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Tactical Satellite Communications

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Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

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Preface

Purpose and Scope

This manual is a basic reference document for using the tactical satellite (TACSAT) communications system. It does not replace technical manuals for equipment or field manuals for signal tactical organizations. The purpose of the manual is to translate doctrine and detailed technical data into practical guidance for planning and operating a TACSAT communications system. It provides guidance for deploying, controlling, and managing TACSAT communications systems and terminals.

This manual includes a description of the TACSAT communications equipment. It also provides instructions for its doctrinal use. This doctrine provides a firm foundation of guidance to TACSAT communications users.

The intended users of this manual are operators/supervisors, planners, and to some extent, maintainers. Operators/supervisors will use the manual for basic instruction and as a guide on how to use the equipment. Planners will use it for system and network planning. Maintainers can use it as an adjunct to the technical manual and as a quick reference when needed. To use this manual, the following references are required: FM 24-18, TC 24-21, DCAC 800-70-1, TC 24-24, and TC 24-4A. TC 24-4A contains all classified TACSAT communications data.

User Comments

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Chapter 1

Introduction

1-1. Army Space Activities

a. Tactical satellite (TACSAT) communications is part of a larger group of Army space activities. The Chief of Staff, US Army (CSA) directs all Army space activities through the Vice Chief of Staff, US Army (VCSA). The VCSA is chairman of the Army space council. This group recommends and guides the CSA in Army space-related activities such as current and future space missions and the Army's mission in the unified United States Space Command (USSPACECOM). The Army space council is made up of representatives from selected Army staff agencies, field operating agencies, and major commands. A general officer from the United States Army Information Systems Command (USAISC) is a member of the Army space council.

b. The Army Space Institute (ASI) and the United States Army Space Command (USARSPACE) are the two Army organizations for space. The ASI is a field operating agency of the United States Army Training and Doctrine Command (TIWIOC). Missions include developing and integrating space-related concepts and doctrine across mission areas. USARSPACE is under the operational command of the USSPACECOM and will expand the Army's role in the operational aspects of space. USARSPACE missions include operating the Regional Space Support Centers (RSSCS). These centers provide the ground mobile forces (GMF) manager support for the super high frequency (SHF) TACSAT segment and GMF control.

1-2. Military Requirements

a. Command, control, and communications (C^3) is the key to success in the AirLand Battle. Due to technological advances, greater mobility, and the extended battlefield, radio communications is paramount in the communications plan. However, while technology has improved the equipment, communications has not kept pace. Two limitations are the congested frequency spectrum and the physical limits on radio wave propagation. The frequency required for long-range radio adds to the frequency congestion problem. Requirements normally exceed the available, useable frequencies. Frequency congestion and inherent limitations of terrain and noise hamper short-range tactical radio.

Coupled with the need for flexibility, security, and reliability, radio communications remains a critical problem to the communicator.

b. TACSAT communications is the first radio system to successfully overcome most of these limitations. Using an orbiting satellite repeater illuminates one-third of the earth for direct line of sight (LOS) operations. This makes it possible to establish tactical communications on a scale never before accomplished. With more frequencies available and a single station LOS relay to almost any point on the battlefield, TACSAT equipment greatly enhances communications.

c. TACSAT communications is reliable, flexible, and survivable. It can replace certain links previously provided by conventional LOS radio relay, troposcatter, high frequency (HF) single sideband (SSB) or frequency modulated (FM) radios. The tremendous bandwidth available and computer switching makes a self-organizing communications network feasible. TACSAT communications is not the answer to all communications problems. However, a well thought-out, properly executed plan that augments the traditional ground-based communications system with appropriate TACSAT resources can improve communications availability, reliability, and flexibility.

1-3. TACSAT Systems

a. TACSAT systems, like terrestrial systems, vary depending on the communications requirements. Just as there is a need for both HF SSB and very high frequency (VHF) FM radio in the tactical environment, there is also a need for different satellite systems. The peculiarities of mission requirements make it necessary to have different TACSAT communications systems.

b The TACSAT communications systems of the US Army ground forces operate in one of four categories.

(1) The Army Multichannel Satellite Communications System's terrestrial terminals are the AN/TSC-85( ) and 93( ). The Air Force terminals are the AN/TSC-94A and the AN/TSC-100A. The satellites used for interconnectivity of these multichannel terminals are Defense Satellite Communications System (DSCS) IIs and DSCS IIIs. The frequency range of this system is SHF (7.9-8.4 GHz for uplink and 7.25-7.75 GHz for downlink.)

(2) The Special Communications System (SCS) is controlled and managed by the ultra high frequency (UHF) Air Force Satellite Communications System. The US Army ground terminals used in SCS are AN/MSC-64(V) and AN/GSC-40(V). The frequency range of the system is UHF (225-400 MHz) for up and downlink communications.

(3) Authorized Army units use the AN/PSC-3, AN/VSC-7, AN/URC-101, and AN/URC-110 for extended range communications. The frequency range of the system is UHF (225-400 MHz) for up and downlink communications.

(4) When fielded, the AN/TSC-124 (known as, single-channel objective tactical terminal (SCOTT)) will provide ground terminals for special communications system and joint theater command communications. The AN/TSC-124 groups users into nets with common cryptographic keys and addresses. It allows a telephone type "dial up" of another net member, mainly in a data mode. The frequency range of this system is extremely high frequency (EHF) (uplink) and SHF (downlink).

1-4. Transmission Techniques

a. To use TACSAT communications effectively, it is necessary to be familiar with the terminology and techniques that are used. It is not practical to have a separate satellite for each radio net or link. The satellite system must make provisions to relay signals of many nets at the same time. This is called multiple access. There are two basic types of multiple access--frequency division multiple access (FDMA) and time division multiple access (TDMA).

(1) FDMA is the first technique used for satellite multiple access because it uses existing frequency division technology and equipment. It is simple to implement, has proven performance and reliability, and is easy to maintain. Using FDMA, each terminal accessing the satellite transmits on a different frequency to the satellite. The satellite receives and retransmits the signals over a broad bandwidth encompassing the frequency range of the ground stations. The satellite electronics package is usually referred to as a transponder. The satellite translates the frequencies and retransmits them with the same relative frequency relationship back to the ground nets. This translation avoids interference between the satellite's input and output signals.

(a) Ground radios in an FDMA satellite net must transmit and receive on separate frequencies. These frequencies are spaced equal to the satellite frequency translation. This prevents direct radio contact between radios operating in the same net. Although this method is simple and reliable, it has drawbacks. Each single-channel net or one-way link requires two radio frequencies. A duplex link through the satellite requires four frequencies. Also, for direct linkage between two ground stations, without going through the satellite, frequency switching of the ground radio transmitter to the satellite transmit frequency is necessary. This complicates operational control and introduces the potential for interference due to operator error.

(b) With many nets operating at the same time, signals can be mixed due to different signal strengths arriving at the satellite. This is called intermodulation. It generates signals which can cause interference and noise. These mixing products also reduce the useable power output of the satellite. Satellite transmit power output must be divided among all the users in an FDMA system. Any power used in mixing and on noise reduces the power available for communications. Also, any unequal distribution of power among the users can impact on the successful operation of the FDMA satellite. Careful frequency selection and control of ground station transmit power is necessary to make an FDMA system work properly. Usually a centralized ground monitor and control point is essential. Despite these limitations, FDMA is an effective tactical system because of its simplicity. It foregoes the need for sophisticated timing necessary in TDMA systems.

(2) TDMA assigns a specific time interval for each ground terminal or net to use the satellite. This eliminates the FDMA need for frequency and power control of each ground station accessing the satellite. TDMA removes the potential for intermodulation caused by nets operating through the satellite at the same time. With each net having its own time to use the satellite, each net can use the maximum 'power and bandwidth of the satellite. However, to make the system work, rapid switching between nets is necessary to eliminate delays in net communications. This reduces the transmission time available to each net. It requires careful timing at each ground station.

(a) An alternative to accurate timing is slow switching among many nets or stations. Slow switching causes a delay in communications but is overcome by a priority break-in feature. For example, by giving each ground station satellite access for 4.5 seconds once every 5 minutes, 50 stations could be accommodated. A 0.5 second time slot is available each 5 seconds for emergency break messages. This technique is most attractive with narrative record communications operating in a store and forward mode. The break-in feature is also useful for some special communications requirements.

(b) Regardless of the switching speed, digital transmission is almost an absolute necessity. The switching of time slots is digital; therefore, the communications must match. This means all signals transmitted in the TDMA system must be digital for transmission. Analog signals must be converted before transmission and reconverted after reception. However, using digital transmission and reception makes TDMA more attractive because of the compatibility with electronic switching systems and cryptographic equipment. TDMA communications is in short intermittent bursts; therefore, the ground stations must store or buffer information allowing continuous input and output of traffic.

b. With multiple access, the number of channels on a satellite is limited. If each channel through the satellite is dedicated to a specific net or user, the number of users can quickly exceed the available channels. If a given channel is not being fully used by a net, a valuable satellite channel is partially wasted. This is not efficient and leads to delays and limited channel availability. FDMA and TDMA do not allow for efficient use of the available satellite resources.

(1) Demand assigned multiple access (DAMA) is a technique which matches user demands to available satellite time. Satellite channels are grouped together as a bulk asset, and DAMA assigns users variable time slots that match the users information transmission requirements. The user notices no difference--to him it seems he has exclusive use of the channel. The increase in nets or users available by using DAMA depends on the type of users. DAMA is most effective where there are many users operating at low to moderate duty cycles. This describes many tactical nets; therefore, DAMA is particularly effective with TACSAT systems.

(2) DAMA efficiency also depends on how the system is formatted. Formatting a DAMA system is how the access is controlled. The greatest user increase is obtained through unlimited access. This format sets up channel use on a first-come-first-serve basis. Other types of formats are prioritized cueing access and minimum percentage access. The prioritization technique is suitable for command type nets, while the minimum percentage is suitable for support/logistic nets. Regardless of format, DAMA generally increases satellite capability by 4 to 20 times over normal dedicated channel operation.

c. Spread spectrum multiple access (SSMA) is a technique which uses a wideband signal to convey intelligence through the satellite. This signal may be many hundreds of megahertz wide. The advantage of a signal spread over a great bandwidth is that power density (watts per hertz) is lowered by the same amount that the spectrum is widened. This interchange of power for spectrum space can reach a point where signals can be transmitted and received while hidden below the background noise. Such low density signals can reduce the problem of interception and at the same time prevent interference to other satellite users. Spread spectrum systems allow many users to share a single wideband channel. Information to be transmitted by spread spectrum is first converted into digital form to provide a primary modulation of the carrier. A secondary pseudorandom noise modulation of much wider bandwidth is then applied to the carrier to spread the spectrum of the primary modulation. At the receiving end, an identical noise generator, synchronized to the transmitter, generates the same noise code to cancel it from the incoming signal. Thus, only the transmitted information remains. This spread spectrum technique is called direct sequence (DS). The basic form of DS is produced by a simple, phase shift keying (PSK) carrier frequency. In the DS spread spectrum signal, the modulated signal appears instantly across the total bandwidth.

(1) The advantages of DS spread spectrum processing are--

- Signals are difficult to detect.
- Maximum transmitted power for the bandwidth used.
- Interference and jamming protection.
- Reduced noise.
- Discrete address.
- Multiple access.

(2) Another form of spread spectrum is frequency hopping (FH). FH uses a pseudorandom code generator to switch the carrier frequencies producing a hopping DS spread spectrum. Frequency hoppers can use hundreds to thousands of frequencies.

d. In spread spectrum systems and TDMA, timing is a necessary process. Transmitter-to-receiver phase and frequency timing requires resolution before a spread spectrum or TDMA receiver can operate. These problems are overcome by transmitting timing signals at the start of each transmission. A system clock produces a timing preamble code for timing of the network. The preamble of a transmission from any terminal carries timing information for the receiving terminal. System or network control assigns the terminal transmitted time slot. This carries timing in the preamble and discrete address(es) in the data segment. Each receiver uses the transmitted preamble for fine adjustments.

e. Addressing a message designated for a specific terminal is similar to a telephone call. When dialing a telephone number, the electronic switching equipment directs the telephone system circuits to connect the caller and addressee. Basically, the telephone system has a "discrete call" capability. A discrete call capability is required in multiple access transmission systems. The form of discrete call needed in a TDMA communications system is transmitter to receiver recognition, not subscriber to subscriber. Although all receivers will fine-tune to the timing signal, only the receiver recognizing its address in the code will copy the text.

1-5. Planning and Control

a. Tactical communications networks change constantly. Unless control of the network is exercised, communications delay and a poor grade of service will result. The best method of providing this control without hampering operation is through centralized planning. Execution of these plans should be decentralized. This concept is applied to the space systems portion and to the ground stations. The US military

satellite systems consist of terminals (ground segment), satellites (space segment), and tracking, telemetry, and control (TT&C) terminals (control segment).

b. The planning and system control process helps communications systems managers react appropriately to the mission of the force supported, the needs of the commander, and the current tactical situation. The type, size, and complexity of the system being operated establishes the method of control.

(1) Communications control is a process in which the matching of resources with requirements takes place. This process occurs at all levels of the control and management structure. In each case, the availability of resources is considered.

(2) Operating systems control is the detailed hourly management of a portion of a theater Army, Army group, corps, or division communications system. Planning and control is according to the system being used.

c. The Defense Communications Agency (DCA) provides technical guidance on satellite control in support of the Joint Chiefs of Staff (JCS). Course allocation of satellite payload communications resources is done by DCA based on JCS directives. The Army, Air Force, and Navy have operational responsibilities for satellites and satellite payloads. These responsibilities involve using several sites worldwide to provide planning and control for a communications satellite constellation.

d. Satellite control is split into two categories: TT&C and payload control. Because there may be hundreds of users on a communications satellite, payload control is often subdivided among major user groups. In DSCS, a portion of the payload bandwidth and power is used to support the GMF terminals. GMF managers and controllers handle the planning and control. The overall DSCS controller monitors the GMF portion of the satellite system either as a subnet or as individual carriers. However, this monitoring depends on the availability of satellite resources. Chapters describing the specific system cover the user's interface with satellite planning and control.

1-6. Space Segment Descriptions

a. The satellite system operating in the UHF band is the Fleet Satellite (FLTSAT) System. FLTSAT is presently providing worldwide support to all services and agencies between the latitudes of 70 degrees north and 70 degrees south. However, the Navy primarily uses this system. Each FLTSAT can relay communications on 23 separate radio frequency (RF) channels. There is one fleet broadcast 25 kHz channel and SHF beacon; nine fleet-relay, 25 kHz channels; 12 Air Force satellite communications (AFSATCOM) narrowband 5 kHz channels; and one AFSATCOM

wideband 500 kHz channel. FDMA allows access to the 500 kHz transponder by seven high data rate (2.4 kbps) users and 13 low data rate (75 bps) users. Army users may request using the nine fleet-relay channels, the five nonprocessed 5 kHz channels, and limited access to the wideband transponder. However, there are currently no satellite transponders dedicated to Army use. Army users must send an access request directly to the Air Force or Navy. Access is based on the established prioritization schedule published in JCS MOP 178. The Office of JCS has formed the Joint Communications Satellite Center (JCSC) to act as the controlling agency for satellite access. Network control and spectrum availability are the responsibility of the Air Force and Navy. All non-Navy users must direct their frequency requests through their local frequency management office to the Navy's frequency management office. The overall FLTSAT system has more than 600 user terminals on board ships, aircraft, and on shore. The FLTSAT space segment consists of four satellites in synchronous orbit. The satellite transponders operate in US military UHF bands.

b. The multichannel TACSAT terminals use the spacecraft transponders of the DSCS. The terminals use both DSCS II and DSCS III satellites. The DSCS II satellite has two transponders, each providing two operational channels. These transponders are cross-linked to provide four operational channels to the earth coverage (EC) and narrow coverage (NC) antennas. Each NC antenna can transmit and receive simultaneously. (DCAC 800-70-1 covers on-board antenna interconnectivity of the DSCS II channel.) The signal transmitted by the ground terminal is received at the satellite in the 7.9 to 8.4 GHz frequency range where it is down converted, amplified, and retransmitted in the 7.25 to 7.75 GHz frequency range. The two NC antennas can be independently steered ±10 degrees, and the footprint--the part of the earth covered by the antenna-- covers an area about 1,200 kilometers (750 miles) in diameter. The newer DSCS II satellites have one of the NC antennas adjusted to provide a 2,400 kilometer-wide (1,500 mile-wide) coverage area, known as area coverage (AC). The EC antennas (transmit and receive horns) provide coverage to about one-third of the earth's surface.

c. The DSCS III satellite has six independent transponders (one per channel), three uplink antennas to receive signals from earth terminals, and five downlink antennas which retransmit the signals back to earth. The signal transmitted by the ground terminal is received at the satellite in the 7.9 to 8.4 GHz frequency range where it is amplified, down converted, and retransmitted in the 7.25 to 7.75 GHz frequency range. The DSCS III will replace the DSCS II satellites over a period of time. At this time, both are in orbit. The DSCS IIIs have some improvements over the DSCS IIs such as increased hardening, a nulling capability (antijam function), and more transponders. However, the DSCS III only has one NC gimballed dish antenna (GDA). This limits the number

of locations that can be covered at any one time. The DCA can change footprint locations. (DCAC 800-70-1 covers on-board antenna interconnectivity of the DSCS III satellite channel.)

1-7. Electronic Warfare

TACSAT communications is an important element of the battlefield command and control system. Part of the enemy's resources are directed against the satellite system through electronic warfare (EW). How vulnerable we are to enemy EW and the success of our actions to deny the enemy success in his EW effort depends on our equipment and our signal personnel. While there are many components of EW, this manual deals only with TACSAT communications systems. The first two EW components, electronic warfare support measures (ESM) and electronic countermeasures (ECM), are technical. We rely on military intelligence (MI) units and the United States Army Intelligence and Security Command (INSCOM) for advice and implementation of ESM and ECM. Radio electronic combat (REC) is the enemy equivalent to our ESM and ECM. To counter enemy use of REC, the Army relies on communicators to use electronic counter-countermeasures (ECCM).

a. Electronic threat. The enemy uses REC measures to collect intelligence data about our signal systems. The enemy then decides what REC would be appropriate from the data gained through intercept. TACSAT communications will be high on the enemy REC target list. Shortly after tactical communications is placed in operation, the enemy will compile data on the satellite. This data will most likely include--

- Data indicating the satellite's orbit and location.
- Information on frequency, bandwidth, and modulation used in the satellite.
- The amount, type, and frequency of traffic relayed by the satellite.

With the satellite relay located, the primary enemy REC threat then is directed toward locating ground stations through radio direction finding (RDF). Due to the highly directional antennas used with SHF/EHF TACSAT communications radios, there is a low probability of intercept and direction finding. But, a satellite-based intercept station orbiting near our satellites can be successful. In this case, the analysis effort can be done by the enemy on his home ground, far from the battlefield. Because of the enemy's massive computer support TACSAT communications stations will hide very little from the enemy. Even without ground station locations, jamming can be directed towards the satellites. When this is done, TACSAT communications nets working through the satellite are operating in a "stressed" mode. Jamming signals directed toward the satellite can originate far from the battlefield. Because of the

directional antennas and frequencies used, jamming directed toward ground stations must come from nearby. Besides jamming, the enemy may attempt deception from either the ground or his own satellites. The enemy may attempt to insert false or misleading information and may also establish dummy nets operating through our satellites to cause confusion. In low- and mid-intensity conflicts however, there is a reduced electronic threat.

b. Defensive EW. TACSAT communications must operate within the REC environment just described. To do this, it is necessary to use available antijamming equipment and sound countermeasures. Communications discipline, security, and training underlie ECCM. Communications security (COMSEC) techniques give the commander confidence in the security of his communications. ECCM equipment and techniques provide confidence in the continued operation of TACSAT communications in a hostile EW or stressed environment. Particularly in TACSAT communications, the two are closely related techniques serving an ECCM role.

(1) COMSEC techniques protect the transmitted information. Physical security safeguards COMSEC materiel and information from access or observation by unauthorized personnel using physical means. Transmission security (TRANSEC) protects transmissions from hostile interception and exploitation. COMSEC and TRANSEC equipment protects most circuits. However, some TACSAT orderwires may not be secure. Technical discussions between operators can contain information important to the enemy. The nature of any mission gives the enemy access to critical information about commanders, organizations, and locations of headquarters. Although revealed casually on the job, this information is sensitive and must be protected. FM 34-62 covers signals security (SIGSEC) and information on COMSEC measures and techniques. TC 24-4A covers COMSEC applications for TACSAT operations.

(2) ECCM techniques protect against enemy attempts to detect, deceive, or destroy friendly communications. Changing frequency can defeat jamming. This requires the jammer to determine the new frequency and move to it. Meanwhile, the frequency can again be changed. This is the principle behind FH. Since it takes about 0.25 seconds for the earth station satellite-earth station trip, FH 4 times per second denies the jammer access to the satellite to earth link. FH at this rate must rely on automated equipment. FH at rates between 4 per second and 75 per second effectively avoids intercept and jamming when the enemy can receive only the downlink. With these low rates, bandwidth is still minimum while providing secure communications. FH forces the jammer to spread his energy (broadband jamming). This reduces the jammer noise density on any one channel. Wideband spread-spectrum modulation is another effective antijamming technique. With this technique, the information transmitted is added to a pseudorandom noise code and is used to modulate the TACSAT terminal transmitter. At the receiving end,

an identical noise generator synchronized to the transmitter is used. It generates the same noise code as the one at the transmitter to cancel the noise signal from the incoming signal. Thus, only the transmitted information remains. The spread spectrum signal can occupy the entire bandwidth of the satellite at the same time with several other spread spectrum signals. Each signal must have a different pseudorandom noise code. The noise code looks the same to the jammer whether or not it is carrying intelligence. This forces the jammer to spread his energy throughout the entire bandwidth of the random noise. This results in a reduced jamming noise density. The jammer has no knowledge of whether the jamming is effective.

c. Electromagnetic compatibility. Electromagnetic compatibility occurs when all equipment (radios, radars, generators) and vehicles (ignition systems) operate without interference from each other. With TACSAT communications terminals, a source of interference is the sun, a very strong source of broadband noise. However, factors such as location and antenna orientation can be controlled to eliminate this source of noise. For each equipment, use proper grounding techniques and follow safety considerations. When TACSAT communications terminals and other sets must be collocated, use a plan that prevents antennas from shooting directly into one another. Maintaining an adequate distance between antennas reduces mutual interference. Desensitization is the most common interference problem. This reduces receiver sensitivity caused by signals from nearby transmitters. Electromagnetic compatibility must be included in the plans for siting a TACSAT communications station.

d. Electromagnetic pulse (EMP). EMP is a threat to all sophisticated electronic systems. Under the proper circumstances, a major portion of the energy released during a nuclear detonation appears as an EMP. It has the same frequencies or wavelengths as those used by some of our TACSAT communications radios.

(1) EMP has two unique properties. First, EMP has a great “killing range.” EMP can disable electronic systems as far as 6,000 kilometers (3,720 miles) from the site of the detonation. Second, EMP can cause severe disruption and sometimes damage when other weapon effects are absent. A high-yield nuclear weapon, burst above the atmosphere, could be used to knock out a TACSAT communications system’s operational status without doing any other significant damage. The range of EMP is diminished if the weapon is detonated at a lower altitude within the atmosphere. An idea of the amplitude of EMP can be gained when we compare it with fields from man-made sources. A typical high level EMP could have an intensity which is 1,000 times more intense than a radar beam. A radar beam has sufficient power to cause biological damage such as blindness or sterilization. The EMP spectrum is broad and extends from low frequencies into the UHF band. The most likely EMP effect would

be stopping communications service temporarily. This can occur even without permanent damage. This delay could give an enemy enough of an advantage to change the outcome of the battle.

(2) The issue is protection against EMP. All TACSAT communications systems incorporate built-in features and techniques to counter the EMP effects. Shielding can further reduce the level of the EMP. Shielding is using equipment location and possible known directions of nuclear blasts to reduce EMP exposure. Shielding also depends on good grounding. Electronic systems depend on protection against EMP.

Chapter 2

Manpack Single-Channel System

2-1. System Description

a. Manpack single-channel TACSAT terminals provide reliable, highly portable communications. They have minimum setup and teardown time and satisfy a need for extended distance communications.

b. The manpack system operates in the UHF band between 225 MHz and 400 MHz. The manpack terminals use a UHF satellite system (FLTSAT and Air Force satellite (AFSAT) space segments).

c. The Army terminals using the FLTSAT space system are the ANIPSC-3, AN/VSC-7, AN/URC-101, and AN/URC-110. The AN/PSC-3 is a manpack terminal carried by one operator. The AN/VSC-7 is a vehicle-mounted terminal which normally acts as a net control station (NCS) and can control up to 15 subscribers. The AN/URC-101 and AN/URC-110 are manpack terminals each carried by one operator.

2-2. Deployment

a. Army units such as Special Forces groups and Ranger battalions deploy manpack TACSAT terminals worldwide. The physical environment does not restrict these deployments. The terminals are lightweight and compact, and they can be moved easily by one person. The NCSS are normally vehicle-mounted. They are usually operated from a forward operating base by Special Forces groups or from a battalion headquarters by Ranger battalions. A network can be a small deployment (three to four terminals with one AN/VSC-7/NCS) or a larger deployment (more than one AN/VSC-7/NCS).

b. Manpack terminals deployed worldwide are issued to support Army units. AN/VSC-7s and AN/PSC-3s satisfy the real-time mission requirements of the following organizations:

- Special Forces.
- Ranger battalions.

- Airborne/air assault divisions.
- Selected infantry divisions (light and mechanized).

2-3. Employment

a. The Special Forces units use the AN/PSC-3s for group/detachment headquarters, forward operating bases, and operational teams spread over extended distances. Command and control between major headquarters is primarily secure voice. All users at the Special Forces team level operate in a data burst mode using the OA-8990 data burst device.

b. The Ranger regiment/battalions command nets provide command and control from regimental headquarters through company headquarters. They use secure voice and data burst in their operations.

c. The airborne/air assault divisions use the AN/PSC-3s primarily to provide a long-haul command and control link between major headquarters during initial deployment. Once on the ground, those headquarters still requiring a communications link not available by LOS means or by multichannel satellite link will continue to operate via the AN/PSC-3 network. The primary mode is secure voice, though secure teletype (AN/UGC-74) is also used.

d. Selected infantry divisions (light and mechanized) use the A.N/PSC-3s to provide a long-haul command and control link between major headquarters during initial deployment of a contingency operation. The primary mode is secure voice, though secure teletype (AN/UGC-74) is also used.

2-4. System Configuration

a. The AN/PSC-3 is a battery operated, highly portable, manpack TACSAT terminal. It employs an RT-1402 receiver/transmitter (R/T) unit that provides two-way communications in the frequency range of 225 MHz to 400 MHz. The R/T functions in both satellite mode and LOS mode of operation. It can be configured to provide data or secure voice.

(1) In the data mode, it uses the digital message device group (DMDG) OA-8990 as the input/output (I/O) device. It provides data rates of 300 bps or 1,200 bps.

(2) In the secure voice mode, the AN/PSC-3 uses either the advanced narrowband digital voice terminal (ANDVT) or a COMSEC interface device such as the VINSON KY-57.

(3) In addition to voice and data, the AN/PSC-3 can interface with facsimile, teletype, net radio interface (NRI), and FM retransmission media.

b. The NCS uses the same basic AN/PSC-3 R/T unit reconfigured to form an AN/VSC-7. The vehicle's electrical system provides power for operation. The NCS can control as many as 15 terminals in a network. Because it is a single-channel system, it is configured with data needs being satisfied by some terminals and secure voice needs being satisfied by other terminals. The call mode operation is a unique calling function. It allows the sending station to alert a distant unit with a visual indication. It also allows an optional 5-second audible alarm. The NCS can transmit or receive any one of 15 selective calls. It can also receive all conference calls regardless of the selective control setting on the NCS applique front panel. The NCS selects any one of the 15 units operating in its net for selective call transmissions. Conference calls will be received by all units operating in the net with their controls set to receive selective call messages.

2-5. Antijamming and ECCM Techniques

Physical damage and hostile electromagnetic jamming threaten all communications including satellite. This system presently does not offer any antijamming protection to the TACSAT terminal. Mobile TACSAT terminals offset the need for providing protected multiple ground relay sites. In addition, it reduces exposure time to hostile actions. The protection of these terminals by terrain, such as valleys, further reduces the possibility of detection. Where ordinary means of communications are subject to varying degrees of RDF, the satellite system can be used to deter enemy RDF success. The short transmission times of burst mode present less attractive jamming targets than the longer continuous communications of regular nets. The only options available to tactical UHF satellite terminals are data burst, alternate frequency selection, mobility, and reducing the on-air time of each transmission.

Chapter 3

Special Communications System

3-1. System Description

a. The SCS permits direct, automated, real-time communications in support of joint forces requiring rapid deployment or redeployment. SCS terminals send and receive record narrative messages over a 5 kHz, narrowband satellite channel.

b. The SCS operates in the UHF spectrum using the 225 to 400 MHz band. The Army, Navy, and Air Force operate SCS terminals. They consist of satellite communication terminals AN/GSC-40, AN/GSC-40A(V)l, AN/GSC-40A(V)2, and AN/MSC-64(V)2.

c. The SCS terminal, AN/MSC-64(V)2, is a highly mobile set installed in an S-280 type shelter. The rack-mounted combined ground command post terminal (CGCPT) AN/GSC-40(*)(V)(*) is configured to the needs of the fixed site at which it is installed.

3-2. Deployment

a. SCS terminals are deployed in Europe and Korea. All Army terminals function within a TACSAT network made up of force terminals (FTs) and command post (CP) equipment.

b. All SCS terminals deployed in a theater are operated as a network. The US Pacific Air Force has operational responsibility for all Air Force SCS terminals in the Korean theater. The US Army provides off-site maintenance support for US Air Force terminals in the Korean theater. Within joint commands, the US Army component commands are responsible for operation and maintenance of the SCS terminals assigned to their subordinate units.

c. SCS terminals deployed to Europe and Korea support Army, Navy, and Air Force real-time communication requirements for on-going special missions.

3-3. Employment

a. The SCS terminal is a single-channel TACSAT set. Each SCS terminal uses an I/O device. The device has a keyboard and display for editing and composing narrative traffic. The keyboard and display equipment is the I/O unit MX-10159/G that functions as the sole subscriber data terminal equipment (DTE). The AN/MSC-64(V) and AN/GSC-40(V) are self-contained terminals.

(1) The AN/MSC-64(V)2 contains a complete communications system housed in an S-280 shelter, carried by a 2 l/2-ton truck, and powered by a trailer-mounted, 10-kilowatt generator. The AN/MSC-64(V)2 can also be powered by the vehicle engine with a 100 amp kit. The I/O unit organic to the terminal is the primary DTE and can be remoted up to 1,500 feet (455 meters). A low gain antenna is used during mobile operations. A high gain antenna is used during stationary operations.

(2) The AN/GSC-40, AN/GSC-40A(V)l, and AN/GSC-40(V)2 are rack mounted CGCPTS. These terminals are installed in CPS and configured according to the physical limits of the site.

b. A high degree of network flexibility is accomplished by using a TDMA control structure and a CGCPT. This technique allows communications to be executed on a time-shared basis between other terminals within the theater network. The terminal can operate in the random or time division multiplexing (TDM) modes. The random mode of operation allows the user to enter the TACSAT communications network on a random basis using an open selected channel.

3-4. Control and Management

a. The control and management procedures discussed here pertain to the communications between AN/GSC-40(V) and AN/MSC-64(V). The AN/GSC-40(V) performs the network control function (NCF) for a net of AN/MSC-64(V) FTs.

b. The NCF, normally located within a CP, performs the following subnet control actions:

- Transmits network timing synchronization message for initialization of a terminal entering the network and for retiming all receivers within the network.
- Transmits satellite operating mode for use by FTs.
- Transmits crypto-control data.

- Performs message preemption to allow transmission of a message with a higher precedence.

- In stressed mode, identifies each frame, establishes priorities, and dynamically assigns use of next slot.

c. The FTs perform the following control actions:

- Acknowledges/transmits messages.

- Loads and monitors the synchronization code.

- Selects transmit channel and time slot.

- Monitors emergency action message alarm.

d. The AN/MSC-64(V) FT is transported by a 2 1/2-ton truck and trailer, and is crewed by three operators. Other technical data is listed below:

- Frequency range--225 to 400 MHz.

- Power output--10 to 100 watts.

- Operating mode--AFSAT.

- Modulation type--Noncoherent frequency shift keying (FSK).

- Data rate--75 bps.

- Encryption device--TSEC/KN-2.

- Spread spectrum technique--FH.

3-5. Antijamming and ECCM Techniques

a. The SCS uses FH emission techniques as an ECCM capability and terminal hardening against the effects of EMP. The CGCPT uses wideband operation of coded m-ary FSK, pseudorandomly generated, suppressed carrier RF burst that is frequency hopped. This type of RF emission provides excellent ECCM protection for discrete addressing, message privacy, and multiple addressing. For narrowband operation, noncoherent FSK is used.

b. Wideband operation is only used between the CGCPT and the National Command Authority AFSATCOM terminals. SCS, a UHF system, lacks any antijamming protection to the TACSAT terminal outside of the emission techniques listed previously. The short transmission times of burst communications present less attractive jamming targets than do longer

continuous communications of regular nets. The only options available to TACSAT UHF terminals, in addition to short burst communications, are alternate frequency selection and mobility.

Chapter 4

Multichannel SHF System

4-1. System Description

a. Multichannel TACSAT terminals provide a reliable communications system. These terminals provide range extension for the area communications system.

b. The multichannel TACSAT systems use the DSCS II or DSCS III satellite and operate in the 7.25 to 8.4 GHz frequency range. The Army, Air Force, and Marine Corps operate these terminals. The Army and Marine Corps use the AN/TSC-85( )/93( ) while the Air Force uses the AN/TSC 94A/ l00A. These terminals are compatible with Tri-Service Tactical Communications (TRI-TAC) and Mobile Subscriber Equipment (MSE) systems. These multichannel TACSAT terminals use FDMA. Therefore, centralized frequency selection and uplink power control are required.

4-2. Deployment

a. Theater through brigade level commanders, special contingencies, and selected divisions use tactical multichannel satellite systems to support Army mission requirements. These systems were developed to augment existing terrestrial multichannel communications systems.

b. Multichannel satellite systems are designed primarily for trunking. Consider these factors when selecting a link requirement for multichannel TACSAT terminals:

- Criticality of the link to tactical command and control and the availability of other primary or supporting transmissions means.
- Ground range over which the link must be operated in various scenarios.
- Responsiveness and flexibility required with respect to siting and system reconfiguration.
- Link survivability requirements.

c. Consider these factors when deploying the AN/TSC-85( )/93( )s:

- Equipment capabilities.
- Network configuration.
- System descriptions.

d. The AN/TSC-85( ) TACSAT terminal is housed in a modified S-280 shelter. It operates with an organic AS-3036/TSC (8-foot diameter) antenna which is moved in an antenna pallet transit frame (APTF). It may also operate with either the nonorganic AS-3199/TSC (20-foot diameter) antenna or the OE-361(V)/G quick reaction satellite antenna (QRSA). All three antennas operate with DSCS satellites.

(1) The four curbside racks inside the shelter contain the baseband (multiplexing or demultiplexing) equipment. The four racks on the roadside of the shelter contain the modems and intermediate frequency (IF) or RF assemblies. The electronic equipment can operate in a nuclear, biological, chemical (NBC) environment.

(2) Each part of the satellite terminal equipment (shelter and APTF) is transportable by road, air (C-130, C-141, C-5A, or helicopter), rail (flatbed), and sea (ship). For the shelter to be mobile by rail or air, the M-720 mobilizer (nonorganic) must be used.

(3) Terminal setup time for a team using the organic AS-3036/TSC is 30 minutes (three-person crew).

e. The AN/TSC-85( ) TACSAT terminal (nodal terminal) provides the following:

- Transmission of a single SHF uplink carrier with up to 48 channels of voice and/or digital data (internally multiplexed). An additional 48 channels of voice and/or digital data from a remote (externally) multiplexed source may also be transmitted.
- On the downlink side, four carriers can be received, demodulated, and switched to user interfaces.
- Fully independent operation from a 15-kilowatt, three-phase, five-wire diesel generator or compatible commercial power.
- Link with a nodal or non-nodal terminal in the point-to-point, hub-spoke, and mesh or hybrid mode. (See Figures 4-1 through 4-3.)
- Links with DSCS gateway terminal to provide Defense Communications System (DCS) entry.

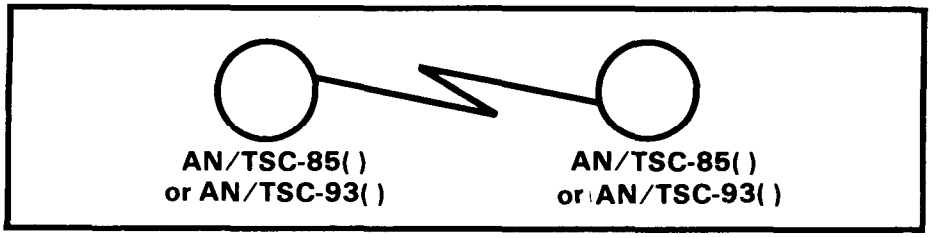


Figure 4-1. Terminals in a point-to-point configuration.

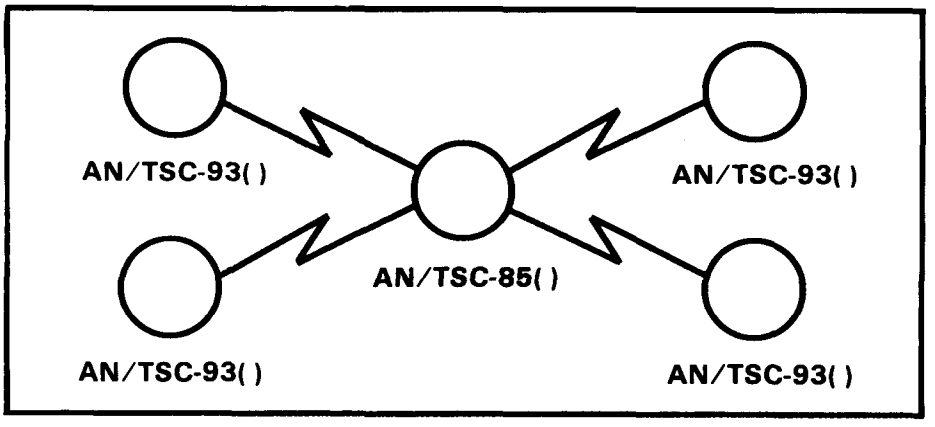


Figure 4-2. Terminals in a hub-spoke configuration.

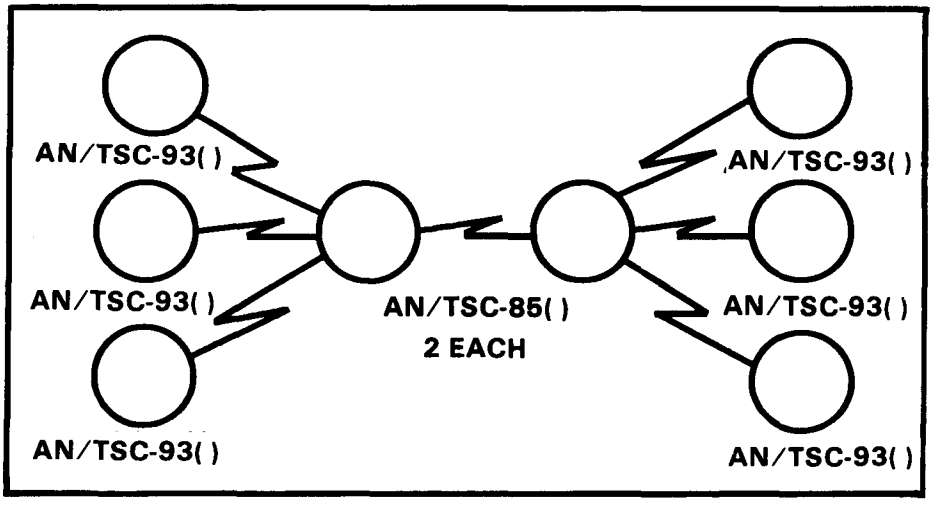


Figure 4-3. Terminals in a mesh or hybrid configuration.

f. A modified S-250 shelter houses the AN/TSC-93( ) TACSAT terminal. It operates with the AS-3036/TSC (8-foot diameter) antenna.

(1) The shelter is normally transported on the bed of a 2 1/2-ton truck with the disassembled 8-foot antenna on an M1028 commercial utility cargo vehicle (CUCV). Each truck tows a trailer-mounted diesel generator or power unit.

(2) Three curbside racks inside the shelter contain the baseband (multiplexing or demultiplexing) equipment. Three racks on the roadside of the shelter contain the modem and IF or RF assemblies.

(3) Each part of the satellite terminal equipment is transportable by road, air (C-130, C-141, C-5A, or helicopter), rail (flatbed), and sea (ship).

g. The AN/TSC-93( ) TACSAT terminal (non-nodal terminal) provides the following:

- Transmission of an SHF uplink carrier with up to 24 channels of voice and/or digital data (internally multiplexed).
- Link with a non-nodal terminal in the point-to-point or a nodal terminal hub-spoke mode.
- On the downlink side, can receive, demodulate, and switch a single SHF carrier via the demultiplexing equipment to the user interface.
- Fully independent operation from a 10-kilowatt, three-phase, five-wire diesel generator or compatible commercial power.
- Link with DSCS gateway terminal to provide DCS entry.

4-3. Employment

a. Limitations. Channel capacity on DSCS II and DSCS III satellites limits the number of TACSAT terminals that can operate at any one time. This number varies depending on several factors. These factors can include the type of terminal, number of channels, condition of terminals and satellite, size of antenna, and location of terminals within satellite footprint. These factors and others (for example, weather) affect how many terminals can use a satellite. For these reasons it is not possible to give a clear-cut number of terminals that can be operated at any one time. Unfortunately, there is not enough space segment to satisfy all the users. It should be stressed that DSCS II and DSCS III satellites support Army, Navy, Air Force, Marine, and other DOD/non-DOD users. The satellite channels on DSCS II and DSCS III are JCS assets and therefore not dedicated to any particular service.

b. Division.

(1) The divisions receiving multichannel TACSAT terminals are selected based on their operational areas, terrain, and distance considerations. The signal battalion installs, operates, and maintains the AN/TSC-85( )/93( )s.

(2) In selected divisions, five multichannel TACSAT terminals provide extended distance connectivity. Division main and division support command (DISCOM) use one AN/TSC-85( ) each. One AN/TSC-93( ) is deployed to each of the three maneuver brigades. This is at the commander's discretion. An AN/TSC-85( ) at division main might terminate links from each maneuver brigade and DISCOM. During division main displacements, the terminal at DISCOM acts as the hub.

c. Corps. In the corps, two AN/TSC-85( )s and four AN/TSC-93( )s are pooled to provide support based on the general support (GS) concept. Terminals in support of corps are used for various missions such as restoration of critical links, out of sector operations, and deep operations. This concept has been developed based on the range extension capability of the MSE system. The corps signal brigade installs, operates, and maintains the AN/TSC-85( )/93( )s.

d. Contingency corps.

(I) AN/TSC-85( )/93( )s are distributed to the contingency corps based on their mission. The corps signal brigade installs, operates, and maintains the AN/TSC-85( )/93( )s.

(2) In the contingency corps, five AN/TSC-85( )s and eight AN/TSC-93( )s provide a low capacity multichannel (6/12 channels) range extension capability, independent of terrain and siting restrictions. It provides links from corps main and forward CPs to corps support command (COSCOM), the subordinate divisions, and other attached units.

e. Echelons above corps (EAC).

(1) At EAC, multichannel TACSAT provides connectivity between key EAC headquarters. EAC has been provided six AN/TSC-85( )s and ten AN/TSC-93( )s based on distance, terrain, criticality of links, and the need to augment LOS relays.

(2) TACSAT provides connectivity between major Army and combined commands in Europe and Korea.

f. Contingency support.

(1) For Army and JCS crisis contingency support missions, AN/TSC-85( )/93( )s are allocated to a TACSAT company, table(s) of

organization and equipment (TOE) 11603. They deploy in support of Army and JCS contingency missions worldwide. This unit uses M-720 mobilizers for its AN/TSC-85( )s. The USAISC installs, operates, and maintains the AN/TSC-85( )/93( )s.

(2) The contingency corps area of operations is normally much larger than a doctrinal corps and requires augmentation. Three AN/TSC-85( )s and six AN/TSC-93( )s are allocated to the 235th Signal Detachment. They augment the contingency corps and Army contingency missions. This unit is also authorized M-720 mobilizers for its AN/TSC-85( )s.

4-4. Control and Management

a. USARSPACE RSSC GMF managers control and manage the TACSAT communications SHF multichannel terminals. These managers are collocated with the DCA elements at DCA-Europe, DCA-Pacific, and DCA-Washington. The GMF managers are the theater Commander in Chief's (CINC) resource managers and interface to the DSCS and DCA. DCA is the overall DSCS system manager and technical director providing satellite resources to the GMF managers.

b. Communications control matches resources against requirements. It occurs at all levels of the control and management structure. The TACSAT multichannel terminals use the DSCS space system which includes the DSCS II and DSCS III satellites. The availability of resources is considered in all cases as in the single-channel TACSAT program. Emphasis is also placed on mission and organizational priorities in accordance with JCS MOP 178.

c. The process for GMF satellite control, management, and access flow follows the path outlined below.

(1) Communications system planning element (CSPE). The CINC'S CSPE planner coordinates, consolidates, and prioritizes the user elements satellite requirements within his theater. He submits satellite access requests (SARS) to the GMF managers. On approval he receives the satellite access authorization (SAA) that provides operation orders (OPORDS) or operation plans (OPLANS) to the terminal operators.

(2) RSSC GMF manager. The RSSC GMF manager--

- Receives the SAR from the CSPE.
- Coordinates with DCA for added resources.

- Develops alternate plans and coordinates with the CSPE if SARS cannot be met due to resource restrictions.

- Initiates and transmits an SAA to the CSPE or denies access based on available resources.

(3) DCA. The DCA--

- Is the system manager and technical director for the DSCS.

- Allocates the resources available.

- Adjudicates resource requirements between GMF and DSCS users.

(4) JCS. The JCS adjudicates differing resource requirements of the CINC which cannot be resolved between the CSPE, the GMT manager, and the DCA due to resource limitations.

(5) GMF network controller (GNC). The GNC--

- Is under the operational control (OPCON) of the GMF manager.

- Has OPCON of all GMF TACSAT terminals.

- Uses resources within the GMF allocation and the SAA.

(6) The Defense Satellite Communications System Operations Center (DSCSOC) controller. The DSCSOC controller--

- Is the satellite network controller (SNC).

- Has overall control of the DSCS satellite.

- Monitors the GMF subnetwork for violations and notifies the GNC for correction.

4-5. System Configuration

a. Capabilities. The AN/TSC-85( )/93( ) terminal configurations allow digital interface with TRI-TAC equipment and MSE. They also provide limited capability for analog input and an ECCM capability for operation in a stressed environment. The Product Improvement Program incorporates replacing the TD-660s, TD-1065s, TD-1069s, KG-27s, and adding the antijam/control modem (AJ/CM), low rate multiplexer (LRM)/ TD-1389, and KG-94A. Upon completing the program, the modified terminals will be redesignated as AN/TSC-85B/93B.

b. AN/TSC-85( ). Four TD-660s and TD-1065s will be replaced by four TD-1389s to function as the multichannel multiplexer for unstressed/clear mode communications. Two CV-1548 telephone signal converters and two MX-9635 echo suppressors will be removed and two CV-1548S and MX-9635S will remain. These two unit pairs will remain to support use of two-wire telephones. Four TD-1069s, or their reserved cavity locations, will be removed and replaced by four TD-1389s to function primarily as a multiplexer for the AJ/CM, or alternately as a submultiplexer into another TD-1389. Eight TD-1389s will be installed in each AN/TSC-85( ). Sufficient crosshatch capability will be provided to permit any TD-1389 to function in any role. Baseband patching will be available to provide access to all baseband ports on the shelter entry panels. This will allow the individual channels of the CV-1548/MK-9635 to be patched into any user channel as required. In addition, four KG-27s will be replaced by four KG-94As to provide bulk encryption for four unstressed/clear mode multichannel groups. A nodal terminal AJ/CM will be installed. It will provide an antijamming communications channel and will replace the FM control orderwire. Four STU-III/equivalent 2.4 kbps secure voice devices will be added to provide an AJ/CM stress mode secure voice capability. All other items in the terminal will remain the same.

c. AN/TSC-93( ). Two TD-660s and two TD-1065s will be replaced by one TD-1389 to function as the multichannel multiplexer for unstressed/clear mode traffic. One CV-1548 and one MX-9635 will be removed and one of each will remain to support use of two-wire telephones. One TD-1069, or its reserved location, will be removed and replaced with one TD-1389 to function primarily as a multiplexer for the AJ/CM or alternately as a submultiplexer into another LRM/TD-1389. A total of two LRM/TD-1389s will be installed. Sufficient crosshatch capabilities will be provided to permit any TD-1389 to function in any role. Baseband patching will be able to access all baseband ports on the shelter entry panels. This will allow the individual channels of the CV-1548/MX-9635 to be patched into any user channel as required. In addition, two KG-27s will be replaced by one KG-94A to provide bulk encryption for one unstressed multichannel group. A non-nodal terminal AJ/CM will be installed. This AJ/CM will provide an antijamming communications channel and replace the FM control orderwire. One STU-111/equivalent will be added to the AN/TSC-93( ) to provide an AJ/CM stress mode secure voice capability.

d. Differences. The main differences in tactical multichannel terminal configurations are the types and amount of redundant equipment in the configuration and the terminal's communications capability. The equipment is configured in either a nodal (hub) or non-nodal (spoke) configuration. A nodal terminal can be configured to operate with up to four terminals in a multipoint operation. Any two terminals, either nodal or non-nodal, can be configured to provide a point-to-point requirement.

4-6. Antijamming and ECCM Techniques

a. AJ/CM is a family of spread-spectrum modem equipment designed to provide GMF TACSAT terminals with an ECCM capability for operation in a stressed environment. The normal mode of operation for high capacity links in a benign or nonstressed environment uses the current biphase shift keying/quadraphase shift keying (BPSK/QPSK) modems and FDMA link accesses.

The family of modems consists of a network control terminal (NCT), a nodal terminal (NT), and a non-nodal terminal (NNT). The AJ/CM provides a lower capacity 75 bps and 32 kbps communications capability and an antijamming control orderwire.

(1) NCT modem. The AN/MSQ-114/FSQ-124 satellite control and monitoring systems use the NCT modem. It is made up of two chassis assemblies: the MD-1133 and the OX-63 coder group.

(a) The MD-1133 network control unit (NCU) interfaces with the terminal frequency reference and distributes time and frequency to the NCT internally. The NCU also provides the NCT modem modulation/demodulation functions. User commands initialize and control NCU hardware elements to perform major NCT operations or processing. The NCT contains bus logic to control an externally-programmable down-converter. The NCT also provides modem and network status monitoring and provides status and messages to the NCT operator.

(b) The OX-63 coder group, TRANSEC, 4-channel unit houses four KGV-9 TRANSEC modules, associated interface circuits, and the necessary power supplies.

(2) NT modem. Army and Marine AN/TSC-85As and Air Force AN/TSC-100As use the NT modem. It is made up of three chassis assemblies: the MD-1131 modem, the MD-1132 communications unit, and the OX-64 coder group.

(a) The MD-1131 modem contains a beacon demodulator, a 75 bps critical control circuit (CCC), and a variable data rate 75 bps to 32 kbps link communications circuit (LCC). This modem also contains all operator controls.

(b) The MD-1132 communications unit contains three LCCS. These circuits provide the three links required for hub operation.

(c) The OX-64 coder group, TRANSEC, 10-channel unit houses ten KGV-9 TRANSEC modules, associated interface circuits, and the power supplies.

(3) NNT modem. Army and Marine AN/TSC-93As, Air Force AN/TSC-94As, and selected satellite fixed station gateway terminals use the NNT modem. It is made up of two chassis assemblies: the MD-1131 modem and the OX-63 coder group.

(a) The MD-1131 modem is identical to the NT modem.

(b) The OX-63 coder group, TRANSEC, 4-channel unit is identical to the NCT modem.

4-7. Data Entry

Data entry requirements for the operator of a multichannel TACSAT terminal AN/TSC-85( )/93( ) consist of information (data) extracted from the SAA by the CSPE and included in either the mission OPLAN or the exercise OPORD. This information takes the form of--

- Operating frequencies. (May not apply until SAA is received.)
- Data rates.
- Transmit power. (May not apply until SAA is received.)
- Mission configuration.
- Terminal identification.
- Terminal locations.
- Satellite "look angles" (azimuth and elevation). (May not apply until SAA is received.)
- Mission start and stop time.
- Priority of communications.

b. The CSPE extracts this information from the OPLAN/OPORD and provides it to the terminal operator. The data entries are categorized and differentiated between operating parameters, network characteristics, and configuration routines. Figures 4-4 and 4-5 are examples of data entry sheets.

(1) Operating parameters include--

- Transmit frequencies.
- Receive frequencies.
- Transmit power.

- Terminal locations.
- Satellite “look angles” (azimuth and elevation).

(2) Network characteristics include--

- Data rates.
- Network configurations.
- Terminal call sign.

CLASSIFICATION
GMF MISSION ORDER # _____

TML ID _____ TML TYPE: AN/TSC-85( )

NETWORK START: DATE _____ TIME _____
STOP: DATE _____ TIME _____
TERMINAL LOCATION:
LATITUDE _____ DEG UTM GRID _____
LONGITUDE _____ DEG
CROSS ELEVATION (AZIMUTH): _____ DEG MAGNETIC
ELEVATION: _____ DEG

SAW

FREQUENCY SETTINGS: XMIT FREQ _____ MHz ____
BEACON REC FREQ _____ MHz ____
OW REC FREQ _____ MHz ____
COMM1 REC FREQ _____ MHz ____
COMM2 REC FREQ _____ MHz ____
COMM3 REC FREQ _____ MHz ____
COMM4 REC FREQ _____ MHz ____
XMIT POWER SETTING: _____ WATTS

MODEM:

DATA RATE (COMPOSITE) _____ KBS COMSEC _____
DATA TYPE: QPSK ____ CODED _____ _____
BPSK ____ UNCODED ____ EMERG FREQ XMIT _____ MHz
REC _____ MHz

AJ TRAFFIC:

MISSION ID NO. _____
TAPE TO USE FOR TRANSEC UNIT _____
CCC ATTENUATOR SETTING _____ dB
CCC REC FREQ _____ MHz

	COMM1	COMM2	COMM3	COMM4
TML ID				
START TIME				
ATTEN. SETTING				
XMIT LINK ID				
REC LINK ID				
TRANSEC (IN/OUT)				
DATE RATE				
DATE TYPE				

CLASSIFICATION

Figure 4-4. Example of a GMF mission order for AN/TSC-85( ).

CLASSIFICATION
GMF MISSION ORDER # _____

TML ID TANGO TML TYPE: AN/TSC-93( )

NETWORK START: DATE _____ TIME _____
STOP: DATE _____ TIME _____
TERMINAL LOCATION:
LATITUDE _____ DEG UTM GRID _____
LONGITUDE _____ DEG
CROSS ELEVATION (AZIMUTH): _____ DEG MAGNETIC
ELEVATION: _____ DEG

SAW
FREQUENCY SETTINGS: XMIT FREQ _____ MHz ____
BEACON REC FREQ _____ MHz ____
COMM1 REC FREQ _____ MHz ____
XMIT POWER SETTING: _____ WATTS
MODEM:
DATA RATE (COMPOSITE) ____ KBS COMSEC _____
DATA TYPE: QPSK ____ CODED ____ _____
BPSK ____ UNCODED ____ EMERG FREQ XMIT ____ MHz
REC ____ MHz

AJ TRAFFIC:

MISSION ID NO. _____
TAPE TO USE FOR TRANSEC UNIT _____
CCC ATTENUATOR SETTING _____ dB
CCC REC FREQ _____ MHz

	COMM1
TML ID	
START TIME	
ATTEN. SETTING	
XMIT LINK ID	
REC LINK ID	
TRANSEC (IN/OUT)	
DATE RATE	
DATE TYPE	

CLASSIFICATION

Figure 4-5. Example of a GMF mission order for AN/TSC-93( ).

Chapter 5
Multichannel Control System

5-1. System Description

a. With multichannel TACSAT communications terminals in use by the Army, Air Force, and Marine Corps, the DSCS controller cannot accommodate the increased number of users. The ground mobile forces satellite communications (GMFSC) system operates as a subnetwork providing its own control system. This prevents interference degradation for other users of the DSCS SHF satellites.

b. The GMF satellite communications control centers (GMFSCCC), AN/MSQ-114 and AN/FSQ-124, provide mobile and fixed control facilities. The USAISC'S operation and control procedures contain specific information and instructions on GMFSC planning control, management, and terminal user procedures. (These procedures are currently being revised.)

c. Specially trained US Army GMF controllers provide GMFSC control for the terminals deployed by the multiservice (Army, Air Force> and Marine Corps) GMFSC system. The GMF controllers continuously monitor the downlink signals for all terminals in their networks to control uplink signals. They direct changes as necessary. The controller ensures that all terminals operate within the proper limits of frequency, power, and channel capacity. Should any discrepancies take place, the controller communicates by orderwire to initiate the changes necessary.

d. The GMFSCCC operates in the SHE frequency range of 7.9 to 8.4 GHz transmit and 7.25 to 7.75 GHz receive. Orderwire and AJ/CM units are used for communicating with terminals under their control. The satellite automatic monitoring system (SAMS) is used to monitor downlink frequencies of all terminals. This provides control over uplink power and frequency.

5-2. Deployment

The AN/MSQ-114 is usually deployed one unit per theater of operation. Since the AN/MSQ-114 is a limited production item, its deployment is rigidly controlled. The AN/MSQ-114 can support forward deployed forces, nonforward deployed forces, or contingency operations. Nonforward deployment usually refers to the home location of the GMFSSCCC

(either AN/MSQ-114 or AN/FSQ-124). The control system must be within the respective satellite footprint, which usually is the NC/AC antenna footprints for DSCS II or the GDA footprint for the DSCS III satellites. (See Figures 5-1 through 5-4.) Using DSCS II, a GMFSCCC located in Korea can control GMF terminals in CONUS, provided the control system and GMF terminals are within the NC/AC footprints on that satellite. (See Figure 5-3.) On DSCS III, the control system and GMF terminals must be within the GDA footprint. If the NC/AC or GDA footprint is moved to support a mission so that the control system falls outside the footprint, the AN/MSQ-114 would be deployed into a footprint to allow control coverage of the GMF mission.

5-3. Employment

a. In their normal employment, the AN/MSQ-114 and the AN/FSQ-124 can control a number of GMFSC terminals. The exact number of terminals being controlled depends on the network configuration and the mission requirement. A point-to-point configuration is used when connectivity between two low capacity terminals is desired. The hub-spoke configuration uses a multichannel terminal as the hub. Up to four low capacity terminals are used as the spokes. When at least two hub terminals are connected by communications and each operates with up to three spoke terminals, a hybrid configuration is derived. The control terminal can monitor and control any configuration that may be active within the control area.

b. In the networks designated for control by an AN/MSQ-114 terminal, the controller--

- Coordinates satellite access data with the GMF manager.
- Establishes positive GMFSC subnetwork satellite control.
- Evaluates and determines satellite link parameters.
- Establishes and reconfigures approved satellite networks.
- Conducts antijamming operations.

The first step in the start procedure after the AN/MSQ-114 is on station at a new location is to activate the control orderwire to the DSCS controller. Frequencies to be transmitted and received are authorized by the GMF manager from an allotment granted to the GMFSC system by DCA. Other system parameters that are determined prior to start are transmit power, number of channels, and type of modulation coding priority. The GMF controller accesses each tactical terminal using the control terminal (CT) orderwire. The controller then directs the adjusting of transmit power to achieve planned link performance. Measurements are made and entered into the SAMS for real-time monitoring of the link.

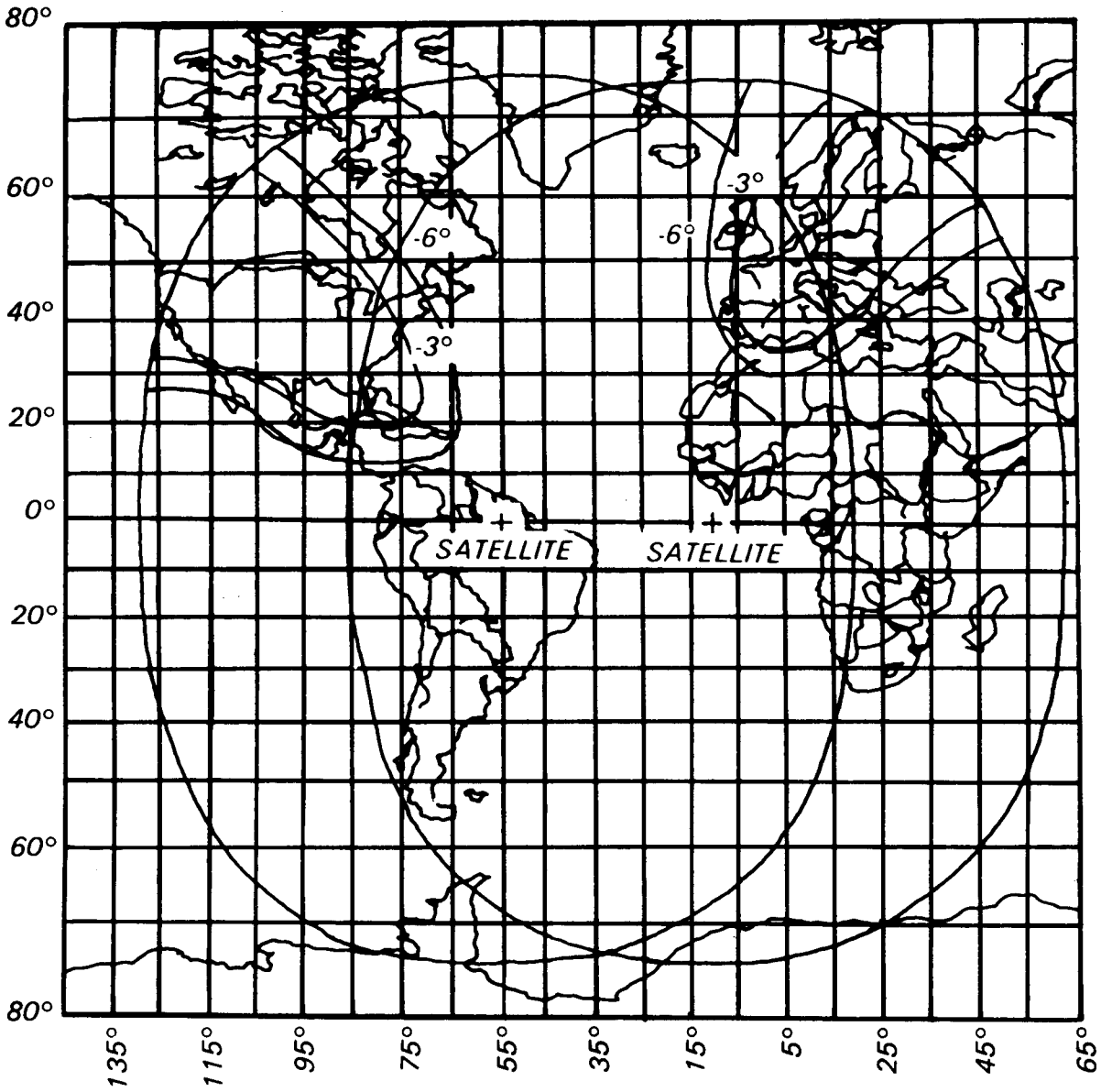


Figure 5-1. Western Atlantic (WESTLANT) and Eastern Atlantic (EASTLANT) satellite areas.

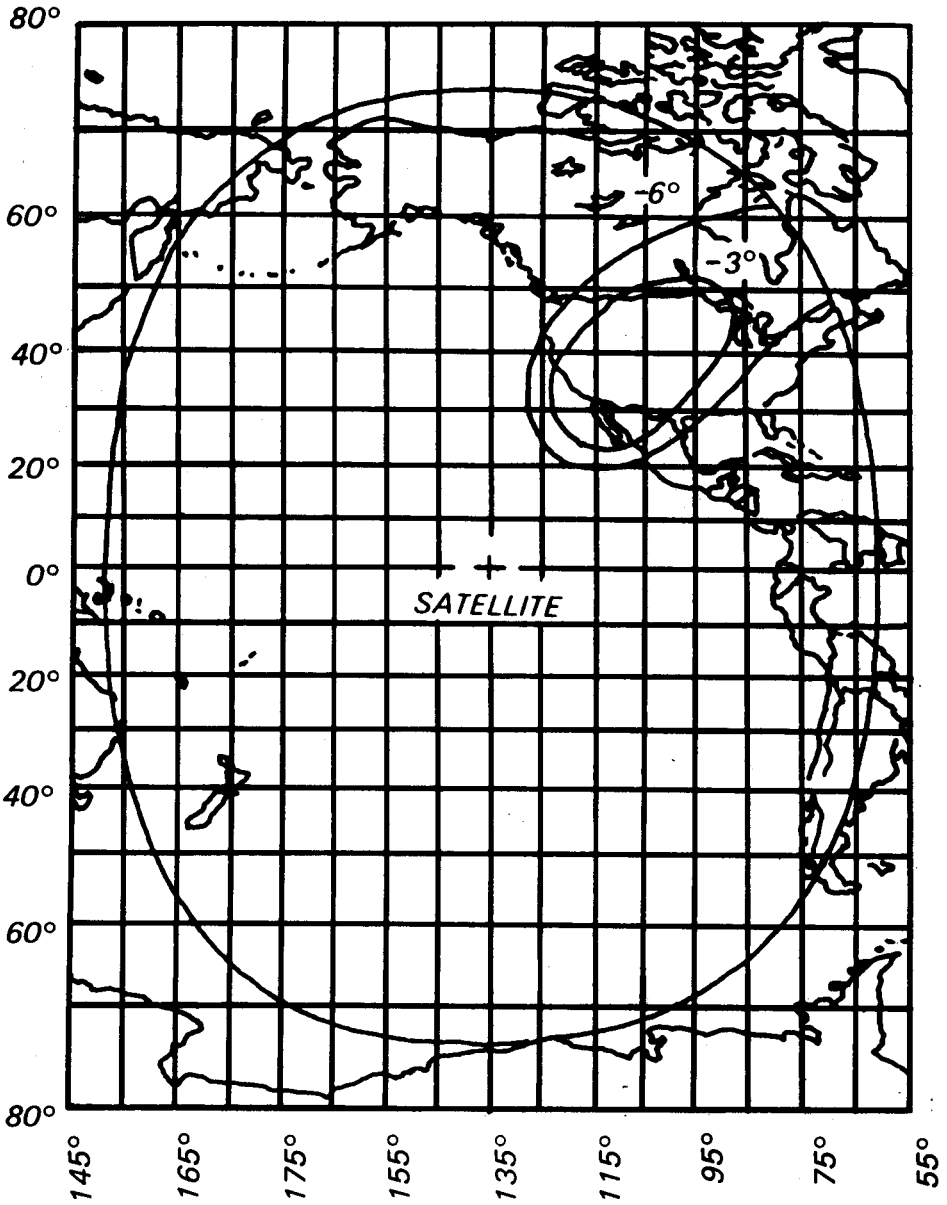


Figure 5-2. Eastern Pacific (EASTPAC) satellite area.

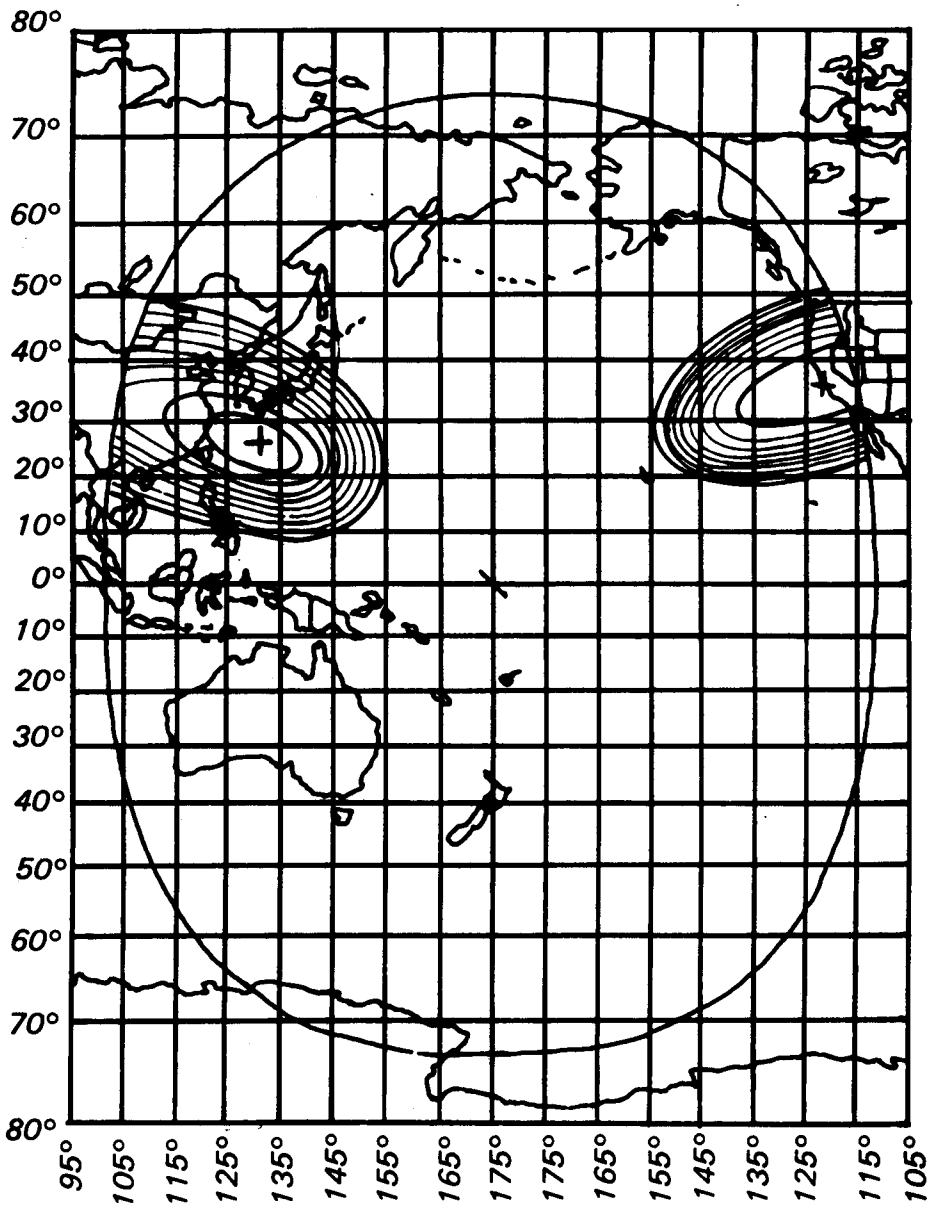


Figure 5-3. Western Pacific (WESTPAC) satellite area.

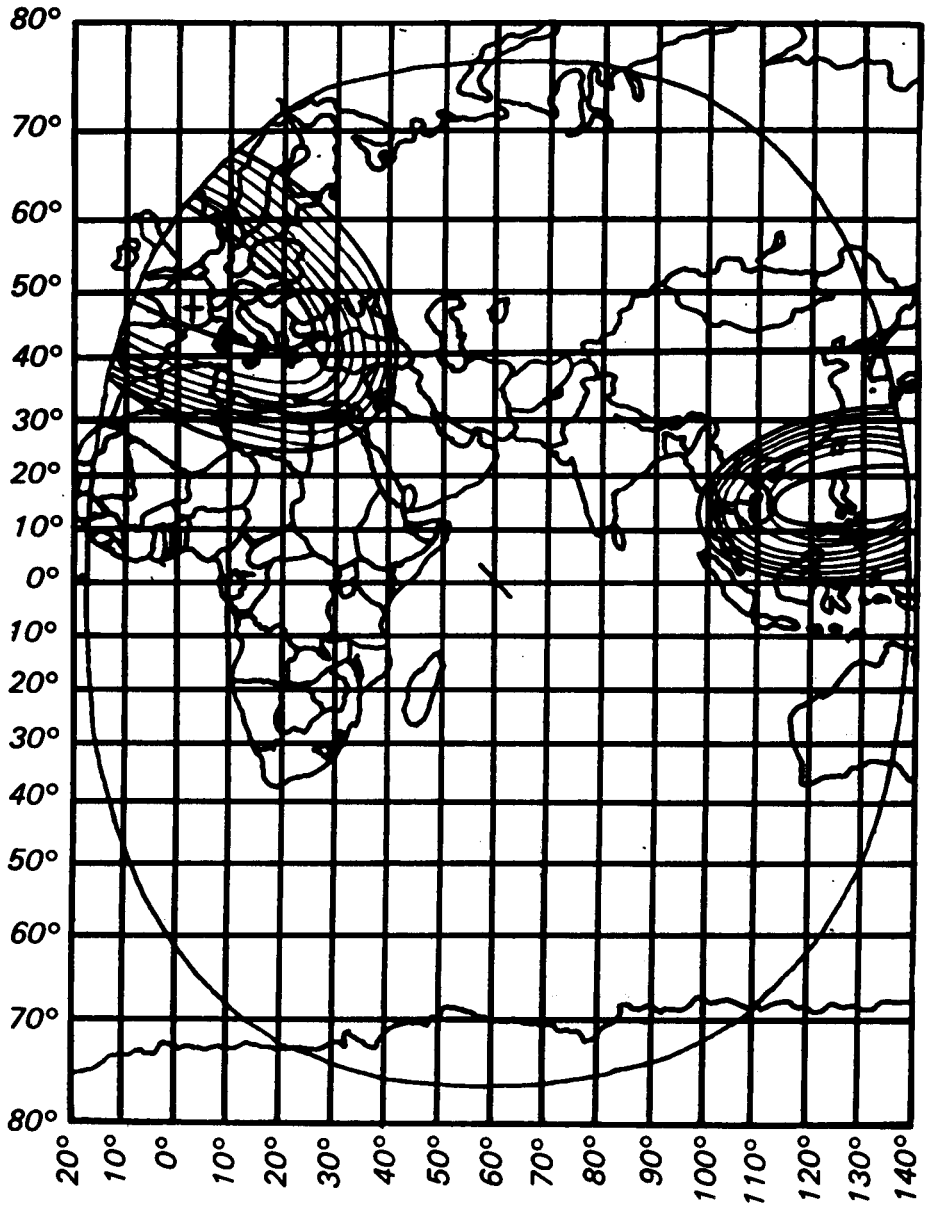


Figure 5-4. Indian Ocean (IO) satellite area.

c. To evaluate link parameters, the SAMS monitors the network for out of tolerance conditions. Manual spectrum analyzers and user reports are also used to evaluate link parameters. Bad weather, equipment, operator errors, satellite problems, and intentional or unintentional interference may cause problem conditions. The GMF controller detects and analyzes network problems. The next step is to direct work-around solutions. These solutions may be temporary power adjustments, reduction-in-link capacity (drop out by priority) or instructions to operators. In some cases, it may be necessary to interrupt service for major maintenance actions. The GMF controller maintains a log of all problems and terminal faults. A network status display printout is also maintained. The status display printouts that are available in the SAMS data base are status and statistics reports. These reports are available as a hard copy, a cathode ray tube (CRT) display, both on command, or at regularly timed intervals.

(1) The status report displays the condition of authorized carriers under control of the AN/MSQ-114. This is done by a measured carrier to noise temperature ratio (C/KT) reading, a calculated energy per bit to noise density ratio (Eb/No), an operating noise temperature, an authorized C/KT and a percentage of satellite allocated power for each terminal. A summary page of the status report shows--

- Measured percentage of transponder power.
- Allocated percentage of transponder power.
- Measured percentage of GMF power.
- Measured transponder C/KT.

(2) The statistics report is generated for a given start and stop time frame with an established number of samples taken. For each terminal under control of the AN/MSQ-114, the report shows--

- Mean C/KT (dB).
- Authorized C/KT (dB).
- Departure from authorized C/KT (dB).
- Highest C/KT and time measured.
- Lowest C/KT and time measured.
- Number of samples taken.

d. Often, during network operations, it may be necessary to reconfigure a real-time link or the whole network. Some of the causes for reconfiguration are:

- Rapid terminal relocation.
- Enemy action.
- Degradation of a link.
- Changes in communication requirements.

e. Reconfiguration by adding or deleting terminals is done by the GMF controller. This involves changes to the SAMS data base and coordination with the tactical terminal by orderwire. Terminal relocation requires immediate action by the controller to coordinate the movement. New system parameters and look angles must be provided and the SAMS data base updated. Adding a new type earth terminal and using a new satellite also requires reconfiguration. The GMF controller has the authority to reconfigure the network until changes in satellite power or new frequency assignments are required; then, the GMF manager must be informed of the change required. The DSCS controller is responsible for the DSCS satellite communications network. Since the GMF network is only a subnet, the GMF controller must interface with the DSCS controller when any action that takes place might impact on network performance. Coordination is normally required--

- Before GMFSC terminals come on the air.
- When changes in GMFSC transmit power are required.
- When serious link degradations occur that cannot be isolated by the GMF controller.

f. A more serious condition is when the DSCS controller informs the GMF controller that violations have taken place in the GMFSC network. As mentioned previously, a major duty of the GMF controller is to monitor the uplink and downlink characteristics of the GMFSC network for out of tolerance conditions. The result of this monitoring is to help TACSAT communications terminal operators find stations that are at fault and correct the problems. In severe cases, such as satellite failure or interference, the DSCS controller must help pinpoint and rectify the problem. The GMF controller, closely coordinating with the DSCS controller, directs and implements network antijamming plans.

5-4. Control and Management

TACSAT communications links are not independent, unlike conventional radio communications such as HF or LOS. All links in a

network use the same satellite transponder. Each of the users must carefully configure their link with reference to other users and keep uplink power within an allotted level. Failure to follow these guidelines will have harmful consequences on all other users. The increase of power on one link improves the quality of that link but intermodulation products increase and cause interference on the other links. A large increase in power causes the downlink carriers on other links to be suppressed. Control of all links using the same satellite transponder is important. While the GMF controller is a major player in the operation, overall control is distributed among six activities. Those responsible for controlling the GMF/TACSAT communications resources are described in the following paragraphs.

a. The planner plans the action and provides the following information when establishing a communications link using a DSCS satellite:

- Types of terminals and locations.
- Connectivity of the network (for example, terrestrial, switchboard, and direct interface).
- Channel requirements.
- Duration of exercise.
- Priorities for individual links.
- Backup communications.

b. The GMF manager is responsible for managing the satellite resources allocated to the GMFSC. The manager combines all requests and coordinates any conflicting requirements by--

- Apportioning a share of the satellite resources to each requester.
- Designating uplink and downlink frequencies, transmit power levels, data rates, C/KT and bit error rates, link margins, and detailed equipment settings.
- Issuing orders for reconfiguring the system due to changing requirements.
- Maintaining logs of system and station failures, interference problems, and violations by the users.

- Interfacing with the DSCS controller to determine proper operation.

- Negotiating for extra power for the GMFSC users as the situations warrant.

c. The DSCS controller is responsible for the DSCS network. This encompasses all users including GMF terminals working a particular satellite. The DSCS controller--

- Closely coordinates with the GMF controller during start and antijamming procedures.

- Informs the GMF controller when violations occur on the GMFSC network.

- Links up with the GMF controller on the control orderwire.

d. The GMF controller operates under the direct supervision of the GMF manager. The controller operates and maintains the control and monitoring equipment. The GMF controller--

- Establishes a positive control with each terminal over the control orderwire.

- Starts communications links within parameters provided by the GMF manager.

- Monitors systems and link performance.

- Controls adjustments of links to satisfy performance requirements.

- Instructs violators to operate within assigned parameters and reports willful violations.

- Analyzes system and station malfunctions.

- Maintains orderwire link with GMF operators and DSCS controllers.

- Analyzes jamming signals and interference to determine corrective actions.

- Determines frequency compatibility when terminals are relocating.

- Assigns previously cleared frequencies to another user when interference in the network is present.

e. The TACSAT communications terminal operator interfaces directly with the GMF controller. The user or operator follows instructions and reports status and performance of the TACSAT communications terminal. The operator--

- Operates and maintains the TACSAT communications terminal.
- Follows the GMF controller's instructions and coordinates during link start for reconfiguration, and at the same time isolates system malfunctions.
- Monitors uplink power, downlink signal levels, and bit error rate (BER).
- Relocates TACSAT communications terminal on proper command.
- Notifies the GMF controller of the move time and new terminal location.
- Interfaces with technical control of the subscriber.

5-5. System Configuration

a. The GMFSCCC is deployed in a number of different system configurations depending on the mission and theater of operations. The simplest configuration is point-to-point, where the GMF controller monitors over two TACSAT communications terminals each used as a point. The slightly more complex network is the hub-spoke configuration. Each low capacity terminal becomes one of the spokes operating with either the AN/TSC-85( ) or AN/TSC-100A. The hybrid configuration deals with a number of hub-spoke configurations with the hubs communicating with each other as well as the spokes in their configuration. A DSCS terminal (a fixed station satellite communications facility called gateway) can replace a low capacity GMF terminal. In these configurations, the AN/MSQ-114 has an orderwire control link with all the TACSAT communications terminals and a monitor link to the satellite. The AN/MSQ-114 can communicate with a DSCS terminal via the terrestrial critical control circuit (TCCC) network using either an established terrestrial link or a communications circuit via the satellite. To make DSCS terminals compatible with GMFSC terminals, additional equipment must be included in the digital communications subsystem (DCSS) of the DSCS terminal. The GMF contingency rack 20 low rate initial production (LRIP) and GMF contingency rack 20A are single racks giving limited operational capabilities to the DSCS terminals in the GMF network. To enhance the capabilities, additional racks are added to produce the DSCS/GMF gateway racks. Included are encryption devices, antijamming modems, LRMs, and patch panels. The complement of racks is increased to six in this configuration.

b. The AN/MSQ-114 terminal consists of an environmentally controlled 34-foot semitrailer, two power generators, a 20-foot parabolic antenna, prime movers, and a shelter for maintenance and storage of spare parts. The AN/FSQ-124 consists of four electrical racks, a roll-around cart, and a control console in the facilities of the host terminal.

c. The AN/MSQ-114 antenna is a 20-foot parabolic antenna type AS-3199/TSC. It has a limited motion of ±l0° cross elevation and a full 90° in elevation. Antenna control can be from inside of the van or remote. The modes of operation provided are manual, acquisition, and auto-track. To acquire a satellite, the antenna must be implaced with the azimuth look angle very close to the bore sight of the feed system.

(1) The receive subsystem consists of redundant antenna mounted low noise amplifiers (LNAs) with 37-41 dB gain each and the down-converters. The receive signal is processed from the LNA to a power divider that provides an eight-way split. Two of the outputs from the divider are dedicated to the SAMS equipment. Five are connected to five down-converters. The eighth is reserved for future addition of a sixth down-converter.

(2) The down-converters are a double conversion type with a 70 MHz output. Frequency selection for the down-converters is accomplished by front panel controls or by a microprocessor in an associated orderwire modem in the remote mode. Three down-converters can feed the AJ/CM with a beacon/CCC signal, an acquisition signal, and a polling signal.

(3) The cesium beam standard, which is the principal part of the frequency generation subsystem, is also redundant. The on-line unit provides outputs of 5 MHz, and one pulse per second for precise timing to the AJ/CM and other units as needed.

(4) The transmit subsystem consists of up-converters, amplifiers/mixers, and power amplifiers (PAs). Redundancy is presented in the PA, high voltage power supply, and amplifier/mixer assemblies. The PA has a maximum power output of 500 watts with an adjustment range of 20 dB. Three up-converters are provided with a future development for a fourth. They accept a 70 MHz signal from the orderwire or AJ/CM modem. Through a conversion process, the transmit frequencies are presented to the intermediate power amplifier (IPA)/attenuator to be raised to a suitable power level for driving the PA.

d. The AN/FSQ-124 is a component of a DSCSOC which is collocated with a host earth terminal. The host earth terminal can be an AN/GSC-39, an AN/GSC-52, or an AN/FSC-78. The AN/FSQ-124 consists of a remote orderwire console and four equipment racks that contain up- and down-converters, SAMS, IPAs, and orderwire modems. The AN/FSQ-124 is operated

and maintained by a specially trained operator who is one of the five individuals normally on shift in the DSCSOC.

5-6. Antijamming and ECCM Techniques

a. The AN/MSQ-114, acting as the NCT, has the AJ/CM (MD-1133) that belongs to a family of spread spectrum modem equipment designed to provide the GMFSC terminals with ECCM capability for operation in a stressed environment. The spread spectrum link provided by the AJ/CM is more difficult to jam. This signal can coexist with the FDMA links by sharing the same frequency spectrum and presenting the appearance of not even being there. This link may well be the last ditch signal available in a stressed environment.

b. The MD-1133 used in the AN/MSQ-114 consists of one chassis assembly, the NCU. The NCU has a control and bus logic which provides functional terminal modem organization, execution, and control. The NCU control processor directs external programmable up-/down-converter synthesizer frequency control. The NCU requires a precise frequency and time reference from an external cesium beam standard. Redundant frequency standards (HP5061A), which are part of the AN/MSQ-114, provide the required time and frequency references. The NCU provides buffering for time and frequency reference signals for computational and code use. Software is modularized to specific terminal operations and functions. Terminal tasks are modularly executed through combinations of software modules, operator control, and fixed microprocessor hardware logic. Network control and status functions are provided on the NCU front panel along with monitor test and fault isolation functions. The AJ/CM replaces the RT-1287 nonsecure FM orderwire. It operates as an orderwire between the NT in addition to its communication's function. In a jammed environment, the AJ/CM equipment provides the antenna tracking signal instead of normal communications tracking.

5-7. Data Entry

a. The SAMS element of the AN/MSQ-114 and the AN/FSQ-124 provides the data base for planning GMF resources. The SAMS also provides the monitor facilities for managing the GMFSC network. The SAMS supports the GMF controller in translating satellite communications (SATCOM) requirements into channel capacities, time schedules, transmitter power, RF frequency assignments, and modes of operation. The SAMS monitors and measures the technical performance of deployed GMF ground terminals. This allows missions to be accomplished with a minimum assignment of available RF power and bandwidth. It also helps determine compliance of GMF ground terminal with assignments.

b. Network management is done by the SAMS software which consists of various resource planning, measuring, calculating, and report

generating programs. These programs present to the GMF controller a real-time description of the satellite downlink.

c. The major parameters to be measured and calculated include carrier-to-noise density (analog and digital signals received by the AN/MSQ-114 and AN/FSQ-124 terminals), operating noise temperature, and percentage of satellite power usage. Alarm conditions and statistical data are also presented to the controller as conditions dictate and/or as required. A real-time operating system controls the SAMS software modules and data bases.

d. The SAMS uses all of the hardware, under control of computer programs, to perform the following required functions:

- Plan GMF links.
- Monitor the GMF downlink spectrum.
- Produce summary reports.
- Interact with the operator through a user friendly man-machine interface.
- Maintain a large data base for use in the planning and monitoring function.
- Manage all operations.

e. The GMF controller makes SAMS data base entries which are directly related to the AN/MSQ-114 and the AN/FSQ-124 functions. These functions are monitoring and controlling the GMFSC networks. The information to be entered comes from the DCA planner and the GMF manager in the DSCS-GMF SAA. This information is entered into the SAMS data base via the keyboard or by prepared cassette tape(s). The following examples of an SAR, sample report 1 (Figure 5-5), and DSCS-GMF SAA, sample report 2 (Figure 5-6), are the worksheets from which data to be entered into the SAMS is taken. The SAR must be in accordance with Defense Communications Agency operations center (DCAOC) contingency/exercise plan. (All entries on these worksheets are fictitious although representative of actual data.)

SATELLITE ACCESS REQUEST

FROM: CDR, 152D SIG BN, FORT GORDON, GA
TO: RSSC CONUS WASHINGTON, DC//MOSC-RSS-CO//

PART 1 OF 1
BT
CLASSIFICATION:
SUBJECT: Request for GMF/SHF Satellite Access Authorization

1. LTC Smith/152d Sig Bn/AV xxx-xxxx

2. STORK/TRAINING

3. FROM: 051400Z Jan 87
   TO: 092200Z Mar 87

4. TYPE OF SERVICE:

   FOR AN/TSC-85 ( ) - VF, Composite Data rate 1176 kbps
   FOR AN/TSC-93 ( ) - VF, Composite Data rate 600 kbps
   FOR AN/TSC-93 ( ) - VF, Composite Data rate 600 kbps

5. MISSION PRIORITY: 6

6. TERMINAL TYPE, SIZE ANTENNA and TERMINAL ID:

   AN/TSC-85 ( ) - (8) - ALPHA 1
   AN/TSC-93 ( ) - (8) - ALPHA 2
   AN/TSC-93 ( ) - (8) - ALPHA 3

7. AN/TSC-85( )

LOCATION:	FORT GORDON
TERMINAL ID:	ALPHA 1
LATITUDE:	33° 24′ 50″ N
LONGITUDE:	82° 10′ 00″ W

UTM: LG 915976
POC: MSG JONES, AV xxx-xxxx

AN/TSC-93( )

LOCATION:	HUNTER AFB
TERMINAL ID:	ALPHA 2
LATITUDE:	32° 01′ 00″ N
LONGITUDE:	81° 10′ 00″ W

UTM: MF 843417
POC: SFC WAYMIRE, AV xxx-xxxx

Figure 5-5. Sample SAR.

AN/TSC-93( )

LOCATION: MACON
TERMINAL ID: ALPHA 3
LATITUDE: 32° 49′ 05″ N
LONGITUDE: 83° 33′ 32″ W
UTM: KG 605337
POC: SFC PIAZZA, AV xxx-xxxx

8. HUB-SPOKE CONFIGURATION

AN/TSC-85( ) ID NO. ALPHA 1, HUB TERMINAL
AN/TSC-93( ) ID NO. ALPHA 2, SPOKE TERMINAL
AN/TSC-93( ) ID NO. ALPHA 3, SPOKE TERMINAL

No changes will be made during mission.

9. AN/TSC-85( ) ID NO. ALPHA 1, SERVICE ON 051400Z JAN 87
SERVICE OFF 092200Z MAR 87

AN/TSC-93( ) ID NO. ALPHA 2, SERVICE ON 051415Z JAN 87
SERVICE OFF 092145Z MAR 87

AN/TSC-93( ) ID NO. ALPHA 3, SERVICE ON 051430Z JAN 87
SERVICE OFF 092130Z MAR 87

10. AN/TSC-85 ( ) ID NO. ALPHA 1: LALMKAA, 12 CHANNELS, LALNKAA, 12 CHANNELS.
AN/TSC-93 ( ) ID NO. ALPHA 2: LALMKAA, 12 CHANNELS.
AN/TSC-93 ( ) ID NO. ALPHA 3: LALNKAA, 12 CHANNELS.

11. N/A

12. Coded (C) for all terminals.

13. QPSK for all terminals.

14. URDB number.

Figure 5-5. Sample SAR (continued).

CDR7THSIGCOMD FT RITCHIE MD//ASN-OP-OC//
CDR 152D SIG BN FT GORDON GA//ABC-S3//
CDRUSAISC SATCOMSTA CP ROBERTS CA
//ASNA-ORD-CR-MSQ/DSCSOC//
DCA PAC WHEELER AFB, HI//P316//

INFO DCAOC WASHDC//N210.4/N240/B440//
CDRUSAISC FT HUACHUCA AZ//AS-OPS-OO//
19991SS SUNNYVALE AFS CA//DSCSOC//
JFP USMCEB WASHINGTON DC//JFP-FM 046//
CUSA CE SVC OFC WASHDC//AS-OPS-CE-C//
JFMO PAC HONOLULU HI
JFMO KOREA SEOUL KS
JFMO JAPAN YOKOTA ABJA
JFMO PHIL SUBIC BAY RP
JFMO GUAM
DOD AFC WSMR NM//AS-OPS-CE-SS//
DOD AFC AZ FT HUACHUCA AZ
AFC WESTERN US PSF SAN FRANCISCO CA//AS-OPS-CE-SW//
OJCS WASHDC//C3SDO//
USCINCPAC HONOLULU HI//CS3TM16//
CDR7THSIGCOMD FT RITCHIE MD//COC//GMF//

CLASSIFICATION

SUBJ: GMFSCS ACCESS ASSIGNMENT MISSION 869-87 (U)

A. MSG, 1523D SIG BN, ABC-S-3 (U) SUBJ: REQUEST FOR GMF/ SHF SATL ACCESS (U) NOTAL.

1. (X) REF A IS A REQUEST FOR SATL ACCESS IN SUPPORT OF OMEGA/TRAINING.

2. (X) ACCESS IS AUTHORIZED ON THE 9443 WEST PAC SATELLITE (BEACON FREQ 7675.1 MHZ) FROM 101300Z THRU 202359Z MAY 87 PROVIDING THE USER OBTAINS FREQUENCY CLEARANCE FROM THE LOCAL BASE/POST AND AREA FREQUENCY COORDINATOR WHERE APPROPRIATE FOR EACH TERMINAL LOCATION TMLS WILL BE OPERATIONAL 24 HOURS DAILY.

3. (U) THIS MSG CONFIRMS AND DOCUMENTS SATL ACCESS REQUEST AND PROVIDES OPERATIONAL AND CONTROL INSTRUCTIONS. THIS IS A PRIORITY ____ MISSION USING ____ PERCENT OF CHANNEL ____ POWER.

4. (X) THE CONFIG FOR THIS MSN IS AN AN/TSC-85 ( ) ____ CHANNEL QPSK-CODED HUB (TML INDIA) LOCATED AT ____ WITH FOUR SPOKES, AN AN/TSC-93 ( ) ____ CHANNEL SPOKE (TML JULIET) LOCATED AT ____, AN AN/TSC-93 ( ) ____ CHANNEL SPOKE (TML KILO) LOCATED AT ____, AN AN/TSC-93 ( ) ____ CHANNEL SPOKE (TML LIMA) LOCATED AT ____, AND AN/TSC-85 ( ) ____ CHANNEL SPOKE (TML MIKE) LOCATED AT ____.

Figure 5-6. Sample SAA.

5. (U) THE CP ROBERTS AN/MSQ-114 WILL PROVIDE PRIMARY SATL ACCESS AND REAL TIME CONTROL FUNCTIONS. TML NAMES INDIA, JULIET, KILO, LIMA, AND MIKE, WHEN SEPARATED FROM GEOGRAPHICAL LOCATIONS, ARE UNCLASSIFIED.

6. (U) 30 MIN PRIOR TO SATL ACCESS TIME THE GMF TERMINALS WILL ACQUIRE THE SATELLITE AND MONITOR THEIR RECEIVE ORDERWIRE FREQ FOR ACCESS INSTRUCTIONS FROM THE GMF CONTROLLER. THE MSQ-114 FM ORDERWIRE TO TML INDIA (HUB) WILL BE ESTABLISHED ON THE RECEIVE FREQ FROM TML JULIET (REF PARA 8 SUB PARA A 2). THE GMF TMLS WILL CONTACT THE GMF CONTROLLER VIA ORDERWIRE WHEN DEGRADATION OCCURS DURING OPS AND WHEN ENDING SATELLITE ACCESS. IF UNABLE TO ESTABLISH ORDERWIRE CONTACT WITHIN 20 MINS, THE NETWORK TMLS WILL CONTACT THE CONTROLLER VIA AUTOVON 312 629-1680 OR COMMERCIAL/FTS 805 238-5056.

7. THE FM ORDERWIRE WILL BE USED FOR CRITICAL CONTROL COMMUNICATION BETWEEN ALL CMF TERMINALS AND THE AN/MSQ-114 CONTROLLER. IF THE FM ORDERWIRE IS NOT OPERATIONAL WITH THE CONTROLLER, THE CONTROLLER AND USER SHOULD USE ANY ALTERNATE MEANS AVAILABLE TO MAINTAIN CONTACT. LACK OF A POSITIVE MEANS OF CONTROL WILL RESULT IN DENIAL OR TERMINATION OF ACCESS.

8. (X) THE FOL OPERATIONAL CRITERIA ARE ESTABLISHED FOR THIS MSN:

A. TML INDIA, UNCLAS NAME LAT LONG (HUB)

(1) TRANSMIT FREQ _____ SAW LT 4
(2) RECEIVE FREQ FM TML JULIET _____ SAW FLT 1
(3) RECEIVE FREQ FM TML KILO _____ SAW FLT 1
(4) RECEIVE FREQ FM TML LIMA _____ SAW FLT 1
(5) RECEIVE FREQ FM TML MIKE _____ SAW FLT 1
(6) TRANSMIT POWER _____ WATTS
(7) DATA RATE _____ KBPS, _____ CH QPSK-CODED
(8) AZIMUTH _____ DEGREES MAGNETIC
(9) ELEVATION _____ DEGREES

B. TML JULIET, UNCLAS NAME LAT LONG (SPOKE)

(1) TRANSMIT FREQ _____ SAW FLT 1
(2) RECEIVE FREQ FM TNL INDIA _____ SAW FLT 4
(3) TRANSMIT POWER _____ WATTS
(4) DATA RATE _____ KBPS, _____ CH QPSK-CODED
(5) AZIMUTH _____ DEGREES MAGNETIC
(6) ELEVATION _____ DEGREES

Figure 5-6. Sample SAA (continued).

C. TML KILO, UNCLAS NAME LAT LONG (SPOKE)

(1) TRANSMIT FREQ _____ SAW FLT 1
(2) RECEIVE FREQ FM TML INDIA _____ SAW FLT 4
(3) TRANSMIT POWER _____ WATTS
(4) DATA RATE _____ KBPS, _____ CH QPSK-CODED
(5) AZIMUTH _____ DEGREES MAGNETIC
(6) ELEVATION _____ DEGREES

D. TML LIMA, UNCLAS NAME LAT LONG (SPOKE)

(1) TRANSMIT FREQ _____ SAW FLT 1
(2) RECEIVE FREQ FM TML INDIA _____ SAW FLT 4
(3) TRANSMIT POWER _____ WATTS
(4) DATA RATE _____ KBPS, _____ CH QPSK-CODED
(5) AZIMUTH _____ DEGREES MAGNETIC
(6) ELEVATION _____ DEGREES

E. TML MIKE, UNCLAS NAME LAT LONG (SPOKE)

(1) TRANSMIT FREQ _____ SAW FLT 1
(2) RECEIVE FREQ FM TML INDIA _____ SAW FLT 4
(3) TRANSMIT POWER _____ WATTS
(4) DATA RATE _____ KBPS, _____ CH QPSK-CODED
(5) AZIMUTH _____ DEGREES MAGNETIC
(6) ELEVATION _____ DEGREES

9. (U) 24HR POC IS THE GMF MANAGER AUTOVON 277-5606 5105. SECURE WB DROP 2137.
DECLAS: OADR

Figure 5-6. Sample SAA (continued).

Chapter 6

Milstar

6-1. System Description

a. The Army's tactical C^2 communications must be reliable, long range, transportable, and secure. These communications must survive in severe EW/NBC environments where ground relay networks that use prominent terrain may be disrupted. They must support the critical communications needs of the tactical commander. The Milstar satellite communications system provides these capabilities. It integrates satellite communications with an ECCM capability and balanced nuclear hardening into ground terminals for installation and operation in communications shelters. The Milstar satellite communications system provides the most survivable communications link on the battlefield in both intense jamming and nuclear environments.

b. The AN/TSC-124 will be the Army's Milstar terminal. It will be fielded in Army units in the early 1990s. It will provide antijamming scintillation-protected, tri-service interoperable satellite communications to support critical C^2 communications. Exclusive of the SCS, the AN/TSC-124 does not replace existing communications equipment on the battlefield; it augments the existing terrestrial C^2 nets when other communications means are degraded or destroyed. The traffic transmitted via the AN/TSC-124 terminals will normally be essential data communications. Voice communications, though possible, are not intended to be the primary method of communications through the Milstar system. System efficiency decreases as voice traffic levels increase. Therefore, data traffic will have a higher priority for channel access throughout the system.

6-2. Deployment

a. SCS. AN/TSC-124 terminals will replace AN/MsC-64s, currently used within the SCS, to operate the Flaming Arrow Net in Europe and Korea.

b. Theater. At EAC in Europe and Korea, AN/TSC-124s will provide for connectivity between the theater main, theater alternate, theater Army main, theater Army alternate, the theater Army Milstar control

center (TAMCC), and six discretionary headquarters such as major joint or allied unit headquarters, additional CINC support and the like. The theater TACSAT signal company will install, operate, and maintain the terminals.

c. Contingency support. The 235th Signal Detachment and 209th Signal Company will each employ AN/TSC-124 terminals in support of Army and JCS operations worldwide. They will augment the theater assets if necessary.

d. Special Operations Command (SOCOM). The l12th Signal Battalion will employ AN/TSC-124 terminals in support of SOCOM operations.

6-3. Employment

The AN/TSC-124 will be a commander's asset. Although regular and recurring association of terminals and headquarters will occur, the terminals can be employed at the commander's discretion. The commander can assign a priority of communications and fight the communications assets as a combat multiplier like any other weapons system.

a. Nets and networks. The unique characteristics and capabilities of the terminals and associated satellite systems make structured nets unnecessary. Because the terminals operate with a DAMA technique, there is no requirement for dedicated channels. Because of the processing capabilities of the satellites and the ability to address discretely any terminal within the system, Milstar terminals can communicate with any other Milstar terminals, whether located within the same theater of operations or not. Different protocols, however, will be required for in-theater and out-of-theater communications. For network identification and TRANSEC key management, all AN/TSC-124 terminals operating within the Army spotbeam footprint on each satellite will make up a network. Therefore, separate nets are unnecessary. However, partitions may be formed by selecting and distributing different COMSEC keys and addresses to the users; for example, distributing like keys to those users who want to operate together to the exclusion of others. The discrete addresses would then be furnished in a format similar to the telephone books now employed. Terminal-to-terminal connectivity would remain possible, with end-to-end communications being possible only if like COMSEC keys are employed at each 1/0 device.

b. System characteristics.

(1) The AN/TSC-124 will consist of the terminal, prime mover, antenna, and trailer-mounted power generator. The AN/TSC-124 will be installed in one S-250 or equivalent shelter. It will be transported under tactical conditions by a standard 1 l/4-ton truck. A 3 kilowatt

generator will be mounted on a standard 3/4-ton trailer that will be towed by the prime mover. Backup power will be provided by an under-hood power plant installed on the vehicle.

(2) The terminal can communicate at the halt; communicating while moving is a planned improvement that will come with future technology. Terminal setup and teardown times will not exceed 30 minutes by a team of three MOS 31C soldiers.

(3) Critical, operator-replaceable spares will be carried to enhance system survivability and ensure rapid repair and return to service. Additionally, crew, crew weapons, personal bags and equipment, camouflage netting, tents, and the like will be carried on the vehicle or in the terminal. C130/C141/STOL aircraft roll-on/roll-off with no preparation is possible.

(4) The terminal will be able to accept up to four individual user inputs of data or voice at rates of 75 bps to 2.4 kbps by using user-controlled interface devices (UCIDS). The devices can be remoted 2,500 feet (758 meters) from the terminal using conventional field wire. Four DR-8s, modified to accept and dispense WF-16 field wire, will be provided with the terminal. The DR-8s will provide a minimum remoting capability independent of customer field wire resources.

(5) Compatibility with the Milstar standard I/O and COMSEC devices (for data, the AN/UGC-74 and KG-84; for voice, the ANDVT) as well as the single subscriber terminal (SST), lightweight digital facsimile, and the Army Command and Control System (ACCS) hardware is provided. Each terminal will be furnished with one AN/UGC-74 and one ANDVT for operator use.

(6) It will be hardened to the effects of electromagnetic pulse (EMP)/high altitude EMP (HEMP) and will operate in EW/NBC environments.

(7) The system will adapt to changes in the jamming environment and changes in traffic demands regardless of environment. The terminal will use spread spectrum, burst, FH, and other techniques to reduce the vulnerability to RDF, interception, exploitation, and jamming. The AN/TSC-124 will be interoperable with all other Milstar terminals.

c. User-controlled interface device.

(1) UCIDs interface between the user of the I/O device and the terminal. It can accept inputs between 75 bps and 2.4 kbps and support full-duplex communications. The user requests service through the UCID. The UCID lets a user tell the terminal which specific I/O and COMSEC devices are attached to the two ports of the UCID. Information relating to the service requested, discrete addresses of sender and receiver(s),

and I/O device and COMSEC compatibility can be entered by the user. This alerts the terminal and the servicing satellite to establish the requested type of link between the sender and receiver(s). Once the link is established, the UCID must alert the sender that he may pass his traffic.

(2) Four UCIDs will be provided with each AN/TSC-124. Each can accept two inputs, though not at the same time. Three UCIDs will normally be provided to the remote users. The fourth UCID will be reserved within the shelter to allow the AN/TSC-124 operator access to the system for the operator I/O devices provided with the terminal (AN/UCG-74 and ANDVT).

(3) The UCID can be used by a general purpose user (GPU) of any grade or MOS. The UCID, although a component of the AN/TSC-124 terminal, will be provided to the user at the user's remote location. The UCID, associated COMSEC (that is, KG-84), and user-owned and provided I/O device will be operated by the user of the communications provided by the terminal.

6-4. Control and Management

a. Milstar.

(1) The USAF Milstar ground command post terminal (GCPT), the Navy EHF Satellite Program (NESP), and the Army SCOTT (AN/TSC-124) provide the services with control and access to the Milstar satellite constellation to support the National Command Authority.

(2) The Milstar mission control element, called the theater Milstar control center (TMCC), will exercise overall control within a theater of operations along with a number of constellation control stations. The specific roles for each and the requirements for interface are being developed by USAF Space Command. The Army Space Command is refining the specific responsibilities and procedures for Army-specific Milstar control.

b. TRANSEC/COMSEC management.

(1) The National Security Agency (NSA) distributes the TRANSEC keys. As part of the initial terminal start-up, the TRANSEC variables are distributed to the units' COMSEC accounts and the operator manually loads the TRANSEC keys. Before the TRANSEC period expires, the mission control element (MCE) distributes, over the air, the keys for the upcoming TRANSEC period. Emergency rekey also occurs over the air (for example, when a network terminal is compromised). Backup and future TRANSEC keys should be on hand with the unit COMSEC custodian to facilitate rekey in the event over-the-air rekey is not possible.

(2) The COMSEC keys are distributed to individual COMSEC accounts for dissemination to individual terminal users. Both the normal and emergency rekey for data and voice COMSEC devices are done manually. Backup and upcoming keys are on hand at the terminal-user locations. The number of variables issued to each terminal and user depends on the mission of that terminal or user and the network in which it operates.

Chapter 7

UHF Air Force Satellite Communications

7-1. System Description

a. AFSATCOM provides reliable, worldwide, C^2 communications. These communications are used by designated Single Integrated Operational Plan (SIOP)/nuclear capable users for emergency action message (EAM) dissemination, JCS-CINC internetting, force direction, and force report-back. AFSATCOM capacity is also provided for a limited number of high priority non-SIOP users for operational missions, contingency/crisis operations, exercise support, and technical/operator training.

b. The AFSATCOM system is made up of a space segment. This space segment consists of UHF transponders aboard several spacecraft and a terminal segment. The terminal segment consists of standard AFSATCOM ground/airborne, manpack, and special communications system terminals. The space segment is Air Force managed transponders of varying capability and capacity. They are carried aboard the fleet satellite communications (FLTSATCOM), leased satellite communications (LEASATCOM), satellite data systems (SDS), Packages B and C, DSCS III, and Lincoln experimental satellites (LES) 8 and 9.

7-2. System Communications Control Hierarchy

The Air Force Communications Command (AFCC) controls system communications as directed by the AFSATCOM program management directive (PMD). Figure 7-1 shows the hierarchy of control elements as follows:

- System operational management office (OMO).
- Master control center (MCC).
- Primary control center (PCC).
- Network control element (NCE).

a. The AFSATCOM control objectives--

- Provide the operator/user with communications with a minimum of control.

- Schedule satellite accesses in keeping with current system limitations, equipment constraints, and validated priorities.

- Prevent users from interfering with each other and/or disrupting the integrity of the system.

- Manage the number and power of satellite accesses ensuring sufficient downlink power margin to those users authorized to operate.

- Provide a control subsystem with enough equipment to monitor satellite communication transponder operations and to recognize and assist with operational or technical system problems.

- Provide high priority users reliable communications during crisis or contingencies.

b. The Chief of Staff, United States Air Force (CSAF) is the executive agent for the management and control of AFSATCOM. The Strategic Communications Division (SCD) is designated the AFSATCOM operational manager for the commander, AFCC. The SCD manages the AFSATCOM satellite system on a day-to-day basis, interacting directly with the Navy telecommunications command (NAVTELCOM) on control procedures involving both services.

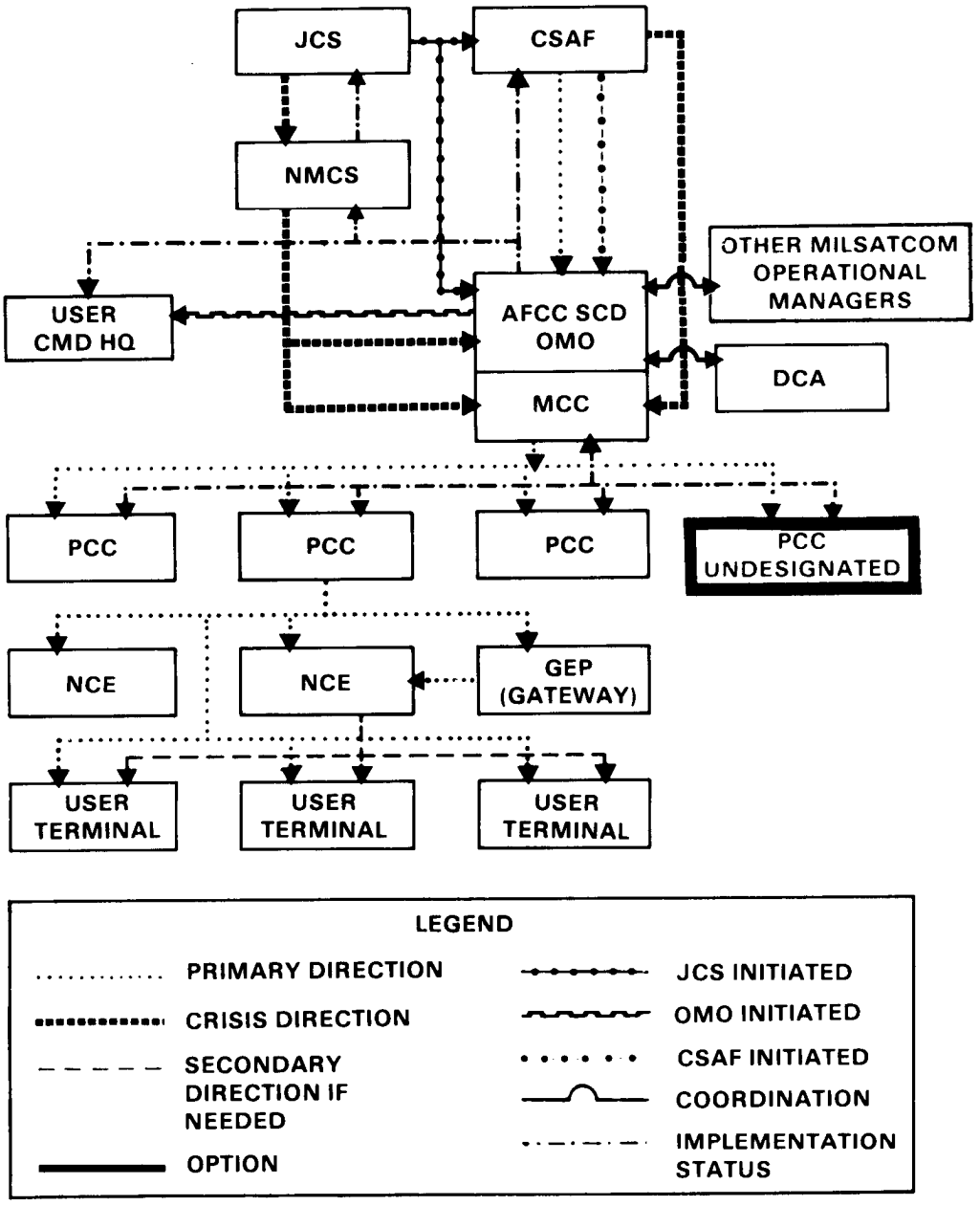


Figure 7-1. AFSATCOM system control hierarchy.

7-3. Access Requests

Access requests should be submitted to the appropriate PCC at least 14 days before the requested start time of the access. If a ground entry point (GEP) (AN/FSC-82) is part of the access, an additional 14 days are required for coordination. PCCS normally begin preparing access schedules 30 days in advance to allow for changing user requirements. Routine access requests must be submitted between 14 and 30 days before requested access start time. Access request may be submitted earlier if lead-time is required for host nation frequency approval. Frequency approval should be requested for all AFSATCOM frequencies in the operating area. (See Tables 7-1 through 7-11.)

Table 7-1. AFSATCOM frequency plan assignments.

SATELLITE	NARROWBAND	WIDEBAND
100° W FLTSAT	PLAN C	PLAN C
72° E FLTSAT	PLAN C	PLAN C
23° W FLTSAT	PLAN B	PLAN B
172° E FLTSAT	PLAN B	PLAN B
SDS	PLANS D & E	NA NOTE 1
105° W LEASAT	PLAN W	PLAN W
77° E LEASAT	PLAN W	PLAN W
15° W LEASAT	PLAN X	PLAN X
177° W LEASAT	PLAN X	PLAN X

NOTE 1: Operations limited to Plan D.

NOTE 2: Mission requirements or satellite equipment failure could dictate a change to these assignments.

Table 7-2. AFSATCOM frequency plan A channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
1	317.045	243.945
2	317.055	243.955
3	317.060	243.960
4	317.065	243.965
5	317.070	243.970
6	317.075	243.975
7	317.080	243.980
8	317.085	243.985
9	317.090	243.990
10	317.095	243.995
11	317.100	244.000
12	317.110	244.010
W/B	294.200	260.600

Table 7-3. AFSATCOM frequency plan B channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
1	317.145	244.045
2	317.155	244.055
3	317.160	244.060
4	317.165	244.065
5	317.170	244.070
6	317.175	244.075
7	317.180	244.080
8	317.185	244.085
9	317.190	244.090
10	317.195	244.095
11	317.200	244.100
12	317.210	244.110
W/B	295.300	261.700

Table 7-4. AFSATCOM frequency plan C channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
1	317.245	244.145
2	317.255	244.155
3	317.260	244.160
4	317.265	244.165
5	317.270	244.170
6	317.275	244.175
7	317.280	244.180
8	317.285	244.185
9	317.290	244.190
10	317.295	244.195
11	317.300	244.200
12	317.310	244.210
W/B	295.900	262.300

Table 7-5. AFSATCOM frequency plan D channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
1	316.595	243.695
2	316.605	243.705
3	316.610	243.710
4	316.615	243.715
5	316.620	243.720
6	316.625	243.725
7	316.630	243.730
8	316.635	243.735
9	316.640	243.740
10	316.645	243.745
11	316.650	243.750
12	316.660	243.760

Table 7-6. AFSATCOM frequency plan E channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
1	316.755	243.855
2	316.765	243.865
3	316.770	243.870
4	316.775	243.875
5	316.780	243.880
6	316.785	243.885
7	316.790	243.890
8	316.795	243.895
9	316.800	243.900
10	316.805	243.905
11	316.810	243.910
12	316.820	243.920

Table 7-7. AFSATCOM frequency plan W channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
9	316.955	243.855
10	316.960	243.860
11	316.975	243.875
12	317.000	243.900
13	317.010	243.910
W/B	297.400	263.800

Table 7-8. AFSATCOM frequency plan X channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
9	317.055	243.955
10	317.060	243.960
11	317.075	243.975
12	317.100	244.000
13	317.110	244.010
W/B	294.200	260.600

Table 7-9. Leased satellite (LEASAT) frequency plan Y channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
9	317.155	244.055
10	317.160	244.060
11	317.175	244.075
12	317.200	244.100
13	317.210	244.110
W/B	295.300	261.700

Table 7-10. LEASAT frequency plan Z channel frequencies (MHz).

CHANNEL	UPLINK	DOWNLINK
9	317.255	244.155
10	317.260	244.160
11	317.275	244.175
12	317.300	244.200
13	317.310	244.210
W/B	295.900	262.300

Table 7-11. AFSATCOM wideband channel frequency assignments (MHz).

PLAN A & X		PLAN B & Y		PLAN C & Z		PLAN W	
UPLINK	DOWNLINK	UPLINK	DOWNLINK	UPLINK	DOWNLINK	UPLINK	DOWNLINK
293.950	260.350	295.050	261.450	295.650	262.050	297.150	263.550
293.975	260.375	295.075	261.475	295.675	262.075	297.175	263.575
294.000	260.400	295.100	261.500	295.700	262.100	297.200	263.600
294.025	260.425	295.125	261.525	295.725	262.125	297.225	263.625
294.050	260.450	295.150	261.550	295.750	262.150	297.250	263.650
294.075	260.475	295.175	261.575	295.775	262.175	297.275	263.675
294.100	260.500	295.200	261.600	295.800	262.200	297.300	263.700
294.125	260.525	295.225	261.625	295.825	262.225	297.325	263.725
294.150	260.550	295.250	261.650	295.850	262.250	297.350	263.750
294.175	260.575	295.275	261.675	295.875	262.275	297.375	263.775
294.200	260.600	295.300	261.700	295.900	262.300	297.400	263.800
294.225	260.625	295.325	261.725	295.925	262.325	297.425	263.825
294.250	260.650	295.350	261.750	295.950	262.350	297.450	263.850
294.275	260.675	295.375	261.775	295.975	262.375	297.475	263.875
294.300	260.700	295.400	261.800	296.000	262.400	297.500	263.900
294.325	260.725	295.425	261.825	296.025	262.425	297.525	263.925
294.350	260.750	295.450	261.850	296.050	262.450	297.550	263.950
294.375	260.775	295.475	261.875	296.075	262.475	297.575	263.975
294.400	260.800	295.500	261.900	296.100	262.500	297.600	264.000
294.425	260.825	295.525	261.925	296.125	262.525	297.625	264.025
294.450	260.850	295.550	261.950	296.150	262.550	297.650	264.050

a. AFSATCOM access request format. The AFSATCOM access request format has two parts. Part 1 is used for general information required to coordinate the access: times, dates, locations, points of contact, narrow or wideband transponder use, power, and bandwidth. Part 2 is used for GEP (AN/FSC-82) access. Figure 7-2 shows the format to request access of the AFSATCOM space segment. First time requests from Category 1 users and all requests from Category 2 must contain Parts 1 and 2. To request changes or extensions, use only the parts containing changed information.

Part 1 —General Request Information

1. Requesting agency and location. User requirements data base (UROB) line number and net name (acronym).

2. Number and type of accesses (for example, narrowband, regenerative, nonregenerative, "wideband, fixed frequency access, AFSATCOM wideband address code).

3. Purpose of access. This section must accurately describe the mission/requirement/purpose insufficient detail to equitably assign user priorities. Failure to provide accurate purpose information could result in a lower priority assignment than actually required or delays in access request processing while additional information is gathered.

4. Geographical limits of access (location of ground stations and maximum/minimum latitude/longitude of airborne terminals).

5. NCE location and using agency, "if different from item 1.

6. Staff POC and/or NCE point-of-contact (person/operations center/CP having immediate contact with NCE)-primary and alternate names and AUTOVON (if overseas, indicate AUTOVON area code). (THESE CONTACTS MUST BE AVAILABLE DURING THE ENTIRE ACCESS PERIOD. IF THE ACCESS IS CLASSIFIED. AN AUTOSEVOCOM NUMBER MUST BE PROVIDED.)

7. Access period(s) start and stop times (ZULU). (Indicate acceptable alternate time periods if possible.)

8. Modulation type and data rate,

9. Terminal(s) characteristics:

   a. Terminal type/nomenclature.
   b. Transmitter output (watts—fixed or variable, maximum/minimum) or maximum effective isotropic radiating power (EIRP).
   c. Antenna nomenclature and gain (in dB) in all cases and manufacturer (if not a standard AFSATCOM antenna).
   d. Receiver G/T (dB) (receiver system figure of merit).
   e. Required Eb/No (dB) for data rate or FM signal-to-noise ratio.
   f. Modem type/nomenclature.

10. Remarks: Name and AUTOVON number of requestor, if different from item 6. If access was approved by phone, name of person contacted. If request is priority 4 or higher, name and office symbol of individual from whom approval was obtained. If request is to extend or modify an existing access, the access authorization number of the original approval. Other information as necessary.

Figure 7-2. AFSATCOM access request message format parts 1 and 2.

Part 2—GEP (AN/FSC-82) Access

11. GEP required (location).

12. Dates/times (ZULU) of requirement for GEP.

13. Type of interface required (voice or data).

14. Type of encryption device at deployed location.

15. Highest classification of traffic to be passed.

16. Specific end item required at GEP terminal (for example, KY-57, KY-65, UYA-7, UGC-1 29).

17. Intended termination at GEP (for example, AUTOVON, NMCC, Washington Switch, dedicated circuitry).

18. Remarks: Other specific information which will help the ground terminal manager meet your requirements.

Figure 7-2. AFSATCOM access request message format parts 1 and 2. (continued)

b. Access request addressees. The access request should be addressed to the PCC controlling the desired satellite. All access requests should also inform the remaining PCCS, the MCC, and the OMO. If the request is for a priority 4 or higher, JCS/C3SDS must also be included as an information addressee. Requests which include requirements using a GEP should also inform that agency and their intermediate headquarters. Table 7-12 lists all current message addressees.

Table 7-12. AFSATCOM access request addressees.

BRANDYWINE PCC:	DET 2 2045CG BRANDYWINE MD//DODB//
MARCH PCC:	33CG MARCH AFB CA//DODB//
KADENA PCC:	1962CG KADENA AB JA//DODB//
MCC (OFFUTT AFB)	SCD OFFUTT AFB NE//YKOP//
OMO (OFFUTT AFB)	SCD OFFUTT AFB NE//YKO//
JCS	JCS WASHINGTON DC//C3SDO//
JCS (PRIORITY 4 or HIGHER)	JCS WASHINGTON DC//C3SDS//
BRANDYWINE GEP:	DET 2 2045CG BRANDYWINE MD//DONB/DODA//
	HQ ACD SCOTT AFB IL//DO/LG//
CLARK GEP:	1961CG CLARK AB RP//DON/LGM//
	HQ PCD HICKAM AFB HI//DO/LG//

7-4. Exercise Access Request

The supported unified or specified command for all supporting and component commands validates, consolidates, and submits satellite access requests for JCS-named, -coordinated, and -directed exercises. (See JCS Publication 2.) Heavy exercise communications traffic causes increased loading of the AFSATCOM system. Before a scheduled exercise, the exercise office of primary responsibility (OPR) notifies the MCC of the exercise scheduled time frame, geographical scope, and of the expected AFSATCOM channel requirements. This information should arrive at the MCC at least 45 days before the exercise start time. If military satellite communications (MILSATCOM) channels are unavailable to support all exercise requirements, the sponsoring CINC prioritizes and recommends allocation of the approved exercise satellite accesses in support of exercises in the CINCS area of responsibility (AOR). Requests for satellite access for unit or major command exercise communications (not in support of JCS-directed or JCS-coordinated exercises) should continue

to be coordinated directly between the requestor and the PCC unless otherwise directed by the theater CINC. Guidance for submitting JCS-named exercise satellite access requests as provided by the various CINCS follows:

a. USCINCEUR. To obtain UHF SATCOM support for exercises within the European theater, supporting units submit access requests through CINCUSAREUR Heidelberg GE//AEAIM-PA-PE//: AUTOVON 370-6868/6646. The USCINCEUR component commands review, validate, and consolidate all UHF SATCOM access requirements for their subordinate command, and submit the request to USCINCEUR Vaihingen GE//C3S-TSC//. AUTOVON is 430-8484/5416 or Secure 6416, drop 6.

b. USCINCCENT. To obtain UHF SATCOM support for exercises within USCENTCOMS AOR, supporting components submit access requests to USCENTCOM components commands as follows:

- Any Army component: COMUSARCENT Fort McPherson GA//AFRD-CE//; AUTOVON 588-4825/4928.

- Any special operations component: SOCCENT MacDill AFB FL// SOCJ6//; AUTOVON 968-6256.

USCENTCOM component commands review, validate, and consolidate all access requirements and submit them to USCINCCENT MacDill AFB FL// CCJ6-CM//; AUTOVON 968-6600, Secure 9163.

c. USCINCPAC. To obtain UHF SATCOM support for exercises within the Pacific theater, supporting units submit access requests to USCINCPAC component or subordinate unified commands as follows:

- Army units (exclusive of Korea and Japan forces): CDR WESTCOM Fort Shafter, Hawaii.

- US Forces in Korea: COMUSKOREA Seoul KOR//SJ-OPO//.

- US Forces in Japan: COMUSJAPAN Yokota AB JA//C3S//.

The component commands or subordinate unified commands review, validate, and consolidate all UHF SATCOM access requirements for their units. They submit these requests to USCINCPAC Honolulu HI//C3S// about 30 days before the exercise starts. This allows enough time for coordination. POC AUTOVON 477-6715/6644.

d. USCINCLANT. To obtain UHF SATCOM support for exercises within USCINCLANTS AOR, subordinate forces submit access requests to USCINCLANT component commands as follows:

- Special operations forces: COMSOCLANT Fort Bragg NC//36//; AUTOVON 236-2213.

- Army forces: CINCARLANT Fort McPherson GA//AFCE-PR//; AUTOVON 588-4129/2239.

USCINCLANT components, Joint Headquarters (CJTF/COMUSFORCTRY), and sub-unified commands (COMICEDEFOR, COMUSFORAZ, COMUSFORCARIB, COMSOCLANT) collect, consolidate, review, and validate exercise AFSATCOM access requirements and submit them as a single package to USCINCLANT Norfolk VA//J62l//; AUTOVON 564-6761.

(1) Components and supporting commands/agencies provide an initial estimate of their access requirements during the initial planning conference.

(2) USCINCSO/SCJ6-0 consolidates all requirements and makes initial coordination with the AFSATCOM management office appropriate PCC during the planning process.

(3) Components and supporting commands provide a final statement of their requirements. It is prepared in the AFSATCOM access request format and sent to USCINCSO Quarry Heights PN//SCJ6-0//, AUTOVON 313-282-3252, no later than 60 days before the access start time.

e. USCINCSO. USCINCSO/SCJ6-0 acts as the central point for all AFSATCOM accesses for any USCINCSO sponsored, JCS-directed, or JCS-coordinated exercise within CINCSO AOR. USCINCSO/SCJ6-0 prioritizes and consolidates requirements and forwards them to the appropriate PCC.

f. USCINCSPACE. When CINCSPACE has been designated as the sponsoring CINC for JCS-directed or JCS-coordinated exercises, CINCSPACE/J3Z, AUTOVON 692-2613, acts as the focal point for exercise support satellite access requests. Military satellite requirements in support of the exercises are directed to CINCSPACE Peterson AFB CO//J3Z//. CINCSPACE/J3Z reviews, validates, and consolidates all access requirements and submits the request to the appropriate PCC. Approved access requests are then assigned to the supporting commands and units based on CINCSPACE determined priorities.

7-5. Emergency Access Request

An emergency/short notice access can be coordinated by telephone. These will be accepted if a properly formatted message traffic follow-up is submitted within 24 hours of the initial telephone access approval. Figure 7-3 shows the AFSATCOM access approval/disapproval message format.

1. Access authorization number.
2. Name of requesting agency.
3. Number and types of access granted on satellite.
4. Purpose of access.
5. Access period (start/stop times/dates).
6. Channel number(s) (narrowband); center frequency(s) or AFSATCOM wide-band address code(s) (wideband).
7. Assigned priority.
8. Maximum authorized EIRP.
9. Maximum authorized bandwidth (kHz).
10. User NCE point of contact (name and AUTOVON).
11. Remarks.

Figure 7-3. AFSATCOM access approval/disapproval message format.

Glossary

Abbreviations and Acronyms

AB	air base
AC	area coverage
ACCS	Army Command and Control System
AFB	Air Force Base
AFCC	Air Force Communications Command
AFSAT	Air Force satellite
AFSATCOM	Air Force satellite communications
AJ/CM	antijam/control modem
ANDVT	advanced narrowband digital voice terminal
AOR	area of responsibility
APTF	antenna pallet transit frame
AR	army regulation
ASI	Army Space Institute
attn	attention
AUTOVON	automatic voice network
AUTOSEVOCOM	automatic secure voice communications
BER	bit error rate
bps	bits per second
BPSK	biphase shift keying
C^3	command, control, and communications
CA	California
CCC	critical control circuit
CDR	commander
CGCPT	combined ground command post terminal
CINC	Commander in Chief
CINCARLANT	Commander in Chief, United States Army Forces, Atlantic
CINCUSAREUR	Commander in Chief, United States Army, Europe
CJTF	Commander Joint Task Force
C/KT	carrier to noise temperature ratio
cmd	command
CO	Colorado
COMICEDEFOR	Commander, Iceland Defense Force
COMSEC	communications security
COMSOCLANT	Commander, Special Operations Command, Atlantic
COMUSARCENT	Commander, United States Army, Central
COMUSFORAZ	Commander, United States Forces, Azores

COMUSFORCARIB	Commander, United States Forces, Caribbean
COMUSFORCTRY	Commander, United States Forces, Country
COMUSJAPAN	Commander, United States Forces, Japan
COMUSKOREA	Commander, United States Forces, Korea
CONUS	continental United States
COSCOM	corps support command
CP	command post
CRD	Confidential Restricted Data
CRT	cathode ray tube
CSA	Chief of Staff, United States Army
CSAF	Chief of Staff, United States Air Force
C-SIGINT	counter-signals intelligence
CSPE	communications system planning element
CT	control terminal
CUCV	commercial utility cargo vehicle
DA	Department of the Army
DAMA	demand assigned multiple access
dB	decibel
DC	District of Columbia
DCA	Defense Communication Agency
DCAC	Defense Communications Agency Circular
DCAOC	Defense Communications Agency Operations Center
DCS	Defense Communications System
DCSS	digital communications subsystem
det	detachment
DISCOM	division support command
DMDG	digital message device group
DOD	Department of Defense
DS	direct sequence
DSCS	Defense Satellite Communications System
DSCSOC	Defense Satellite Communications System Operations Center
DTE	data terminal equipment
E	east
EAC	echelons above corps
EAM	emergency action message
EASTLANT	Eastern Atlantic
EASTPAC	Eastern Pacific
Eb/No	energy per bit to noise density ratio
EC	earth coverage
ECM	electronic countermeasures
ECCM	electronic counter-countermeasures
EHF	extremely high frequency
EIRP	effective isotropic radiating power
EMP	electromagnetic pulse
ESM	electronic warfare support measures
EW	electronic warfare
FDMA	frequency division multiple access

FH	frequency hopping
FL	Florida
FLTSAT	fleet satellite
FLTSATCOM	fleet satellite communications
FM	frequency modulated/field manual when used with a number
FSK	frequency shift keying
FT	force terminal
GA	Georgia
GCPT	Ground Command Post Terminal
GDA	gimballed dish antenna
GE	Germany
GEP	ground entry point
GHz	gigahertz
GMF	ground mobile forces
GMFSC	ground mobile forces satellite communications
GMFSCCC	GMF satellite communications control center
GNC	GMF network controller
GPU	general purpose user
GS	general support
G/T	ratio of antenna gain to noise temperature
HEMP	high altitude, EMP
HF	high frequency
HI	Hawaii
HQ	headquarters
IF	intermediate frequency
IL	Illinois
INSCOM	United States Army Intelligence and Security Command
I/0	input/output
I0	Indian Ocean
IPA	intermediate power amplifier
JA	Japan
JCS	Joint Chiefs of Staff
JCSC	Joint Communications Satellite Center
JCS MOP	Joint Chiefs of Staff Memorandum of Policy
kbps	kilobits per second
kHz	kilohertz
KOR	Korea
LCC	link communications circuit
LEASAT	leased satellite
LEASATCOM	leased satellite communications
LES	Lincoln experimental satellites
LNA	low noise amplifier
LOS	line of sight
LRIP	low rate initial production
LRM	low rate multiplexer
MCC	master control center

MCE	mission control element
MD	Maryland
MHz	megahertz
MI	military intelligence
MILSATCOM	military satellite communications
MOP	memorandum of policy
MOS	military occupational specialty
MSE	Mobile Subscriber Equipment
NA	not applicable
NAVTELCOM	Navy telecommunications command
NBC	nuclear, biological, chemical
NC	narrow coverage/North Carolina
NC/AC	narrow coverage/area coverage
NCE	network control element
NCF	network control function
NCS	net control station
NCT	network control terminal
NCU	network control unit
NE	Nebraska
NESP	Navy EHF satellite Program
NMCC	National Military Command Center
NMCS	National Military Command System
NNT	non-nodal terminal
NRI	net radio interface
NSA	National Security Agency
NT	nodal terminal
O	Official Use
OMO	operational management office
OPCON	operational control
OPLAN	operation plan
OPORD	operation order
OPR	office of primary responsibility
PA	power amplifier
PCC	primary control center
PMD	program management directive
PN	Panama
POC	point of contact
PSK	phase shift keying
pub	publication
QPSK	quadraphase shift keying
QRSA	quick reaction satellite antenna
RDF	radio direction finding
REC	radio electronic combat
RF	radio frequency
RSSC	Regional Space Support Center
R/T	receiver/transmitter
SAA	satellite access authorization
SAMS	satellite automatic monitoring system

SAR	satellite access request
SATCOM	satellite communication(s)
SCD	strategic communications division
SCOTT	single-charnel objective tactical terminal
SSC	Special Communications System
SDS	satellite data systems
SHF	super high frequency
SIGSEC	signals security
SIOP	Single Integrated Operational Plan
SNC	satellite network controller
SOCCENT	Special Operations Command, Central
SOCOM	Special Operations Command
SSB	single sideband
SSMA	spread spectrum multiple access
SST	single subscriber terminal
supp	supplement
TACSAT	tactical satellite
TAMCC	theater Army Milstar control center
TC	training circular
TCCC	terrestrial critical control circuit
TDMA	time division multiple access
TMCC	theater Milstar control center
TO	technical order
TOE	table(s) of organization and equipment
TRADOC	United States Army Training and Doctrine Command
TRANSEC	transmission security
TRI-TAC	Tri-Service Tactical Communications
TT&C	tracking, telemetry, and control
UCID	user-controlled interface device
UHF	ultra high frequency
UNAAF	Unified Action Armed Forces
URDB	user requirements data base
us	United States (of America)
USAF	United States Air Force
USAISC	United States Army Information Systems Command
USARSPACE	United States Army Space Command
USCENTCOM	United States Central Command
USCINCCENT	United States Commander in Chief, Central
USCINCEUR	United States Commander in Chief, Europe
USCINCLANT	United States Commander in Chief, Atlantic
USCINCPAC	United States Commander in Chief, Pacific
USCINCSO	Commander in Chief, United States Southern Command
USCINCSPACE	United States Commander in Chief, Space Command
USSPACECOM	United States Space Command
VA	Virginia
VCSA	Vice Chief of Staff, United States Army
VHF	very high frequency

W	west
W/B	wideband
WESTCOM	United States Army Western Command
WESTLANT	Western Atlantic
WESTPAC	Western Pacific

Terms

BIPHASE SHIFT KEYING (BPSK). Modulation process whereby the phase of the subcarrier is discretely varied in relation to phase of previous signal element by two modulating signals 180 degrees out of phase.

CRITICAL CONTROL CIRCUIT (CCC). The orderwire link, commonly spread spectrum, used by the NCT to provide command and control to each of the NTs and to receive status/replies.

CROSS-ELEVATION. The sector of antenna movement in azimuth from an initial emplacement position due to limits imposed in antenna drive design.

DATA BASE. A collection of necessary operational data entered into a computer that can be retrieved with speed and ease in different formats.

FOOTPRINT. Coverage patterns of satellite antennas on portions of the earth's surface.

GEOSTATIONARY. As applied to a satellite located at an altitude of approximately (35,000 kilometers) over the equator traveling at a rate of speed to appear stationary with respect to a point on earth.

LOOK ANGLE. Azimuth and elevation angles necessary for a terminal antenna position to access a satellite (LOS to satellite).

MILSTAR. A new generation satellite communications system designed to meet the minimal essential wartime communications needed to satisfy specified strategic and tactical mission requirements.

NET. An organization of terminals capable of direct communications with each other using a common frequency or channel for a common purpose.

NETWORK. An organization of terminals capable of communication with each other but not necessarily on the same frequency or channel for a common purpose.

NODAL. The terminal situated at the hub of a net (AN/TSC-85( ) or AN/TSC-100A) passing communications to a number of terminals.

QUADRAPHASE SHIFT KEYING (QPSK). The modulating of a subcarrier by four signals 90 degrees out of phase. Two times as much intelligence for the same bandwidth as BPSK.

SPREAD SPECTRUM. A special digital modulation process in which the carrier is suppressed and the signal is distributed over the entire bandwidth.

TERRESTRIAL. Pertaining to the earthbound communication other than by satellite (that is, land line, wireless, LOS).

TRANSPONDER. Name applied to satellite or devices in satellite to receive and retransmit communications signals.

References

Required Publications

Required publications are sources that users must read in order to understand or to comply with this publication.

Defense Communications Agency Circulars (DCACS)

800-70-1	Operation and Control of the Defense Satellite Communications System (DSCS)
800-70-l(Supp-2)	Satellite Communications Reference Data Handbook, Volumes I and II

Field Manual (FM)

24-18	Tactical Single-Channel Radio Communications Techniques

Joint Chiefs of Staff Memorandum of Policy (JCS MOP)

178	Military Satellite Communications Systems

Training Circulars (TCS)

24-4A	(CRD) COMSEC Applications for Tactical Satellite Communications
24-21	Tactical Multichannel Radio Communications Techniques
24-24	Signal Data References: Communications-Electronics Equipment

Related Publications

Related publications are sources of additional information. They are not required in order to understand this publication.

Army Regulation (AR)

380-5	Department of the Army Information Security Program

Field Manuals (FMs)

11-23	Theater Communications Command (Army)
11-24	Signal Tactical Satellite Company
11-50	Combat Communications Within the Division (How to Fight)
11-486-13	Telecommunications Engineering: Digital Communications
24-1	Combat Communications
34-62	Counter-Signals Intelligence (C-SIGINT) Operations

Joint Chiefs of Staff Publication (JCS Pub)

2	(0) Unified Action Armed Forces (UNAAF)

Training Circular (TC)

34-41	Jamming Handbook

Technical Manuals (TMs)

11-5895-808-13-3	Operator's, Organizational and Direct Support Maintenance Manual for Satellite Communications Set, AN/USC-28(V)
11-5895-1104-10-1	Operator's Manual for Satellite Communications Terminal, AN/MSC-64(V)2
11-5895-1127-10	Operator's Manual for Satellite Communications Terminal, AH/TSC-93A
11-5895-1128-10	Operator's Manual for Satellite Communications Terminal, AN/TSC-85A
11-5895-1180-10	Operator's Manual for Radio Set AN/PSC-3
11-5895-1190-12	Operator's and Organizational Maintenance Manual Satellite Automatic Monitoring Subsystem OL-325/FSQ
11-7025-221-10	Operator's Manual for Multiplexer, Digital, TD-1337(V)l/G, TD-1337(V)2/G, TD-1337(V)3/G and TD-1337(V)4/G

Technical Orders (TOS)

31R2-2TSC94-11	Satellite Communications Terminals
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