Crosslinks between the Milstar satellites permit worldwide communications relay without using intermediate ground stations. Crosslinks are helpful in a jamming scenario. Milstar satellites employ the EHF band for the following reasons—

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

### MILSTAR CAPABILITIES

D-4. Milstar enables worldwide, secure, survivable, jam-resistant communication; satellite-to-satellite relay; autonomous operation; ability to reposition to meet theater requirements; and ability to directly support deployed forces. Milstar performs communications processing and network routing onboard the satellite, eliminating dependence on land-based relay stations and reducing the chance of interception.

D-5. The Milstar constellation supports the Army's protected SATCOM architecture by using the medium data rate payload on the Milstar II satellites. Milstar users can reconfigure their terminals without submitting a new satellite access request, as long as the terminal operates within the allocated resources identified in the satellite access authorization.

D-6. The medium data rate 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 the link and service data from the uplink signal and retransmits on the appropriate downlink beam based on allocated terminal and service configurations in the payload table. If necessary, the satellite crosslinks the data to another Milstar satellite.

D-7. Adaptive nulling antennas resist jamming from within respective coverage areas by changing gain patterns during a jamming event. The distributed user coverage antennas provide high-gain and low side lobes. The antennas are individually steerable to a desired latitude and longitude.

D-8. The Milstar frequency bands, waveforms, and signal processing algorithms are robust. Survivability and endurance in the design of the space and mission control segments ensure Milstar users maintain essential communications connectivity. Milstar flexibility allows communications services with more configuration options.

## MILSTAR LOW DATA RATE PAYLOAD

D-9. The Milstar low data rate payload (block I) supports narrowband communications with various antennas and beams. There are one earth coverage antenna and a UHF antenna for transmit and receive signals. Milstar satellites have nine EHF uplink coverage beams: one earth coverage, one wide spot beam, two narrow spot beams, and five agile beams. Each satellite also has five SHF downlink beams: one earth coverage beam, one wide spot beam, two narrow spot beams, and one agile beam. The low data rate payload 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 payload provides processes incoming signals so that adding and subtracting user terminals does not require power and bandwidth balancing.

D-10. The low data rate crosslinks consist of a classified number of 75 and 600 bps crosslink slots. If a service data rate is 75–300 bps, the signal uses one to four 75 bps crosslink slots. If a service data rate is 600 bps–2.4 kbps, the signal uses one to four 600 bps crosslink slots. Low data rate crosslinks are bi-directional between two or more satellites.

D-11. The low data rate waveform, low frequency hopping, and high frequency hopping rates provide joint interoperability for ground 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. User privileged terminals can dynamically control spot beam coverage throughout the earth coverage footprint. Crosslinks join adjacent satellites, provide worldwide connectivity, and synchronize timing for the global constellation to permit instant call set-up; secure connectivity; and secure telemetry, tracking, and command signals.

## MILSTAR MEDIUM DATA RATE PAYLOAD

D-12. The Milstar (block II) satellites support higher data rates by adding a medium data rate payload. The medium data rate payload provides secure, jam-resistant communications services through onboard signal and data processing capabilities. The medium data rate payload sends and receives individual voice, video, and data services at data rates up to 1.5 Mbps. The medium data rate payload processes the link and service data received on the uplink signal and retransmits the data on the appropriate downlink beam, based on allocated terminal and service configurations in the payload table. If necessary, it relays the data to another satellite using crosslink.

D-13. 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 medium data rate and low data rate payloads.

D-14. The medium data rate payload uses two nulling antennas and six distributed user coverage antennas. The antennas are mapped to onboard demodulators and are programmable to different numbers of channel configurations if necessary. All are steerable spot beams with approximately 450 nautical mile footprints. The nulling antennas can attenuate the uplink signal received from specific portions of the footprint if off-key or off timed energy from jamming, effectively eliminating jamming effects on the satellite and subscriber services. Milstar uplink beams are very narrow. This limits enemy ability to detect and deny, degrade, or disrupt the signal with downlink or uplink jamming.

## MILSTAR TO ADVANCED EXTREME HIGH FREQUENCY TRANSITION

D-15. Before the first AEHF satellite was launched, the mission control segment transitioned to support both Milstar and AEHF constellations. In addition to low data rate and medium data rate, the newer AEHF satellites also carry the extended data rate payload and can process data rates up to 8.192 Mbps (see figure D-1).

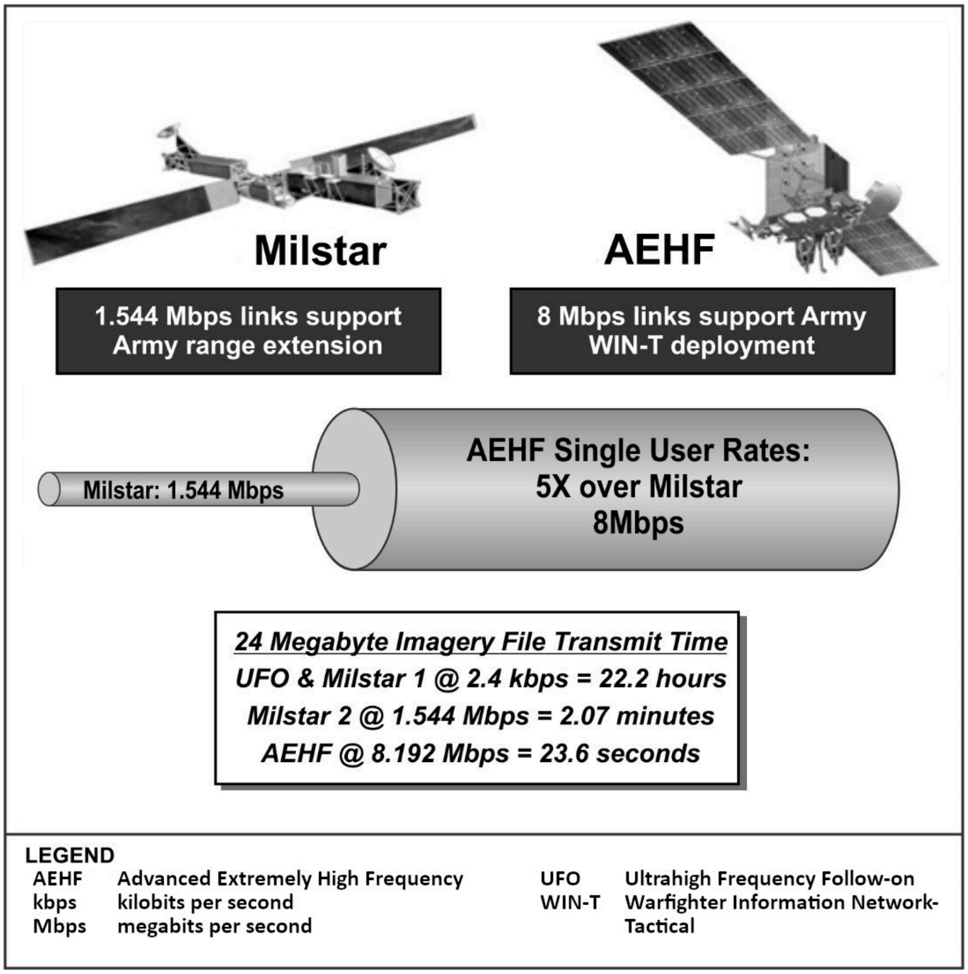


**Figure D-1. Milstar and advanced extremely high frequency data transfer capabilities**

# ADVANCED EXTREMELY HIGH FREQUENCY SATELLITE COMMUNICATIONS

D-16. The AEHF satellite constellation provides overlapping worldwide coverage, on-orbit redundancy, and protected SATCOM interoperability with multinational mission partners. AEHF still uses an EHF uplink and SHF downlink, but with more steerable and configurable beams. All of the steerable beams are 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.

D-17. The AEHF SATCOM system has three segments—

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

## ADVANCED EXTREMELY HIGH FREQUENCY SPACE SEGMENT

D-18. The constellation of Milstar and AEHF make up the AEHF space segment (see figure D-2 on page D-4). The space segment utilizes EHF uplink frequencies and SHF downlink frequencies. AEHF satellites can crosslink AEHF and Milstar satellites using the V band. Crosslinking enables worldwide communications without using vulnerable ground relay sites.

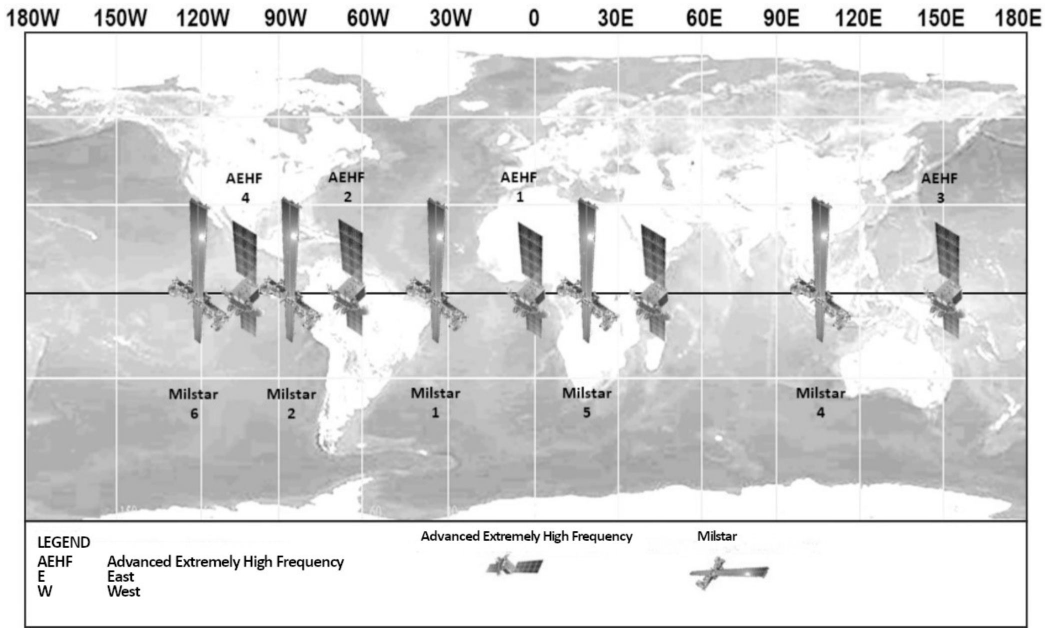


**Figure D-2. Advanced extremely high frequency space segment**

D-19. Theater coverage divides into high resolution and medium resolution coverage areas. The AEHF system can cover multiple geographic theaters simultaneously. Theater coverage supports geographically concentrated tactical air, ground, and maritime forces.

## ADVANCED EXTREMELY HIGH FREQUENCY CONTROL SEGMENT

D-20. The control segment consists of four elements. Together these elements provide command and control capabilities supporting the space, control, and terminal segments:

- **Mission control**—payload reconfiguration, satellite maintenance, and satellite relocation.
- **Mission planning**—planning networks and generating terminal images at the unit level on the Tactical Mission Planning Subsystem, AN/PYQ-19.
- **Mission and operations support**—mission planning assistance and resource allocation and monitoring from RSSCs.
- **Training and simulation**—support for training throughout the evolution and life cycle of the control segment.

## ADVANCED EXTREMELY HIGH FREQUENCY TERMINAL SEGMENT

D-21. The terminal segment is interoperable, joining the Services and networks using common voice, data, cryptographic, and data network devices. The AEHF terminals can pass communications over AEHF and Milstar networks. The terminal segment configurations include—

- Fixed ground.
- Mobile ground.
- Man-portable.
- Transportable.
- Airborne.
- Submarine.
- Ship-borne.

D-22. AEHF terminals, including the SMART-T, can operate in both AEHF extended data rate and Milstar low data rate or medium data rate modes, but not simultaneously. All legacy Milstar terminals remain compatible with Milstar satellites and may also operate over AEHF satellites if the AEHF satellite configuration supports Milstar backward-compatible services.

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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

| | |
|---|---|
| **ADP** | Army doctrine publication |
| **AEHF** | Advanced Extremely High Frequency |
| **AR** | Army Regulation |
| **ATP** | Army techniques publication |
| **C-SSE** | consolidated satellite communications system expert |
| **CFSCC** | Combined Force Space Component Command |
| **CJCSI** | Chairman of the Joint Chiefs of Staff instruction |
| **CIO** | chief information officer |
| **DA** | Department of the Army |
| **DAMA** | demand assigned multiple access |
| **DD** | Department of Defense form |
| **DISA** | Defense Information Systems Agency |
| **DISN** | Defense Information Systems Network |
| **DOD** | Department of Defense |
| **DODD** | Department of Defense directive |
| **DODI** | Department of Defense instruction |
| **DODIN** | Department of Defense information network |
| **DODIN-A** | Department of Defense information network-Army |
| **DSCS** | Defense Satellite Communications System |
| **EHF** | extremely high frequency |
| **FM** | field manual |
| **FORSCOM** | United States Army Forces Command |
| **G-6** | assistant chief of staff for communications |
| **GBS** | Global Broadcast System |
| **GHz** | gigahertz |
| **INMARSAT** | international maritime satellite |
| **J-6** | communications system directorate of a joint staff |
| **JP** | joint publication |
| **Ka-STARS** | Ka Band Satellite Transmit and Receive System |
| **Kbps** | kilobits per second |
| **kHz** | kilohertz |

| | |
|---|---|
| **Mbps** | megabits per second |
| **MHz** | megahertz |
| **MUOS** | Mobile User Objective System |
| **NETCOM** | United States Army Network Enterprise Technology Command |
| **NIPRNET** | Non-classified Internet Protocol Router Network |
| **RSSC** | regional satellite communications support center |
| **SATCOM** | satellite communications |
| **SC(T)** | signal command (theater) |
| **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 |
| **UFO** | Ultrahigh Frequency Follow-On |
| **UHF** | ultrahigh frequency |
| **USASMDC** | United States Army Space and Missile Defense Command |
| **USSPACECOM** | United States Space Command |
| **VHF** | very high frequency |
| **WCDMA** | wideband code division multiple access |
| **WGS** | Wideband Global Satellite Communications |
| **WIN-T** | Warfighter Information Network-Tactical |
| **WSOC** | wideband satellite communications operations center |

## 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. (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)

**Department of Defense information network-Army**

An Army-operated enclave of the Department of Defense information network that encompasses all Army information capabilities that collect, process, store, display, disseminate, and protect information worldwide. Also called **DODIN-A**. (ATP 6-02.71)

**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 satellite communications access and coordinate necessary changes in the frequency/channel, power level, or network settings. Coordination of access can use alternative communication means (e.g. radio, telephone, or orderwire, etc.) to help in the adjustment of power levels, frequency, and user modem settings with RSSC or WSOC guidance. All satellite communications access must be under positive control, access will be denied/terminated to links that lack positive control. As the technology built into systems allow, positive control through automated methods will be used. (CJCSI 6250.01F)

**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)

**regional hub node**

The gateway transport node for the Warfighter Information Network-Tactical and the transport medium for theater-based network service centers. (ATP 6-02.60)

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# References

All URLs accessed 27 August 2020.


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

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## RELATED PUBLICATIONS

These documents contain relevant supplemental information.

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JP 3-85. *Joint Electromagnetic Spectrum Operations*. 22 May 2020.

## PRESCRIBED FORMS

This section contains no entries.

## REFERENCED FORMS

Unless otherwise indicated, DA forms are available on the Army Publishing Directorate (APD) Website: (https://armypubs.army.mil).

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

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

## WEBSITES

These are the websites quoted or paraphrased in this publication.

General Services Administration Satellite Services Website: https://www.gsa.gov/satellite.

# Index

Entries are by paragraph number.

**ATP 6-02.54**

**05 November 2020**

By Order of the Secretary of the Army:

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*Chief of Staff*

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