

**FM 11-23**

**DEPARTMENT OF THE ARMY FIELD MANUAL**

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**U.S. ARMY STRATEGIC  
COMMUNICATIONS  
COMMAND  
(THEATER)**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

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HEADQUARTERS  
DEPARTMENT OF THE ARMY  
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**U.S. ARMY STRATEGIC COMMUNICATIONS  
COMMAND (THEATER)**

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**PART ONE****U.S. ARMY STRATEGIC COMMUNICATIONS COMMAND (THEATER)****GENERAL DOCTRINE****CHAPTER 1****1-1. Purpose**

This manual establishes U.S. Army doctrine, and provides guidance for the development of and the control exercised by the U.S. Army Strategic Communications Command (USASTRATCOM) (theater) in establishing and controlling type a theater of operations. The USASTRATCOM (theater) is responsible for organizing and structuring signal units for a communications zone (COMMZ) in support of an army group, field army, independent corps, or independent corps (oceanic theater). Where the army is the operator of the Defense Communications System (DCS) or a significant portion thereof, the USASTRATCOM organization at theater level will include all army signal units above field army/field force level or the largest tactical maneuver unit except air defense and supply and maintenance units.

**1-2. Scope**

*a.* This manual is divided into three parts. The material presented in Part One covers the organization of a theater and a theater army, command communications relationships, communications requirements, signal organizations, and communications systems doctrine. Part Two includes detailed descriptions of the command and control elements for a USASTRATCOM (theater), a signal group, and a signal battalion. Part Three includes detailed descriptions of the light and heavy signal tropospheric companies. Subsequent parts of this manual will be published as changes to the basic document and will include detailed descriptions of signal organizations that may be assigned or attached to a USASTRATCOM (theater). Appendix A consists of applicable references; appendix B includes tropospheric scatter planning factors.

*b.* The information in this manual is applicable to—

(1) General war, to include consideration for the employment of and protection from nuclear munitions, and chemical, biological, and radiological (CBR) agents.

(2) Limited war.

(3) Cold war, to include stability operations.

*c.* This manual is in consonance with the following International Standardization Agreements which are identified by type of agreement and number at the beginning of each appropriate chapter in the manual: STANAG 2079, Rear Area Security and Rear Area Damage Control and Intelligence Reports; STANAG 2043, Principles and Procedures for Establishing Communications.

**1-3. References**

This manual should be used with FM 24-1 and field manuals covering signal units that may be assigned or attached to USASTRATCOM (theater) but are not included herein. These unit-type field manuals and other pertinent publications are listed in appendix A.

**1-4. Definitions**

*a. Area Signal Center.* A signal center which provides communications support, within its geographical area of responsibility, to all units requiring signal center facilities to supplement their organic means for external communication to higher, subordinate, or adjacent units.

*b. Command Signal Center.* A signal center which provides communications support to a specific command headquarters, and at the discretion of the center commander, to units located in its immediate vicinity.

*c. Communications Center.* A communications facility charged with the responsibility for receipt, transmission, and delivery of messages re-

ceived or sent via signal communications means. A communications center normally contains a message center section, cryptographic (crypto) section, messengers, and telegraph and/or teletypewriter terminal equipment for transmitting and receiving messages. Other capabilities such as facsimile, tape relay and data transmission may be provided when authorized.

*d. Communications-Electronics.* The direction and systematic employment of devices and techniques designed to acquire or transmit information essential to the command control of friendly military forces, and to counteract the effectiveness of similar operations conducted by the enemy.

*e. Message Center.* A communications activity, normally found as an element of a communications center, charged with the responsibility for acceptance and processing of messages to be sent via signal communication means and for receipt and delivery of incoming messages. Delivery of incoming messages normally will be made to a commander or unit distribution center.

*f. Operational Control/Operational Command.* Those functions of command involving the composition of subordinate forces, the assignment of tasks, the designation of objectives and the authoritative direction necessary to accomplish the mission. Operational command should be exercised by the use of the assigned normal organizational units through their responsible commanders or through the commanders of subordinate forces established by the commander exercising operational command. It does not include such matters as administration, discipline, internal organization, and unit training, except when a subordinate commander requests assistance.

*g. Overjump.* The techniques of employing tropospheric scatter radio equipment to reconstitute the TACS when transmission centers or transmission subcenters become inoperable and the distance between operable centers or subcenters exceeds the range of conventional multichannel radio (radio relay) equipment.

*h. Patching Central.* A facility in a communications system utilized to interconnect circuits on a semipermanent basis, to fulfill circuit routing requirements, or to improve quality of circuits. Normally, a part of a facilities control center differs from a switching central which interconnects established circuits temporarily in response to subscriber request.

*i. Signal Center.* A groupment of signal communication facilities installed, operated, and maintained by a Signal Corps unit. Each signal center normally provides the following: communications center, switching central, technical control center, and appropriate external means of signal communications. There are two types of signal centers grouped within this term: area signal center and command signal center.

*j. Switching Central.* A facility in a communication system utilized to manually or automatically interconnect telephone, teletypewriter, data, or radio telephone circuits temporarily in response to a subscriber request. Differs from a patching panel central which interconnects circuits on a semipermanent basis.

*k. Technical Control Center.* A communications center work area containing distribution frames and associated jacks or switches through which equipment and facilities are patched to arrange the desired circuit. The center is charged with the responsibility of maintaining optimum performance of teletypewriter, data, telephone, and radio circuitry. Various types of test equipment are utilized in exercising circuit/facility quality control. Technical control centers coordinate the routing of circuits within their assigned portion of the communications system.

*l. Traffic (Communications).* All transmitted and received messages.

## 1-5. Comments on Publication

Users of this manual are encouraged to submit recommendations to improve its clarity or accuracy. Comments should be prepared according to AR 310-3 and keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commanding Officer, U.S. Army Combat Developments Command Communications-Electronics Agency, ATTN: Doctrine Division, Fort Monmouth, New Jersey 07703. Originators of proposed changes which would constitute a significant modification of approved Army doctrine may send an information copy, through command channels, to the Commanding General, United States Army Combat Developments Command, to facilitate review and follow-up.

## CHAPTER 2

### USASTRATCOM (THEATER)

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#### Section I. INTRODUCTION

##### 2-1. General

A USASTRATCOM (theater) has the responsibility of providing army signal communications within the communications zone of a theater of operations. Normally, the COMMZ extends from the water's edge to the rear area of the largest tactical maneuver element in the theater. However, in some theaters, depending on the type of conflict, the COMMZ may be superimposed on the combat zone. The theater army communications systems (TACS) provide signal communications facilities for combat service support elements in the COMMZ. They also provide the defense communications systems in the theater with facilities for access to the TACS, and they provide the theater commander with command and control communications with which he can readily influence operations of theater air force, theater navy, theater army and other major U.S. or allied military elements directly subordinate to him. To carry out the theater army mission, the theater army commander is provided with the same command and control facilities as the theater commander.

##### 2-2. Factors Affecting Organization

The extent and complexity of signal communications in the COMMZ of a theater of operations depend on many factors. Among the major factors are the mission of the theater commander and the number and type of forces at his disposal; the geographical size and location, topographical features, and climatic conditions of the area; the attitudes of the local population and their governing bodies; environmental conditions; and availability of indigenous communications facilities. A brief discussion of some of these factors will aid in understanding the necessity for tailoring a USASTRATCOM (theater) to fit the needs of the COMMZ as opposed to the use of fixed signal organizations such as those organic to a field army.

*a.* Communications requirements will vary from one theater to another because of size, loca-

tion, mission, and force deployment. A USASTRATCOM (theater) that supports a field army or army group will of necessity be larger than one that supports an independent corps in a remote area or an oceanic theater.

*b.* The terrain and climatic conditions will vary from one theater to another and may even vary within a theater. Some theaters may be located in oceanic areas consisting of widely scattered island bases with varying climatic conditions; for example, the extreme cold of the Aleutians, the torrid climate of the Pacific, and the mild climate of the Caribbean. Certain terrain conditions reduce the effectiveness of some communications equipment while they enhance the effectiveness of others. Therefore, the type of signal units best suited for the area must be employed to support the theater army force.

*c.* Indigenous communications facilities in the theater of operations should be considered, but not relied upon, when a USASTRATCOM (theater) is organized. During the course of operations in the theater where favorable employment of indigenous communications appears feasible, signal units capable of rehabilitating and interfacing these systems for possible integration into the TACS may be assigned to USASTRATCOM (theater).

##### 2-3. Flexibility of Organization

Flexibility of organization in a USASTRATCOM (theater) is achieved by tailoring the grouping of basic building block signal units to perform specific functions.

*a.* Basic building-block signal units are separate tables of organization and equipment (TOE) companies grouped under a command and control element such as a headquarters and headquarters detachment (HHD) (TOE 11-116) to form a type signal battalion. Another basic building-block unit is the fixed signal battalion organized under a specific TOE with its organic command



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and control element and organically assigned companies.

b. Building-block units may be further grouped under a command and control element, such as a headquarters and headquarters detachment (TOE 11-122), to form a type signal group. If a signal group only is required in the theater, the command and control element, headquarters and headquarters detachment (TOE 11-122), may be organized under standard requirements code (SRC) 20 variation of the TOE. This TOE variation provides the group headquarters with additional personnel and equipment for establishing, engineering, and controlling the TACS in the COMMZ.

c. In large theaters of operations where the force structure is of a field army or larger, two or more type signal groups are placed under a command and control element such as a headquarters and headquarters company (HHC) USASTRATCOM (theater) (TOE 11-302). This company has its own organic TACS control element. Building-block units of company or battalion size may also be assigned or attached directly to a USASTRATCOM (theater) to provide special communications capabilities. This tailoring of units applies to signal group organizations where sepa-

rate companies are assigned directly to the group to provide specialized communications services. It is this organization tailoring capability, the adding or deleting of units, which gives a USASTRATCOM (theater) flexibility and versatility in supplying the proper communications equipment and personnel to meet the signal communications requirements. In addition, this tailoring capability conserves the communications-electronics resources in any theater under current or future concepts of operations.

d. USASTRATCOM (theater) organizations that support several *type* force models operating in a variety of theaters are discussed in the following section. Refer to Part Two of this manual for detailed missions, employment, and methods of operation of the command and control elements of a headquarters and headquarters company, USASTRATCOM (theater); a headquarters and headquarters detachment, signal group; and a headquarters and headquarters detachment, signal battalion. For information covering the detailed missions, capabilities, employment, and operations of other TOE units assigned to USASTRATCOM (theater) refer to subsequent parts of this manual or applicable unit field manuals and to tables of organization and equipment.

## Section II. TYPE USASTRATCOM (THEATER) ORGANIZATIONS

### 2-4. General

To provide flexibility, a USASTRATCOM (theater) is made up of building-block units that can be added or deleted as the situation requires. The organization of each USASTRATCOM (theater) will be different because each will be tailored to support a specific force structure in a specific theater of operations.

### 2-5. Type Communication Zone Signal Organization

COM (theater) for establishing, operating, and controlling a TACS in the COMMZ in support of one field army is shown in figure 2-1. The command and control element for such a USASTRATCOM (theater) directs the operations of two signal groups in establishing axes of communications throughout the COMMZ. The TACS interconnects with the field army communications system where the boundaries of the COMMZ and the field army meet. Two or more lines of com-

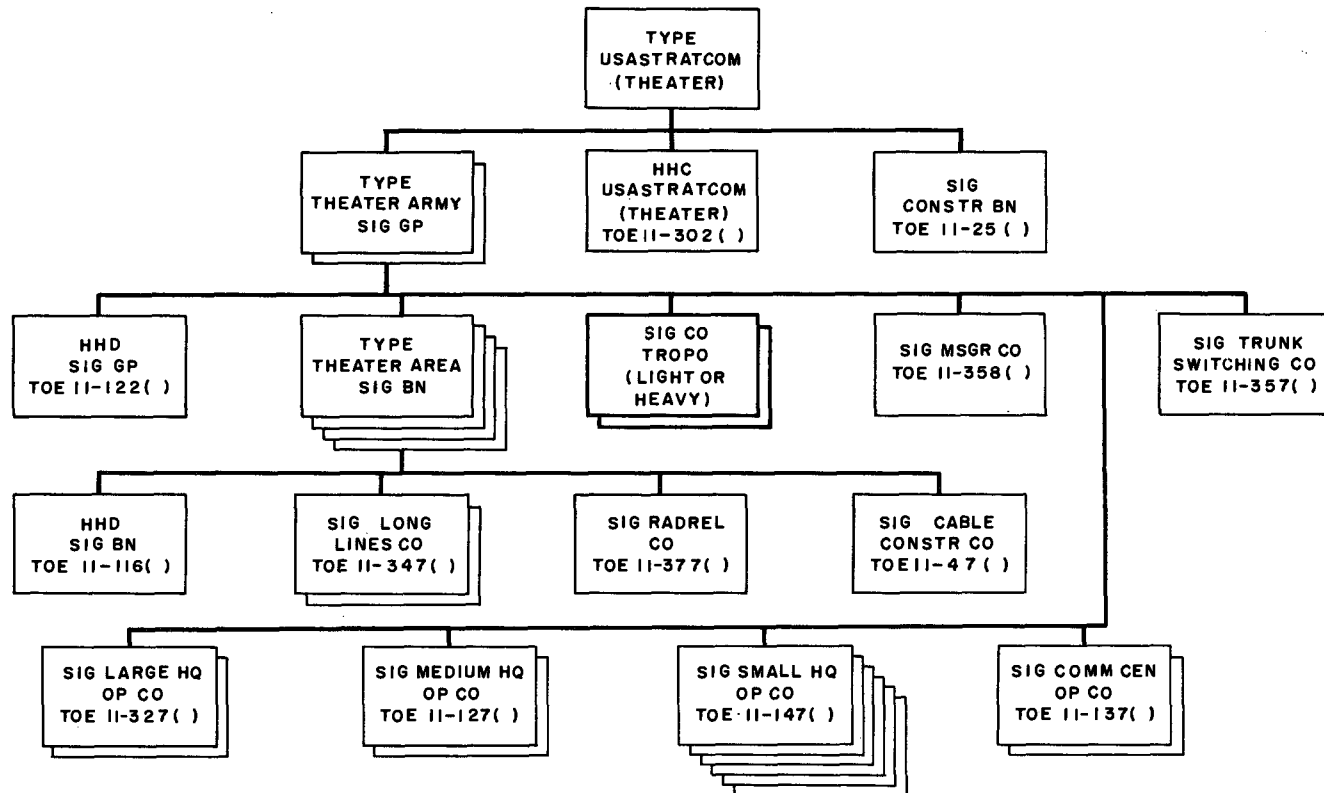
The organizational structure of a USASTRATCOM (theater) communications (LOC) are established in the COMMZ to support one field army. Each LOC may contain highway, railway, and waterway networks. The theaters, major command headquarters, combat support units, and combat service support units will be dispersed along these LOC; the tempo of warfare will determine their exact deployment. Signal communications axes provided by the USASTRATCOM (theater) will parallel the LOC.

a. *Signal Groups.* Two of the type theater army signal groups shown in figure 2-2 are the major operational organizations assigned to a USASTRATCOM (theater). They are organized to support the communications-electronics doctrine of superimposing a command communications system on an area communications system to provide an optimum TACS in the COMMZ. Each signal group is also organized to support the communications doctrine applicable to operations of fragmented major headquarters. Each group provides

both command and area communications systems in its area of responsibility. The two major axes of communications are interconnected laterally, forming an integrated TACS. If an imbalance between requirements and capabilities develops in a signal group, the commander of a USASTRATCOM (theater) may reassign elements of one group to the other. This restructuring technique provides signal organization flexibility and promotes the conservation of communications-electronics resources in the COMMZ. The area and command communications systems are covered briefly in *b* and *c* below, and in more detail in paragraphs 5-3 and 5-2, respectively. The command and control element of the signal group is a headquarters and headquarters detachment, signal group (TOE 11-122) (chap 10).

*b. Area Communications System.* The area communications system provided by each signal group is established along the communications axis by the four signal operation battalions.

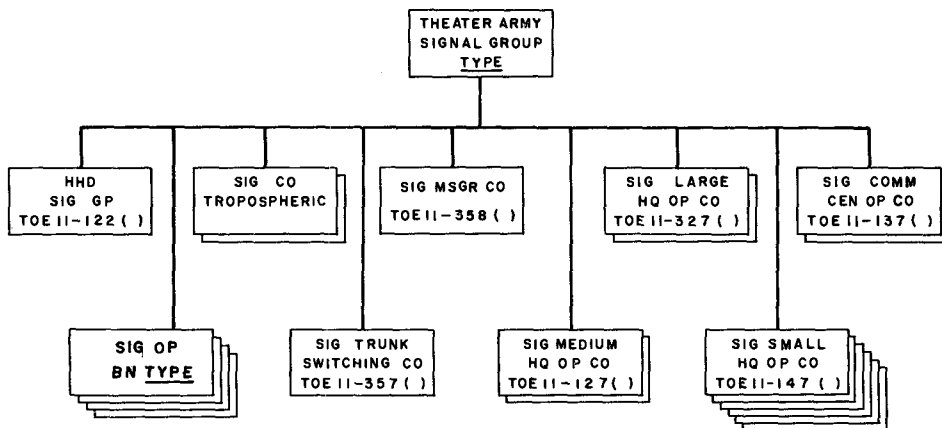
These are *type* signal battalions as shown in figure 2-3. The command and control element for each battalion is a headquarters and headquarters detachment organized under TOE 11-116 (chap 10). Each signal operation battalion provides long distance trunk circuits which form the TACS, and trunking facilities for access to the TACS, in a designated area along the axis of communications in the COMMZ. Each battalion installs transmission centers and transmission subcenters. The transmission center and every third transmission subcenter are communications system nodes and have channel-drop and -insert capabilities. Equipment and personnel for these facilities are provided by the two signal long lines companies (TOE 11-347) assigned to the battalion. In addition, the signal cable construction company (TOE 11-47) assigned to each battalion is capable of laying field wire and field cable from the trunk switching facility to subscribers located in the area served by the battal-



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Figure 2-1. Type USASTRATCOM (theater) organization.





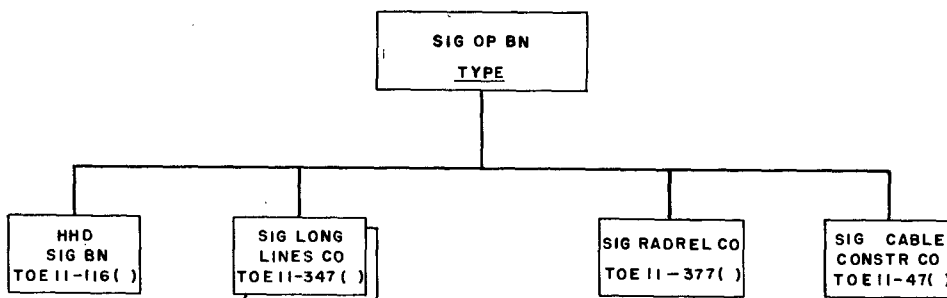
FM 11-23-2

Figure 2-2. Type theater army signal group.

ion. The signal radio relay company of the battalion provides multichannel radio links and wire carrier systems from the transmission centers and from the transmission subcenters having channel drop and insert capabilities to various headquarters within the same area. Thus, this battalion is capable of providing both long lines multichannel radio and cable communications facilities which form the TACS, as well as multichannel radio and cable facilities for access into the TACS. Additionally, the battalion can pro-

vide wire and cable distribution circuits to miscellaneous small units and activities within its area of operations.

c. *Command Communications System.* Several major headquarters such as theater, theater army, theater navy, theater air force, and theater army support command (TASCOM) are established in the COMMZ. The theater commander requires direct, point-to-point, multichannel communication links to these headquarters for com-



FM 11-23-3

Figure 2-3. Type signal operation battalion.

mand and control of theater operations. These links are referred to as the command communications system of the TACS. The signal companies tropospheric, TOE 11-367 and TOE 11-368, assigned to each signal group fill this requirement. Tropospheric scatter (tropo) radio links may also be employed for TACS restoral purposes. In the case of system restoral, command system links may be used to handle urgent area system traffic. This traffic is routed from a transmission center over a TACS access system to a command signal center where it is retransmitted over a command link to another command signal center. From there it is retransmitted over a TACS access system to another transmission center in the area system, bypassing one or more transmission centers or subcenters which have become inoperative. Tropo radio links may also be used to interconnect axes of communications laterally where distances between these axes are great, and the intervening area is not conducive to the use of radio relay repeaters because of enemy action, terrain, or other environmental conditions.

*d. Trunk Switching.* The signal trunk switching company (TOE 11-357) provides one high capacity, major trunk switching center and tape relay service where required. Additionally, a limited trunk switching capability exists at each of the transmission centers organic to the long line company (TOE 11-347).

*e. Messenger Service.* In any theater of operations, conditions are present which preclude sole reliance upon electrical or electronic means of communication. For example, lengthy, low precedence message traffic can overload circuits. Other types of message traffic that may require transmission by courier include: maps, overlays, reports, films, diagrams, directives, and publications. To forward this type of message traffic, a signal messenger company (TOE 11-358) is assigned to each of the signal groups. This unit provides both air messenger and motor messenger service along the signal group's axis of communication, and may also be employed to provide lateral communications between signal axes within the COMMZ.

*f. Terminal Facilities.* Major command headquarters and headquarters of various combat support and combat service support units deployed along the communications axis not only require access trunk circuits into the TACS, but also need the terminal facilities; for example, teletypewriter, data, facsimile and telephone instruments.

These headquarters also need internal communications within their organizational complex for daily operations. The signal group is organized to provide this service. Signal units assigned to the group which provide this support are the signal large headquarters operations company (TOE 11-327, signal medium headquarters operations company (TOE 11-127), and the signal small headquarters operations company (TOE 11-147). These units will not be assigned to the supported headquarters. Attachment orders normally will state that the unit depends upon the supported headquarters for rations, quarters, and administration. Units organized under TOE 11-327 normally support headquarters such as theater and theater alternate, and theater army and theater army alternate. Signal units organized under TOE 11-127 support a TASCOM headquarters, a theater army civil affairs command headquarters, or a headquarters of comparable size, whereas the signal small headquarters operations company, TOE 11-147, is employed at an area support command headquarters or similar size headquarters which does not have organic signal communications facilities.

*g. Signal Centers.* There are other smaller headquarters of brigade or comparable size and separate units along the axis of communications which require signal center support. The two signal communications center operations companies assigned to each signal group provide this support. Platoons from the signal center operations company may be attached to these smaller headquarters, or may be centrally located in an area to provide signal center support for several units in heavily populated troop areas.

*h. Cryptologic Support.* Cryptologic support is a responsibility of the theater army support command (TASCOM) and the field army support command (FASCOM) in accordance with Department of the Army-approved field manuals FM 29-11 (Test), FM 54-8 (Test), and FM 100-10. Thus, the TASCOM will provide cryptologic support in the theater army area and, in addition, will provide cryptologic support to the FASCOM. The FASCOM will be responsible for providing cryptologic support in the field army area.

## **2-6. Type Signal Organization in Support of an Army Group**

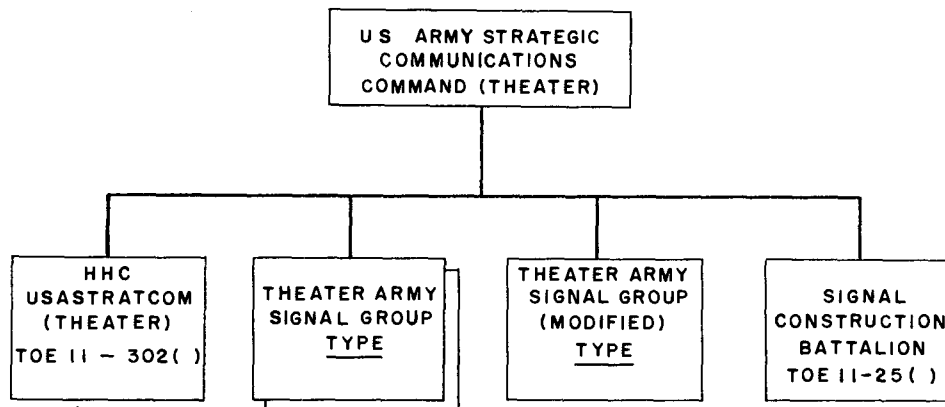
The organization structure of USASTRATCOM (theater) for establishing, operating and control-

ling a TACS in support of an army group consisting of two field armies is shown in figure 2-4. It is similar to the structure shown in figure 2-1 except that it consists of three signal groups. Two of these groups are identical with the signal group shown in figure 2-2 and function in a similar manner. The third signal group is slightly modified as shown in figure 2-5. The modified signal group provides a third axis of communications in the COMMZ to meet the signal communications needs of additional combat support and combat service support units required to support another field army. Signal large headquarters operations companies are not included since the introduction of another major maneuver element into the theater does not require the establishment of other headquarters of theater or theater army size. Command communications links between army group headquarters and its major subordinate headquarters are provided by a signal company tropo. Internal communications for army group headquarters are provided by the signal medium headquarters operations company. The number of signal small headquarters operations companies has also been reduced. The combat support and combat service support units needed to support the operations of another field army may be assigned to existing support brigade or group headquarters until the size and complexity of support operations warrant establishing other similar headquarters. This method of oper-

ation will reduce requirements for signal small headquarters operations companies in the COMMZ.

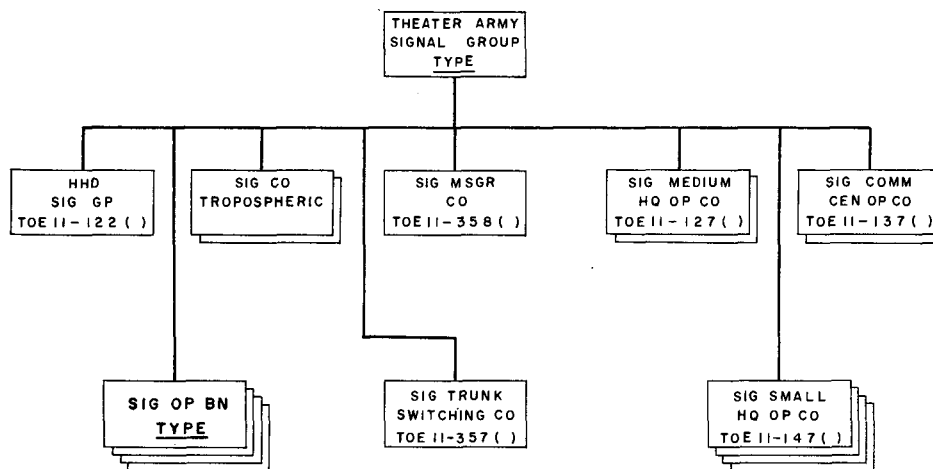
**2-7. Type Signal Organization of an Independent Corps**

Command communications for a corps that is assigned to a field army are furnished by an organic corps signal battalion (FM 11-92), and area communications are provided by an army area communications system. When the corps to which this organic signal battalion is assigned operates independently, however, the requirements for corps signal communications increase so much that they greatly exceed the capabilities of the organic battalion. (For example, both command and area communications systems are required.) To satisfy these increased communications requirements, the organic corps signal battalion, A signal Army area battalion, a signal support company, a signal medium headquarters operations company, a headquarters and headquarters detachment, and other assigned or attached units as required are organized into a type corps signal group (fig. 2-6). This group has communications capabilities similar to, but not equal in capacity to, those of a field army signal brigade. The communications requirements of an independent corps operating in a remote area, in a small theater of operations, and in an oceanic theater are discussed below.



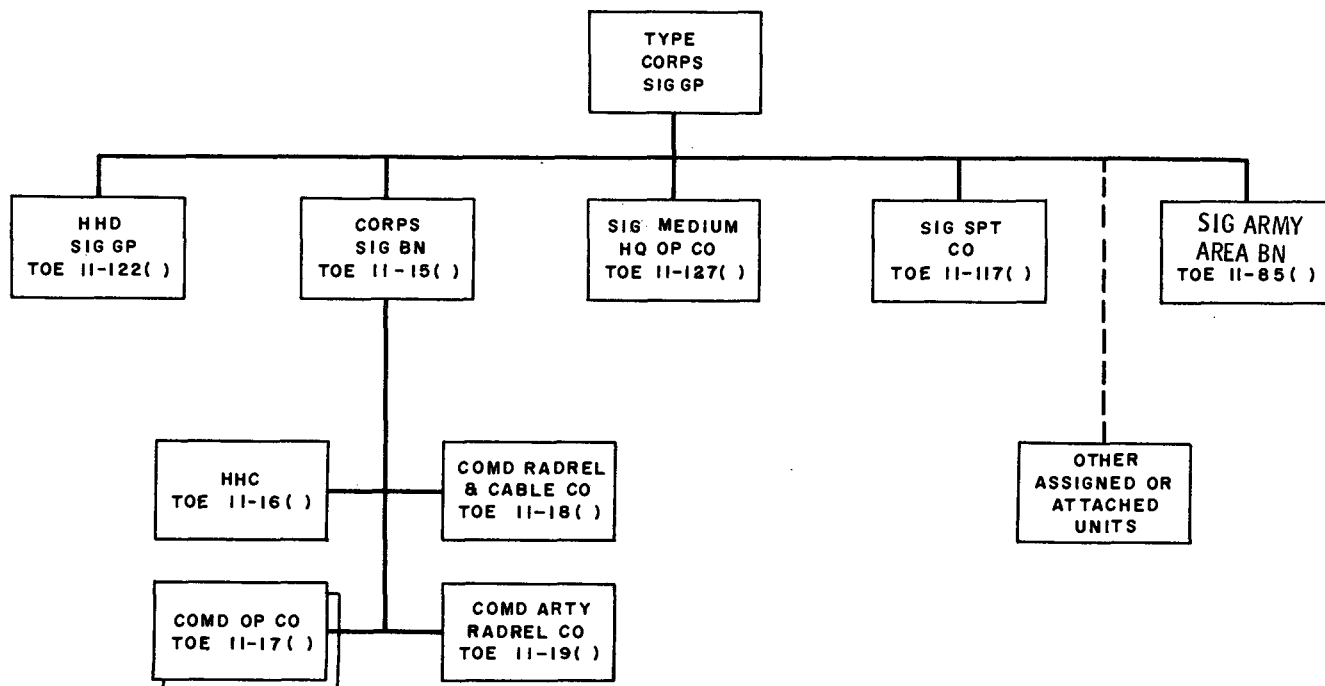
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Figure 2-4. Type USASTRATCOM (theater) modified.



FM 11-23-5

Figure 2-5. Type theater army signal group, modified.



FM 11-367-2-7

Figure 2-6. Type corps signal group, independent corps (remote area).

*a. Independent Corps Operations in a Remote Area.*

(1) *Corps communications.* If the independent corps is to operate at extended distances and the tactical situation or the terrain will prevent effective employment of the multichannel radio (radio relay) equipment normally assigned to the independent corps signal group, the corps signal officer requests appropriate light and heavy tropo units.

(2) *COMMZ communications.* An independent corps operating in a remote area will usually require a COMMZ behind it. To provide the command and area communications required by this COMMZ, a USASTRATCOM (theater) signal group, similar to the signal group shown in figure 2-6, may be sufficient to establish the communications system in support of the corps. Additional units providing communications security, signal construction, and other areas of support are assigned to this signal group as required.

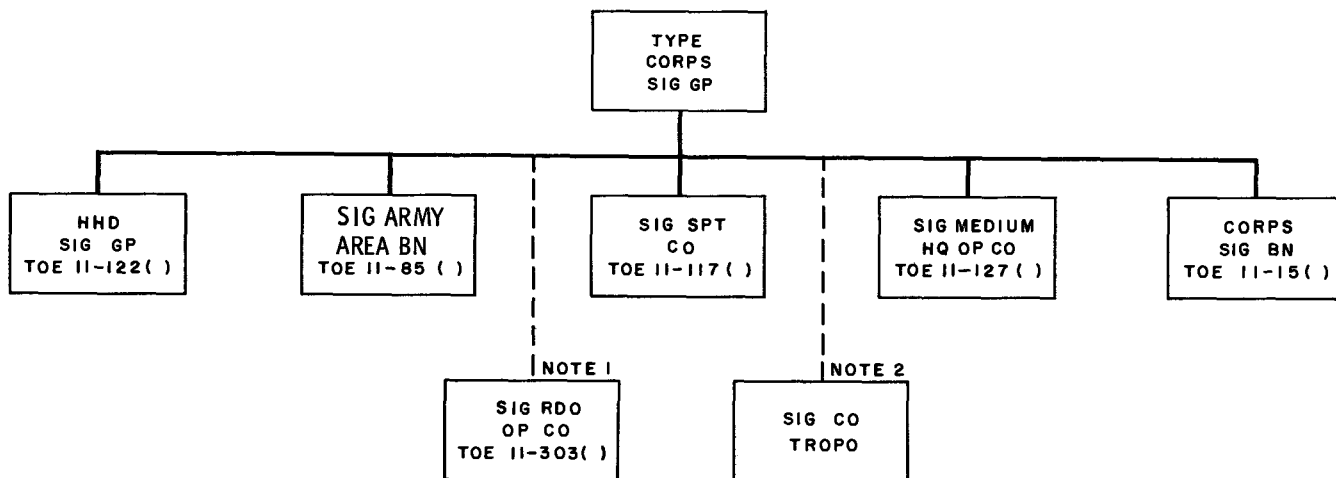
*b. Independent Corps Operations in a Small Theater.* In a small land-mass theater of operations, the independent corps may not require a COMMZ as such. The rear area of the corps may serve as the COMMZ. Under these conditions, the

additional signal group provided by USASTRATCOM (theater) (*a* above) might not be required, and the corps signal group (fig. 2-6) would provide the signal communications required by the corps except for two defense communications system access points which would be provided by USASTRATCOM (theater).

*c. Independent Corps Operations in an Oceanic Theater.*

(1) *Corps communications.* In an oceanic theater the independent corps commander is responsible for all communications throughout his area of operations and must, therefore, establish both command and area communications systems. The independent corps signal group organized as shown in figure 2-6 is insufficient for this purpose, and the type corps signal group shown in figure 2-7 is required. Tropospheric scatter companies may be used to provide both command system links and area system links. Where distances exceed tropo equipment capabilities, a radio operations company (TOE 11-303) will be used to provide high frequency (HF) long distance links.

(2) *COMMZ communications.* In island hopping or peninsula operations, the geographic size of the independent corps area may vary from 100



NOTES:  
 1-AS REQUIRED.  
 2-TOE 11-367 (LIGHT) OR  
 TOE 11-368 (HEAVY)  
 AS REQUIRED.

Figure 2-7. Type corps signal group, independent corps (oceanic theater).

to 150 kilometers (km) in width, and from 200 to 2,500 km in length, up to approximately 8,000 square km. In the island type oceanic theater, isolated islands may be extremely remote from the corps headquarters. However, islands may also occur in clusters, and may be within line-of-sight of other islands. A USASTRATCOM (theater) signal group, similar to that discussed in *a*(2) above, may be sufficient for corps COMMZ communications. On the other hand, the distances involved may require variations in the mix of units providing multi-channel communications. In this case, tropo communications may have a larger role in establishing the COMMZ area communications system, thus reducing the number of area signal battalions needed, and increasing the number of light or heavy tropo companies or teams needed.

## **2-8. Tools for Restructuring Building-Block Type Signal Units**

The type theaters of operation and the tailored USASTRATCOM (theater) organizations developed to establish, operate, and control the TACS in the COMMZ of these theaters of operation point up the fact that no single grouping of signal units can be developed to satisfy all COMMZ communications requirements in all theater army areas of operations. However, USASTRATCOM (theater) units do exist which can be grouped

under command and control elements of various levels to accomplish army signal communication missions in the COMMZ of a given theater. Appendix A lists the table of organization and equipment for USASTRATCOM building-block type units. These tables show organizational structure and state the unit mission, capabilities, and limitations. Field manuals that provide doctrinal information on the employment and methods of operation of each unit are also listed. Other tools, such as TOE 11-500 cellular teams and modified table of organization (MTOE) teams are also available in the tailoring of USASTRATCOM (theater) units.

*a. TOE 11-500 Teams.* If the capabilities of building-block signal units prove to be insufficient to meet specific requirements, they may be augmented by the assignment of TOE 11-500 cellular teams.

*b. Modified Tables of Organization and Equipment.* Another important tool available for unit structuring is the use of an MTOE. This method is employed when additional tasks are assigned to building-block signal units or when a radical change in the mission of the unit requires it to provide services which cannot be accommodated by standard TOE or cellular teams. An MTOE should be prepared and submitted by this unit as prescribed in AR 310-31.





## CHAPTER 3

## COMMAND AND COMMUNICATIONS RELATIONSHIPS

**3-1. General**

Communications for the theater headquarters, and from the theater headquarters to and between component services within a theater of operations, is the responsibility of the theater commander. The theater commander normally will assign the functions of this responsibility to the theater army commander. The theater army commander is responsible for communications support, to include the operational control of terminal signal communications facilities at theater headquarters, and the operational control of the theater army communications system. This operational control responsibility is exercised through the commanding general, USASTRATCOM (theater). The responsibility for providing communications support to combat forces remains with the tactical force commander.

**3-2. Army Signal Brigade Relationships**

The army signal brigade is a major organizational element of the field army. The signal brigade commander is responsible for the installation, operation, maintenance, and operational control of signal communication provided by the brigade. The mission of the army signal brigade is to provide the field army communications system, provide an air and motor messenger service throughout the field army, and operate a ground photographic service for the field army. Detailed information concerning the mission, capabilities, and operational methods of the army command signal operations battalion and the army command signal radio and cable battalion are given in FM 11-95 and FM 11-75, respectively.

**3-3. Strategic Communications Command Relationships**

*a.* The U.S. Army Strategic Communications Command (theater) is the signal communications organization which will provide the entire TACS within the COMMZ. The USASTRATCOM (theater) signal organization is under the operational control of the theater army commander. The commanding general, USASTRATCOM (theater) is

doctrinally charged with establishing, operating, and controlling the TACS. This arrangement assures full responsiveness to the requirements of the army component commander.

*b.* In a theater of operations where the army is the operator of the Defense Communications System facilities, or a significant portion thereof, the USASTRATCOM organization at theater level will include all signal organizations and facilities above field army/field force or the largest tactical maneuver unit except air defense, and supply and maintenance units which provide direct support (DS) and general support (GS) signal maintenance. The commanding general, USASTRATCOM, will exercise sufficient technical control over each USASTRATCOM (theater) to insure army responsiveness to the operational direction and management of the Defense Communications System by the Defense Communications Agency (DCA), and will provide a single point of contact for the DCA in each theater. The commanding general, USASTRATCOM (theater), serves in a dual capacity. He is the commander of USASTRATCOM (theater) and he also serves as the Deputy or Assistant Chief of Staff for communications-electronics on the theater army commander's staff.

*c.* When the mission of a corps requires that it not operate as part of a field army, it is referred to as an independent corps. Under this condition, the independent corps is provided an administrative and logistics capability to provide its own COMMZ (corps COMMZ) by the attachment of a corps support command (COSCOM) which includes selected army combat service support units. When the theater army component commander in the COMMZ to the rear of corps is not the commander of the independent corps, communications in this COMMZ are provided by USASTRATCOM (theater) and are under the operational control of the theater army component commander. If the independent corps commander is also the theater army component commander, communications in the COMMZ to the rear of the corps are under the operational con-

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control of the corps commander even though some of the signal units are provided by USASTRATCOM (theater). Under this command arrangement, USASTRATCOM (theater) is responsible only for providing DCS facilities in the theater

of operations. The independent corps commander is responsible for providing both command and area signal communications systems in his area of operations for combat, combat support, and combat service support units.

## CHAPTER 4

## COMMUNICATIONS REQUIREMENTS

## Section I. USER REQUIREMENTS

**4-1. General**

The total communications requirements between and among headquarters, units, and installations within the COMMZ will depend on many and varying factors. Some of these factors include, but are not limited to, the large volumes of traffic relating to—

a. Voice and record (hard copy) traffic load between theater headquarters and service components headquarters, and between theater headquarters and an allied headquarters.

b. Voice and record traffic load between theater army support command (TASCOM) and the field army support command (FASCOM). Digital data traffic between these two headquarters will be the largest single digital traffic load link in the theater.

c. Traffic generated within and to the theater army air defense command.

d. Traffic generated by rear area protection operations.

e. Area support and mission command message traffic for combat service support action. Because the tempo of activity in the COMMZ will be great, the requirement exists for a communications system capable of handling large volumes of traffic in short periods of time, and capable of rapid expansion in the geographical area without disruption of traffic flow.

**4-2. Major Headquarters Requirements**

The theater, theater alternate, theater army, theater army alternate, theater army support command, major commands, area support command, and area support group headquarters require responsive internal communications systems. These internal systems consist of cable, wire, and radio facilities. Signal units to provide distribution and terminal facilities are available within the USASTRATCOM (theater) to satisfy these requirements, as discussed in chapter 2.

**4-3. Direct Multichannel Communications Requirements**

The voice and record traffic loads between theater headquarters and service component headquarters, and between theater army headquarters and its major subordinate command headquarters are heavy and require direct multichannel communications links. Direct multichannel communications links are provided between theater main headquarters, theater alternate headquarters, and the service component headquarters. Direct multichannel communications links are also required between theater army headquarters, theater army alternate, TASCOM, and the army group or field army headquarters. These direct links form the command communications systems of the TACS. The DCS long haul circuits from the continental United States (CONUS) terminate at the DCS theater access points within the theater, and interface with the theater army communications system which provides direct communications to appropriate major headquarters. In addition, the theater army air defense command provides direct multichannel communications links between its headquarters and its major subordinate elements as required. The channel quality of direct multichannel links must be high to provide reliable voice, teletypewriter, facsimile, and data communications.

**4-4. Tactical Response Communications Requirements**

Tactical response communications requirements in the COMMZ increase during periods of enemy partisan or guerrilla activity. It may become necessary for the theater army commander to commit a large combat force to contain or overcome the partisan or guerrilla activity during such periods and at such locations. Theater army communications *must include mobile tactical communications* facilities to satisfy this requirement. The USASTRATCOM (theater) organization for the COMMZ must be capable of providing these facilities.

#### 4-5. Special Command Communications Requirements

The communications system for the COMMZ must provide special communications facilities for the theater and theater army commanders when they are away from their command posts. These special facilities consist of highly mobile terminal equipments for direct link with their command posts. These special facilities must be secure, self-sustained, highly responsive, and must have sufficient capacity to serve the commanders anywhere within the theater of operations.

#### 4-6. Combat Service Support Requirements

The TASCOM, mission commands, area support commands, and area support groups will generate large volumes of both voice and record traffic required for combat service support actions. The traffic generated by TASCOM, mission commands, and area support command headquarters will be required to insure control and coordination in the delivery of supplies and the provision of services throughout the COMMZ. The communications system to satisfy these requirements must be extensive throughout the COMMZ. It will provide communications service to all combat support and combat service support headquarters, units, and installations. Because the combat support and combat service support headquarters, units, and installations will be randomly deployed throughout the COMMZ, an area communications system will be required. This area communications system will consist of wire, radio, multichannel radio, and messenger facilities.

#### 4-7. Sole-User Requirements

The area communications system cannot satisfy all communications requirements on a common-

user basis because of the precedence or volume of traffic between addressees in the COMMZ. Sole-user circuits must be made available when justified and approved. Normally, sole-user circuits are justified for warning and alert, stability, world-wide intelligence, and air traffic control operations. High volume traffic between certain headquarters, units, and installations also may require sole-user circuits.

#### 4-8. Automatic Data Processing Requirements

The communications system within the COMMZ should be planned and designed to handle data traffic as data processing subsystems are established in the theater. The data subsystem will consist of computer complexes or data processing centers located at headquarters or installations which require their use. At outlying locations, users with input-output devices will be connected electrically to one or more of the computer complexes or data processing centers located at headquarters or installations which require their use. The circuits to interconnect the computer complexes, and to connect the users with the computer complexes, will depend on the type and the amount of data traffic to be handled. Computer complexes may be required at the following locations:

a. Theater headquarters, theater alternate headquarters, theater army headquarters, theater army alternate headquarters, TASCOM headquarters, selected area support group headquarters, mission commands, and the inventory control center.

b. At various headquarters and installations of the theater navy and theater air force.

c. Within the theater army air traffic regulation and identification system.

## Section II. SYSTEMS REQUIREMENTS

#### 4-9. General

The communications system to support the COMMZ must provide sufficient capacity to handle traffic generated therein, and must be capable of adapting to the tactical situation. In addition, it must satisfy certain requirements to handle traffic and to survive in an active theater of operations. Some of these requirements pertain to the type of equipment and to equipment configura-

tions, while others pertain to the mode and type of message transmission and reception.

#### 4-10. Mobility of Communications Equipment

The mobility of communications facilities in the COMMZ varies in accordance with the mobility of the headquarters, units, and installations served. Mobility is also required for the commun-

ications facilities to survive mass destruction weapons. Therefore, the communications facilities are vehicle mounted and are comparable in mobility with the communications facilities of the field army signal units. Currently projected mobile theater army communications equipment is similar to that projected for use in the field army and, compared to current equipment, is more responsive and more versatile. In addition, it has improved survivability characteristics over current equipment and will provide back-up for the field army communications systems.

#### **4-11. Dispersion of Communications Equipment**

The area of the COMMZ will vary in size and will become larger as the combat forces move forward. The COMMZ to support a field army may be considered to be 300 kilometers (km) in width and 600 km in length. As combat operations develop, the size of the COMMZ may be expanded up to 400 km in width and 1,000 km in length. Within this area the combat support and combat service support headquarters, units, and installations will be dispersed to minimize the effect of possible enemy nuclear attack. The dispersion of combat support, and combat service support headquarters, units, and installations requires a corresponding dispersion of communications facilities to insure adequate communications support. Thus, a requirement exists for a communications system which can expand in width and depth to provide the communications service to widely dispersed headquarters, units, and installations. Dispersion will require additional long lines access points, and the capability for resolving these problems is a considered factor in the accomplishment of the signal communications mission.

#### **4-12. Alternate Routing**

Alternate routing is an absolute requirement for communications systems in a theater of operations. The communications system is designed to provide alternate routing to bypass any damaged or destroyed communications facility within the communications system. Within the area type communications system, each transmission center is connected to a minimum of two other transmission centers. In addition, command direct communications links provide a backup for the area type links. High frequency radio teletypewriter and voice radio nets also provide a backup for the

area and command communications links. The communications system provides facilities for the restoration of service after equipment is damaged or destroyed.

#### **4-13. Security of Communications**

The security of a communications system consists of three elements: cryptosecurity, transmission security, and physical security. These elements are covered in paragraphs 6-4 through 6-8.

#### **4-14. Record Traffic**

Headquarters, units, and installations within the COMMZ have requirements to transmit and receive large volumes of record traffic. The requirements for this electrically transmitted hard copy necessitate the use of transmission media such as teletypewriter (including tape relay), facsimile, and data input-output devices. In addition to hard copy transmitted by electrical means, large volumes of correspondence, maps, map overlays, data files, and other bulky items must be processed and transmitted by other means. A messenger service is established to satisfy this requirement.

#### **4-15. Switching Facilities**

The communications systems in support of the COMMZ must provide for both local and long distance switching. There is a requirement for switching at transmission centers, major headquarters, and communications centers serving units on an area basis. There is also a requirement for trunk switching centers for long distance tandem trunking within the area type portion of the communication system. The size of the switching facilities provided depends on the number of long distance circuits served by the facility.

#### **4-16. Terminal Facilities**

The terminal communications equipments of headquarters, units, and installations are predicated upon the amount, types, and destination of traffic.

a. The signal large and medium headquarters operation companies have terminal equipments with a simultaneous multiple-address transmission capability in order to economically process a message to several addressees. Multiple-address transmission equipment is at tape relay centers located at each of the major headquarters within COMMZ.



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b. The meteorological services and the military police activities in the COMMZ require facsimile service. Therefore, the terminal facilities serving these activities will require facsimile equipment.

c. Encrypted terminal-to-terminal service for hard copy traffic is required on both an on-line and off-line basis. In addition, some user-to-user voice encryption is required.

#### **4-17. Messenger Facilities**

The communications system for the COMMZ provides both local and long distance messenger service. The local messenger service delivers messages in a relatively small area of the COMMZ and the long distance messenger service delivers messages throughout the COMMZ.

#### **4-18. Radio Netting Facilities**

The requirement for radio netting facilities within the COMMZ is not as extensive as it is in the combat zone. The circuit and channel requirements for radio netting make single channel multistation nets undesirable. The number of channels required precludes the use of conventional HF single sideband (SSB) systems; point-to-point multichannel links (command system) constitute the most effective method of meeting the requirements for radio communications within the COMMZ. Thus, each major headquarters in the COMMZ requires point-to-point multichannel radio links. The channel requirement can best be met by using multichannel troposcatter radio equipment. High frequency single sideband radio equipment is provided as backup to selected troposcatter links, to alert warning nets, and to stability operations control nets.

## CHAPTER 5

COMMUNICATIONS DOCTRINE FOR  
THEATER ARMY COMMUNICATIONS SYSTEMS**5-1. General**

a. The communications systems to support the headquarters, units, and installations established within the COMMZ consist of a multimeans, multi-axis, integrated network extending from the rear of the theater, through the COMMZ, and interfacing with the communications systems of the combat zone. The theater army communications system must also interface with the defense communications system at theater access points. The TACS must be secure, reliable, flexible, and survivable to meet the communications demands placed upon it. The TACS consists of long lines radio and cable trunking systems, communications centers, patching and switching facilities, and multichannel access systems. The TACS varies in composition and magnitude from one theater to another depending on many operational, terrain, and tactical considerations. Thus, the TACS cannot be predetermined and must be planned and engineered concurrently with operational planning.

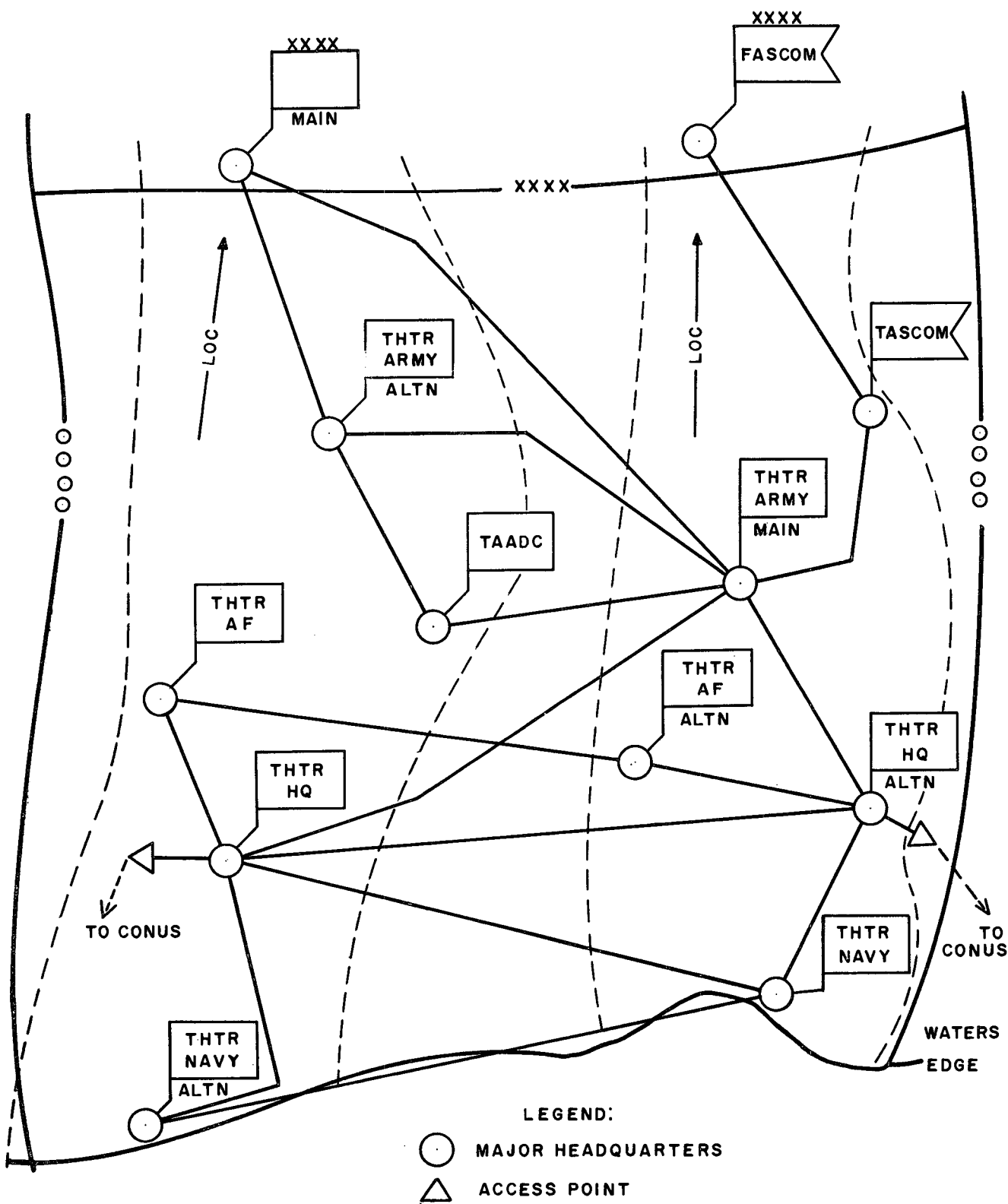
b. The theater commander is responsible for providing communications between component services, joint task forces, and other governmental agencies within the theater of operations. Normally, the theater commander delegates the functions of this responsibility for signal communications to the component commanders, and to commanders of joint task forces. In a large landmass type theater of operations, the theater commander will delegate the function for communications to the theater army commander. The theater army commander normally retains the functions for communications in the COMMZ while assigning the responsibilities for communications within the combat zone to the major maneuver force commander.

c. A theater of operations is divided into a combat zone and communications zone. The manner of organizing and controlling communications for the combat zone and the COMMZ is different. The major difference between COMMZ and the com-

bat zone communications is that the combat communications are provided by signal units organically assigned to field army, corps, and divisions. The field army provides area communications system support to those subordinate elements not having an organic area communications capability. In the COMMZ, communications systems are established through the use of building block signal units to provide the required COMMZ communications. The COMMZ is that area of operations to the rear of and contiguous to the combat zone. The COMMZ is organized vertically into LOC extending from the port area or base of support, to the rear area of the combat zone. The LOC's consist of areas for the organization of supply, maintenance, and services, and for their movement by railway, highways, inland waterways, and air transport into the combat zone. The organizational and operational considerations of the theater army in the COMMZ make centralized control the most desirable method of operations. Therefore, the TACS to support the COMMZ is installed, operated, maintained, and controlled by the USASTRATCOM (theater). Because of the organizational and operational concepts of the COMMZ, the TACS to support the headquarters, units, and installations located therein consists of both a command communications system and an area communications system.

**5-2. Command Communications System**

The command communications system (fig. 5-1) consists of multichannel communications links connecting the major headquarters within the theater of operations. For example, in the COMMZ for a theater of operations, several major headquarters such as theater, theater army, theater navy, theater air force, and TASCOM are established. These headquarters are interconnected with direct multichannel communications links for command and control of theater operations. Communications links are required from theater headquarters to DCS access points, theater alternate, theater army, theater navy, and theater



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Figure 5-1. Type COMMZ command communications system.

air force headquarters. Direct links are also required from theater army headquarters to theater army alternate, TASCOM, army group or field army, and allied field army headquarters. In addition, direct communications links may be required between other major headquarters when the area communications system cannot satisfy the communications requirements between these headquarters. For example, direct communications links may be required between the TASCOM and FASCOM headquarters. These direct communications links are provided by tropo, single channel radio, multichannel radio, or cable facilities.

*a. Tropospheric Scatter Communications Links.* The command communications system of the TACS is provided primarily by multichannel tropo links. Tropo provides highly reliable, multichannel, link-secured (with appropriate security equipment) communications links. In comparison to multichannel radio links, tropo links have the following advantages:

(1) They require fewer personnel than multichannel radio (radio relay) systems if the distance to span is greater than 100 km.

(2) The vulnerability of the communications links and the installation time are less because repeaters are not required.

(3) Over long distances, reliability is increased because there are fewer items of equipment involved, i.e., repeaters.

(4) Tropo equipment does not always require hilltop positions (para 13-24 and 14-23).

(5) Tropo is less vulnerable to known enemy electronic warfare systems.

*b. Multichannel Radio Communications Links.* Although tropo equipments are the primary facilities used for direct links, multichannel radio equipments should be considered for direct links when multichannel radio is more economical or will satisfy the communications requirements. For example:

(1) High capacity multichannel radio (48/96 channels) may be more economical for direct communications links when many channels are required and the links do not require repeaters.

(2) Medium capacity multichannel radio (12/24 channels) may be more economical when relatively fewer channels are required.

*c. Wire and Cable Facilities.* Wire and cable facilities are installed as required in long lines communications systems. However, when the COMMZ is established in an area where extensive indigenous wire and cable facilities exist, these indigenous facilities should be utilized to the fullest extent. In such situations, wire and cable circuits should be used for direct communications links between headquarters. In addition, multichannel cable systems may be installed as direct links if electronic warfare becomes a factor.

*d. Switching and Patching Facilities.* Switching and patching facilities are provided major headquarters such as theater, theater army, and TASCOM. The size of the headquarters, the number of staff personnel, and the amount of signal traffic generated by the headquarters determine the size of the switching and patching facilities.

(1) *Patching facilities.* Each headquarters is provided a patching panel that is capable of both four- and two-wire service. This patching panel is provided for the control of trunk and long local circuits and for the routing of these circuits into the main frames and distribution points of a headquarters complex. Each patching panel includes test equipment for checking the serviceability of circuits.

(2) *Switching facilities.* The switching facilities for major headquarters are provided by multiposition manual telephone switchboards or automatic electronic switching equipment.

*e. Communications Centers.* Communications centers are provided at major command headquarters for operations in the command communications system. The communications center (COMM-CEN) capability provided at each headquarters is determined by the size of the headquarters and the volume of message traffic generated. Each headquarters is provided facilities for tape relay, manual teletypewriter, COMSEC, messenger, and message center service.

(1) *Tape relay facilities.* The majority of command message traffic handled for theater, theater army, and TASCOM will average approximately five addresses. To prevent message processing and transmission delays, the tape relay facilities provided these headquarters have multiple address routing capabilities.

(2) *Manual teletypewriter facilities.* Each major command headquarters is provided a manual teletypewriter facility to handle teletypewriter traffic. Subordinate commands, not directly

connected into the command tape relay system, will pass traffic through the small communications centers providing area-type coverage.

(3) *COMSEC facilities.* Although the long lines communications links throughout the command communications system employ link security equipment, a requirement exists for terminal COMSEC facilities. The size and composition of the COMSEC facilities provided are predicated upon the size of the headquarters and the amount of classified traffic. To provide on-line terminal COMSEC service, each crypto center will use the equipment and circuitry in the tape relay and manual teletypewriter facilities. On-line encrypted messages thus may be handled over tape relay or single address manual teletypewriter circuits.

(4) *Teletypewriter conference facility.* Each major command headquarters, such as theater, theater army, and TASCOM, is provided secure teletypewriter conference (TELECON) facilities for command and operational traffic. TELECON circuits are established through coordination with TACS control and the technical control at lower echelons of the USASTRATCOM (theater).

(5) *Voice COMSEC facilities.* Voice enciphering equipment is authorized to commanders and staff officers at major headquarters as prescribed by the theater commander.

(6) *Message center facilities.* The message center section of the communications center is the message processing and handling activity serving the headquarters. The message center section maintains constant surveillance over the availability of transmission means terminating within the communications center. The message center section must be large enough to process and route outgoing messages, and to process and dispatch incoming messages to the staff message control facility of the headquarters served.

(7) *Messenger facilities.* The communications service provided a headquarters includes signal messenger service in the general vicinity of that headquarters. These messenger teams also deliver and pick up message traffic at message relay stations of the long distance messenger service. Outgoing messages are delivered to the message relay stations and incoming messages are picked up and delivered to message center sections for redistribution to the staff message control facility of the headquarters. The reproduction and distribution of messages within the

headquarters. The reproduction and distribution of messages within the headquarters is the responsibility of the adjutant general element of the headquarters is the responsibility of the adjutant general element of the headquarters. Signal personnel are not provided for this purpose. Nonscheduled messenger service will be provided for high priority operational message traffic.

(8) *Radioteletypewriter facilities.* HF SSB radio teletypewriter facilities are provided for major headquarters within the COMMZ. These facilities provide point-to-point, secure radio teletypewriter links to higher, lower, and adjacent command headquarters, as a backup to the command multichannel radio, tropo and cable links. In addition, these facilities may be used to establish alert warning and rear area protection control nets, and to provide communications for the commander when he is away from the headquarters complex.

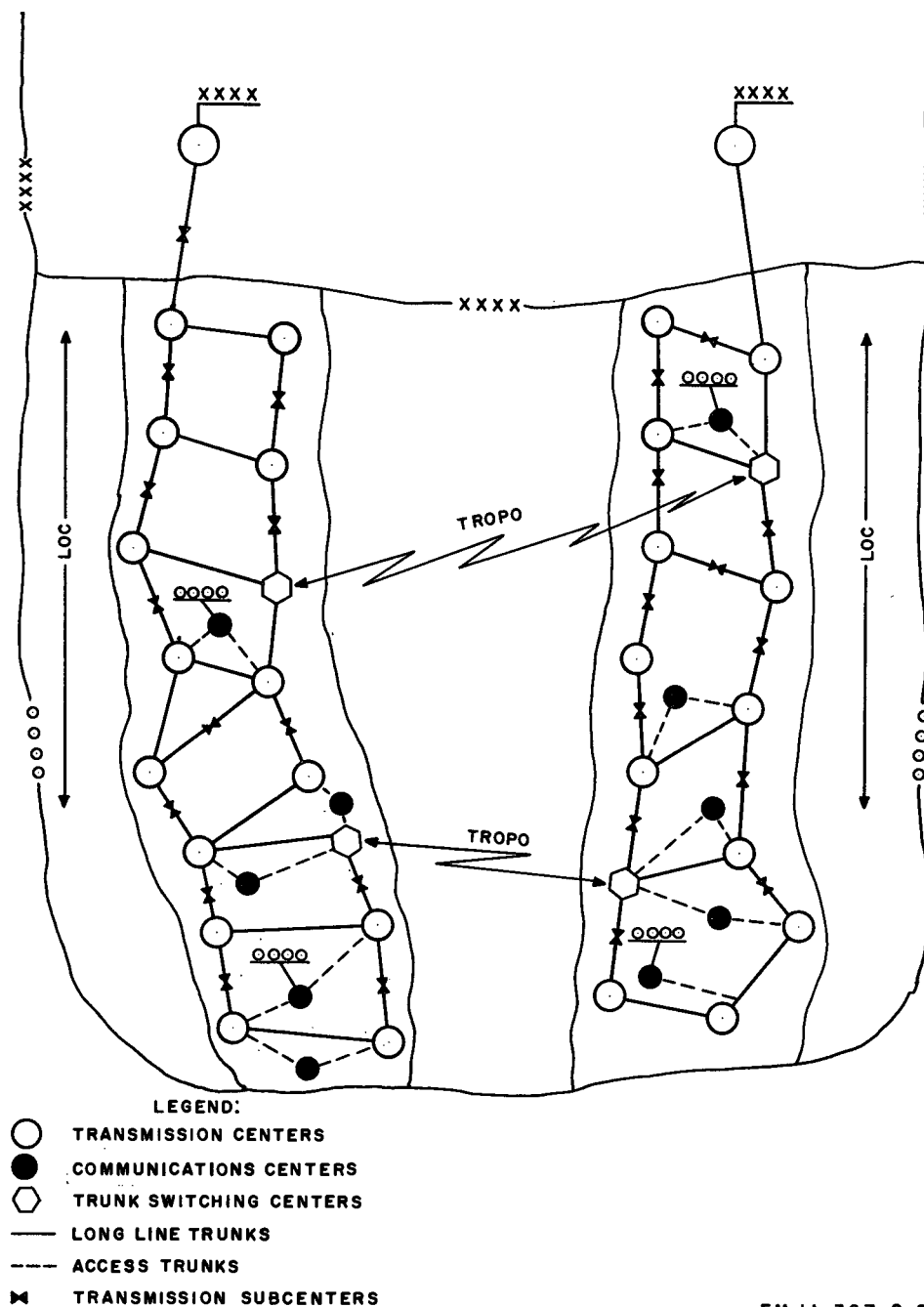
### 5-3. Area Communications System

In the COMMZ of a theater of operations, many subordinate commands of the theater army are established to provide combat, combat support, and combat service support to headquarters, units, and installations. These subordinate commands are widely dispersed throughout the COMMZ and require extensive communications for coordination of operations. These communications requirements are satisfied by the area communications system of the TACS.

*a. Long Lines Multichannel Radio.* The long lines multichannel radio system consists of transmission centers, transmission subcenters, and trunk switching centrals. These installations are dispersed along the lines of communications to provide long lines trunking, patching, and switching. Figure 5-2 shows how these centers and subcenters may be interconnected to form the area communications system. Microwave multichannel radio is the principal means used for the links. However, tropo radio and cable communications systems may be used.

(1) The transmission centers (fig. 5-3) contain the microwave terminals and also provide for patching and switching long line trunk circuits. At a transmission center, each system may be demodulated and the circuits connected at voice frequency into the patching panel. From the patching panel, some circuits are terminated in a switchboard. Other circuits may be routed





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Figure 5-2. Type COMMZ area communications system.

through the transmission center without switching.

(2) The transmission subcenters primarily provide extension of the multichannel radio links; however, when a channel drop or insert capability is required, a patching panel must be

provided for this purpose. A channel drop and insert capability is desirable when small units are located near the relay points. They can be connected into the long lines system by field wire and field cable. Each transmission center has a trunk switching capability.



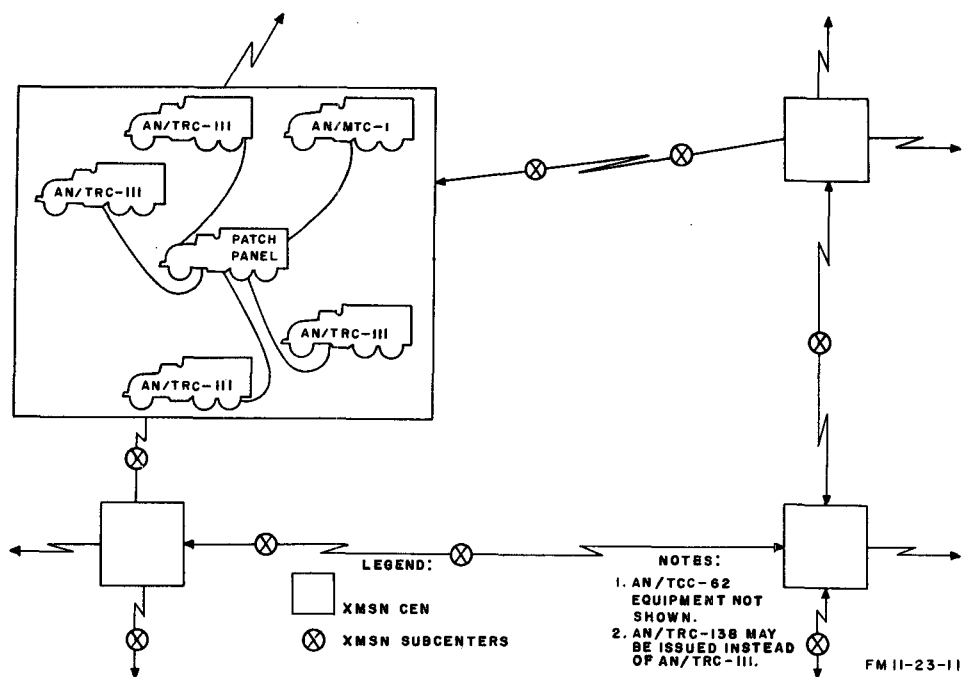


Figure 5-3. Type equipment configuration at transmission center.

b. *Troposcatter Radio.* While tropo equipment is used primarily to provide command links, additional equipment is provided to establish overjump links. The multichannel radio long lines facilities provide a rerouting capability between transmission centers. Should a transmission center become inoperative, overjump tropo links will augment the reroute capability.

c. *Multichannel Radio Access Links.* Multichannel radio access links are required to connect headquarters, units, and installations into the long lines multichannel radio system. These access links may consist of only a single hop or they may consist of multiple hops provided by multichannel radio repeaters.

d. *Landline Carrier Access Systems.* In addition to multichannel radio access links, landline carrier (multiplex) access systems will be required (fig. 5-4). Landline carrier access systems consist of coaxial cable with associated repeater and carrier equipments. These systems may connect the headquarters, units, and installations with transmission centers, or with transmission subcenters which have a channel drop-and-insert capability. When units or installations are located near these transmission centers or transmission subcenters and there requirements consist of only

a few circuits, field wire or field cable may be used to connect the units or installations into long lines multichannel radio system.

e. *Radio Wire Integration Facilities.* Another means of providing user access into the area communications systems is through the use of radio wire integration (RWI) facilities. RWI facilities are provided all large, medium, and small headquarters and area communications centers. Units having vehicular radio equipment can employ RWI to gain access to the area communications system.

f. *Switching and Patching Facilities.* Switching and patching facilities within the area communications system are provided at transmission centers and trunk switching centrals. Communications centers also have a trunk switching capability. Each transmission center and switching central is provided patching panels capable of four- or two-wire operations. The facilities within the patching panels include equipment for the testing of long lines and long local cable, wire and radio relay circuits.

g. *Area Communications Center Facilities.* Located along the LOC's are many small units and installations which require communications serv-

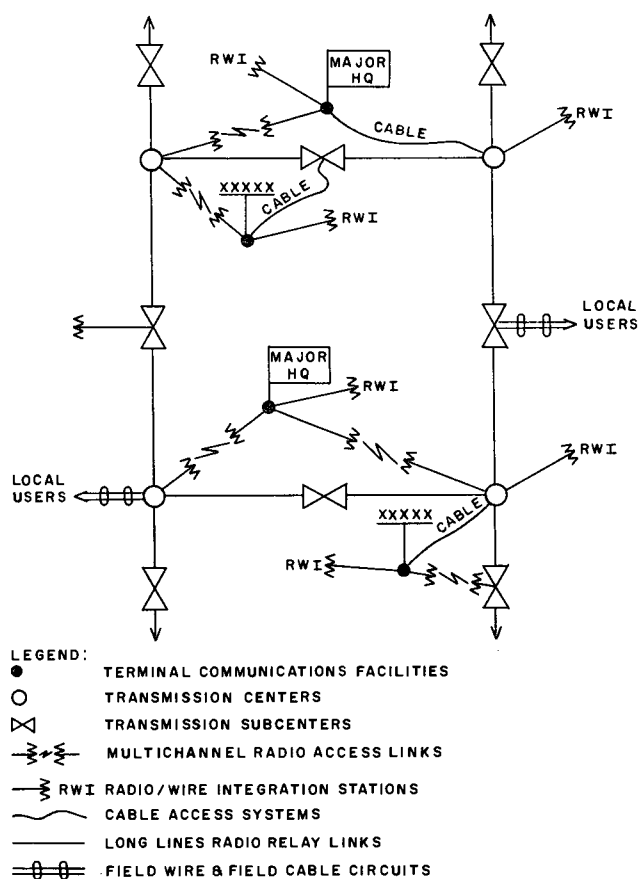


Figure 5-4. Type multichannel radio and landline carrier access facilities.

ices. Signal center platoons are located in the areas of high troop density to provide communications service to these units on an area basis. The area communications centers are connected to units and installations by field wire or field cable circuits, and to the long lines trunking system by multichannel access facilities. The area communications centers provide message center, teletypewriter, COMSEC, radio teletypewriter, radio wire integration, and messenger service.

(1) *Message center facilities.* A message center section is included in each communications center. This section maintains traffic logs and records, has cognizance of the communications situation, and prescribes the means by which message traffic will be transmitted.

(2) *Teletypewriter facilities.* A teletypewriter facility is provided each area communications center. This facility will receive hard copy message traffic to be introduced into the manual tele-

typewriter system from small units and installations within the area. Point-to-point circuits may be established between the teletypewriter facility and those organizations having organic teletypewriter equipment. Incoming teletypewriter traffic will be delivered by messenger to those units and activities not having organic teletypewriter equipment.

(3) *COMSEC facilities.* Both on-line and off-line COMSEC equipment is required. This equipment is provided to encipher and decipher classified teletypewriter traffic.

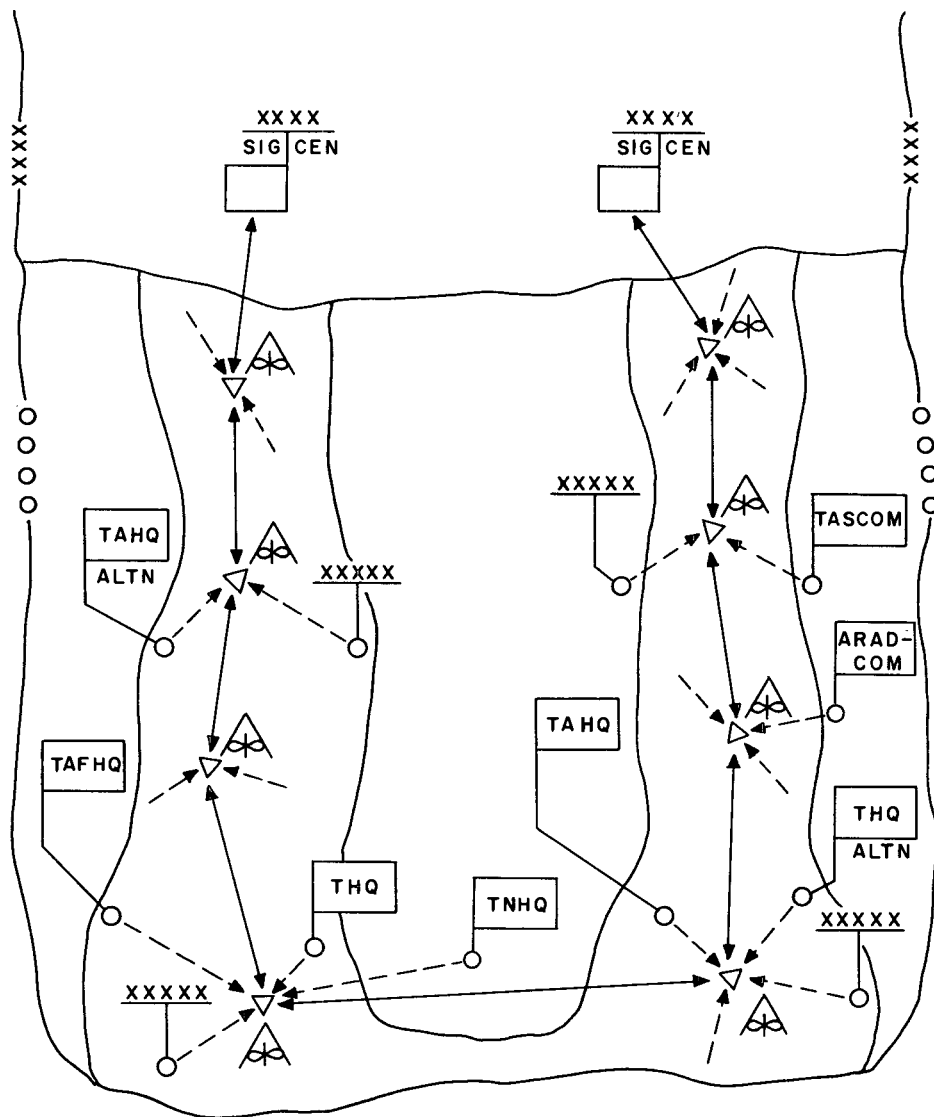
(4) *Radio teletypewriter facilities.* Each area communications center is provided HF SSB/radio teletypewriter equipment. Normally, these sets are employed as terminal stations in an operational net, such as alert warning nets, or as backup for the area communications system.

(5) *Radio wire integration facilities.* Radio wire integration facilities are provided each area communications center. These facilities provide access to the area communications system for those units and organizations that have organic vehicular radio sets.

(6) *Messenger facilities.* Local messenger teams are provided at each area communications center. These teams provide scheduled and non-scheduled messenger service to all units within the area of responsibility of the area communications center. These teams also provide message pickup and delivery to the message relay stations provided by the signal messenger company.

*h. Long Distance Messenger Service.* The headquarters, units, and installations located within the COMMZ generate large volumes of message traffic that is bulky or of low priority and therefore not suited for electrical transmission. To move this message traffic between the headquarters, units and installations, a messenger service is established. This messenger service includes both air and motor messengers. Figure 5-5 shows a type messenger communications system (COMMZ).

(1) *Air Messenger service.* The air messenger service is provided by fixed and rotary wing aircraft. Normally, the fixed wing aircraft provide scheduled messenger service between the message relay stations. Rotary wing aircraft provide scheduled messenger service to the small communications centers and the message relay stations. Unscheduled messenger service is provided by either fixed or rotary wing aircraft as required.



LEGEND:

- ↔ LONG DISTANCE MESSENGER RUNS
- - - LOCAL MESSENGER RUNS
- △ MESSENGER RELAY STATIONS
- COMMAND COMMUNICATIONS CENTERS
- AREA COMMUNICATIONS CENTERS
- ⊕ LANDING STRIP

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Figure 5-5. Type messenger communications system (COMMZ).

(2) *Motor messenger service.* The primary purpose of the motor messenger service is to provide a relay type messenger service throughout the COMMZ. Motor messenger teams, stationed at message relay stations located approximately 100 km apart along the axis of communications, provide long distance messenger service.

#### **5-4. Special Communications Requirements**

The theater army communications system is sufficiently flexible and has the necessary capacity to satisfy the common user and normal allocated channel requirements for railway systems, POL distribution, air traffic regulation and identification, and rear area protection operations. Contingency planning for operations in any specific area of the world will necessitate minor modifications to theater army communications systems and organizations. The TACS will satisfy known minimum essential requirements in the more probable areas of employment of a large theater signal system. However, it will not provide internal communications system for these special purpose activities. Unusual requirements must be met on an individual basis by establishing special signal facilities.

#### **5-5. Indigenous Communications Facilities**

Requirements for the construction of new communications facilities within a theater of operations should be kept to a minimum. In many instances, this can be accomplished by rehabilitating indigenous communications facilities to serve both the U.S. military forces and the host nation government. Rehabilitated indigenous facilities may be used in the theater command communications system; they may also be used in the area communications system to provide access links. Unless indigenous communications facilities are under U.S. control and are fully protected, they may be less reliable and more subject to sabotage than U.S. facilities. If indigenous communications facilities are not available, communications requirements must be met by the TACS.

#### **5-6. Doctrinal Employment of Communications Systems**

In a large landmass theater of operations, the theater army requires a signal communications system with facilities and equipment to operate direct point-to-point communications providing optimum responsiveness to national and theater command needs. The command and area commun-

ications systems, deployed simultaneously, satisfy these needs. As a communications zone established between port areas and the rear boundary of a tactical maneuver element expands, and the territory to the rear of a field army is secured, fixed plant communications equipment and compatible indigenous communications networks may be integrated with the COMMZ area communications system. The doctrine of a command system superimposed on an area system provides the optimum communications system for a COMMZ. The command system provides the theater commander and theater army commander with the means to exercise command and control of combat operations; the area system serves the needs of the combat support and the combat service support elements. The two systems are also complimentary because the communications centers at the major command and major subordinate command headquarters have access to both of the systems. Thus, when command headquarters move or when portions of either system become inoperative, high precedence traffic being passed over the affected system may be rerouted through operating portions of the other system.

#### **5-7. Communications System Planning Objectives**

To provide flexibility and survivability during combat operations, communications system planning objectives must include the following:

- a. Simplicity of system design.
- b. Simplicity of operation.
- c. Positive command control over mobile and widely dispersed organizations.
- d. High mobility characteristics.
- e. Standardization of equipment (to reduce training requirements).
- f. Integration capability with joint and allied communications systems.
- g. Reduction in logistics support requirements.
- h. System expansion capability to meet additional operational demands.

#### **5-8. Wire Doctrine**

Signal communications elements of USASTRATCOM (theater) install wire circuits for units, organizations, and activities within their area of responsibility. These circuits provide access to the area communications system as follows:

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a. To group, separate battalion, and separate company headquarters.

b. To activities and installations, when located more than 5 km from the next higher echelon, that introduce signal traffic directly into the common-user system without reference to a superior headquarters.

c. To battalions and companies not collocated with the next higher headquarters.

### 5-9. Messenger Doctrine

a. *U.S. Army Strategic Communications Command Units.* These units having organic local messenger capability are responsible for providing local messenger service for the supported headquarters, and between the supported headquarters and the headquarters of the following:

(1) Groups, separate battalions, separate companies, and separate installations of the supported headquarters complex not having their own organic messenger service or access to the TACS long distance messenger service.

(2) Battalions, companies, and installations not collocated with their next higher echelon of command and not having their own organic messenger service or access to the TACS long distance messenger service.

(3) Between the supported headquarters and the message relay stations.

b. *Long Distance Theater Messenger Service.* A long-distance theater air and ground messenger system having an objective 24-hour service schedule is established by the signal messenger company. It operates in the area from the rear of the COMMZ to the rear of the field army. The system, consisting of message relay stations installed and operated along the axis of the LOC's and where possible collocated with signal communications centers, provides long distance mes-

senger service for headquarters supported by units of the USASTRATCOM (theater). The motor messenger teams of the messenger service. Fixed-wing aircraft of the system provide scheduled messenger service between the message relay stations. Rotary-wing aircraft provide scheduled messenger service to the small type communications centers. Nonscheduled air messenger service is provided as required, but serves principally the major headquarters in the COMMZ.

### 5-10. Signal Center Doctrine

A signal center, installed, operated, and maintained by a signal organization of USASTRATCOM (theater), is provided each of the large, medium, and small headquarters located within the COMMZ. There are two *types* of signal center installations: a command signal center and an area signal center. A command signal center provides communications support to a specific command and, when required, to units within its immediate vicinity. An area signal center provides communications support within its geographical area of responsibility to all units requiring communications center services to supplement their organic means.

### 5-11. Tropospheric Scatter Doctrine

In the COMMZ of a theater of operations, where major headquarters such as theater, theater army, theater navy, theater air force, and TASCOCOM require extended distance highly reliable, multichannel communications links for command and control of theater operations, tropo links are used. The command communications system of the TACS is provided primarily by tropo links. Tropo links also are provided to establish other headquarters-to-headquarters links as required, for restorative purposes and to provide an over-jump capability.



## CHAPTER 6

### SECURITY AND TRAINING

#### STANAG 2079

*Note.* The information in this chapter pertains, as applicable, to all signal units described in Part Two and subsequent parts of this manual. Information unique to a specific signal unit will be included in the description of that unit.

#### Section I. PHYSICAL SECURITY

##### 6-1. General

Physical security includes those measures taken to protect the unit against the following:

- a. Attack by enemy ground, air, and airborne elements.
- b. Chemical and biological warfare attack.
- c. Nuclear burst and the resultant radiological activity.
- d. Enemy guerrilla activity.
- e. Enemy observation.

##### 6-2. Mission Diversion

The missions of signal units require them to furnish communications support on a 24-hour basis. Under certain conditions, the dispersion of units may require that considerable amount of the communications support efforts of the units be diverted from communications to provide necessary physical security for their installations. To insure the maximum productive use of the units' communications capability, security for the units' installations within the areas of the various supported headquarters must be assumed by the troops that provide the security forces for these headquarters.

##### 6-3. Installation Security

Physical security for communications facilities is

required to insure that these facilities may operate undisturbed by local enemy action. This security may be provided by the headquarters that is supported by the communications facilities, or it may be provided by the element of the signal unit that is responsible for the communications facilities. A summary of installation security information is presented in *a* through *c* below.

*a. Perimeter Defenses.* The perimeter defenses of the supported headquarters provide the physical security required by signal elements that may be located within that perimeter.

*b. Site Defenses.* Many communications sites are installed outside the defense perimeters of the supported headquarters. Depending on local conditions, physical security for these installations may be provided by the signal element, but usually must be provided by the supported headquarters. Refer to FM 7-15 and FM 21-75 for detailed information on individual and small unit defense actions.

*c. Stability Operations Security.* During stability operations (para 6-9 through 6-11) it may be necessary for signal elements to be established in hostile, nongovernment controlled areas. If the parent organization cannot provide both the necessary physical security for these sites and adequate communications support, requests are made for support by physical security forces. According to the circumstances, either United States or host country forces may provide this support.

#### Section II. ELECTRONIC WARFARE AND COMMUNICATIONS SECURITY

##### 6-4. General

The mission of many signal units makes them especially lucrative targets for signal intelligence and electronic warfare exploitation. Signal units

must utilize all available communications security and electronic counter-countermeasures to reduce the impact of such exploitation on unit operations.



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**6-6. Electronic Warfare**

All actual or suspected jamming and imitative communications activities by the enemy will be reported to the net control station (NCS). To reduce the effects of jamming, special attention is required to the provisions for alternative means of communication. General guidance for employment of electronic counter-countermeasures in unit radio operations is provided in FM 32-20.

**6-6. Communications Security**

Communications security is defined as the protection resulting from all measures designed to deny to unauthorized persons information of value which might be derived from the possession and study of telecommunications, or to mislead unauthorized persons in their interpretations of the results of such a study. Communications security includes cryptosecurity, physical security, and transmission security.

*a.* Cryptosecurity is that component of communications security which results from the provision of technically sound cryptosystems and their proper use.

*b.* Physical security, as included here, is that part of communications security concerned with physical measures designed to prevent unauthorized access to equipment, facilities, material, and documents. Refer to AR 380-5 and AR 380-40 for detailed information.

*c.* Transmission security is that component of communications security which results from all measures designed to protect transmissions from unauthorized interception, traffic analysis, and imitative deception.

**6-7. Application of Communications Security**

The basic objective of COMSEC is to prevent unauthorized personnel from gaining useful information from communications. This objective can only be realized if all personnel are security conscious and are aware of their personal responsibilities in this regard. COMSEC should be a habit . . . a state of mind developed through training and application in daily routine. All personnel should be thoroughly familiar with and follow the security practices designed to minimize the value of communications as a source of intelligence to unauthorized personnel. A summary of the more basic practices for effective COMSEC

follows. (Refer to FM 32-5 for a more detailed discussion.)

*a. Cryptosecurity.*

- (1) Use only authorized cryptosystems.
- (2) Insure strict compliance with the operating instructions.
- (3) Use cryptosystems designed to provide the degree and term of security required.

*b. Physical Security.*

- (1) Maintain proper safeguards against capture, theft, or unauthorized observation of messages and COMSEC materials at all times.
- (2) Maintain adequate emergency evacuation and destruction plans and practice them frequently.
- (3) Guard against carelessness and laxity by frequent inspections and tests of security measures.

*c. Transmission Security.*

- (1) Use radio transmission only when other means of communications are not adequate.
- (2) Be aware that all means of transmission, not only radio, are subject to interception by unauthorized personnel. Restrict unclassified plain language transmission to a minimum.
- (3) Maintain circuit discipline and avoid extraneous transmissions.
- (4) Assign call signs/words and frequencies in a random manner and change them simultaneously at frequent intervals.
- (5) Make transmissions brief.
- (6) Use broadcast and intercept transmission methods when possible.
- (7) Use only prescribed communications operation procedures.
- (8) Use authentication properly.
- (9) Use minimum power required.

**6-8. Communications Security Assistance**

COMSEC assistance for facilities used by signal units may be provided, as appropriate, by tactical support elements of the U.S. Army Security Agency (USASA) group of a field army or by USASA (theater) headquarters, in accordance with AR 10-122.

### Section III. STABILITY OPERATIONS

#### 6-9. General

Stability operations is that portion of internal defense and internal development operations provided by the U.S. Army to maintain, restore, or establish a climate of order within which responsible government can function effectively and without which progress cannot be achieved. The field army or other organization to which a signal unit is assigned may operate in these stability operations. When the field army, for instance, is engaged in such operations, each signal unit adapts its standing operating procedures (SOP) to the local situation and performs its regular communications mission for the field army.

#### 6-10. Additional Functions in Stability Operations

In addition to performing its regular mission in support of a field army or other unit, a signal unit, as applicable, may be assigned the following additional functions:

*a. Civil Emergency Communications.* The unit may have to assist in establishing civil emergency communications if communications facilities in the area have been damaged beyond use or if they never existed.

*b. Civil Communications Extension.* The unit may have to extend existing civil communications

facilities if such extensions are required by the civil internal defense effort of the receiving state.

*c. Friendly Military Communications.* Augmenting the communications capability of friendly forces may be an additional function of a signal unit. This function may be generated by international U.S. commitments with respect to internal defense and internal development operations.

*d. Advice and Assistance.* Technical advice and assistance in the field of communications may be another additional function. Such advice and assistance with respect to the stability operations of a U.S. force may be in connection with either the training activities or the tactical operations of military forces of the receiving state.

#### 6-11. Capability Reduction

When a signal unit is committed to fulfill the above additional functions to any great extent, it normally will have to divert personnel and equipment from its regular mission. This results in a reduced capability to satisfy normal communications requirements. A detailed discussion of the effects of internal defense and internal development operations on signal communications is contained in FM 11-57 and FM 24-1. The following manuals contain detailed information on doctrine and procedures concerned with internal defense and internal development operations: FM 31-16, FM 31-22, FM 31-22A, FM 33-1, and FM 100-20.

### Section IV. DEFENSE AGAINST ENEMY AIRCRAFT

#### 6-12. General

In any combat theater, all units must realize the threat of attack by enemy aircraft and must be prepared to take action against the attack. The attack may be in the form of air strikes, aerial reconnaissance, and airmobile operations. Actions that might be taken against such air attacks may be either passive or active. Because an active defense may also present danger to friendly troops and installations, an active defense must be a command decision. The air defense plan of the supported headquarters, based on theater headquarters doctrine, will define when and how active or passive defense will be employed against enemy aircraft. Commanders must insure that their units are familiar with the air defense plans of the supported headquarters.

#### 6-13. Passive Defense Measures

The effectiveness of enemy air attacks may be curtailed to some extent by employing passive measures such as camouflage and dispersion. Passive measures should always be in effect to decrease the possibility of surprise attack by enemy aircraft. It may be more important to employ passive measures against enemy aircraft than to actively engage the aircraft and disclose the location of the supported headquarters.

#### 6-14. Active Defense Measures

Active defense against enemy aircraft is emphasized because large volumes of small arms fire are capable of destroying both high-speed and low-speed aircraft or disrupting their attack. To max-

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imize the effectiveness of organic weapons when employing them in an air defense role, the following actions should taken:

a. Commanders must insure that their unit air defense SOP's are based on the SOP's of the supported headquarters. These SOP's must contain firm guidance on how to identify aircraft, the personnel who are to engage enemy aircraft, the techniques of fire to be used, the rules of engagement, and the controls to be exercised.

b. All personnel must be made aware of the ef-

fectiveness of a large volume of small-arms fire against low-flying aircraft. Emphasis must be placed on the aggressive engagement of hostile aircraft in accordance with the SOP.

c. All personnel must be well trained and kept current on aircraft identification, techniques of firing at aerial targets, fire discipline, and response to control methods. Extreme emphasis must be placed on the threat to friendly aircraft involved in failure to properly identify and discriminate between friendly and enemy aircraft.

## Section V. CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL DEFENSE

### 6-15. Defensive Measures

The use of unit chemical, biological, and radiological defensive measures is necessary to permit the unit to operate effectively in a CBR environment (FM 21-40). These defensive measures include—

a. Using chemical agent detectors and alarm systems.

b. Wearing protective clothing.

c. Employing protective equipment.

d. Using protective shelters.

e. Dispersing personnel and equipment.

f. Decontaminating equipment and personnel.

g. Administering first aid.

### 6-16. Responsibilities

Unit readiness to operate with maximum individual and unit effectiveness under conditions produced by either friendly or enemy employment of CBR weapons is a command responsibility. In addition, individual members of the unit have responsibilities for certain general functions connected with CBR defensive operations.

a. *Individual Soldier.* The individual soldier learns individual and unit CBR protection procedures so that he can carry out his mission with the last risk of injury.

b. *Unit Officers and Noncommissioned Officers.* Commensurate with the level of their authority, unit officers and noncommissioned officers (NCO) insure that CBR defensive measures are taught to and applied by all unit personnel.

### 6-17. CBR Organization and Training

The signal unit commander appoints an officer (preferably CBR school-trained) to the additional duty of unit CBR officer. He also appoints NCO's additional duty as company CBR specialists. The NCO's should also be CBR school-trained, if possible. The specific assignments, equipment, and duties of these CBR personnel are designated in the unit SOP. Training in CBR defense must result in all personnel having the ability to carry out CBR defense instructions and, in the absence of specific instructions, to take the proper actions when faced with any unusual CBR activity.

### 6-18. Army Medical Service

The army medical service provides the unit with medical treatment and with biological agent identification. In addition, the army medical service furnishes advice to unit commanders on the following subjects, as required: immunization procedures field sanitation, first aid, capabilities of medical facilities, fitness of food, and the effects of CBR agents on personnel.

## Section VI. TRAINING

### 6-19. General

a. The training objective of a signal unit is to help personnel to become proficient in their assigned tasks, to cross-train them in other related

tasks, and to achieve the balance of skills and the cooperation necessary to achieve efficient individual, team, and unit performance. Training is continuous, and will always be concerned with some

aspect of performance achievement. Broad training principles and policies to be used by all commanders are included in AR 350-1. Signal communications training considerations are discussed as a doctrinal matter in FM 24-1.

*b.* Training is conducted on an individual, group, or unit basis. It may consist of service school training, unit school training, on-the-job training (OJT), correspondence and extension course training, or any combination thereof. Training is supplemented, as required, by refresher courses to keep personnel and units informed of new methods, techniques, and equipment. A review of certain subjects, which may not be directly associated with the technical mission, is essential for maintaining proficiency in general military subjects. Subjects which must be reviewed periodically include military justice, CBR operations, internal defense and internal development operations, first aid, physical training, survival and escape procedures, qualification in arms, and the code of conduct.

*c.* Communicators should be trained to react properly to enemy attempts at jamming radio communications and to enemy intrusion into nets with imitative communications. Signal security is a command responsibility and all responsible personnel should be indoctrinated on the contents of FM 32-5, FM 32-20, and FM 32-20A.

### **6-20. Responsibilities**

The unit commander is responsible for insuring that all assigned or attached personnel are adequately trained. Emphasis must be placed upon the training of the soldier to enable him not only to perform his technical duties, but also to defend himself and his installation should the need arise. The unit commander and the unit training officer establish training programs, supervise the training and cross-training of the unit personnel, operate and supervise unit schools, furnish training assistance and advice where needed, and conduct training inspections. The unit recommends personnel to fill school quotas allocated by higher headquarters, and coordinates the training activities of the unit elements. Subordinate commanders are responsible for insuring that their per-

sonnel are trained; for conducting on-the-job, individual, and refresher training; for providing qualified instructors, as necessary, to staff unit schools; for providing training materials to support schools established by the unit; and for selecting personnel to attend schools.

### **6-21. Methods**

*a.* The army provides an extensive system of service schools to teach officers and enlisted personnel the special skills required to perform their duties effectively. It is desirable that the maximum number of personnel be school-trained and that full advantage be taken of quotas authorized by these schools. Prospective students must be carefully screened, however, to insure that they will be able to successfully complete the courses of instruction.

*b.* Unit training is conducted by using assigned personnel as instructors. Most company training is decentralized. Certain centralized training, however, such as technical control training, can be best conducted at company level. This centralized training is normally consolidated because of limited platoon training facilities, complexity of subject matter, or the need for close supervision and evaluation by the company commander and the training officer. Unit training provides instruction to those who cannot attend school courses and gives special instruction not provided by service schools. Unit training may be necessitated by the receipt of new equipment; modifications made to existing equipment; changes in procedure, mission, or doctrine; or changes in methods of operation. Because of the nature of signal unit missions, technical training is frequently fragmented, with emphasis placed upon individual, team, and platoon training.

*c.* OJT is a training process whereby students or trainees acquire knowledge and skills through actual performance of duties under competent supervision, in accordance with an approved, planned program. The most effective method of OJT is to group experienced specialists with untrained personnel. Untrained personnel are given simpler jobs to perform until proficiency is attained. Later, as experience is gained and skills are developed, these personnel are permitted to undertake tasks that are progressively more complex.





## CHAPTER 7

### SUPPLY AND MAINTENANCE

*Note.* The information in this chapter pertains, as applicable, to all signal units described in Part Two and in subsequent parts of this manual. Information unique to a specific signal unit will be included in the description of that unit.

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#### Section I. SUPPLY

##### 7-1. Supply Responsibilities

The acquisition and the timely distribution of adequate supplies are essential to the successful accomplishment of a signal unit's communications mission. Commanders must be familiar with the status of supplies and equipment at all times and must continuously consider the logistical support required for current and future operations. The supply officer insures that the unit logistical support system is flexible and responsive to the requirements of the unit. He is responsible for the preparation of logistical estimates, portions of the unit's operations orders and plans, and the supervision of logistics functions. Proper planning, maintaining accurate records, and supervision are required to insure the steady flow of supplies required by the unit.

##### 7-2. Deployment Considerations

Because many signal elements are deployed over extensive areas, logistical support is a major problem. Before the deployment of any element, the unit commander or the supply officer will coordinate supply plans with the S4 of the next superior command or with the supporting FASCOM or TASCOM unit (depending on unit assignment and deployment) so that the appropriate unit of the FASCOM or TASCOM can be alerted to an upcoming support requirement. Upon or before arrival at his operational site, it is the responsibility of a deployed element commander to establish liaison with the designated FASCOM or TASCOM unit that has been alerted to provide logistical support to his element.

##### 7-3. Supply Operations

a. Supply operations are geared to produce effective supply support for a unit and its deployed elements. Internal supply procedures must insure responsiveness of the unit supply system. Although supply procedures must conform with the criteria

established by AR 735-35 and other pertinent supply directives (app A), the requisitioning and distribution of supplies may be influenced by the factors listed below:

- (1) Dispersement of organic units and elements.
- (2) Transportation.
- (3) Supply sources.
- (4) Mission to be performed.

b. Commanders must supervise the conservation of supplies and materiel by all personnel of their command. Through publication and strict enforcement of specific supply economy instructions and directives, and by frequent inspections, the commander insures that every individual, whether or not he is personally signed for the equipment or materiel he is using, is responsible for its care, preservation, and conservation.

c. Supply procedures and techniques for internal defense and internal development operations require special planning because of the hazards that may be encountered along roads and at isolated operational sites and upon the possible dependence on aerial supply. Supply planning must consider the stockage of larger quantities of essential items and the planning of resupply well in advance of the normal requisitioning cycle.

##### 7-4. Combat Service Support, Field Army Support Command

The field army support command provides combat service support to the field army except personnel replacement. The FASCOM provides combat service support through two kinds of major subordinate elements: army-wide service organizations and support brigades.

a. *Army-Wide Service Organizations.* Army-wide service organizations such as medical, military police, and transportation units are provided



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throughout the field army area by separate brigade size organizations.

*b. Support Brigades.* The support brigades provide supply, maintenance, and specialized services in a designated area. A corps support brigade is employed in the corps area and an army rear support brigade is employed in the army service area. The support brigades provide a variety of services (supply, maintenance, POL, postal, finance) within their assigned areas. Their primary missions are supply and maintenance of all equipment and supplies except those provided by army-wide service brigades. Each of the corps support brigades provides general support to the divisions and both direct and general support to nondivisional units in the corps area. The army rear support brigade provides direct and general support to the units in the army service area.

### 7-5. Combat Service Support, Theater Army Support Command

The mission of the TASCOM is to provide combat

service support to army forces in a theater of operations. Services provided include general support to the field army, direct and general support to the communications zone, and rear area security and area damage control within a communications zone.

*a. Functions.* Combat service support functions performed by the TASCOM include administration civil affairs, engineer, maintenance, medical, military police, movements personnel, legal, field services, comptroller and finance, supply, and transportation.

*b. Organization.* The TASCOM is normally organized with the following major subordinate commands:

- (1) Area support command.
- (2) Engineer command.
- (3) Medical command.
- (4) Personnel command.
- (5) Supply and maintenance command.
- (6) Transportation command.

## Section II. MAINTENANCE

### 7-6. Maintenance Responsibilities

Maintenance of equipment includes all actions taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes the routine care exercised by operators and users, as well as the repair, rebuilding, and overhaul performed by trained technicians. The army materiel maintenance system is divided into four categories: organizational maintenance, direct support maintenance, general support maintenance, and depot maintenance (AR 310-25) and AR 750-1). These categories, which are based upon the extent of the capabilities, facilities, and skills required to perform authorized maintenance operations, are used as the means of designating the scope of maintenance to be performed at the various command levels. Commanders at all levels are responsible for compliance with established practices and procedures for preventive maintenance operations, for the training of personnel in their command in preventive maintenance of equipment, for insuring that proper security safeguards are in effect during maintenance tests, and for the allocation of sufficient time to perform the required preventive maintenance.

*a.* Commanders, maintenance section chiefs, and subordinate commanders must give priority and

personal attention to the preventive maintenance program. They must know the equipment and demonstrate their interest by personal supervision of maintenance operations and by frequent informal inspections. Command maintenance management inspections, conducted as prescribed by AR 750-8, insure that proper maintenance is being performed on all major items of equipment and that the information on preventive maintenance contained in D PAM 750-1 and in the equipment technical manuals is being applied. Details on the preparation and use of maintenance performance records are contained in TM 38-750 and TM 38-750-1. Additional maintenance reference publications are listed in appendix A.

*b.* It is the responsibility of each officer, warrant officer, and noncommissioned officer to initiate on-the-spot corrective action whenever he observes deficiencies in the condition or operation of equipment. Evidence of abuse will be immediately investigated and corrective action taken. Some common abuses are—

- (1) Improper, careless, or negligent use of equipment.
- (2) Lack of lubrication, overlubrication, or use of unauthorized lubricants.

(3) Deferred maintenance, including lack of proper servicing.

(4) Attempted repairs by unauthorized personnel or the use of improper tools.

(5) Failure to assign direct maintenance responsibility.

(6) Lack of adequate inspection.

(7) Unauthorized cannibalization.

### **7-7. Organizational Maintenance**

Signal units have the capability of performing organizational maintenance on organic weapons, vehicles, power generators, and electronic equipment. With reference to organic weapons and vehicles of company elements, the organizational maintenance capability of the company elements is augmented by company level maintenance personnel assigned to the company headquarters.

### **7-8. Maintenance Support Beyond Organizational Level**

Most signal units have a direct support level maintenance capability on organic electronic equipment. When this direct support level capability and capacity of the unit is exceeded, the unit commander or the maintenance section chief will

coordinate maintenance support requirements with the maintenance element of the next superior command. The superior command element will in turn make the necessary maintenance support arrangements with the supporting FASCOM or TASCOM unit. In addition, the unit commander or the maintenance section chief makes the necessary arrangements for the continuous maintenance support of deployed units or elements of the unit. When an item requires maintenance or repairs at the general support level or beyond, it is evacuated to the supporting direct support unit, which then assumes the responsibility for further evacuation of the item to the general support maintenance level. Detailed procedures for supply and maintenance are provided in the maintenance support plans of the field army support brigade and the TASCOM major subordinate commands furnishing these services. Refer to FM 29-22 for further information on maintenance operations in the field.

### **7-9. Maintenance Data Collection**

Commanders at all echelons, in accordance with AR 750-1, must insure that data generated by the army equipment record procedures are accurately recorded and used in maintenance management. The system and its procedures are described in TM 38-750 and TM 38-750-1.



**PART TWO**  
**USASTRATCOM (THEATER) COMMAND AND CONTROL ELEMENTS**  
**CHAPTER 8**  
**INTRODUCTION**

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**8-1. General**

The size and the complexity of the theater army communications systems established in the COMMZ of any theater of operations depend to a large extent on the variables discussed in paragraphs 2-1 through 2-3. Consequently, signal communications requirements in each COMMZ will vary. The signal units necessary to meet specific COMMZ requirements must be planned for and organized to provide reliable, high quality, signal communications. These communications must be responsive to the needs of the theater and theater army commanders, and to the combat, combat support, and combat service support elements located in the COMMZ. The USASTRATCOM is responsible for preparing signal communications plans to support the contingency plans for any theater of operations. The USASTRATCOM (theater) is the

signal organization responsible for executing the signal communications plans for COMMZ communications in a specified theater.

**8-2. Command and Control Elements**

A USASTRATCOM (theater) requires selected assemblages of signal units to install, operate, and maintain the TACS in the COMMZ of a theater. The following elements, described in chapters 9, 10, and 11 respectively, provide command and control for these assemblages.

- a.* Headquarters and Headquarters Company, USASTRATCOM (theater).
- b.* Headquarters and Headquarters Detachment, Signal Group.
- c.* Headquarters and Headquarters Detachment, Signal Battalion.



CHAPTER 9

HEADQUARTERS AND HEADQUARTERS COMPANY USASTRATCOM (THEATER)

Section I. UNIT CHARACTERISTICS

9-1. Mission

The mission of the headquarters and headquarters company (fig. 9-1) of a type USASTRATCOM (theater) is as follows:

- a. To provide the commander with the means to command and control assigned and attached units.
- b. To formulate and implement signal plans, policies, and procedures for the installation, operation, maintenance, and management of the TACS.
- c. To furnish signal planning and engineering support for special purpose communications systems.

9-2. Assignment

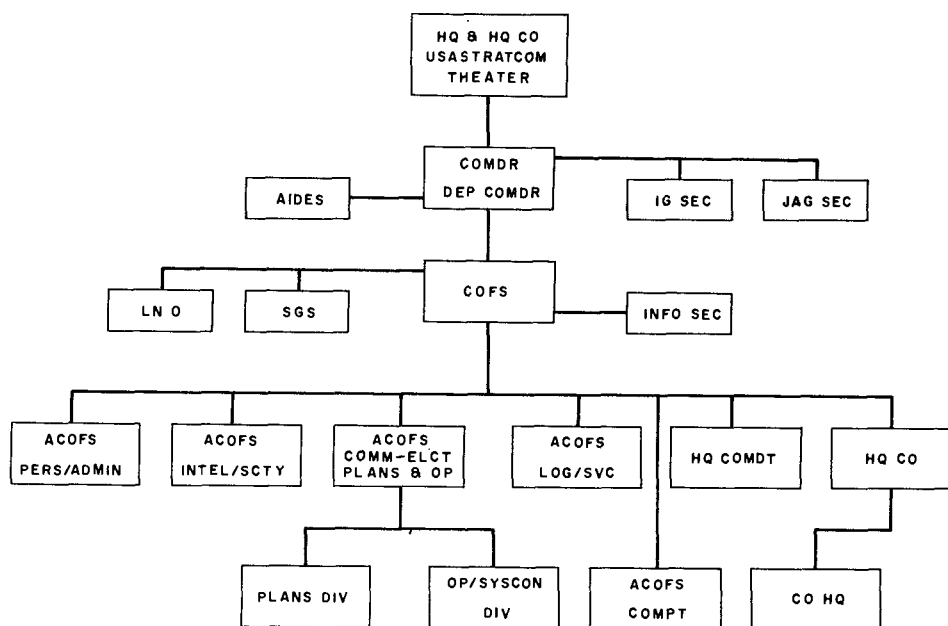
a. The headquarters and headquarters company is assigned to a type U.S. Army Strategic Com-

munications Command (theater) for which it provides command and control.

b. USASTRATCOM exercises sufficient technical control of a USASTRATCOM (theater) to insure Army responsiveness to Defense Communications System requirements and to provide a single point of contact for the Defense Communications Agency in the theater.

9-3. Capabilities

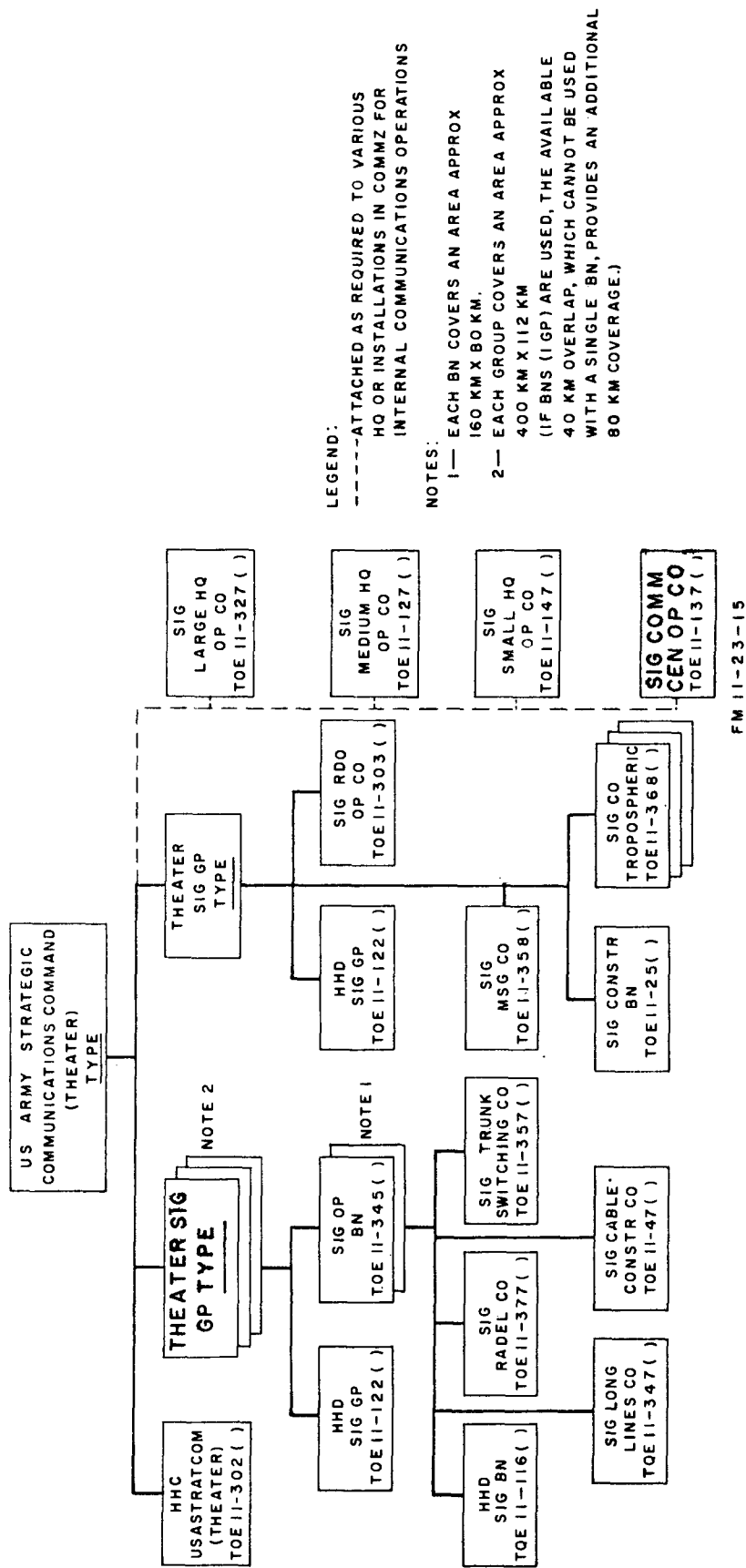
a. The HHC, USASTRATCOM (theater) provides command and control of two to four signal groups and such other separate battalions and companies as may be required to carry out the USASTRATCOM (theater) mission. The battalions and companies are organized under subordinate command and control elements as described



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Figure 9-1. HHC, USASTRATCOM (theater).





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LEGEND:  
 - - - - - ATTACHED AS REQUIRED TO VARIOUS HQ OR INSTALLATIONS IN COMMZ FOR INTERNAL COMMUNICATIONS OPERATIONS

NOTES:  
 1— EACH BN COVERS AN AREA APPROX 160 KM X 80 KM.  
 2— EACH GROUP COVERS AN AREA APPROX 400 KM X 112 KM (IF BNS (IGP) ARE USED, THE AVAILABLE 40 KM OVERLAP, WHICH CANNOT BE USED WITH A SINGLE BN, PROVIDES AN ADDITIONAL 80 KM COVERAGE.)

Figure 9-2. Type USASTRATCOM (theater), additionally modified.

in chapters 10 and 11. The command will have a possible strength in excess of 10,000 personnel which will be deployed over areas of 20,000 to 80,000 square kilometers. Figures 2-1 and 2-4 show type USASTRATCOM (theater) organizations. Figure 9-2 shows another possible organizational arrangement for this command. Command and control include command-level administration, training, logistics support, supervision, and employment of all assigned and attached signal units.

*b.* The HHC also provides signal staff planning, communications systems engineering, signal traffic engineering, signal plant engineering, automatic data processing engineering, and circuit control and allocation for the theater army signal officer. Technical liaison is maintained by elements of the unit with signal elements of other U.S. armed forces components, allied forces, and civilian communications agencies at the USASTRATCOM (theater) level.

*c.* Other signal capabilities are technical control, coordination of operations, and broad signal planning and engineering for the theater army communications systems facilities installed and operated by units assigned or attached to the USASTRATCOM (theater). This includes dissemination of radio propagation data; allocation and control of radio frequencies; planning and supervising audio-visual functions such as film and equipment exchanges, photographic laboratories, and still and motion picture photography; planning and coordinating the air and ground messenger service within the COMMZ; and planning and supervising ground environment facilities and tracking stations used in satellite communications. It also provides engineering support and coordinates the requirements for pipeline,

railway, highway, and inland waterways communications systems.

*d.* Other administrative and logistics capabilities of the unit include comptroller activities such as planning, programming, coordinating budgets and fund requests; providing aircraft for command and staff visits; operating a mess for the commanding general and his staff; and operating a mess for other members of the unit.

#### 9-4. Limitations

*a.* The HHC depends upon service organizations in its area of operations for services such as medical, dental, and military pay. It also depends on service organizations for additional motor and air transportation as required.

*b.* The unit depends on aviation service units for general support and direct support maintenance on its organic aircraft.

#### 9-5. Training and Mobility

*a.* Personnel assigned to the unit, in addition to formal or on-the-job training in their basic military occupational speciality (MOS) skills, receive further unit training under Army Training Program (ATP). All personnel, except the chaplain, are trained to engage in effective, coordinated defense of the units area or installation. This includes but is not limited to rear area protection procedures, internal defense operations, stability operations, and operations under both conventional warfare and CBR conditions.

*b.* Organic transportation allocated on the TOE provides the HHC with a ground transportation mobility of approximately 45 percent. This unit is designated a category III unit as referred to in AR 310-25.

## Section II. ORGANIZATION AND EMPLOYMENT

### 9-6. General

*a.* The headquarters and headquarters company organized under TOE 11-302 includes the organizational structure and a nucleus of professional and technical communications-electronics (COMMEL) and administrative personnel to provide command and control for all units assigned or attached to a USASTRATCOM (theater). This element also provides centralized control over all signal communications systems, facilities, and

COMMEL functions installed, operated, or performed by these assigned or attached units.

*b.* The HHC performs the theater army electronics engineering and communications systems control in addition to the normal staff work for a command of this size. In engineering, supervising, and directing the entire field of theater army COMMEL activities within the COMMZ, close coordination and liaison with the theater air force, theater navy, allied forces, high-level joint or

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combined headquarters such as NATO, and with local civilian and/or government communications enterprises is maintained. Elements of the HHC also establish and direct COMMZ level signal training activities to update the technical skills of personnel assigned to the various signal units. This is particularly necessary when new signal communications equipment is introduced into the theater for use in the TACS or into the combat area communications system.

c. The need for technical engineering and training services is seldom encountered in the usual staff organization. This HHC, therefore, when compared with other headquarters and headquarters companies, may appear administratively heavy. However, the mission requirements imposed on a USASTRATCOM (theater) to direct highly technical signal units generates a need for a highly refined staff.

### 9-7. Organization

a. The headquarters and headquarters company (fig. 9-1) is organized into a command headquarters and a headquarters company. The command headquarters contains the commander and his personal staff, a chief of staff, the secretary of the general staff, liaison officers, and an informa-

tion officer. The coordinating staff officers are designated assistant chiefs of staff with the exception of the headquarters commandant. There is no special staff as such; however, organized under the assistant chief of staff for communications-electronics (C-E) are two divisions. One is the plan division, and the other is the operations and systems control division. The method of operation of these divisions and that of the other staff sections is described in the following section.

b. The headquarters company consists of company headquarters, unit supply, mess, and motor sections.

### 9-8. Unit Employment

a. The headquarters and headquarters company is employed by the USASTRATCOM (theater) commander to command and provide staff supervision for all theater army signal units and installations located within the COMMZ, and to maintain centralized operational control over the TACS which they install, operate, and maintain.

b. The HHC is also employed to provide administrative, logistic, and technical support for the commander, his staff, and the headquarters company.

## Section III. OPERATIONS

### 9-9. General

a. The USASTRATCOM (theater), of which the headquarters and headquarters company is the command and control element, is assigned to and under the operational control of the theater army commander. It is also under the technical control of the theater army commander. It is also under the technical control of the USASTRATCOM as it pertains to integrating the TACS into world-wide communications systems through DCA facilities within the theater.

b. In exercising command, control, and staff supervision over subordinate units, the doctrinal principles of command and staff supervision outlined in FM 101-5 are followed. However, in executing the command's mission responsibility of maintaining centralized control over the TACS, elements of the coordinating staff participate actively in the planning and operating of the TACS. This is accomplished by elements of the coordinating staff who maintain informal, direct liaison with operating staffs and elements of sub-

ordinate units on technical matters and communications systems control. The command headquarters is organized with a command section and the various personal and coordinating staff sections as shown in figure 9-1.

c. The staff that supports the command section is organized into personal staff sections and functional assistant chief of staff (ACofS) sections. Special staff functions are performed by personnel assigned to the coordinating staff sections or to operating divisions under the control of a coordinating staff section. The personal staff consists of the inspector general and judge advocate general sections. The coordinating staff sections are the ACofS personnel and administration, ACofS intelligence and security, ACofS communications-electronics for plans and operations, and the ACofS logistics and services sections. The headquarters commandant and information sections may be considered as special staff sections operating under control of the chief of staff. Similarly, the plans division and the operations and

systems control division may be considered as special staff sections operating under the ACoFS communications-electronics.

*d.* The coordinating staff sections operate under the staff supervision of their respective assistant chiefs of staff as shown in figure 9-1. The assistant chiefs of staff in turn are responsible to the chief of staff. The headquarters company commander also operates under the direct control of the chief of staff. The chief of staff, however, may place the headquarters company under the staff supervision of the headquarters commandant for ease of operations. The duties of the coordinating general staff officers are stated in detail in FM 101-5. The coordinating staff sections include officers who perform the duties of special staff officers and operate under the control of the assistant chief of staff for their section.

### 9-10. Command Section

The command section includes the commander, deputy commander, their aides, and clerk stenographers. Both the commander and the deputy commander are general officers.

*a.* The USASTRATCOM (theater) commander is also the deputy chief of staff for communications-electronics on the theater army commander's staff. He has staff responsibility for all theater army communications-electronics functions and activities. As commander of the USASTRATCOM (theater), he exercises command and control and discharges his responsibilities through his deputy commander by issuing orders to the various staff officers in the command headquarters and to the commander of signal groups and separate companies and battalions comprising the command.

*b.* The deputy commander assists the commander by directing operations during the commander's absence. He serves as the point of contact with commanders of equal level headquarters of commands on signal communications and other operational matters of mutual interest.

*c.* The remaining personnel assigned to the command section of the headquarters include commissioned aides and enlisted clerical assistant who perform duties prescribed for their grade and MOS.

### 9-11. Chief of Staff Section

The chief of staff section includes the chief of staff, his deputy, liaison officers, the secretary and

assistant secretary to the general staff, the sergeant major, and administrative and clerical enlisted assistants.

*a.* The chief of staff, assisted by his deputy, directs, supervises, and integrates the work of the other staff sections. He formulates and coordinates policies for operations of the various staff elements to insure that orders and instructions are executed in accordance with the desires of the commander. He is the principal assistant of, and advisor to, the commander on all staff matters. He may be delegated authority that amounts to command of the staff.

*b.* The secretary to the general staff provides executive assistance to the chief of staff and as such is neither a coordinating, special, or personal staff officer. He operates as the office manager for the offices of the commander, deputy commander, chief of staff, and deputy chief of staff. He maintains temporary records, receives visiting officials, and performs such other duties assigned him by the chief of staff. The assistant secretary of the general staff aids him in these functions.

*c.* The liaison officers maintain technical liaison, assure continuity in the exchange of information, and promote cooperation with signal elements of other U.S. armed forces components, allied forces, and civilian communications agencies in the theater at USASTRATCOM (theater) level. They also coordinate and maintain liaison with the transportation and quartermaster elements in the command's area of responsibility for the purpose of coordinating requirements involving signal planning and engineering support for special type transportation and POL communications systems, for example: highway transportation, railway, inland waterways, and pipeline communications systems.

*d.* The command's sergeant major operates under staff supervision of the chief of staff. He performs all duties prescribed for this position under the provisions of AR 611-201. He also supervises the work of other enlisted personnel assigned to the section.

### 9-12. The Inspector General Section

The inspector general is a member of the commander's personal staff. His section includes commissioned and enlisted specialists who assist him in performing his duties. He is responsible for making necessary inquiries and reporting to the



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commander on matters which pertain to the performance of the mission, state of discipline, efficiency, and economy of the command. He conducts inspections, investigations, surveys, and studies as directed by the commander, and as prescribed by pertinent army regulations, or as required by law.

### 9-13. Judge Advocate General Section

The judge advocate general is a personal staff officer. His section includes several assistant staff judge advocates, a legal technician, and enlisted personnel trained in law and associated procedures. As a member of the personal staff he furnishes legal advice to the commander, the staff, and subordinate commands; supervises the administration of military justice within the command; and communicates directly with the commander on military justice matters. He insures that all procedures relating to personnel subject to the uniform code of military justice are strictly complied with. The section also maintains custody of special and summary court-martial records of trial. The judge advocate general supervises military justice training within the command; recommends policies relating to liaison with law enforcement and judicial agencies in the civilian community; and furnishes legal assistance and advice to military personnel, their dependents, and other authorized persons concerning personal, civil, and legal problems. With assistance from his staff, he provides legal opinions and advice on local and international law matters, such as the Hague Regulations, the Geneva Conventions, status of forces agreements, etc, and on the applicability of United States laws in foreign countries. He examines procurement, lease, or rental contracts and furnishes legal advice to the commander in these matters especially when they pertain to real estate involving multichannel radio, tropo radio terminal, and other communications facility sites.

### 9-14. Information Section

The information section operates under the staff supervision of the chief of staff. The information officer is a special staff officer and his duties as they pertain to the command are enumerated in FM 101-5.

### 9-15. Personnel and Administration Section

The personnel and administrative section includes the chief administrative officer, chaplain,

personnel management officer, classified documents officer, a warrant officer personnel technician, and enlisted personnel.

a. The chief administrative officer acts as the adjutant general. As such, he is responsible for the orderly, economical, and efficient operation of the section. His duties and responsibilities include supervising section operations and providing administrative services. This includes records management, postal services, publications management, special services matters, and miscellaneous administrative functions. It also includes personnel assignment, reassignment, and transfers within the command. He distributes, safeguards, and accounts for administrative classified documents, publishes, authenticates and distributes all orders and instructions *except operational orders, certain technical instructions and those instructions issued by staff officers in their respective duties effecting the installation, operation, maintenance, and management of the TACS*. He supervises all administrative procedures within the headquarters and formulates directives pertaining thereto. He supervises records administration in the headquarters and in subordinate units throughout the command, and performs all other duties as required that come under the adjutant general's responsibilities. He is assisted in these functions by the other officers, except the chaplain, assigned to the section.

b. The chaplain operates as a special staff officer. He advises the commander on the use of chaplains in the command. He furnishes estimates and information, and makes recommendations and plans in the fields of religion, morality, and morale. He coordinates religious activities of the command and establishes liaison with chaplains of higher, adjacent, and subordinate commands to insure religious coverage for all units and operating elements of the command.

c. The enlisted administrative personnel of the section include the administrative supervisor, personnel sergeants, classified document specialists, clerks, stenographers, chaplain assistant, records specialist, file clerks, pay specialist, typist, and mail clerks. These personnel provide clerical and administrative assistance to the director of personnel and administration and to his staff.

### 9-16. Security and Intelligence Section

The security and intelligence section is responsible for the G2 functions of the command; as outlined in FM 101-5. This includes all security

functions, technical intelligence, physical security, etc, that are not the specific responsibility of the Army Security Agency.

### 9-17. Communication-Electronics Plans and Operations Section

The ACofS, C-E plans and operations, aided by a deputy, is responsible to the commander for the overall formulation and implementation of signal plans, policies, and procedures for the installation, operation, maintenance, and management of the theater army communications system. To accomplish this function, the staff section is organized into a plans division and an operations/systems control division.

*a.* The plans division operates under control of the ACofS C-E, plans and operations. The division contains a staff for communications system planning and engineering consisting of officers knowledgeable in the fields of wire, radio, multichannel radio, ADPS, communications center, and overall communications systems. A plans NCO, technical enlisted specialists, draftsmen, and clerical personnel are included to support the division. The division is responsible for formulating broad plans, policies, and procedures for the establishment, operation, and maintenance of a high quality, high capacity, multimeans, multiaxis, integrated communications network. The division is also responsible for the coordination of plans and requirements for special purpose communications systems such as automatic data processing system (ADPS), pipelines, railway, highway, and inland waterways communications systems. Some of the major specific duties and operational responsibilities of personnel assigned to the division are as follows:

(1) Chief, plans division, operates under the control of the assistant chief of staff, communications-electronics, plans and operations. His duties include direction of division operations to include studies of a planning nature on signal communications matters, and studies concerning detailed communications engineering to implement signal plans and traffic studies of existing communications systems.

(2) Plans officer (assisted by the two plans officers, a force development officer, and the plans NCO) conducts communications studies to support the entire theater signal communications system. The force development officer must be well versed in the missions, capabilities, and organization of TOE signal units. In order to make

recommendations as to the number and types of signal units needed to install, operate, and maintain the planned communications facilities, the forces development officer must be familiar with the army regulations used in developing TOE signal units.

(3) Communications system engineer (assisted by the ADPS officer, two communications center officers, radio tropo engineer, communications center officers, radio/microwave officer, and power engineer officer) conducts detailed communications systems engineering to insure that adequate and flexible communications systems are available to support all units within the theater army. Communications system engineering includes technical circuit characteristics; equipment suitability, adaptability, and compatibility with existing military or indigenous communications systems; capabilities and limitations of equipment; and overall quality of transmission facilities.

(4) Traffic engineer (assisted by the telephone and teletypewriter inside plant officer and the wire officer) conducts traffic studies and data analysis in a continuing effort to relieve communications traffic congestion, and coordinates the results with the communications system engineer.

(5) The wire NCO, tropo NCO, COMM-CEN NCO, radio NCO, COMM-CEN sergeant, and wire sergeant perform duties in the communications engineering field similar to those performed by the engineering officers.

(6) The design, construction, and general draftsmen produce the large volume of technical drawing required to support activities within the plans division.

(7) A secretary stenographer takes and transcribes dictation from the division engineering officers. This increases the overall operating efficiency of the division by making more productive planning and engineering time available to the planning officers.

(8) The clerk-typists provide the clerical support for the work generated in normal division operation.

*b.* The operations/systems control division operates under control of the ACofS, C-E, plans and operations. The division contains a division chief, a staff of communications systems operations officers (radio, wire, ADPS, power, multichannel radio, frequency allocation, communications center), as well as technical and clerical en-



listed personnel. The division is responsible for the overall day-to-day technical control and engineering of communications systems and facilities to insure maximum efficiency and flexibility of operations. Some of the major specific duties and operational responsibilities of personnel assigned to this division are as follows:

(1) The chief, operations division, operates under control of the ACofS C-E, plans and operations. He is responsible for directing the division's efforts along the signal communications planning guidelines established by the plans division.

(2) The operations officer, traffic officer, ADPS officer, wire officer, radio officer, communications center officers, and telephone and teletypewriter officer, assist the chief of the operations/systems control division in day-to-day engineering of communications systems and facilities.

(3) The radio frequency allocation officer and the radio propagation officer evaluate radio propagation data to determine allocation of radio frequencies. They allocate frequencies to units in the command, coordinate radio frequency requirements, maintain records, prepare reports, and initiate correspondence to theater army on all radio frequency matters. They are also responsible for assembling and coordinating other communications data for inclusion in the signal operation instructions (SOI).

(4) The COMSEC staff officer assists the chief of the operations/systems control division in discharging his responsibilities by advising him on COMSEC matters for which the command is responsible. He also coordinates with the ACofS, security and intelligence, on matters of mutual interest.

(5) The two photo officers are responsible for supervision and coordination of the photo activities of the command.

(6) The training officer and the training NCO are responsible for planning, coordinating, and the staff supervision of a master training program for the command.

(7) The staff aviation officer is responsible for staff supervision of aviation matters relating to the command and assigned and attached units. He develops plans for the command and serves as the point of contact for coordinating requests for use of aircraft organic to all units assigned or attached to the command. He also is responsible for

coordinating requests for tactical airlift support. He supervises the implementation of tactical airlift directives of theater army by units of the command. To do this, he prepares standard operating procedures for requesting tactical airlift support in consonance with tactical airlift operations doctrine, as stated in FM 100-27 as it applies to the need and operational requirements of the command.

(8) The operations NCO assists the chief, operations division and other officers by coordinating the efforts of the enlisted technical specialists and supervising the work of the draftsman and clerical personnel assigned to the division.

(9) The frequency allocation specialist and frequency control clerk assist the officers responsible for frequency allocation and for preparation of the SOI.

(10) The radio relay NCO, COMMCEN NCO, secretary-steno, clerk-typists, and draftsman provide the section with necessary technical and clerical support to take care of the workload generated by the division.

c. The personnel required to direct the command's system control (SYSCON) activities are the systems officer, radio relay officer, system control officer, tropo officer, wire officer, circuit control sergeants, tropo NCO, wire NCO, draftsmen, a clerk, radio teletypewriter operators, and teletypewriter operators. Their general responsibilities include allocation of circuit routes and alternate routes. They accomplish this by coordinating the centralized control of circuits. They insure efficient services by directing the subordinate control sections of the organic signal groups to reroute or rearrange circuits to relieve traffic congestion in the TACS, based on information received from the plans division. They are responsible for the preparation and dissemination of priority lists and detailed emergency schedules to the subordinate control sections for coordinating uniform restoration of circuits in the event of disruption of communications or damage to any part of the system. They are also responsible for processing channel assignments, maintaining current availability and usage records of circuits and facilities, coordinating the maintenance of accurate current records at subordinate control installations, and maintaining technical control over all technical control activities and functions in the TACS. The personnel operate from a communications operation center which is connected

to the SYCON of the signal groups by radio and landline teletypewriter circuits.

(1) The system control officer is responsible for the coordination of the activities of the SYCON with the plans division to insure quality, adequacy, and availability of long distance communications circuits. He also directs circuit control activities from the communications operation center and insures that this facility functions 24 hours per day.

(2) The systems control officer, radio relay officer, tropo officer, and wire officer perform the day-to-day, shift-by-shift circuit and system control functions required for coordinating and directing the establishment of the TACS.

(3) The circuit control sergeants, tropo NCO, and wire NCO operate the communications center at the command SYSCON on a 24-hour basis.

(4) The draftsmen and the clerk-typist provide the clerical and drafting support to handle the workload generated by the SYSCON facility.

(5) The teletypewriter operators, on a basis of one per 12-hour shift, handle the landline circuit control and allocation (techchannel) traffic. This traffic is between the TACS control communications operation center van (located at the command headquarters) and subordinate systems control centers (located at headquarters of the signal groups) and between the TACS control communications operation center van and other technical control facilities in the theater area communication systems.

(6) The radio teletypewriter operators operate the radio teletypewriter set on a 24-hour basis. This set is utilized as the NCS at the command headquarters in the SYSCON net and backs up the landline teletypewriter system mentioned above. Personnel operating the radio set are assigned to this division, but the radio set is organic to the company headquarters. Figure 9-3 shows the internal wire communications system for the command headquarters. Figure 9-4 shows a type employment of radio and wire facilities for command and communications systems control.

### 9-18. Logistics and Services Section

The logistics and services section consists of commissioned officers, warrant officers, enlisted technical specialists, and clerical support personnel.

The section assists the ACofS logistics and services in assessing USASTRATCOM (theater) logistical requirements so that he may provide the commander with accurate and timely logistics information on which command decisions may be based. Section personnel include those specialized in the fields of material readiness, food service, and signal supply maintenance.

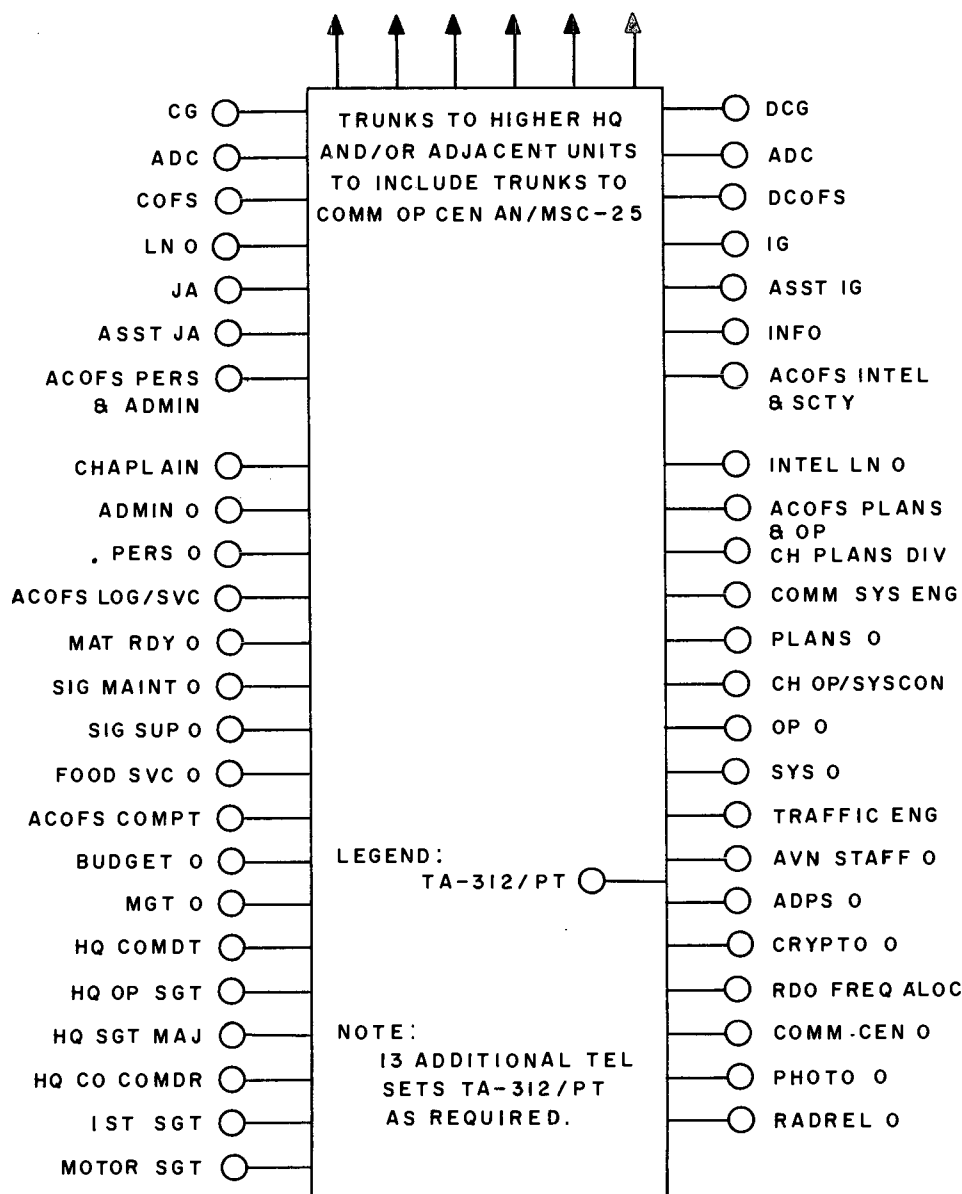
*a.* The signal supply officer, in addition to his normal logistics qualifications, must be well versed in COMMEL supply matters pertaining to COMMEL equipment which may be required for special class IV signal projects. He must be familiar with signal communications systems and the equipment necessary for their installation. As an expert in his field he will be required to brief the commander and other coordinating staff officers on COMMEL supply matters.

*b.* The material readiness officer prepares standing operating procedures and directives for implementing the material readiness plans of the command. In a technically oriented command such as this, it is mandatory that the communications equipment, the transportation that carries it, and the electrical power equipment required to operate it are in a high state of operational readiness to meet the varying COMMZ signal communications requirements. The material readiness officer, through continuous supervision of and coordination with material readiness personnel assigned to all units of the command, inspects signal units, their communications facilities and ancillary equipment log books to insure that the command's material readiness program is implemented.

*c.* The food service technician supervises all food service activities in the command. He files reports and makes recommendations to the ACofS in his area of responsibility.

*d.* The signal maintenance officer and warrant officer are staff advisors at this level of command and are responsible for inspecting signal equipment utilized in the TACS and recommending policies and procedures for preventive maintenance and on-site repair of equipment. They work in close contact with the material readiness officer.

*e.* Enlisted technical specialists and clerical personnel assigned to the section perform duties according to their grade and MOS to support the section's activities and functions.



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Figure 9-3. Type wire diagram, HHC USASTRATCOM (theater).

**9-19. Comptroller Section**

The comptroller section contains the comptroller and his staff who assist the commander in fiscal matters. This is particularly true when requirements for fiscal accountability exist in matters pertaining to class IV signal projects or in fiscal dealings with foreign governments on indigenous signal communications matters. The duties of the comptroller are outlined in detail in FM 101-5.

**9-20. Headquarters Commandant Section**

The headquarters commandant is responsible for the housekeeping functions of the headquarters. He supervises the arrangement and movement of the headquarters. In addition to performing all the duties of this position as stated in FM 101-5, he has the HHC organic aviation capability assigned to his section. This includes the aircraft, pilots, and crew chief. He insures that the air-

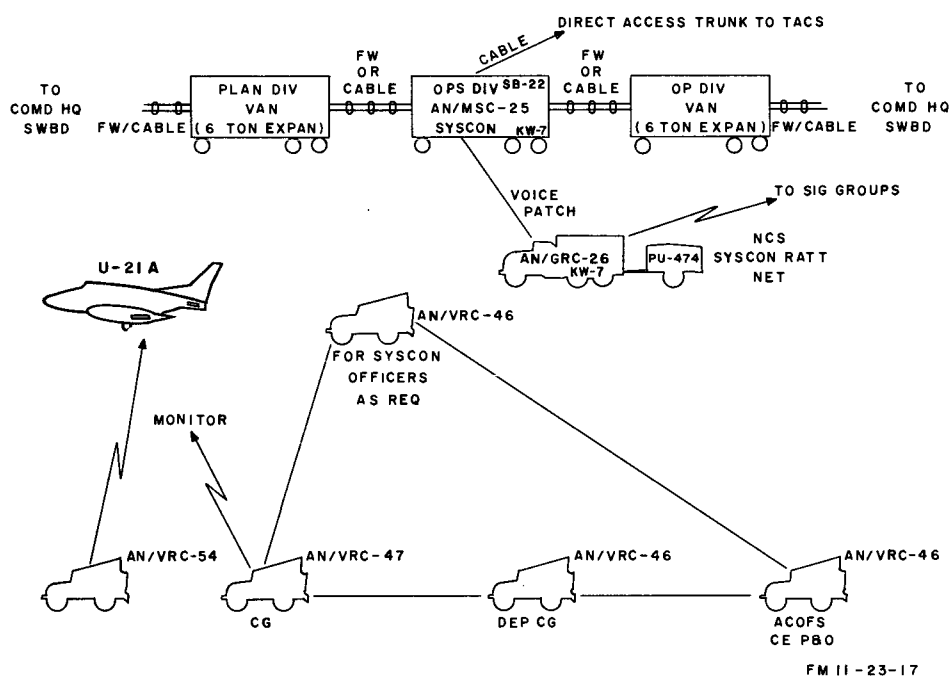


Figure 9-4. Type radio command and control net and communication systems planning and control facilities, HHC, USASTRATCOM (theater).

craft is available to the commander and his staff for command visits and inspections. He coordinates all flight requests with the aviation staff officer assigned to the plans and operations section.

### 9-21. Company Headquarters

The company headquarters contains the normal complement of personnel and facilities for command control and coordination of the company's training and operational mission. It provides supervision for the company's administrative, supply, motor, and mess function; and provides organizational maintenance of organic arms. In addition, it provides housekeeping support for the command headquarters. The headquarters company commander normally serves under operational control of the headquarters commandant.

a. The first sergeant, mess steward, and supply sergeant supervise assigned personnel performing duties in their respective areas of responsibilities. The duties of the assigned personnel are self-evident. A motor sergeant has been included to supervise motor maintenance for the large

number of vehicles required to support the command headquarters. His responsibilities include supervising the first echelon maintenance performed by the chauffeurs and light vehicle drivers, the dispatch of unit vehicles, the organizational motor maintenance performed by the wheel vehicle repairmen, and the operation and maintenance of power generating equipment organic to the headquarters and headquarters company. Maintenance on the high power generating equipment is performed by power generator specialists assigned to the unit.

b. The assistant mess steward and additional mess personnel operate the general's mess using the unit's cooking facilities. Other personnel assigned to the company include the commander's and deputy commander's enlisted aides, armorer, wireman, and telephone switchboard operators.

c. The internal wire communication system shown in figure 9-3 supports the command headquarters and the headquarters company. It is installed and operated by the wireman and switchboard operators assigned to the headquarters company.



## CHAPTER 10

### HEADQUARTERS AND HEADQUARTERS DETACHMENT, SIGNAL GROUP

#### Section I. UNIT CHARACTERISTICS

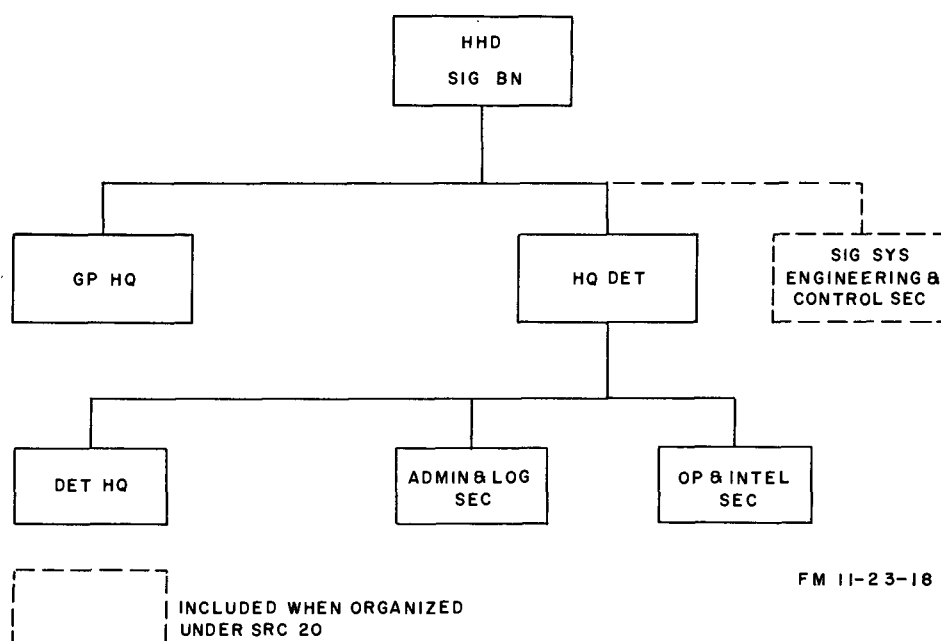
##### 10-1. General

Establishing extensive communications systems along the lines of communications within a COMMZ requires the combined efforts of a variety of signal units. Several factors must be considered before these signal units can be grouped together to function as an integrated unit for the establishment of communications systems. Some of these factors are: distances to be covered; types and number of headquarters, units, and installations to be supported; and communications requirements. An organic signal battalion, such as a signal construction battalion, which has its own organic headquarters and headquarters company and organically assigned companies; type signal battalions as discussed in chapter 11; and separate companies are grouped under the command and control of a headquarters and headquarters detachment signal group (TOE 11-122)

to form a type signal group. Several type signal groups have already been discussed in chapter 2. Chapter 10 deals specifically with the unit characteristics for headquarters and headquarters detachments organized under both standard requirements code 10 and 20 of TOE 11-122. Signal units which may be assigned or attached to such a group are discussed only where clarification of the signal group's command and control responsibilities are involved.

##### 10-2. Mission

The mission of the headquarters and headquarters detachment of a type signal group is to provide the signal group commander with personnel and equipment to assist him in fulfilling all signal mission responsibilities imposed on the group. Figure 10-1 shows the organization of an HHD, signal group.



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*Figure 10-1. HHD, signal group.*



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**10-3. Assignment**

The headquarters and headquarters detachment is assigned to a *type* signal group for which it provides command and control. The signal group, in turn, may further be assigned to a type USAS-TRATCOM (theater) to perform a portion of the overall mission of the USASTRATCOM (theater). The signal group may also operate as a separate unit and be attached to an independent corps or similar size task force operating in a remote area or oceanic theater. In this case, it augments the communications organic to the supported force. Command relationships governing employment of USASTRATCOM (theater) units under these conditions are discussed in chapter 3. In any case, the HHD signal group will provide command and control for signal units assigned or attached to the group.

**10-4. Capabilities**

The unit provides command control, staff planning, coordination, and supervision for a group consisting of two to seven signal battalions. It directs and coordinates operations, training, administration, and logistics functions of assigned and attached units, and it provides administrative and logistics support for the group command headquarters and the headquarters detachment. When organized under SRC-10 of TOE 11-122, it develops plans, policies, and procedures for communications systems installed, operated, and maintained by the group. This includes technical control of the communications facilities and coordination of the signal plans of subordinate units which relate to the overall signal communications systems or COMMEL activities for which the signal group has mission responsibility. When organized under SRC-20, the HHD has the additional capability of providing detailed communications systems engineering and communications systems control within its area of responsibility. The HHD provides the group commander and his

staff with an aircraft for command and staff visits to group units.

**10-5. Limitations**

The HHD depends upon assigned or attached units for mess, motor maintenance, signal equipment maintenance, and maintenance of personnel and pay records. When the unit is required to operate separately, and not in close proximity with any of its assigned or attached units, appropriate mess and motor maintenance teams will be provided by composite service organization such as TOE 29-500. Other services required by the HHD, such as medical, dental, and finance support or additional motor transportation are also provided by combat service support units located in the group headquarters area. This includes direct and general support maintenance for the unit's organic aircraft. Because of the distances involved and the large area over which signal units of the group are dispersed, the signal group may require tactical airlift support to augment assigned and attached unit capabilities. Provisions for such support are stated in FM 100-27 and will be discussed in paragraphs 10-9 through 10-11.

**10-6. Training, Mobility, and Category**

Assigned personnel, in addition to formal or on-the-job training in their basic MOS skills, receive further unit training under ATP 11-122. All personnel, except the chaplain, are trained to engage in effective, coordinated defense of the units area or installation. This includes, but is not limited to, rear area protection procedures, internal defense, operations in stability operations and operations under both conventional warfare and CBR conditions. Organic transportation allocated on the TOE provides the HHD with a ground transportation mobility of approximately 75 percent for moving the entire unit at one time. This unit is designated a category II unit as referred to in AR 310-25 (unit categories).

**Section II. EMPLOYMENT****10-7. General**

*a.* The command and control element organized under TOE 11-122 provides a flexible type headquarters and headquarters detachment which is employed to control various types of signal groups. The HHD is a TOE grouping of person-

nel and equipment utilized by the group commander to control the activities of two to seven signal battalions which operate together to perform given tasks and missions as a signal group. It may serve as the command and control element for a theater army signal group; a signal group,

independent corps or similar size task force; a signal service group; or a signal construction group if all battalions in the group happened to be signal construction battalions. The signal group designation would thus depend on the mission and the type signal battalions assigned to the group to perform that mission. The HHD simply provides the command and control to insure that the group's overall mission is accomplished.

b. The mission of the headquarters and headquarters detachment has been stated in paragraphs 10-1 through 10-3. The mission of the *type* signal group will be stated in the group's activation orders, along with the capabilities and limitations. These will depend on the number and composition of the signal battalions grouped together under control of the HHD. Figures 2-2, 2-5, 2-6, and 2-7 show different type signal groups, but each group is assigned an HHD TOE 11-122 command and control element. The mission of the group will normally be stated clearly and concisely. For example, the mission statement for a theater army signal group may be—*to provide TACS long line and terminal communications facilities for a designated axis of communications in the communications zone.* On the other hand, the mission of a corps signal group may state: *to augment organic corps command communications systems.* The group's capabilities and limitations will be the combined capabilities and limitations of the signal units that form the group. The number and type of operating signal units allocated per group and assigned or attached to the group will be determined by the communications requirements of the supported force. Only one command and control element is allocated and assigned to each signal group.

## 10-8. Unit Employment

a. The headquarters and headquarters detachment is employed by the signal group commander to direct and coordinate the operation, training, administration, and logistics functions of the group headquarters and for assigned and attached units. The group headquarters includes the commander and his staff. The commander employs his staff to establish and monitor the personnel, administrative, and logistics functions of the group and to maintain technical and/or operational control over subordinate units and the communications systems they establish or the other COMMEL activities in which they are engaged.

b. The headquarters detachment is employed to provide administrative and logistical support for the command headquarters and the headquarters detachment, to assist the S3 in carrying out his intelligence and signal operations responsibilities, and to install and operate the internal wire communications system for the signal group headquarters.

c. When the HHD is organized under SRC-20 of TOE 11-122, the signal systems engineering and control section provides communications planning, supervision, traffic control, signal information service, circuit engineering, and centralized technical direction of the army area communications system; or provides detailed communications systems engineering and communications control for a designated axis of communication, when operating as a subordinate headquarters of a USASTRATCOM (theater).

## Section III. OPERATIONS

### 10-9. Introduction

The command headquarters includes the group commander and his staff. The group commander exercises command control through his staff by issuing orders to the responsible section of the detachment and to subordinate units. The group's executive officer acts as chief of staff and coordinates the staff activities of the group headquarters. He also acts as liaison officer between the group commander and commanders of subordinate units. In addition, he commands the group during the commander's absence.

### 10-10. Group Headquarters

a. The S1, S4, and sergeant major supervise personnel, administrative, and logistics functions of the group. However, only those personnel, administrative, and logistics functions which require coordination or resolution at group level or are necessary for effective command control are handled by the group headquarters.

b. The S3 is responsible for the preparation of operations orders, standard operating procedures, training directives, and technical operating in-

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structions. He implements signal plans of higher headquarters, supervises the preparation of unit contingency plans, and keeps the commander informed of the signal situation. The S3 also is responsible for group S2 functions. He supervises the operations and intelligence activities of the group and is responsible for the preparation of operations and security orders, SOP's, and technical and training directives. He supervises the preparation of contingency plans for expanded operations. This planning entails preparation of a basic communications plan to include facilities required, area to be served, probable system load conditions, and network control arrangements for efficient operation of the proposed system. He plans lists of priorities for establishment of a communications system. He is also responsible for providing the group commander with up-to-date COMMEL situation information. As the S2, he provides information to the commander on all matters pertaining to the security function of the unit. He prepares and insures compliance with directives for internal and area security for group headquarters and for assigned and attached units.

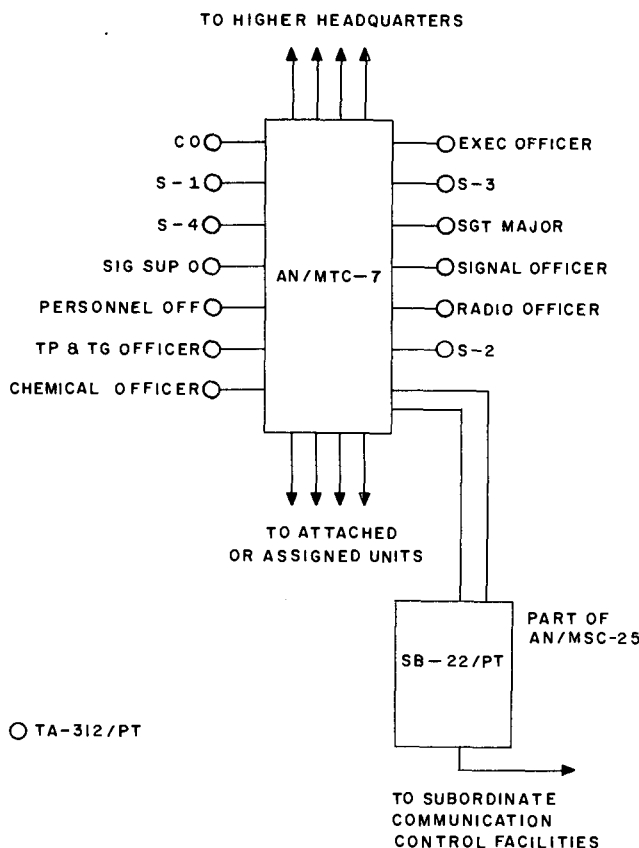
c. The chaplain advises the group commander on all religious matters pertaining to the group headquarters and to assigned or attached units. He is responsible for coordinating with chaplains in the areas where units of the group are located to insure religious activities' coverage, especially where operating elements are located in isolated or remote areas (multichannel radio teams, etc). He is the commander's special staff officer for religious activities and maintains active liaison with subordinate unit chaplains. The chaplain may be required to serve with operating elements of the group when the need arises and sufficient religious activity coverage cannot be provided by chaplains assigned to signal units subordinate to the group.

10-11. Headquarters Detachment

The headquarters detachment is organized as shown in figure 10-1. It provides the personnel and facilities required by the group staff officers for supervision and coordination of group activities. The detachment commander also coordinates mess requirements, motor maintenance, supply and medical service with the supporting units, and performs the duties of headquarters commandant. He is responsible for the unit loading plan and supervises movement operations when the headquarters displaces.

a. *Detachment Headquarters Section.* The detachment headquarters section operates a unit supply facility and provides mess and organizational motor maintenance personnel to augment the unit that provides vehicle maintenance and mess support. Unit personnel matters are also handled by the detachment headquarters section. The manual telephone central office and the group internal wire communications system with the personnel to install and operate it are organic to this section. Figure 10-2 shows a type internal wire communications system for the signal group.

b. *Administration and Logistics Section.* The administration and logistics section contains personnel and equipment to provide the commander and his staff with clerical and technical support in the areas of administration and logistics at group level. Staff responsibility for the section is shared by the S1 and S4. Enlisted personnel as-



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Figure 10-2. HHD, signal group, type wire diagram.

signed to the section are under the administrative control of the sergeant major, but perform duties for the commander and his staff in line with their MOS skills.

(1) The signal equipment maintenance and repair officer is an advisor to the S4. He recommends policies and procedures for preventive maintenance and on-site repair of COMMEL equipment used in communications systems provided by the group. He makes inspections and insures that group directives dealing with these matters are implemented by signal units subordinate to the group.

(2) The food service technician, assisted by an enlisted food service supervisor, inspects mess operations throughout the group.

(3) The material readiness general supply

and the signal supply personnel directly support the S4; the information specialist and the personnel specialists directly support the S1. The services of the stenographer, clerk typists, and drivers are pooled. They perform duties in their respective fields to meet the needs of the headquarters. One of the vehicles organic to the administration and logistics section has a vehicle mounted radio set. This is used by the group commander for operations in the group command net for command and control purposes. The driver assigned to the vehicle is cross-trained as a radio operator. A type group command and control radio net is shown in figure 10-3.

c. *Operations and Intelligence Section.* The operations and intelligence section provides the technical staff and equipment to support the S3

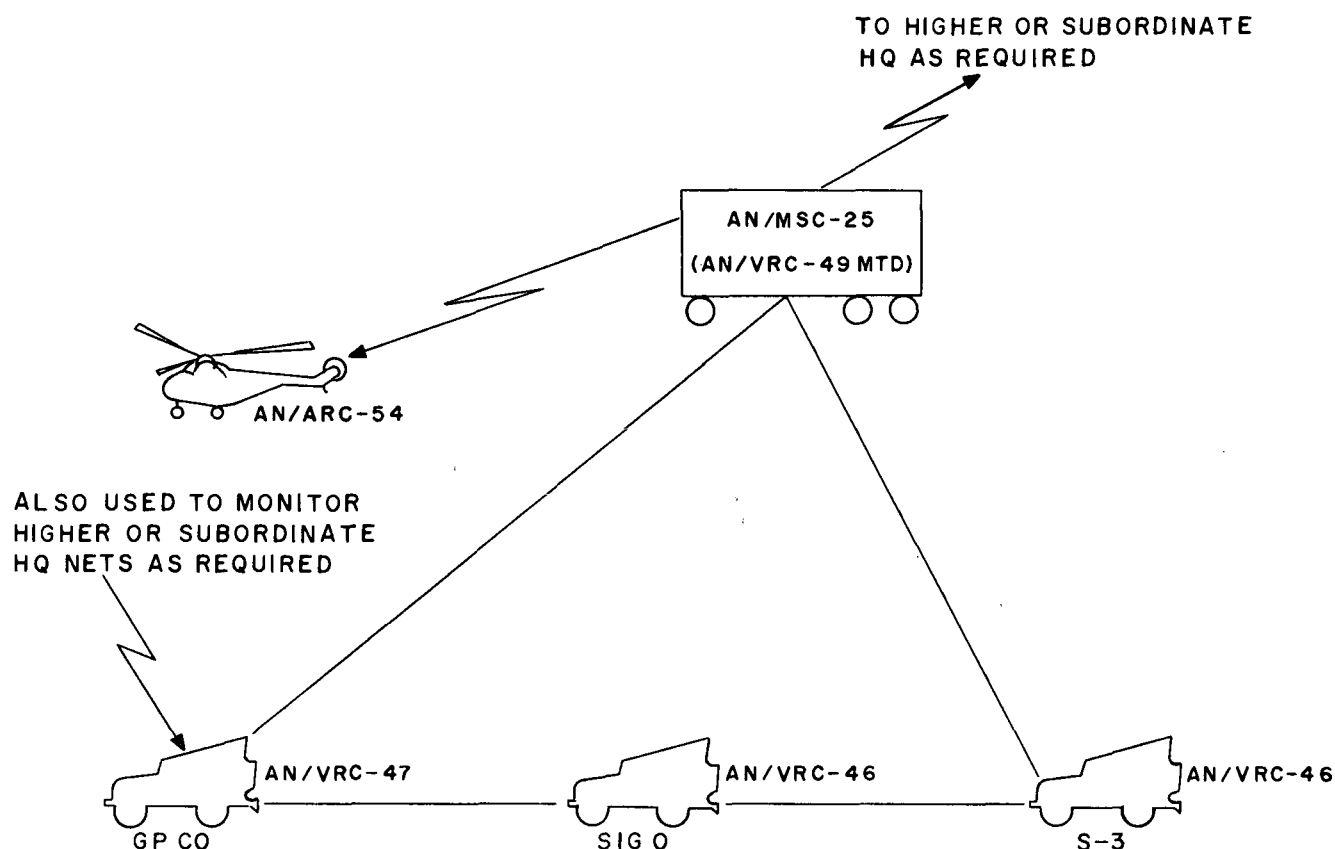


Figure 10-3. Type radio command and control net, HHD, signal group (HHD organized under SRC-10 of TOE 11-122).



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and S2 operations of the group. Although the S3 is primarily concerned with group signal plans and operations, he is also responsible for all aspects of security for the group headquarters, and insures that group security directives are implemented by assigned and attached units. The same responsibilities apply to other training activities of the group. The S3 section is also the point of contact for coordinating requests for use of the aircraft organic to the section, and for coordinating requests for tactical airlift support as required. Personnel assigned to the section, in addition to performing duties within their specialized field, perform such other additional duties as the S3 may direct to accomplish the group's operations and training and security and intelligence functions.

(1) A signal officer, communications engineer officer, radio officer, and a telephone and telegraph officer assist the S3 in fulfilling his various responsibilities. They assist in planning, engineering, and coordinating the communications system established by the group to insure ready availability of circuit routes and alternate routes and to prevent or relieve traffic congestion. They maintain current usage and availability records of circuits, circuit facilities, and radio frequencies. The radio officer, in addition to his other duties, performs the radio frequency allocation functions for the group. This staff furnishes system control information to subordinate units operating the communications systems.

(2) The helicopter pilot, in addition to flying his aircraft, coordinates requests for use of the aircraft and keeps the S3 informed on the aircraft's operational readiness and on weather conditions. He implements tactical airlift directives of higher headquarters by preparing standard operating procedures for requesting tactical airlift support in consonance with tactical airlift operations doctrine as stated in FM 100-27 as it applies to the need and operational requirements of the group. He disseminates this information to all signal units subordinate to the group.

(3) The operations sergeant, in addition to his technical duties, assists the S3 and other technical staff officers by coordinating the efforts of the enlisted technical specialists and supervising the work of the draftsmen, clerical, and driver personnel assigned to the section. The intelligence sergeant is trained in signal intelligence and is familiar with communications security practices and procedures. He assists the S3 in carrying out his S2 responsibilities.

(4) Facilities for planning, engineering, and maintaining technical control over communications system and installations established by the signal group are organic to the operations and intelligence section. The section uses a communications operations center van for this purpose. It contains a telephone switchboard, teletypewriter equipment, local telephone circuits and display board facilities. A radio set is also mounted in the van. Two other vehicles assigned to the section also have radio sets mounted in them. This equipment is employed as shown in figure 10-3 for controlling group operations. This facility handles technical channel, systems control, and circuit allocation message traffic between higher headquarters and subordinate units, and provides technical control information and direction to subordinate units. The circuit control sergeant, under supervision of the operations sergeant, insures that the facility is operational and manned 24 hours a day. Communications systems and facilities established by units assigned to the group are posted on the display board. This information is kept current to insure effective and reliable communications and to keep the commander advised on the signal communications situation.

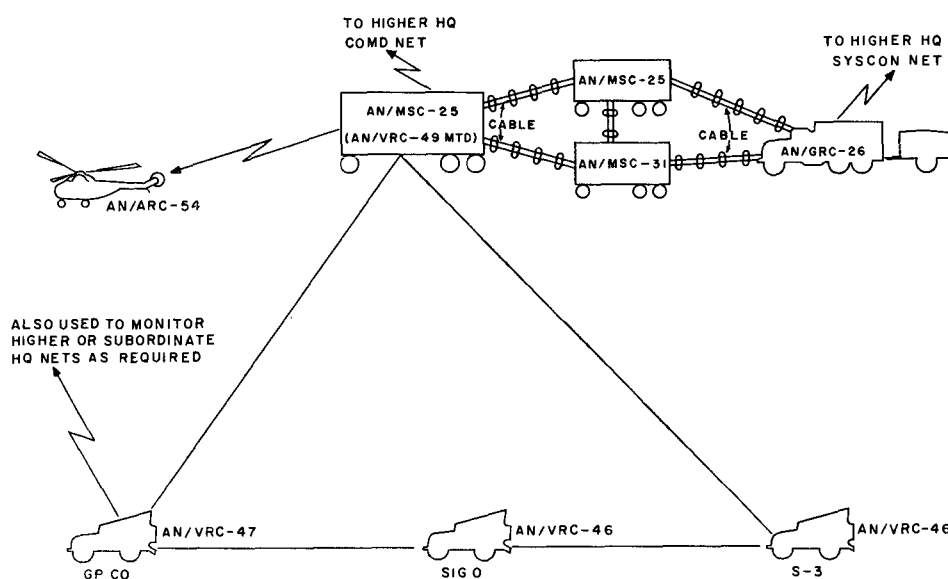
*d. S3 Section Under SRC-20 of TOE 11-122.* The S3 section and its operation discussed in *c* above relate to its capabilities when the headquarters and headquarters detachment is organized under SRC-10 of TOE 11-122. When it is organized under SRC-20 of this TOE, the section's capabilities increase. Normally, the HHD signal group will be organized under SRC-20 when the group which it controls operates as an independent unit in support of an independent corps or similar size task force. It may also be organized under SRC-20 when operating as a subordinate unit assigned to a USASTRATCOM (theater). The determining factor will be the signal group's overall mission. If a requirement for detailed signal systems planning, engineering, and control exists, then organization under SRC-20 will do the job.

(1) The signal systems engineering and control section includes a staff of technical personnel to augment the operations and intelligence section when the signal group supports an independent corps or similar size task force and is thus required to engineer and control a corps area signal system. A signal officer is included in the section. He will assume the duties of group S3. The assigned S3 then becomes assistant S3. The additional personnel are integrated with the existing

operations and intelligence section personnel of the detachment to provide added staff planning, coordination, and operational control of assigned and attached units. A message traffic engineer, communications center engineer, radio officer, communications traffic engineer, assistant radio officer, telephone and telegraph officer, field line construction officer, and the necessary enlisted assistants, are provided to plan, coordinate, and engineer all communications required for a separate corps area system. A signal directory officer, a directory supervisor, and clerks are provided to operate the signal information service which is responsible for collecting, recording, and disseminating signal directory information. A general draftsman and an assistant general draftsman are provided to prepare the necessary charts, equipment layouts, circuit diagrams, and schematics.

(2) This section has its own organic equipment to perform its mission. When it is integrated into the signal group's section, all equipment and facilities are used to expand the S3 section's capabilities. This equipment includes a communications center operations van equipped with a telephone switchboard for intercommunications and local telephone circuits. It has drafting and display board facilities. Interconnected with the operations center is another truck-mounted operations center. It also has telephone

switchboard and display facilities, and in addition, it has teletypewriter equipment, both hard copy and reperforator transmitter equipment used for technical control of signal communications facilities established and operated by the group. Contact is maintained through the operations centers with operating elements of the group, and with the centralized systems control and circuit allocation elements of higher headquarters. The group will implement such communications control directives as are directed by higher headquarters and will establish standard operation procedure within its area of responsibility as may be authorized by the centralized communications system control element of that headquarters. Separate circuits used for these purposes are often referred to as engineering circuits, order wire circuits, or systems control circuits. They are of the sole-user type, used entirely for maintaining efficient and effective control over communications systems operating elements. This insures the users of the installed communications systems and networks a reliable, responsive signal communications system to meet their operational needs. A radio teletypewriter team chief and three radio teletypewriter operators are provided to operate a teletypewriter in the SYSCON radio net. A type radio net and communications control facility for the HHD, signal group organized under SRC-20 is shown in figure 10-4.



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Figure 10-4. Type radio command and control net, HHD, signal group (HHD organized under SRC-20 of TOE 11-122).





## CHAPTER 11

## HEADQUARTERS AND HEADQUARTERS DETACHMENT, SIGNAL BATTALION

## Section I. UNIT CHARACTERISTICS

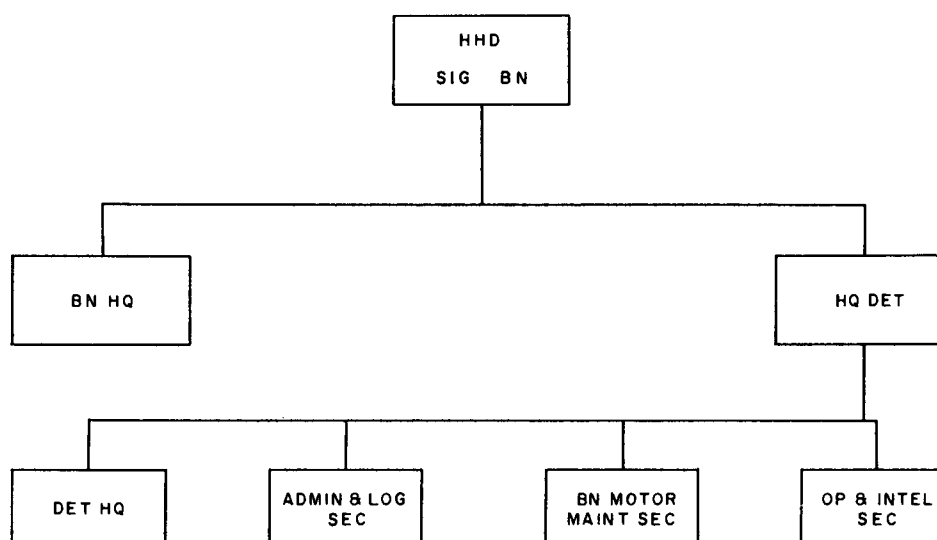
## 11-1. General

Theater army COMMZ operations require versatile and responsive signal communications systems. Plans for COMMEL support must keep pace with contingency planning for COMMZ operations. To meet changing requirements, building-block signal units of company size have been developed as TOE organizations (app A) to perform a variety of signal communications functions. Some may operate as separate units providing communications service for the unit to which they are attached. In most instances, however, they will be grouped together and function as a signal battalion. When this occurs, the selected units are placed under a command and control element called a headquarters and headquarters detachment, signal battalion, organized under TOE 11-116. The mission of the type signal

battalion will be stated in the battalion's activation orders. The battalion's mission will determine the number and type of building-block signal units assigned to the battalion to accomplish the mission. Subsequent paragraphs relate primarily to the unit characteristics of a headquarters and headquarters detachment signal battalion.

## 11-2. Mission

The mission of a headquarters and headquarters detachment of a type signal battalion is to direct and coordinate all operations of the signal battalion and to provide the battalion commander with personnel and equipment to carry out the mission. Figure 11-1 shows the unit organization of an HHD signal battalion.



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Figure 11-1. HHD, signal battalion.

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**11-3. Assignment**

The headquarters and headquarters detachment is assigned to a type signal battalion for which it provides command and control. The battalion may further be assigned or attached to a type signal group to perform a portion of the signal groups' overall mission. The type battalion to which the HHD is assigned may be attached or assigned directly to a USASTRATCOM (theater) to perform a specific theater or theater army communications mission or it may be assigned as a separate signal battalion and provide direct signal communications support for a special task force.

**11-4. Capabilities**

The HHD provides command control, staff planning, and supervision for, and directs the training and operations of a signal battalion consisting of two to seven companies. Battalion level personnel services and logistics support, such as battalion level maintenance for organic vehicles and electrical power units, is also provided. To accomplish this, personnel specialists and equipment maintenance personnel from the other units assigned to the battalion are used to augment the battalion personnel section and motor maintenance section. Provisions for these personnel are made in the organization of building-block TOE

units. The HHD also provides the battalion commander and his staff with an aircraft for command and staff visits.

**11-5. Limitations**

Because the HHD has no organic mess or organizational arms maintenance capability, it depends on one of the other assigned units for these services. Other services required by the battalion such as medical, dental, and finance or additional motor transportation and direct support maintenance of organic aircraft, are provided by combat service support units in the battalion's area of operation.

**11-6. Training, Mobility, and Category**

Assigned personnel, in addition to training in their basic skills, receive further training under Army Training Program 11-116, to operate as an effective unit. All personnel, except the chaplain, are trained to engage in effective coordinated defense of the unit's area or installation. This includes, but is not limited to, rear area protection procedures, operations in an internal defense, and operations under CBR conditions. The HHD has organic transportation to provide 85 percent mobility for moving the entire detachment at one time and is designated a category II unit as referred to in AR 310-25.

**Section II. EMPLOYMENT****11-7. General**

a. The command and control element organized under TOE 11-116 provides a flexible type headquarters and headquarters detachment which may be employed to control various types of signal battalions. The headquarters and headquarters detachment is a TOE grouping utilized by a battalion commander for command control, and to provide logistics support for two to seven signal companies, which operate together to perform given tasks or missions as a signal battalion. The headquarters and headquarters detachment may serve as the control and support element for a signal service battalion, a signal operations battalion, a signal support battalion, a theater area signal battalion, or other battalion designations, depending on the type of signal units assigned to the battalion.

b. The mission of the HHD *must not* be confused with that of the signal battalion which it

controls. The mission of the HHD has been stated in section I of this chapter. The mission of the type signal battalion will be stated in the battalion's activation orders along with the capabilities and limitations. This will depend on the number and type of signal units grouped together under control of the HHD. Figure 2-3 shows a type signal operation battalion. It has an HHD (TOE 11-116) control element, and four operating companies organized under their respective TOE. The overall battalion mission in this case will be to provide TACS long lines and TACS access trunking circuits and facilities in a designated area of the COMMZ. The battalion's capabilities and limitations, therefore, will be the combined capabilities and limitations of the units forming the battalion. It should also be noted that only one HHD is allocated and assigned to a type signal battalion, whereas the designated type *signal battalion*, in this case the signal operation battalion, is assigned to a theater army signal group (fig. 2-2),

and four battalions are allocated to this group. The theater army area variables considered in paragraphs 2-1 through 2-3 will determine the type signal battalion required in a COMMZ for which an HHD, signal battalion will provide command control.

### 11-8. Unit Employment

*a.* The headquarters and headquarters detachment is employed by the signal battalion commander to direct and coordinate operations and training and to provide administrative and logis-

tics support for signal units assigned or attached to the battalion.

*b.* The battalion headquarters is employed by the commander for command and control and staff supervision of signal units assigned or attached to the battalion.

*c.* The headquarters detachment is employed to furnish administration and logistics support for the battalion and to assist the battalion S3 in carrying out operations and intelligence activities.

## Section III. OPERATIONS

### 11-9. Introduction

The headquarters and headquarters detachment is organized into a battalion headquarters and a headquarters detachment. The battalion headquarters contains the battalion commander and his staff. The battalion commander exercises command control through his staff by issuing orders to the operating sections of the detachment and subordinate units. He is assisted by an executive officer. The executive officer commands the battalion during the commander's absence. He gives staff task assignments to the battalion staff officers and resolves differences and problems which arise in the course of day-to-day operations. This leaves the commander free to check on units under his command to insure that they are carrying out their respective missions in support of the battalion's overall signal communications mission.

### 11-10. Battalion Headquarters

In addition to the commander and the executive officer, the battalion headquarters includes an S3, a chaplain, a motor officer, an S1, an S4, and a sergeant major. Each staff officer has responsibilities in his respective area of interest.

*a.* The battalion S3, who also functions as the S2, supervises the operations and intelligence activities of the battalion. As S3, he is responsible for the preparation of operations orders, standing operating procedures, training directives, and technical operating instructions. He implements signal plans of higher headquarters, supervises the preparation of unit contingency plans and keeps the commander informed of the signal situation. As S2, he supervises the preparation of security plans and insures their implementation.

He provides information and advises the commander on matters involving security, to include rear area protection and internal security for the battalion headquarters and for assigned or attached units.

*b.* The S1 has staff responsibility for the administrative functions of the battalion, and the S4 serves in a similar capacity for the battalion's logistical functions.

*c.* The chaplain and the motor officer act as special staff officers. The deployment of signal units and, in addition, the dispersion of signal personnel assigned to those units, makes individual or unit participation in religious activities difficult. Nevertheless, the battalion commander is required to insure that all personnel are afforded an opportunity to participate in religious services and activities. The chaplain assists the commander in discharging this responsibility. Similarly, the deployment of battalion elements puts great demands on the battalion motor officer in the areas of motor maintenance and transportation.

*d.* The sergeant major, as chief enlisted representative in the command element of the HHD, should be experienced in all phases of signal operations. He performs duties as directed by the commander and coordinates all battalion activities with senior noncommissioned officers of the battalion at the NCO level.

### 11-11. Headquarters Detachment

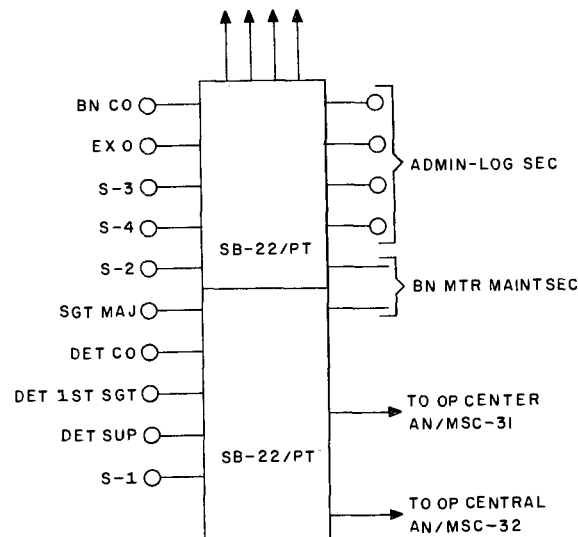
The headquarters detachment is organized into a detachment headquarters, an administrative and logistic section, a battalion motor maintenance section, and an operations and intelligence sec-

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tion. It provides personnel and equipment required by the battalion staff officers for supervision and coordination of battalion activities.

*a. Detachment Headquarters.* The detachment headquarters includes the detachment commander, the first sergeant, and the supply and clerical personnel required for normal detachment operations. The cook assigned to the detachment headquarters is utilized to augment the mess of the unit to which the HHD is attached for mess purposes. Personnel and organic signal equipment used to provide internal communications for the battalion are also assigned to the detachment headquarters. The detachment commander and first sergeant are responsible for normal day-to-day operations such as sick calls, passes, unit fund, unit supply, quartering personnel, discipline, training, etc. The detachment commander is also responsible for preparing the HHD loading plan and supervising unit displacement. In addition, he acts as battalion headquarters commandant. Vehicles and other equipment required for detachment headquarters operations are provided for in the HHD TOE. Detachment headquarters personnel operate the local battalion switchboard. It may be located in either the battalion or detachment headquarters, because the command and detachment headquarters are usually collocated. When located in the battalion headquarters, personnel assigned to the administration and logistics section should be cross-trained in switchboard operations. These personnel will assist in operating this facility to conserve manpower and provide 24-hour telephone service. Figure 11-2 shows a typical battalion telephone system.

*b. Administrative and Logistics Section.* The administrative and logistics section includes the personnel and equipment necessary to provide administrative and clerical assistance to the battalion commander and his staff. The personnel specialists assigned to this section provide only the nucleus necessary for performing battalion personnel functions. The section is augmented by personnel specialists of the signal units which are assigned or attached to the battalion. These personnel specialists assist in performing battalion level personnel functions. The section has a warrant officer, unit personnel technician and unit supply technician, assigned to supervise clerical personnel performing duties in those respective areas. Staff responsibility for this section is shared by the S1 and S4. This method of opera-



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Figure 11-2. Type wire diagram, HHD, signal battalion.

tion allows independent action, yet provides for mutual assistance in administrative and logistical operations with a corresponding savings in manpower.

*c. Motor Maintenance Section.* The battalion motor maintenance section includes a warrant officer (automotive maintenance technician) and sufficient personnel and equipment to form the nucleus of a battalion motor maintenance section. The section is augmented by TOE 29-500 teams or by motor maintenance personnel of TOE units assigned or attached to the battalion. The types and quantities of these personnel are determined by the number of motor vehicles organic to the signal units assigned or attached to the battalion. The motor maintenance section is under the staff supervision of the motor officer. Usually, the section operates in an area some distance from battalion headquarters. It has motor transport for automotive maintenance spare parts and POL. It also has fuel storage and fuel dispensing equipment and a motor vehicle maintenance set which includes vehicle recovery equipment. Headquarters detachment vehicles are kept in the battalion



motor pool area and company level organizational maintenance on these vehicles is performed by the battalion motor maintenance section.

*d. Operations and Intelligence Section.* The operations and intelligence section is the nerve center of a signal battalion. The commander relies on it to accomplish the battalion's signal communications mission. It is under the staff supervision of the S3. The operations and intelligence section contains personnel and equipment to support the S2 and S3 functions. The area signal center officer, carrier system officer, microwave officer, and teletypewriter/telephone officer are technical specialists assisting the S3 in discharging his COMMEL responsibilities by advising him on matters in their respective fields of specialization. The operations sergeant, in addition to his technical duties, assists the S3 and other technical staff officers by coordinating the efforts of section NCO's and enlisted technical specialist. He supervises the work of the SOI clerk, draftsman, drivers, and other assigned personnel. He is responsible for the operational readiness of the vehicle-mounted operations center and operations central. He insures communications continuity by scheduling technical control personnel to provide 24-hour operation of these facilities. The intelligence sergeant is trained in signal intelligence and is familiar with communications security practices and procedures. He assists the S3 in accomplishing battalion S2 duties.

(1) The trunk-mounted field communications operations office is equipped with a telephone switchboard for intercommunication and local telephone circuits. It also includes the drafting and display board facilities required by the S3 to plan, engineer and coordinate the installation and operation of communications facilities provided by the battalion. The signal communications situation is kept current by use of the display board facilities. Interconnected with the operations center is a truck-mounted operations central. It also has a telephone switchboard and display facilities; in addition, it has teletypewriter equipment, both page copy and reperforator tape transmitter equipment used for technical control of signal communications facilities established and operated by the battalion. Contact is maintained through this operations central with operating elements of the battalion and with centralized systems control and circuit allocation elements of

higher headquarters. The battalion will implement such communications control directives as are directed by higher headquarters. It will establish standing operating procedures within its area of responsibility as may be authorized by the centralized communications system control element. Separate circuits used for these purposes are often referred to as engineering circuits, order wire circuits, or system control circuits. They are of the sole-user type, used entirely for maintaining efficient and effective control over communications systems operating elements. This insures the users of the installed communications systems and networks a reliable, responsive signal communications system to meet their operational needs. Figure 11-3 shows a type FM radio communications diagram for the headquarters and headquarters detachment, signal battalion.

(2) The aircraft organic to the HHD, together with the pilot and mechanic, are assigned to the operations and intelligence section. They are employed as required to meet the needs of the battalion. Requests for aircraft support for inspections, staff visits, or resupply of critically needed personnel and equipment to isolated battalion elements are processed through the S3 section. Operations and intelligence section also has radio equipment installed in the operations center or operations central to contact the aircraft in flight, or to contact a vehicle-mounted radio used by the S3 or the commander when they are away from the installation. Since much of the communications systems control traffic may be classified, teletypewriter security equipment is provided in the operations central. Employment of the equipment requires that procedures for safeguarding the COMSEC equipment be established and implemented in accordance with current Army Security Agency directives.

(3) Detailed signal operations orders, plans, SOI, standing signal instructions (SSI), and the types of systems installed, operated, and maintained by the battalion will depend upon the type and number of building-block units grouped together to form the signal battalion. However, the S3 section and other organizational elements organic to the headquarters and headquarters detachment, signal group, provide a balanced organization to carry out the command and control mission assigned to this unit.



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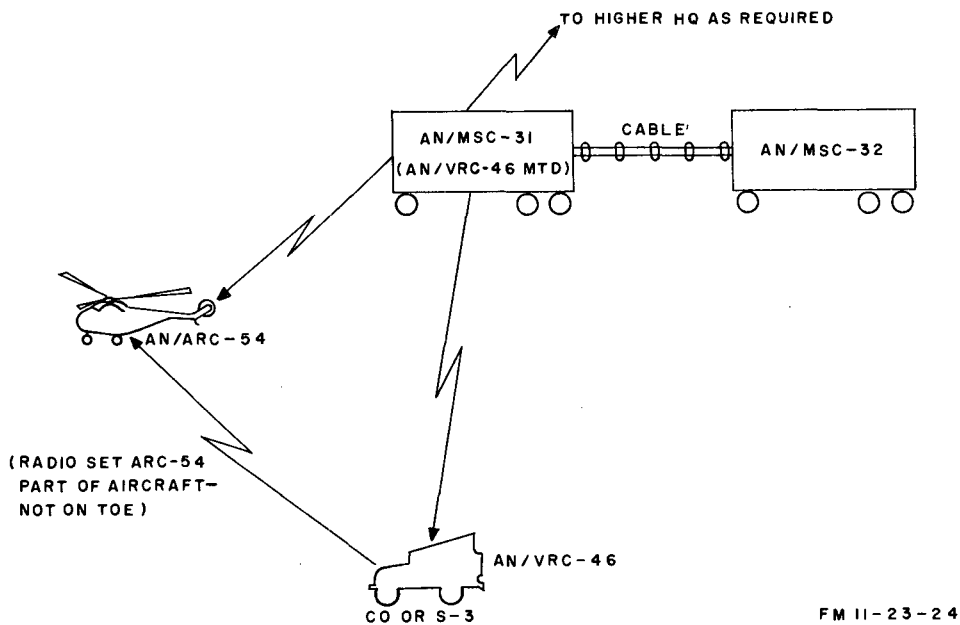


Figure 11-3. Type FM radio diagram, HHD, signal battalion.

**PART THREE**  
**SIGNAL COMPANIES, TROPOSPHERIC**  
**CHAPTER 12**  
**INTRODUCTION**

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**12-1. General**

*a.* Both the signal company tropospheric, light (light tropo company) and the signal company tropospheric, heavy (heavy tropo company) may be assigned to a USASTRATCOM theater). They are used in the COMMZ to provide multilink or single-link portions of the command communications system of the TACS. Tropo companies (or teams) however, may also be used as required to provide connecting or overjump portions of the area communications system of the COMMZ. Command, operational control, and technical control of the tropo companies are exercised by the headquarters element of the USASTRATCOM (theater) to which they are assigned.

*b.* Should a requirement exist for tropo links in an army signal brigade, it has the capability in a light Tropo Company. If the tactical situation, terrain, and the requirements of the combat commander dictate a capability greater than that provided by the light Tropo company a heavy Tropo company could be assigned to fulfill the re-

quirement. Troop companies may be used to provide multilink or singlelink portions of the army command communications system. In addition, they may be used as required to provide connecting or overjump links in portions of the army area communications system.

**12-2. Light Tropo Company**

The light tropo company is characterized by the following (with reference to the heavy tropo company): easier emplacement and displacement, lower radio frequency (RF) power, shorter distance span, and fewer voice channels. The light tropo company is described in detail in chapter 13.

**12-3. Heavy Tropo Company**

The heavy tropo company is used when distance spans or voice channel requirements exceed the capabilities of the light tropo company. The heavy tropo company is described in detail in chapter 14.



## CHAPTER 13

## SIGNAL COMPANY, TROPOSPHERIC, LIGHT

## Section I. UNIT CHARACTERISTICS

**13-1. Mission and Assignment**

The mission of the light tropo company is to provide multichannel communications facilities on a 24-hour basis using tactical tropospheric scatter radio equipment. These communications facilities may consist of a complete system, extensions, or special communications links as required. The company may be fragmented (platoons or sections plus support personnel attached to other signal elements) to provide some special communications extensions or links. Normally when a tropo element, for instance a section, is attached to another signal unit to provide both terminals of a tropo link, technical control of the section also passes to that signal unit. The company is normally assigned to a USASTRATCOM (theater), a field army signal brigade, or an independent corps signal group.

**13-2. Category and Organization**  
(fig. 13-1)

The light tropo company is a category II unit (AR 310-25) and is organized under TOE 11-367. It is

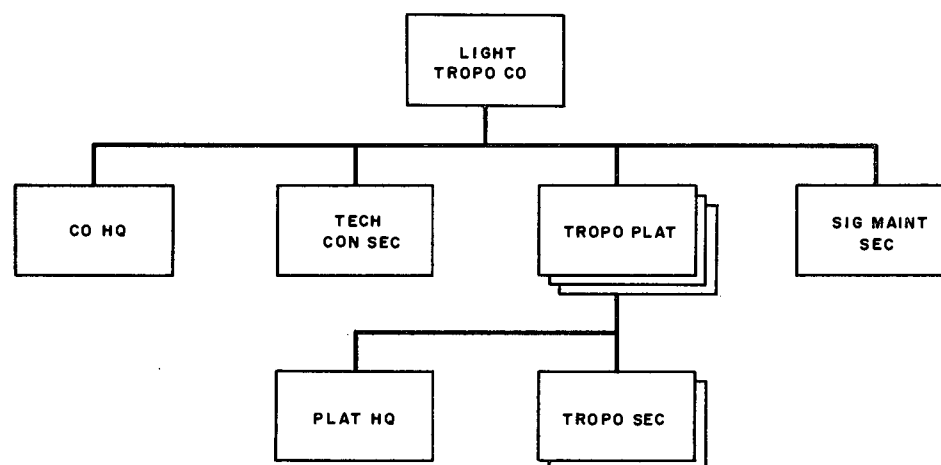
not adaptable to a type B organization. The term *light tropo* refers to the technical capabilities of the company (para 13-4). The company elements are listed below and are described in subsequent paragraphs of this chapter.

- a. A company headquarters.
- b. Three tropo platoons.
- c. A technical control section.
- d. A signal maintenance section.

**13-3. Administrative and Logistic Capabilities**

The light tropo company has the following capabilities:

- a. Provides command and control, planning, and supervision of the operating elements of the company.
- b. Provides company level administrative, personnel, and supply services, including resupply of tropo sites.



FM 11-367-4-1

Figure 13-1. Light tropo company organization.

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c. Provides organizational maintenance of organic arms, electronic equipment, vehicles, and power generators.

d. Provides direct support level maintenance of electronic equipment.

e. Provides 24-hour mess service.

f. Establishes and operates a technical control center.

### 13-4. Technical Capabilities

a. *TOE Levels 1 and 2.* When the light tropo company is at TOE strength levels 1 and 2 (AR 220-1 and AR 135-8), it provides 12 tropo terminals. Each terminal consists of both radio frequency and multiplex equipment. Two terminals are required to provide a communications link and the terminals may be separated by as much as 160 kilometers. The communications link may provide either 24 voice channels or 23 voice channels and 16 full-duplex teletypewriter channels. The company also provides technical control facilities for control of circuits when an extensive tropo system is installed by the company or to complement the technical control facilities of signal units to which the tropo company is assigned or attached. These facilities include a company technical control center (TECHCONCEN) consisting of a patching central (PATCENT) and an operations central (para 13-18 through 13-20). A PATCENT for each pair of tropo terminals is also included (para 13-17).

b. *TOE Level 3.* When the light tropo company is at TOE strength level 3, its communications capabilities are reduced by the deletion of one communications link (two tropo terminals) and the associated PATCENT facility.

### 13-5. Limitations

a. Installation of light tropo sites may require geodetic survey for topography, exact location, soil condition, terrain and distances between terminals, true bearings, and angle to the horizon.

b. Appropriate TOE 11-500 field cable and radio relay (multichannel radio) augmentation teams are required if extension circuits to outlying units must be provided by the light tropo company.

c. Aviation support may be required to supply and maintain tropo terminals operating in isolated areas.

d. Frequency allocation service by the signal element of the supported headquarters is required.

e. At TOE strength levels 2 and 3, personnel strengths are reduced to 90 and 80 percent respectively. Sustained operation at these levels with the company fully committed will result in a reduction of personnel effectiveness.

### 13-6. Mobility

Half of the light tropo company TOE authorized personnel and equipment can be moved at one time with organic transportation (AR 310-31). The company is air transportable with C-130 type aircraft.

### 13-7. Displacement

After the initial deployment of the light tropo company, simultaneous displacement of all company elements is unlikely. Sufficient organic vehicles (para 13-6) are available to move company elements in support of tactical operations.

### 13-8. Tactical Airlift Operations

a. Air Force tactical airlift forces increase the battlefield mobility of the Army in land combat operations. Basically, the Air Force will provide the Army with the capability to airland or airdrop combat elements (combat support) and to provide Army elements with sustained logistical support (combat service support).

b. Complete details governing joint Army-Air Force doctrine for tactical airlift operations are contained in FM 100-27.

### 13-9. Defense Capability

The light tropo company can engage in effective coordinated defense of the company area and remote installations. If such activity is sustained, however, assistance may be required to prevent curtailment of the mission capabilities of the company. Refer to chapter 8 for security information.

## Section II. COMPANY HEADQUARTERS OPERATIONS

### 13-10. General

The company headquarters provides command and administrative control and coordination of the company operational and training mission. The company headquarters normally will be located in the vicinity of the greatest concentration of company elements. This allows greater control, better supervision, and a consolidation of administration, logistics, and messing facilities.

### 13-11. Administration and Logistics

The company headquarters conducts its administrative and logistical operations with normal support from comparable activities of the headquarters to which it is assigned. Messing facilities are available at the company mess 24 hours a day. Some isolated elements of the tropo company may require mess support from adjacent units. Supply operations are geared to the large amount of repair parts required for the continuous operation of the company's electronic equipment and tactical vehicles. The company provides organizational maintenance of arms, motor vehicles, and power generators and direct support level maintenance of organic electronic equipment.

### 13-12. Command and Control

The company commander receives direction and routine administrative support through normal channels from the organization (USASTRATCOM (theater), field army signal brigade, or independent corps signal group, etc) to which his company is assigned. Operational (technical) orders are received through technical channels from the communications element of the organization exercising technical control. Because the distances between elements of the company make control difficult, the company commander makes maximum use of standing signal instructions and company and platoon standing operating procedures for accomplishment of the mission and support activities of the company. In addition, he has available the company communications facilities (para 13-13). The company commander is assisted by the technical control officer, whose duties include the following:

*a.* Assists the company commander in supervision of company operations.

*b.* With the company commander, on a shift basis, exercises direct control over the company.

*c.* Plans, coordinates, and furnishes staff supervision of the operations of the company including site selection, frequency utilization, and technical supervision of operations.

*d.* Functions as the company intelligence officer.

*e.* Supervises the preparation of physical and communications security plans and insures their implementation.

*f.* Insures that all personnel are familiar with electronic counter-countermeasure (ECCM) plans and orders and that these personnel are capable of employing prescribed ECCM procedures.

### 13-13. Company Communications

*a. Wire Communications.* The light tropo company type telephone net (fig. 13-2) normally is installed by personnel of the technical control section. Figure 13-2 shows nine telephones and the operations central connected to the switchboard. Two trunks to the area system also are shown. This is a *type* telephone communications net and it should be noted that two of the tropo platoon headquarters probably will be so distant that they will obtain access to the company headquarters through the area communications system rather than through long locals.

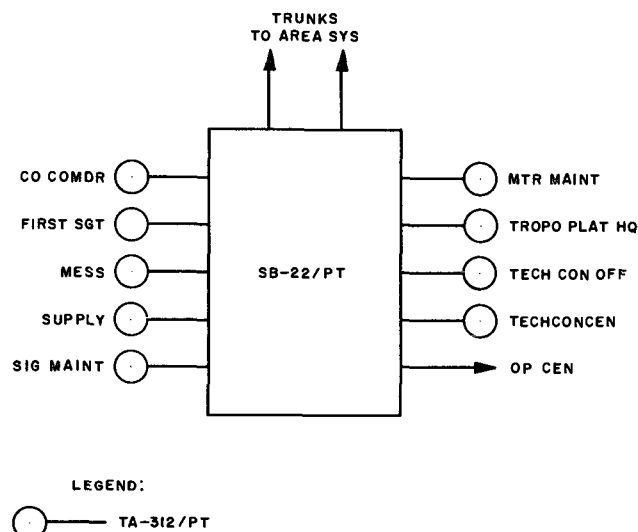


Figure 13-2. Light tropo company type telephone net.

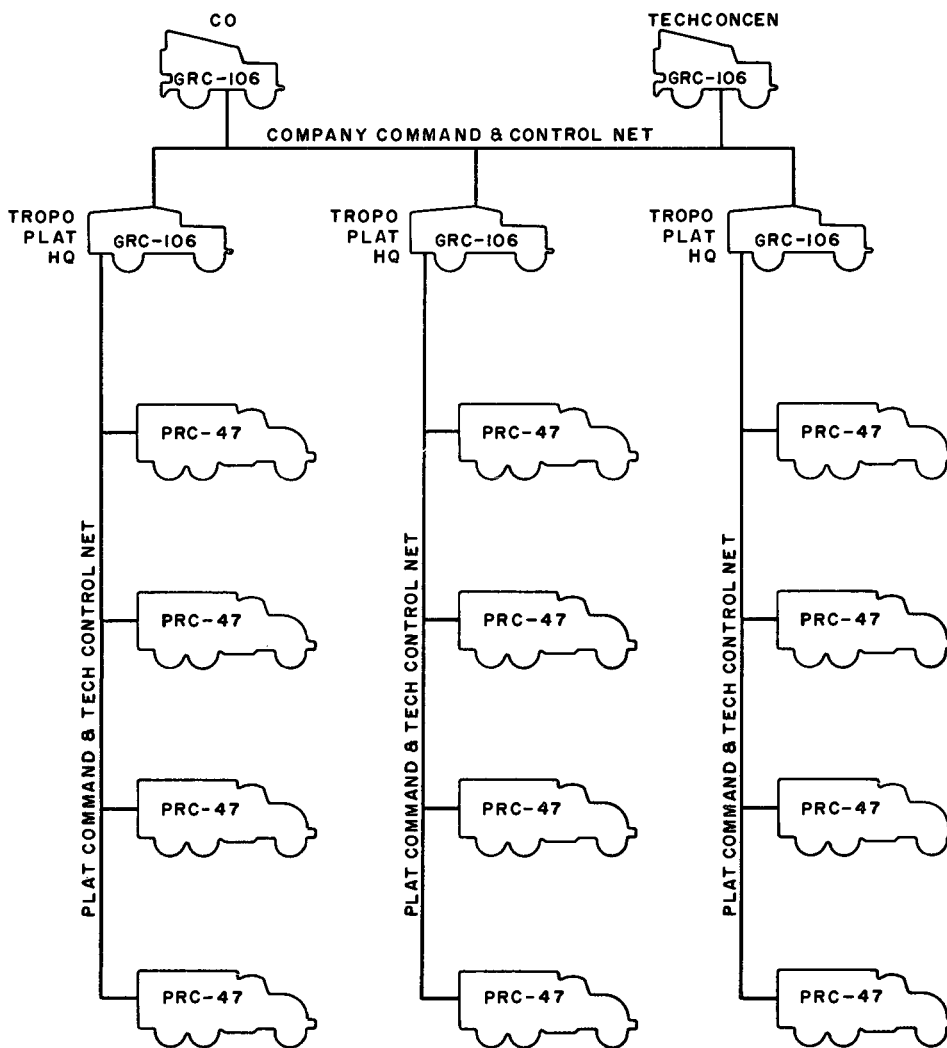


b. *Radio Communications.* The single sideband command and technical control net is used by the company commander to maintain command and control of the company and its operational functions. This net is also used by the company technical control section to control and supervise tropo system installation, system quality, circuit rerouting, and facility displacement. The technical channel (order wire) network of the tropo system, although normally used for terminal to terminal maintenance, is available to the com-

pany commander. Figure 13-3 shows the SSB radio equipment available in the company but is not meant to represent an actual net. A type SSB command and control net for the company is described in paragraph 13-18.

**13-14. Coordination**

Coordination requirements are extensive because the facilities provided by the light tropo company may connect with heavy tropo, multichannel



NOTE:  
AN/PRC-47 SSB RADIOS PART OF  
AN/TRC-129 TROPO TERMINALS.

FM 11-367-5-2

Figure 13-3. Light tropo company SSB radios.

radio, and wire and cable facilities. The company commander and the technical control officer coordinate with commanders, staffs, and technical

control elements of all signal units associated with the tropo company operations including communications, mess, and area defense.

### Section III. TROPO PLATOON OPERATIONS

#### 13-15. Introduction

The tropo platoon installs, operates, and maintains four multichannel tropo terminals and associated patching central facilities as directed (para 13-20a). The platoon includes a headquarters element and two tropo sections.

#### 13-16. Platoon Headquarters

The platoon headquarters includes a platoon leader, a platoon sergeant, a light-truck driver, and a radio operator who operates an SSB radio mounted in the platoon headquarters truck. The SSB radio is used in either the company command and control net or in the platoon command and control net as required. The platoon headquarters is located in the vicinity of or is collocated with one or more of its tropo terminals.

#### 13-17. Tropo Section

A tropo section includes a section supervisor and 25 other personnel. It is organized into two tropo teams and a PATCENT. The two tropo teams operate a multichannel communications link, the terminals of which may be separated by as much as 160 km. The section PATCENT is collocated with one of these terminals. The other terminal of the section must be provided with PATCENT facilities from another communications element, such as a collocated multichannel radio or a heavy tropo terminal. Sufficient personnel are assigned to the section to provide an on-site 24-hour operational and direct support level electronic maintenance capability (para 13-21).

*a. Tropo Team Personnel.* Each of the two tropo teams of the section installs, operates, and maintains the tropo and multiplex equipment of a tropo terminal. To accomplish this, a light tropo team is assigned the following personnel:

- (1) A tropo team chief.

- (2) Two fixed station multiplex equipment operator/repairmen.

- (3) A senior multipurpose power generator operator/mechanic.

- (4) A senior tropo operator.

- (5) A multipurpose power generator operator/mechanic.

- (6) Two tropo operators.

*b. PATCENT Personnel.* The PATCENT element installs, operates, and maintains the equipment used to interconnect, reroute, and test all communications circuits entering or leaving the tropo site. To accomplish this, the PATCENT element is assigned the following personnel:

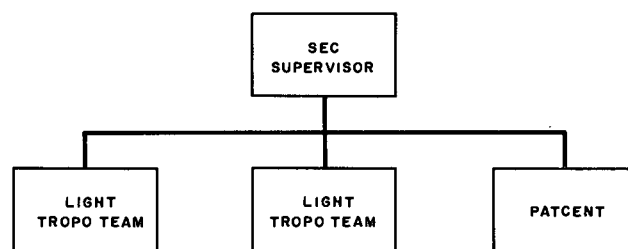
- (1) A fixed station technical control supervisor.

- (2) Four fixed station technical controllers.

- (3) Two fixed station electronic equipment repairmen.

- (4) A senior multipurpose generator operator/mechanic.

- (5) A multipurpose power generator operator/mechanic.



FM 11-367-5-3

Figure 13-4. Light tropo section functional organization.

### Section IV. TECHNICAL CONTROL SECTION OPERATIONS

#### 13-18. Introduction

The company commander and the technical control officer provide 24-hour officer supervision of the 16-man technical control section. This section,

using a TECHCONCEN consisting of an operations central (para 13-19) and a patching central (para 13-20) provides technical control, circuit patching, limited test facilities, and supervision

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of the communications facilities operated by the light tropo company. The PATCENT permits interconnection of the light tropo facilities with multichannel radio, heavy tropo, and wire facilities. The section is assigned an SSB radio and communicates with the distant tropo sites by means of the company command and control net and the platoon command and control nets (fig. 13-5). In addition, the technical channel of the tropo equipment may be available for passing technical instructions and information to the other PATCENTS of the system (one PATCENT at each tropo terminal) although this channel is normally terminated at the tropo equipment and is not extended to the PATCENTS. Note that figure 13-5 shows a type net and does not preclude variations to suit other deployment requirements.

### 13-19. Operations Central

The primary functions and the personnel of the operations central are listed in *a* and *b* below.

#### *a. Operations Central Functions.*

(1) Prepare system plans, diagrams, and circuit orders.

(2) Supervise the installation, operation, and maintenance of the tropo system.

(3) Reroute circuits as required or as directed by the higher echelon systems control element that controls the company's operational mission.

(4) Coordinate with supported units regarding locations, service required, and planned displacements.

(5) Prepare company signal operation instructions, standing signal instructions, and standing operating procedures.

(6) Plan and prepare company training directives and supervise training.

(7) Provide coordination during redeployment of company communications capabilities.

(8) Maintain information on the current status of company communications capabilities, including map profiles of systems.

#### *b. Operations Central Personnel.*

(1) A technical control officer.

(2) A fixed station chief technical controller.

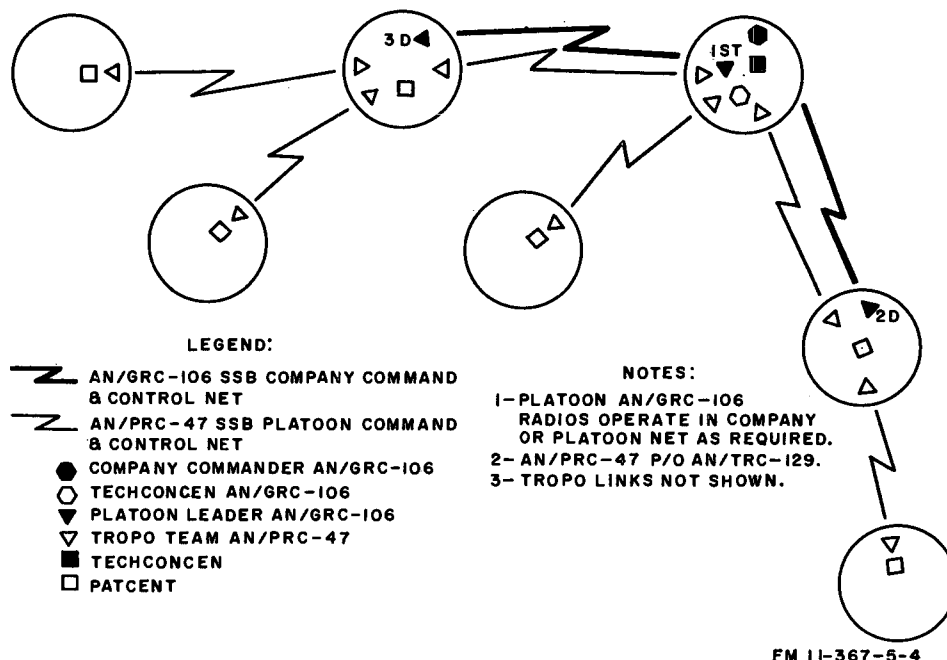


Figure 13-5. Light tropo company type command and control nets.

- (3) Two fixed station technical controllers.
- (4) A general draftsman.
- (5) A reports clerk.
- (6) Two teletypewriter operators.
- (7) A radio operator.

### 13-20. Patching Central

The primary functions and the personnel of the PATCENT are listed in *a* and *b* below.

#### *a. PATCENT Functions.*

(1) Provide an interface facility and interconnect and test all communications systems and circuits that enter or leave the site.

(2) Reduce circuit outage time by rerouting circuits or channels.

(3) Establish emergency interconnections between tropo terminals and between tropo terminals and the communications systems extension facilities provided by other communications units.

(4) Clear communications difficulties between local and distant facilities by causing equipment checks to be made.

(5) Conduct tests to locate and evaluate sources of trouble.

(6) Maintain circuit outage records and place additional circuits into service as the traffic load requires.

(7) Use judgment, initiative, and technical knowledge to insure continuity and responsiveness of communications.

#### *b. PATCENT Personnel.*

(1) A fixed station technical control supervisor.

(2) Four technical controllers.

(3) A fixed station electronic equipment repairman.

(4) Two multipurpose power generator operator/mechanics.

(5) A fixed station electronic equipment repairman apprentice.

## Section V. SIGNAL MAINTENANCE SECTION OPERATIONS

### 13-21. General

The signal maintenance section performs direct support level maintenance on company electronic equipment and scheduled organizational maintenance on company tropo site air-conditioning equipment. Although the operators of tropo terminal electronic equipment are operator/repairman type personnel, normally, they analyze and isolate equipment troubles and restore equipment to service by repairing it. Assembly repair is performed by the signal maintenance section. Because the elements of the light tropo company are so widely separated, the signal maintenance section is deployed in two teams.

### 13-22. Section Deployment

A type deployment of the signal maintenance section is shown in figure 13-6. The intent of the deployment is to place the two maintenance teams near electronic equipment population centers. For example, in figure 13-6, maintenance team No. 1 is collocated with the company and 1st platoon headquarters at site E; maintenance team No. 2 is collocated with the 3d platoon headquarters at site C. Many other deployment patterns are possible, and the following considerations will influ-

ence the selection of the most advantageous pattern.

*a.* Distances between company elements.

*b.* Road conditions between company elements.

*c.* State of technical training of both operator/repairman and signal maintenance section personnel.

*d.* Availability of air transportation.

### 13-23. Maintenance Team Composition

The composition of the two maintenance teams given in *a* and *b* below is a *type* composition and is based in general on the type deployment shown in figure 13-6.

#### *a. Team No. 1.*

(1) Electronic technician.

(2) Senior tropo repairman.

(3) Field radio repairman.

(4) Multiplex equipment repairman.

(5) Tropo repairman.

(6) Multiplex equipment repairman apprentice.

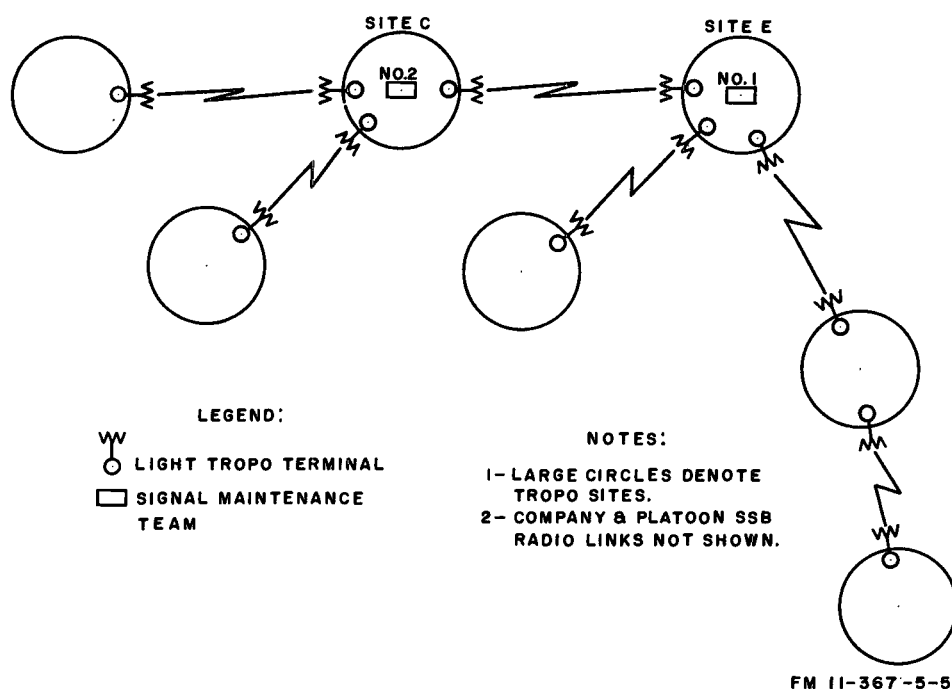


Figure 13-6. Light tropo signal maintenance section type deployment.

- (7) Refrigeration specialist.
- (8) Repair parts specialist.
- (9) Teletypewriter equipment repairman.

b. Team No. 2.

- (1) Tropo repair supervisor.
- (2) Multiplex equipment repairman.
- (3) Tropo repairman.
- (4) Multiplex equipment repairman apprentice.

## Section VI. COMPANY DEPLOYMENT AND SITE CONFIGURATION

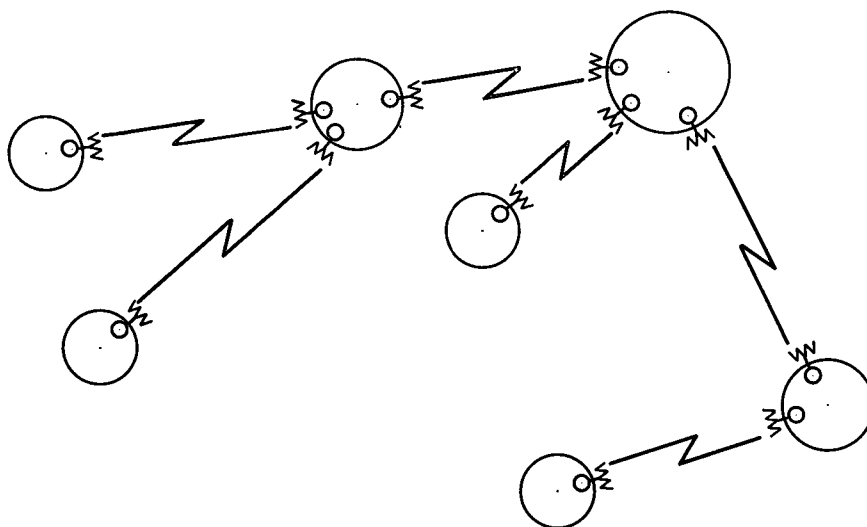
### 13-24. Company Deployment

In a theater of operations, a light tropo company may be deployed to provide six highly reliable, multichannel communications links, normally in the command communications systems but available for use in the area communications systems. A link consists of two terminals separated by as much as 160 km, depending on the terrain and the locations of supported elements. Each link is established by one of the six light tropo sections of the company (para 13-17). Although the requirements for tropo terminal elevation are not as demanding as those of very high frequency or ultrahigh frequency (UHF) multichannel radio, light tropo terminals should be sited on high ground whenever possible. Tropo site elevation is important because tropo path loss is highly dependent on the angle the antennas at each end of

the path make with the horizon and also because clearance of nearby obstructions by the antenna beam is imperative. Tropo terminal siting is covered in detail in the applicable tropo equipment technical manual. The deployment of the light tropo company could range from interconnected links, which include all the tropo terminals of the company (fig. 13-7), to six geographically separated links (fig. 13-8). Figure 13-9 shows a type deployment of the light tropo company that is between these two extremes. This illustration shows sites A, B, C, D, E, and F interconnected, and sites G and H connected as terminals in a single link. Although no attempt is made here to show every possible deployment of the light tropo company, the operational concept and type equipment configurations at sites A, C, and E (fig. 13-9) are developed in paragraphs 13-25 through 13-27

respectively, and will provide a base of information for all other deployment variations. For convenience, sites A, C, and E are referred to in paragraphs 13-25, 13-26, and 13-27 as a tropo *team* site, a tropo *platoon* site, and a tropo *company*

site respectively. SSB radio at each tropo site is initially used to provide communications for tropo link or system lineup. After the tropo links are operational, the tropo equipment technical channel may be used for technical control orders.

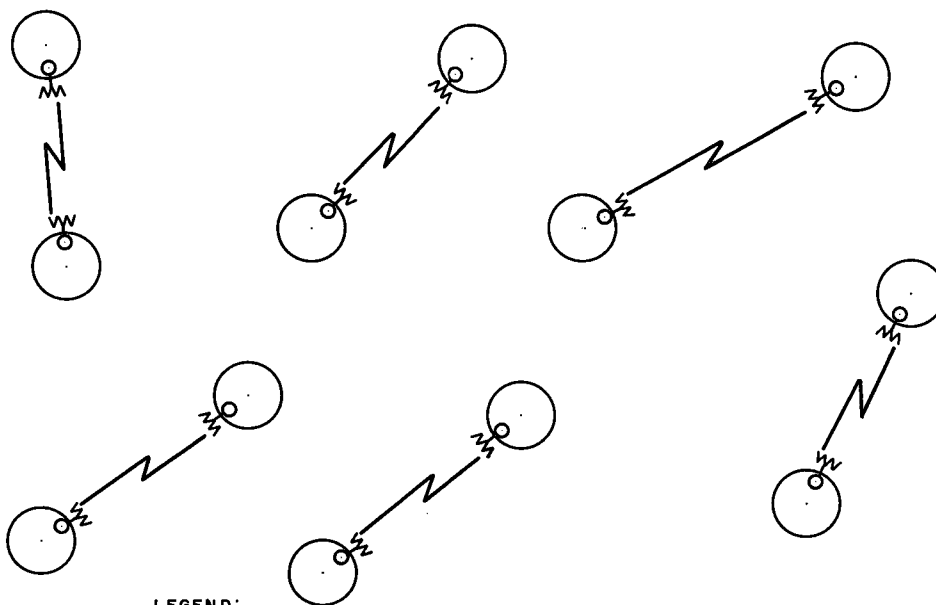


LEGEND:

⊕ LIGHT TROPO TERMINAL

FM 11-367-6-1

Figure 13-7. Light tropo company deployed as interconnected links.



LEGEND:

⊕ LIGHT TROPO TERMINAL

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Figure 13-8. Light tropo company deployed in separate links.



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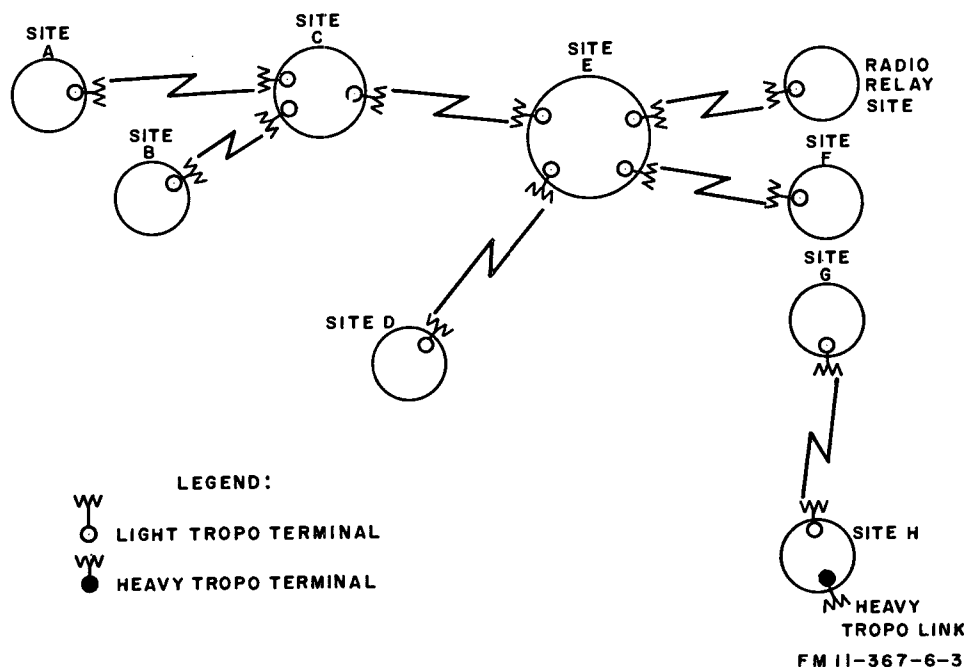


Figure 13-9. Light tropo company type deployment.

### 13-25. Light Tropo Team Site

*a. General.* The tropo team chief at site A (fig. 13-10, upper left) is the site commander and is responsible for the administration of the site and for the operation and maintenance of the equipment. Because site A has only one tropo link (the link to site C), it has the minimum number of major items of equipment for a complete tropo site. In a tropo site with but one terminal, the site layout problem (including power and communications cable pattern) is usually not complicated. However, the relatively few cables and wires of the site do require routing that will avoid damage from personnel and vehicle traffic. The major items of equipment at site A are a patching central with its power units and a tropo terminal with its power units. Sites B, D, F, and G have similar equipment configurations except that site G would include the SSB radio of the third platoon headquarters. Site H, however, shows a light tropo terminal collocated with a heavy tropo terminal. In the type company deployment shown in figure 13-10, the site H light tropo terminal would not include a PATCENT that is organic to the light tropo company, but would use the PATCENT facilities of the collocated heavy tropo team. Because of the limited number of personnel

at a tropo team site, arrangements should be made, if possible, to mess with a larger unit in the area or to operate a consolidated mess with other small units. However, if the site is completely isolated, appropriate light tropo company mess personnel will be assigned.

*b. Site Configuration.* The rectangular insert on figure 13-10 shows the 26-pair cable, spiral-four cable, and field wire that carry circuits from supported elements (para 13-5b) to the tropo site. These circuits terminate in the PATCENT which has facilities to patch, reroute, and test all communications circuits entering or leaving the site. At the PATCENT, the cable and wire facilities are interconnected with the tropo facilities in accordance with the SYSCON SOP or in accordance with SYSCON orders received through technical channels. Up to four 26-pair cables may be required between the PATCENT and the tropo terminal to carry the incoming and outgoing voice and teletypewriter channels (a maximum of 24 voice channels or 23 voice channels and 16 teletypewriter channels).

### 13-26. Light Tropo Platoon Site

*a. General.* The tropo platoon leader at site C (fig. 13-11) is the commander of the site and is

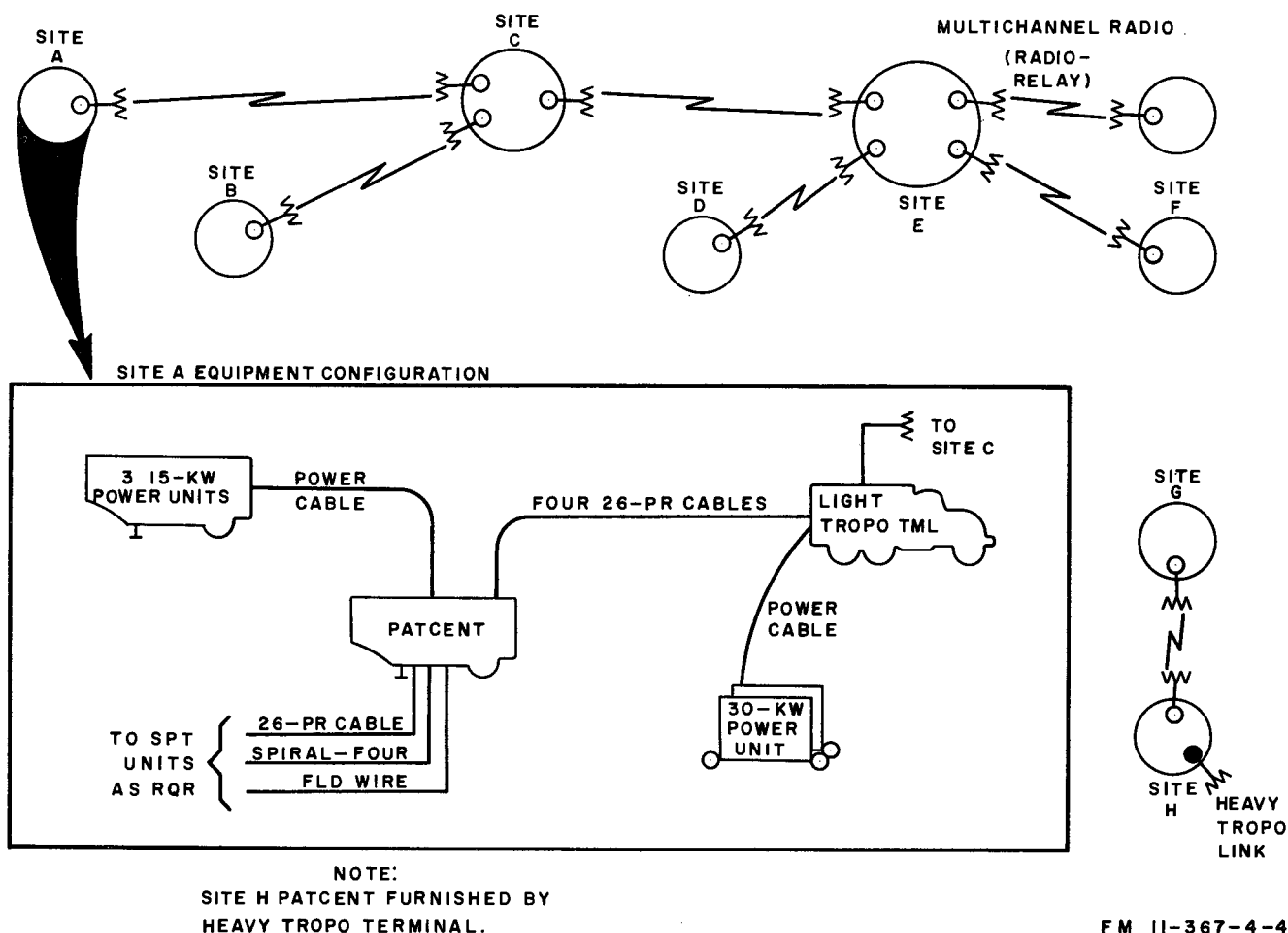


Figure 13-10. Type equipment configuration at light tropo team site.

responsible for its administration and for the operation and maintenance of its equipment. In the type deployment of the light tropo company shown in figure 13-11, site C has three tropo terminals with their power units, a PATCENT with its power units, and a mobile electronic shop with its power units. In addition, platoon headquarters with its SSB radio will also be located at or near the tropo site. This amount of equipment makes preplanning of the site layout mandatory. Preplanning must include the routing of power cables, communications cables and field wire to protect them from damage by personnel and vehicle traffic.

b. *Site Configuration.* The rectangular insert on figure 13-11 shows the major items of equipment at site C. In operation, spiral-four cable, 26-pair cable, and field wire carry circuits to the

tropo site from supported elements in the surrounding area. These circuits terminate in the PATCENT which has facilities to patch, reroute, and test all communications circuits at the site. The circuits from the supported elements are patched to the three tropo terminals in accordance with the SYSCON SOP or in accordance with SYSCON technical orders. Up to four 26-pair cables may be required between the PATCENT and each of the three tropo terminals.

**13-27. Light Tropo Company Site**

a. *General.* Site E (fig. 13-12) is the major operating site of the light tropo company. The technical control section is located here to provide technical control and direction to the operating elements of the company. Three tropo teams, a mobile electronic shop, and a platoon headquarter-

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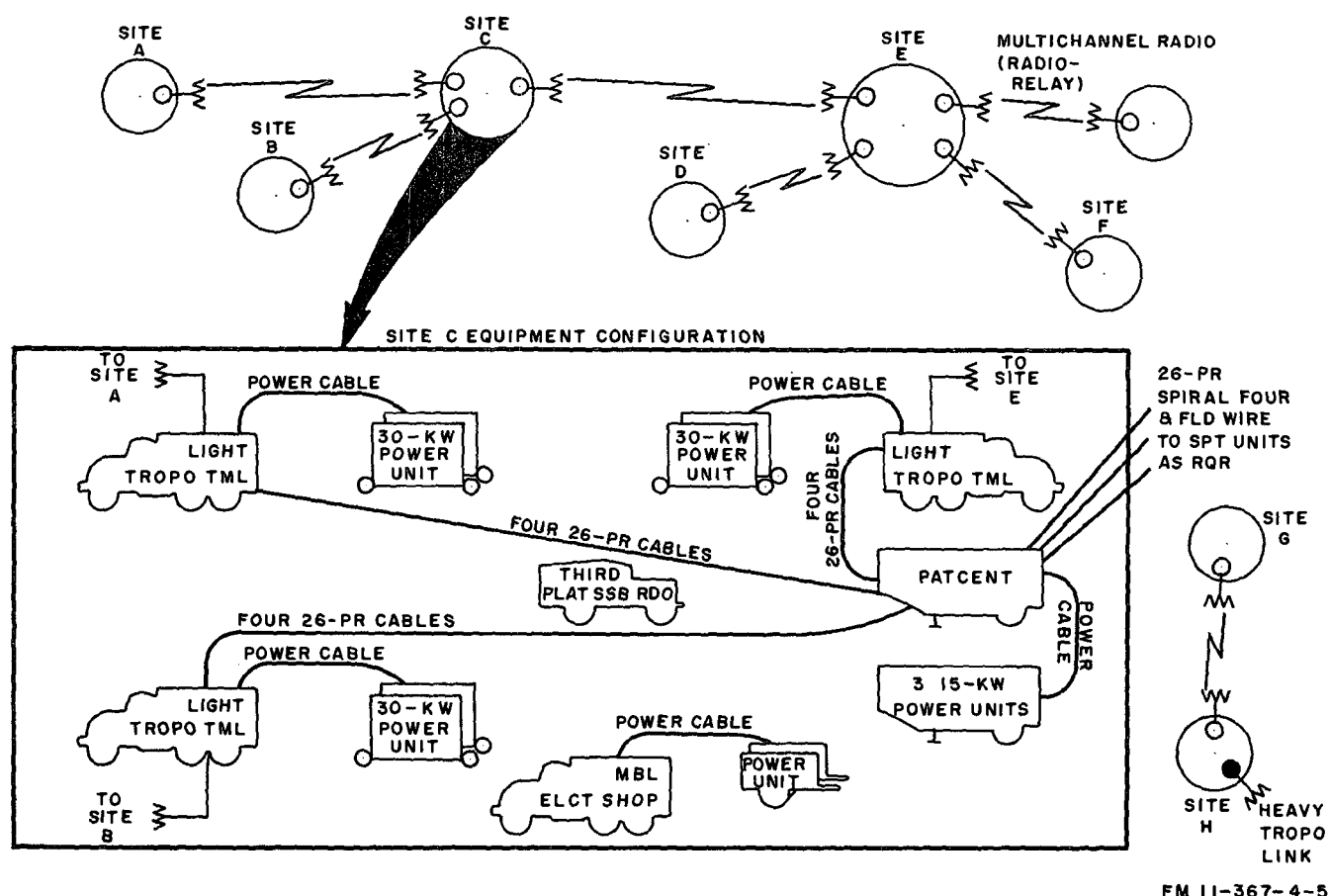


Figure 13-11. Type equipment configuration at light tropo platoon site.

ters (two platoon headquarters under some circumstances) are also located at the site. In the figure 13-12 deployment, the tropo company commander commands the site but under other circumstances he and his personnel could be tenants in an area controlled by another communications activity. The rectangular insert on figure 13-12 shows the considerable number of major items of equipment at the site including the following: three tropo terminals with their power units, TECHCONCEN (including a PATCENT with its power units and an operations central with its power units), and a mobile electronic shop with its power units. In addition, the company headquarters SSB radio and the 2d platoon headquarters SSB radio may be located at or near the site. This concentration of equipment makes preplanning of the site layout (including routing of power cables, communications cables, and field wire) imperative.

b. *Technical Control Functions.* The company commander, the technical control officer, and a 16-man technical control section establish a TECHCONCEN consisting of an operations central and a PATCENT to provide technical control of the communications facilities of the company. (Technical control of the link consisting of sites G and H, however, is exercised by the technical control element of the command to which the site G and H tropo teams are attached.) The operations central is used as a company planning and technical record keeping facility; the PATCENT is used to control all incoming and outgoing circuits. These circuits are interconnected in accordance with the applicable portion of the higher signal echelon standing signal instructions and standing operating procedures of the system control plan. The SSI and SOP assist technical control section personnel to solve emergency communications problems by de-

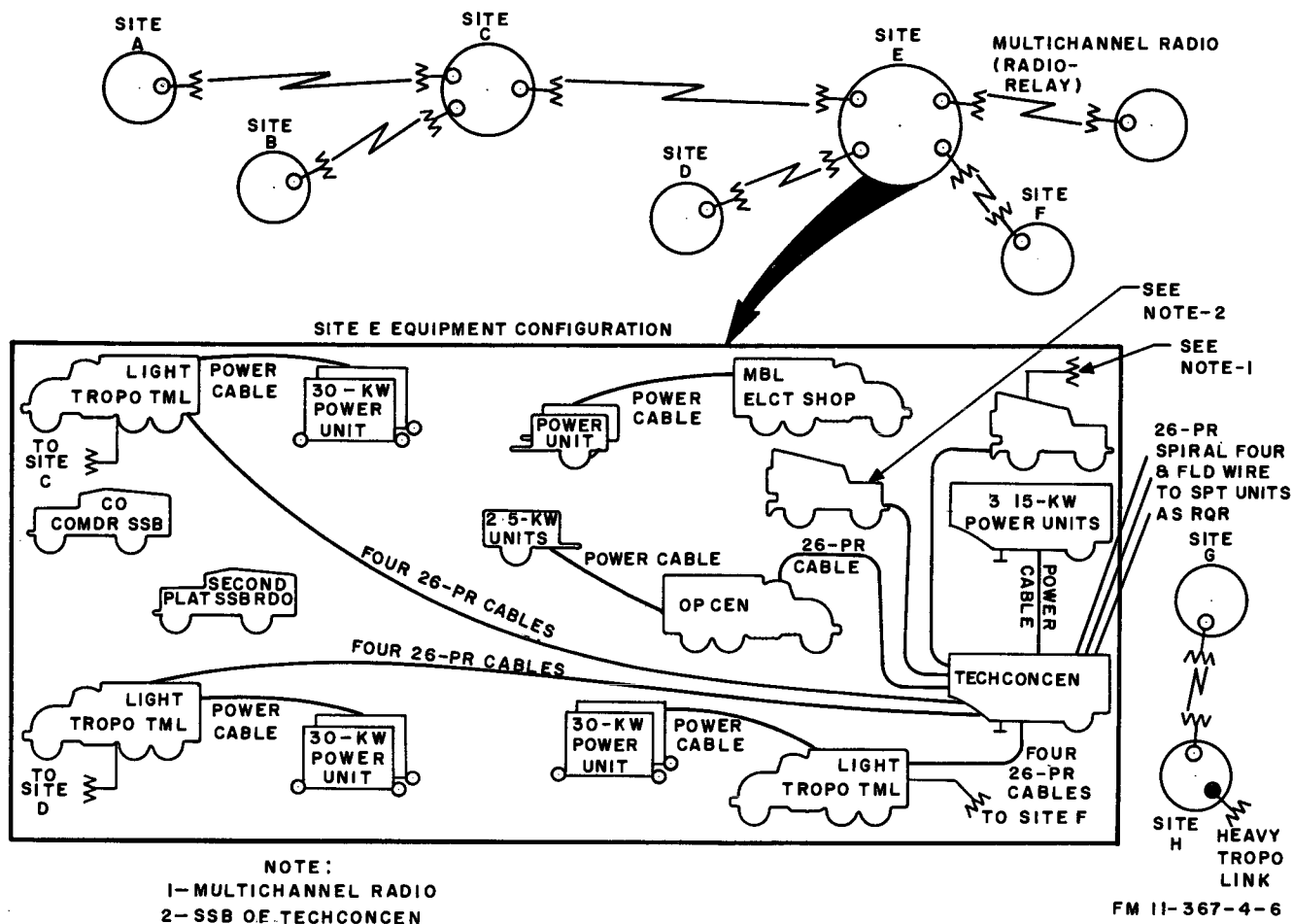


Figure 13-12. Type equipment configuration at light tropo company site.

termining faults and rerouting circuits. To cope with rapidly changing communications problems, however, all personnel must be alert and adapta-

ble. The detailed functions of technical control section personnel are covered in paragraphs 13-19 and 13-20.



## CHAPTER 14

## SIGNAL COMPANY, TROPOSPHERIC, HEAVY

## Section I. INTRODUCTION

**14-1. Mission and Assignment**

The mission of the heavy tropo company is to provide multichannel communications facilities on a 24-hour basis, using heavy tropospheric scatter radio equipment. These communications facilities may consist of a complete system, extensions, or individual communications links as required. The company may be fragmented (platoons or sections and company support personnel attached to other signal elements) to provide special communications extensions or links. Normally, when a tropo element, for instance a section, is attached to another signal unit to provide both terminals of a tropo link, technical control of the tropo element also passes to that signal unit. The heavy tropo company is normally assigned to USASTRATCOM (theater), a field army signal brigade, or the signal group of an independent corps.

**14-2. Category and Organization**

The heavy tropo company is a category II unit (AR 310-25) and is organized under TOE

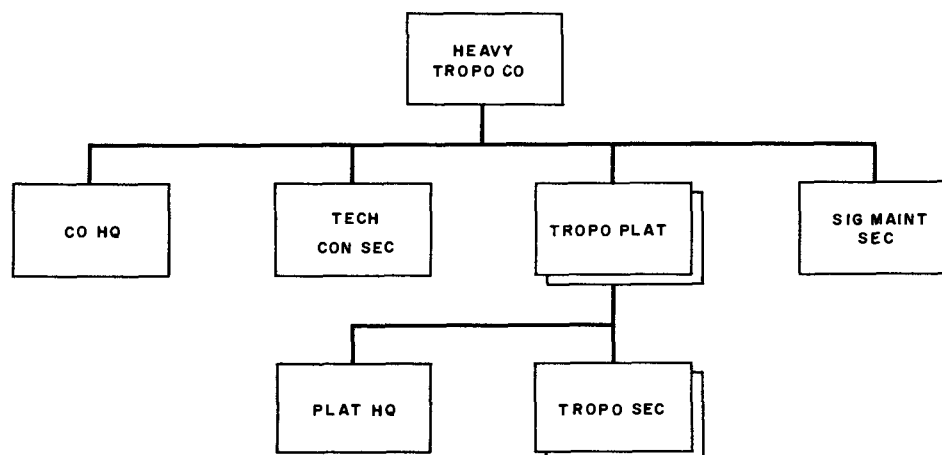
11-368. It is not adaptable to a type B organization. The term *heavy tropo* refers to the technical capabilities of the company (para 14-4). The company elements are listed below and are described in subsequent paragraphs of this chapter:

- a. A company headquarters.
- b. Two tropo platoons.
- c. A technical control section.
- d. A signal maintenance section.

**14-3. Administrative and Logistic Capabilities**

The heavy tropo company has sufficient personnel assigned to perform as follows:

- a. Provide command and control, planning, and supervision of the operating elements of the company.
- b. Provide company level administrative, personnel, and supply services, including resupply of tropo sites.



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Figure 14-1. Heavy tropo company organization.



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c. Provide organizational maintenance of organic arms, electronic equipment, vehicles, and power generators.

d. Provide direct support level maintenance for electronic equipment.

e. Provide 24-hour mess service.

f. Install and operate a technical control center.

**14-4. Technical Capabilities**

a. *TOE Levels 1 and 2.* When the heavy tropo company is at TOE strength levels 1 and 2 (AR 220-1 and AR 135-8), it provides 8 tropo terminals. Each terminal includes both radio frequency and multiplex equipment. Two terminals provide a communications link and the terminals may be separated by as much as 400 kilometers. The communications link may provide either 60 voice channels or 59 voice channels and 16 full-duplex teletypewriter channels. The company also provides technical control facilities for control of circuits when an extensive tropo system is installed by the company or to complement the technical control facilities of signal units to which the tropo company is assigned or attached. These control facilities include a company technical control center consisting of a patching central and an operations center (para 14-17 through 14-19). A patching central for each pair of tropo terminals (para 14-16) is also included.

b. *TOE Level 3.* When the heavy tropo company is at TOE strength level 3 its communications capabilities are reduced by the deletion of one communications link (two tropo terminals). The associated PATCENT facility is retained for backup and for additional interface capability.

**14-5. Limitations**

a. Installation of heavy tropo sites may require geodetic survey for topography, exact location, soil condition, terrain and distances between terminals, true bearings, and angle to the horizon. Engineer support may also be required for construction of concrete foundations and hard-stands

and for furnishing rigger personnel for antenna installation.

b. Appropriate TOE 11-500 field cable and radio relay (multichannel radio) augmentation teams are required if extension circuits to outlying units must be provided by the heavy tropo company.

c. Aviation support may be required to supply and maintain tropo terminals operating in isolated or underdeveloped areas.

d. Frequency allocation service by the signal element of the supported headquarters is required.

**14-6. Mobility and Displacement**

The heavy tropo company operates semifixed communications facilities and frequent displacement of the company or its elements is unlikely. The company is tactical, however, and 65 percent of the TOE authorized personnel and equipment can be moved at one time with organic vehicles (AR 310-31). Supplemental 5-ton tractor trucks are required for displacement of heavy organic equipment. The company is air transportable with C-130-type aircraft.

**14-7. Tactical Airlift Operations**

a. Air Force tactical airlift forces increase the battlefield mobility of the army in land combat operations. Basically, the Air Force will provide the Army with the capability to air-land or air-drop combat elements (combat support) and to provide Army elements with sustained logistical support (combat service support).

b. Complete details governing joint Army-Air-force doctrine for tactical air-lift operations are contained in FM 100-27.

**14-8. Defense Capability**

The heavy tropo company can engage in effective coordinated defense of the company area and remote installations. If such activity is sustained, however, assistance may be required to prevent curtailment of the mission capabilities of the company.

## Section II. COMPANY HEADQUARTERS OPERATIONS

### 14-9. General

The company headquarters includes the personnel required for command and administrative control and coordination of the company operational and training mission. The company headquarters normally is located in the vicinity of the greatest concentration of company elements. This allows greater control, better supervision, and a consolidation of administration, logistics, and messing facilities.

### 14-10. Administration and Logistics

The company headquarters conducts its administrative and logistical operations with normal support from comparable activities of the headquarters to which it is assigned. Messing facilities are available at the company mess 24 hours a day. Some isolated elements of the tropo company may require mess support from adjacent units. Supply operations are geared to the large amount of repair parts required for the continuous operation of the company's electronic equipment and tactical vehicles. The company provides organizational maintenance of arms, motor vehicles, and power generators. The company also provides direct support level maintenance of organic electronic equipment.

### 14-11. Command and Control

The company commander receives direction and routine administrative support through normal channels from the organization (USASTRAT-COM (theater), field army signal brigade, or signal group of an independent corps) to which his company is assigned. Operational (technical) orders are received through technical channels from the communications element of the organization exercising technical control. Because the distances between elements of the company make control difficult, the company commander makes maximum use of company and platoon standing operating procedures. In addition, he has available the company communications facilities (para 14-12). The company commander is assisted by the technical control officer, whose duties include the following:

*a.* Assists the company commander in supervision of company operations.

*b.* With the company commander, on a shift basis, exercises direct control over the company.

*c.* Plans, coordinates, and furnishes staff supervision of the operations of the company including site selection, frequency utilization and technical supervision of operations.

*d.* Functions as the company intelligence officer.

*e.* Supervises the preparation of physical and communications security plans and insures their implementation.

*f.* Insures that all personnel are familiar with ECCM plans and orders, and that these personnel are capable of employing prescribed ECCM procedures.

### 14-12. Company Communications

*a. Wire Communications.* The heavy tropo company type telephone net (fig. 14-2) is installed by the technical control section. Figure 14-2 shows nine telephones and the operations center connected to the switchboard. Two trunks to higher headquarters, connected through the area system, are also shown. This is a type telephone communications net and it should be noted that one of the tropo platoon headquarters will probably be so distant that it would have access to the company headquarters switchboard

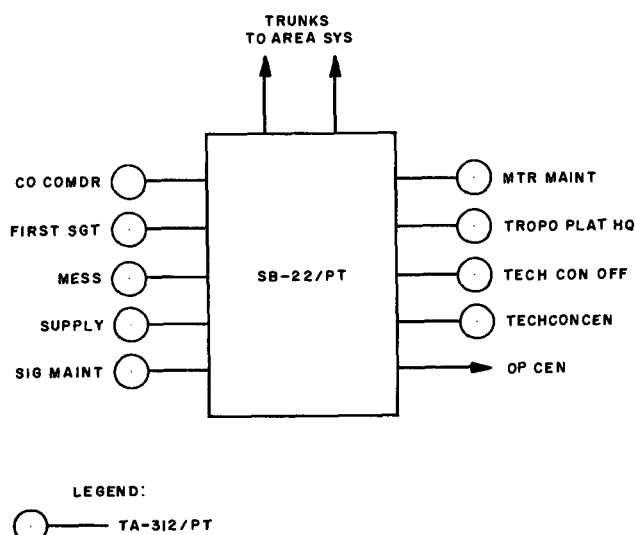


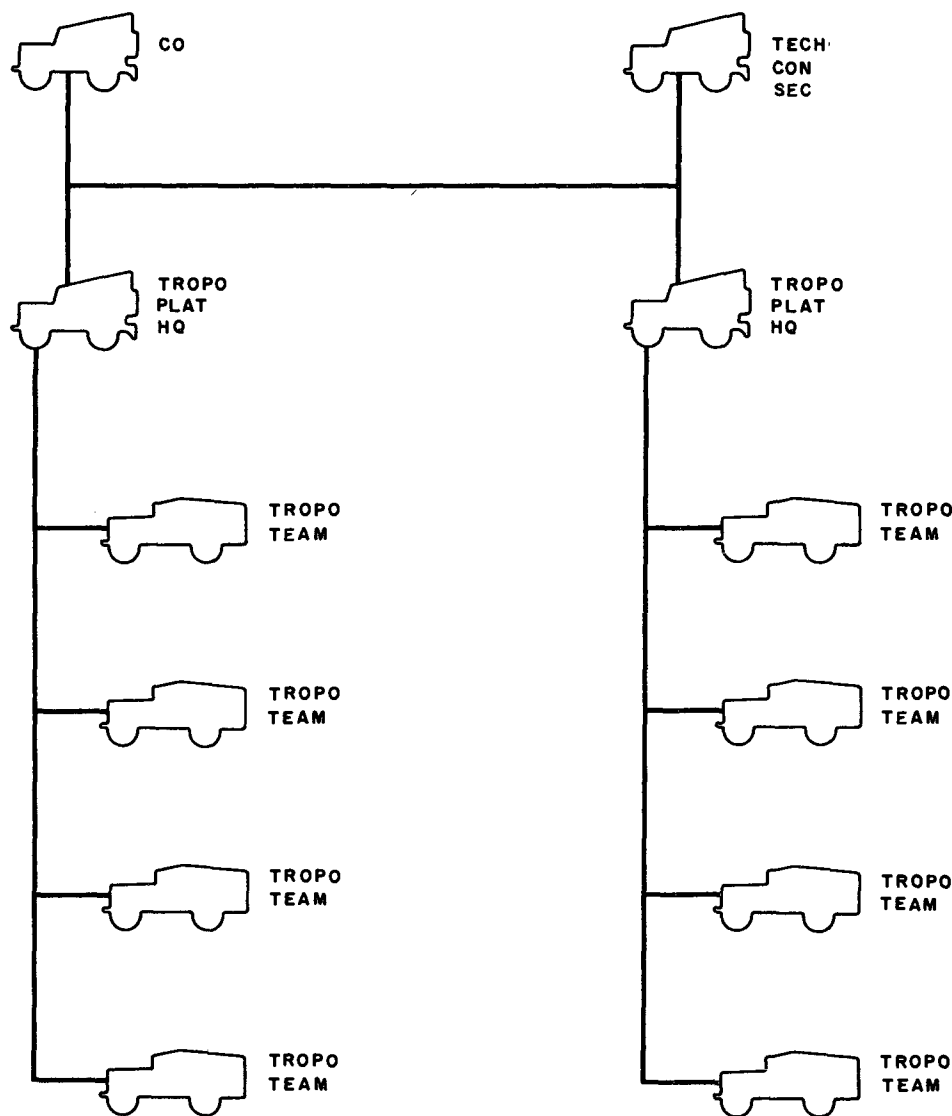
Figure 14-2. Heavy tropo company type telephone net.

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through the area communications system rather than through a long local.

b. *Radio Communications.* The single sideband command and technical control net is used by the company commander to maintain command and control of the company and its operational functions. This net is also used by the company technical control section to control and supervise

tropo system installation, system quality, circuit rerouting, and facility displacement. Also available to the company commander is the technical channel (order wire) network of the tropo system. Figure 14-3 shows the SSB radio equipment available in the heavy tropo company but is not meant to represent an actual net. A type SSB command and control net for the company is described in paragraph 14-17.



NOTE:  
ALL STATIONS USE AN/GRC-106.

FM 11-367-7-3

Figure 14-3. Heavy tropo company SSB radios.

### 14-13. Coordination

Coordination requirements are extensive because the facilities provided by the heavy tropo company may connect with light tropo, multichannel

radio, and wire and cable facilities. The company commander and the technical control officer coordinate with commanders, staffs, and technical control elements of all signal units associated with the tropo company operations.

## Section III. TROPO PLATOON OPERATIONS

### 14-14. Introduction

The tropo platoon installs (para 14-5a), operates, and maintains four multichannel heavy tropo terminals and associated communications patching central facilities, as directed. The platoon includes a headquarters element and two tropo sections.

### 14-15. Platoon Headquarters

The platoon headquarters includes a platoon leader, a platoon sergeant, a light-truck driver, and a radio operator who operates a single side-band radio mounted in the platoon headquarters truck. The SSB radio is used in either the company command and control net or in the platoon command and control net, as required. The platoon headquarters is located in the vicinity of, or is collocated with, one or more of its tropo terminals.

### 14-16. Tropo Section

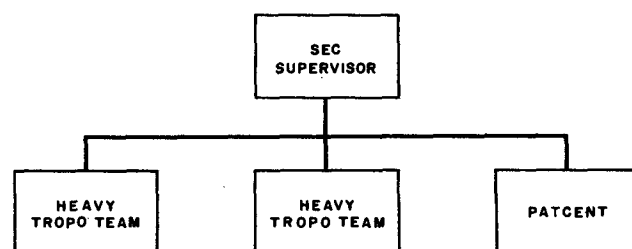
A heavy tropo section includes a section leader, a section supervisor, and 31 other personnel who are organized into two tropo teams and a communications patching central element. The assignment of personnel to the two tropo teams and to the PATCENT is covered in *a* and *b* below. Local circumstances, however, such as state of individual training, isolation of sites, and other factors, may dictate variations in team organization. The two tropo teams operate a multichannel communications link, the terminals of which may be separated by as much as 400 km. The section PATCENT is collocated with one of these terminals. The other terminal of the section must be provided with PATCENT facilities from another communications element. Sufficient personnel are assigned to the section to provide an on-site 24-hour operational and direct support level electronic maintenance capability (para 14-22).

*a. Tropo Team Personnel.* Each of the two tropo teams of the section operates and maintains the tropo and multiplex equipment of a tropo terminal. To accomplish this, a heavy tropo team is assigned the following personnel:

- (1) A tropo team chief.
- (2) Two senior tropo operators.
- (3) Four fixed station multiplex equipment operator/repairmen.
- (4) A senior multipurpose generator operator/mechanic.
- (5) Two tropo operators.
- (6) A multipurpose power generator operator/mechanic.

*b. PATCENT Personnel.* The PATCENT element installs, operates, and maintains the equipment used to interconnect, reroute, and test all communications circuits at the tropo site. The PATCENT element is assigned the following personnel:

- (1) A fixed station technical control supervisor.
- (2) A fixed station electronic equipment repairman.
- (3) Four fixed station technical controllers.
- (4) A senior multipurpose power generator operator/mechanic.
- (5) A fixed station electronic equipment repairman apprentice.
- (6) A multipurpose power generator operator/mechanic.



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Figure 14-4. Heavy tropo section functional organization.

Section IV. TECHNICAL CONTROL SECTION OPERATIONS

14-17. Introduction

The company commander and the technical control officer provide 24-hour officer supervision of the 16-man technical control section. This section, using a TECHCONCEN consisting of an operations center (para 14-18) and a patching central (para 14-19) provides technical control, circuit patching, limited test facilities and supervision of the communications facilities operated by the heavy tropo company. The PATCENT permits interconnection of the heavy tropo facilities with multichannel radio, light tropo, and wire/cable facilities. The section is assigned an SSB radio and communication with the distant tropo sites is provided by the company command and control net and the platoon command and control nets (fig. 14-5). In addition, the technical channel of the tropo equipment may be available for passing technical instructions and information to the other PATCENT facilities of the system (one PATCENT at each tropo terminal) although this channel is normally terminated at the tropo equipment and is not extended to the PAT-

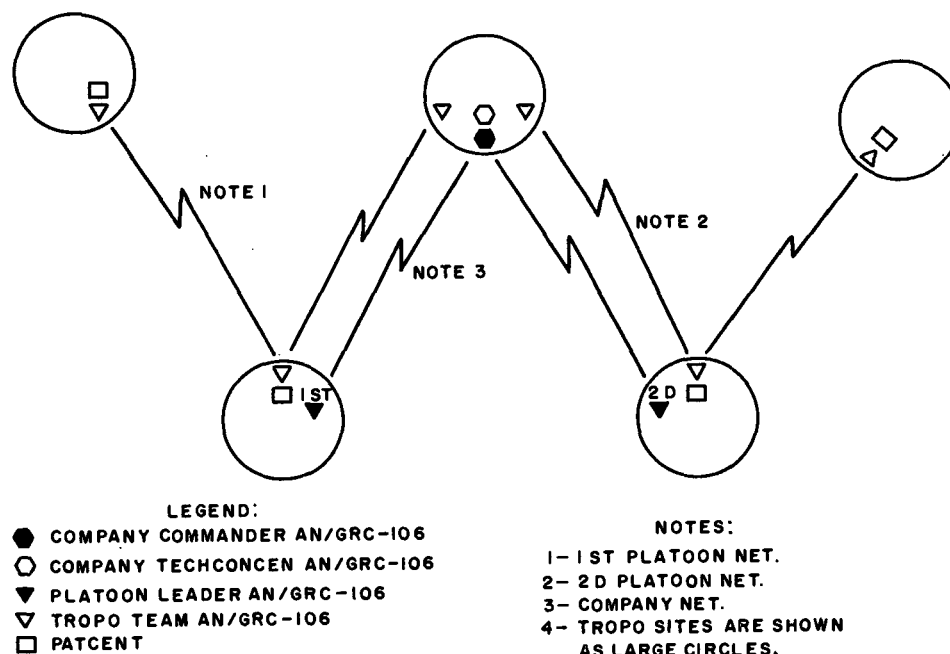
CENTS. Note that figure 14-5 shows a type net and does not preclude having distant tropo team PATCENT facilities in direct SSB communication with the company TECHCONCEN.

14-18. Operations Center

The primary functions and the personnel of the operations center are listed in *a* and *b* below.

*a. Operations Center Functions.*

- (1) Prepare system plans, diagrams, and circuit orders.
- (2) Supervise the installation, operation, and maintenance of the heavy tropo system.
- (3) Reroute circuits as required or as directed by the higher echelon systems control element that controls the company's operational mission.
- (4) Coordinate with supported units regarding locations, service required, and planned displacements.
- (5) Prepare company signal operation in-



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Figure 14-5. Heavy tropo company type command and control nets.

structions, standing signal instructions, and standing operating procedures.

(6) Plan and prepare company training directives and supervise training.

(7) Provide coordination during redeployment of company communications capabilities.

(8) Maintain information on the current status of company communications capabilities, including map profiles of systems.

*b. Operations Center Personnel.*

(1) A technical control officer.

(2) A fixed station chief technical controller.

(3) Two fixed station technical controllers.

(4) A general draftsman.

(5) A reports clerk.

(6) Two teletypewriter operators.

#### 14-19. Patching Central

*a. PATCENT Functions.*

(1) Provide an interface facility and interconnect and test all communications systems and circuits that enter or leave the site.

(2) Reduce circuit outage time by rerouting circuits or channels.

(3) Establish emergency interconnections between heavy tropo terminals and between heavy tropo terminals and the communications systems extension facilities provided by other communications units.

(4) Clear communications difficulties between local and distant facilities by causing equipment, circuit, and channel checks to be made.

(5) Conduct tests to locate and evaluate sources of trouble.

(6) Maintain circuit outage records and place additional circuits into service as the traffic load requires.

(7) Use judgment, initiative, and technical knowledge to insure continuity and responsiveness of communications.

*b. PATCENT Personnel.*

(1) A fixed station technical control supervisor.

(2) Four technical controllers.

(3) A fixed station electronic equipment repairman.

(4) Two multipurpose power generator operator/mechanics.

(5) A fixed station electronic equipment repairman apprentice.

### Section V. SIGNAL MAINTENANCE SECTION OPERATIONS

#### 14-20. General

The signal maintenance section performs direct support level maintenance on company electronic equipment and scheduled organizational maintenance on company tropo site air-conditioning equipment. Although the operators of tropo terminal electronic equipment are operator/repairman type personnel, normally they analyze and isolate equipment troubles and restore equipment to service by replacing an assembly rather than by repairing it. Assembly repair is performed by the signal maintenance section. Because the elements of the heavy tropo company are so widely separated, the signal maintenance section is deployed in two teams.

#### 14-21. Section Deployment

A type deployment of the signal maintenance section is shown in figure 14-6. The intent of the de-

ployment is to place the two maintenance teams near electronic equipment population centers. For example, in figure 14-6, maintenance team No. 1 is located at a tropo site in the left portion of the tropo system and will service the tropo teams in that area; maintenance team No. 2 is located at a tropo site in the right portion of the tropo system and will service tropo teams in that area. Many other deployment patterns are possible and the following considerations will influence the selection of the most advantageous pattern.

*a.* Distances between company elements.

*b.* Road conditions between company elements.

*c.* State of technical training of both operator/repairman and signal maintenance section personnel.

*d.* Availability of air transportation.



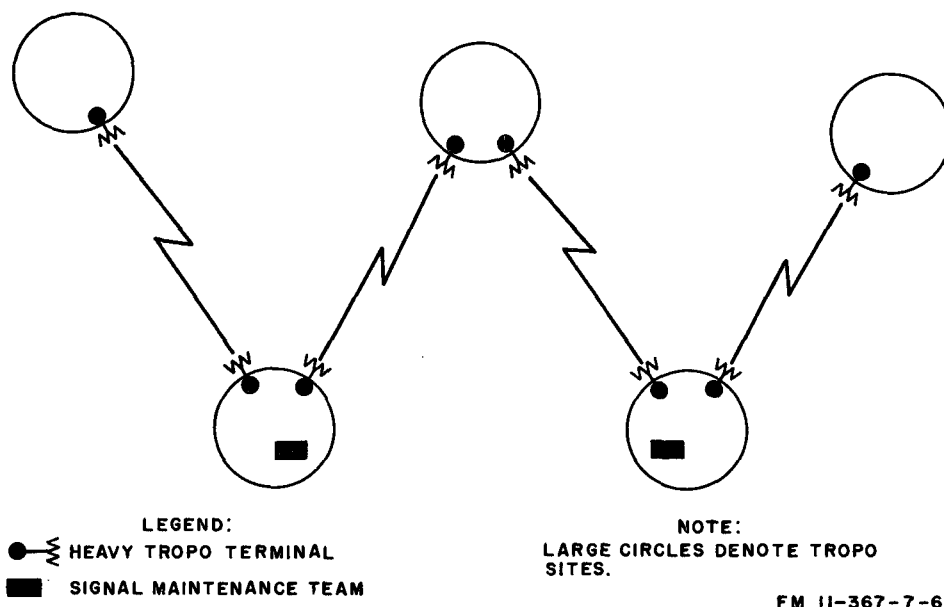


Figure 14-6. Heavy tropo signal maintenance section type deployment.

**14-22. Heavy Tropo Maintenance Team Composition**

The composition of the two maintenance teams given in *a* and *b* below, is a *type* composition and is based in general on the apparently equal equipment population division shown in figure 14-6.

*a. Team No. 1.*

- (1) A section chief.
- (2) A tropo repair supervisor.
- (3) A senior tropo repairman.
- (4) A field radio repairman.
- (5) A senior multiplex equipment repairman.
- (6) A tropo repairman.

- (7) Two multiplex equipment repairman apprentice.
- (8) A refrigeration specialist.
- (9) A repair parts specialist.
- (10) A teletypewriter equipment repairman.

*b. Team No. 2.*

- (1) A tropo repair supervisor.
- (2) A senior tropo repairman.
- (3) A field radio repairman.
- (4) Two senior multiplex equipment repairmen.
- (5) A tropo repairman.
- (6) A multiplex equipment repairman apprentice.
- (7) A refrigeration specialist.

**Section VI. COMPANY DEPLOYMENT AND SITE CONFIGURATION**

**14-23. Introduction**

The heavy tropo company may be used to provide four highly reliable, multichannel tropo communications links in a theater of operations, normally in the command communications systems,

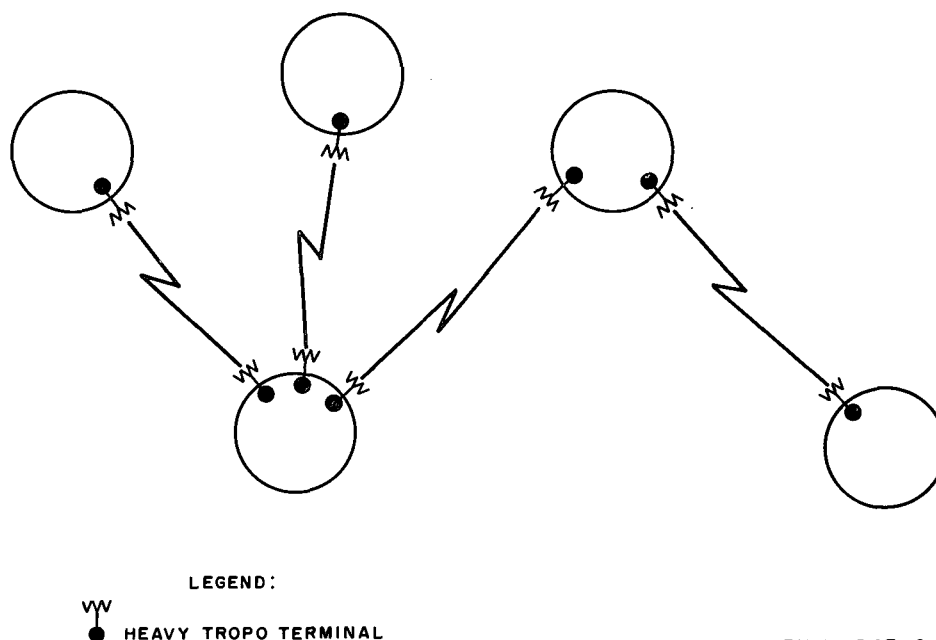
but also available for use in the area communications systems. The links, each consisting of two terminals, may be used to span distances as great as 400 km, depending on the terrain and on the requirements for communications. Each link is in-

stalled by one of the four heavy tropo sections of the company (para 14-2). Although the requirements for tropo terminal elevation are not as demanding as those for VHF or UHF multichannel radio installation, heavy tropo terminals should be sited on high ground whenever possible. Tropo site elevation is important because tropo path loss is highly dependent on the angle the antennas at each end of the path make with the horizon and also because antenna beam clearance of nearby obstructions is imperative. Tropo terminal siting is covered in detail in the applicable tropo equipment technical manual. The deployment of the heavy tropo company can range from interconnected links which include all the tropo terminals of the company (fig. 14-7) to four geographically separated links (fig. 14-8). In figure 14-9, a heavy tropo company type deployment is shown that is between these extremes. In this illustration, heavy tropo sites A, B, C, and D are interconnected and sites E and F are connected as terminals in a single link. Although no attempt is made here to show all types of heavy tropo company deployment, the operational concept and type equipment configurations shown at sites A,

E, and C (fig. 14-9) and developed in paragraphs 14-24, 14-25, and 14-26 will provide a base of information for all other deployment patterns. For reference convenience, site A, Site E, and Site C are referred to in paragraphs 14-24, 14-25, and 14-26 as a heavy tropo *team* site, a heavy tropo *platoon* site, and a heavy tropo *company* site, respectively. Single sideband radio at each tropo site is initially used to provide communications for tropo link or system lineup. After the tropo links are operational, the tropo equipment technical channel may be used for technical control orders.

#### 14-24. Heavy Tropo Team Site

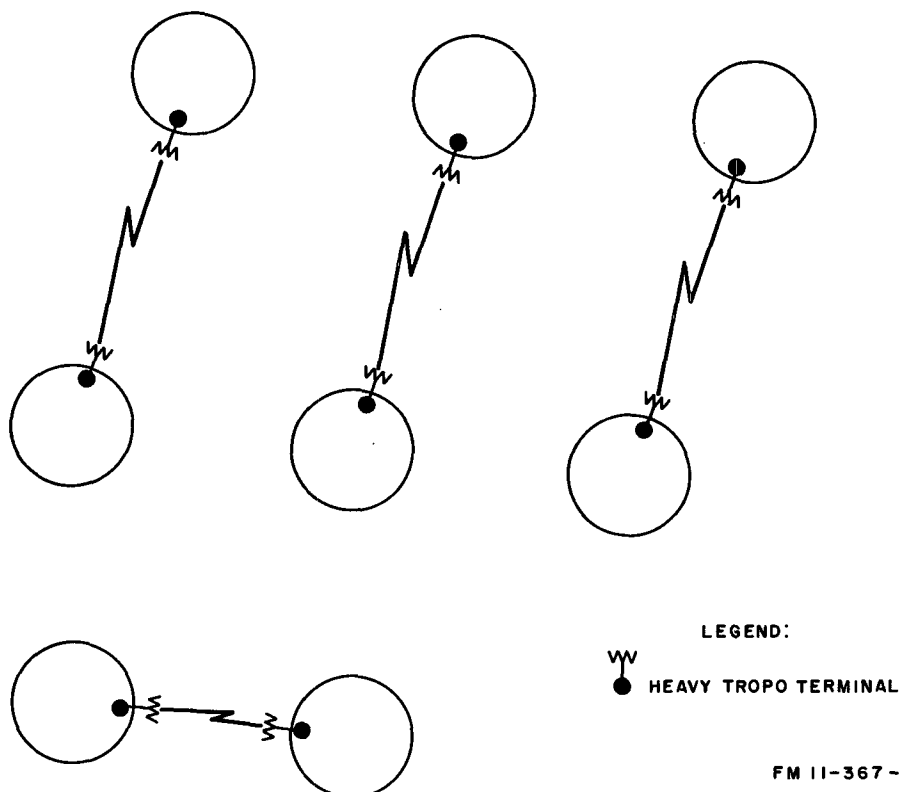
*a. General.* In the company deployment shown (fig. 14-10), the heavy tropo team chief at site A is the site commander, and he is responsible for the operation and maintenance of the equipment and for the administration of the site. Because site A has only one tropo terminal, it has the minimum number of major items of equipment required for a complete tropo site. A site with but one terminal has a relatively simple site layout



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Figure 14-7. Heavy tropo company deployed as interconnected links.

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FM 11-367-8-2

Figure 14-8. Heavy tropo company deployed in separate links.

problem, including the problem of routing communications and power cable to prevent damage. Figure 14-10 shows the major items of equipment, including a heavy tropo terminal, a patching central, associated power units, and block-diagram type cable interconnections. Sites B and F have similar equipment configurations. In the type company deployment shown, the site D heavy tropo terminal would not include a PATCENT that is organic to the heavy tropo company, but would use the PATCENT facilities of the collocated light tropo team. Because of the limited number of personnel at a tropo team site, arrangements should be made, if possible, to mess with a larger unit in the area or to operate a consolidated mess with other small units. However, if the site is isolated, appropriate heavy tropo company mess personnel will be assigned.

*b. Operations.* The rectangular insert on figure 14-10 shows 26-pair cable, spiral-four cable, and field wire that may carry circuits from supported elements (para 14-5) to the tropo site. For clarity, only one of each of these cables and wire

pairs is shown; in practice, a number of cables and wire pairs are used. The circuits from supported elements terminate in the PATCENT, which has facilities to patch, reroute, and test all communications circuits entering or leaving the site. At the PATCENT, the cable and wire facilities are interconnected with the tropo facilities (and any collocated multichannel radio facilities for which the PATCENT has responsibilities) in accordance with the SYSCON SOP or in accordance with SYSCON orders received through technical channels. Up to seven 26-pair cables may be required between the PATCENT and the heavy tropo terminal to carry the incoming and outgoing voice and teletypewriter channels (a maximum of 60 voice channels or 59 voice channels and 16 teletypewriter channels).

#### 14-25. Heavy Tropo Platoon Site

*a. General.* In the type deployment of the heavy tropo company (fig. 14-11), the 2d platoon headquarters is located at or in the vicinity of site E. Thus, the platoon leader is the heavy tropo site

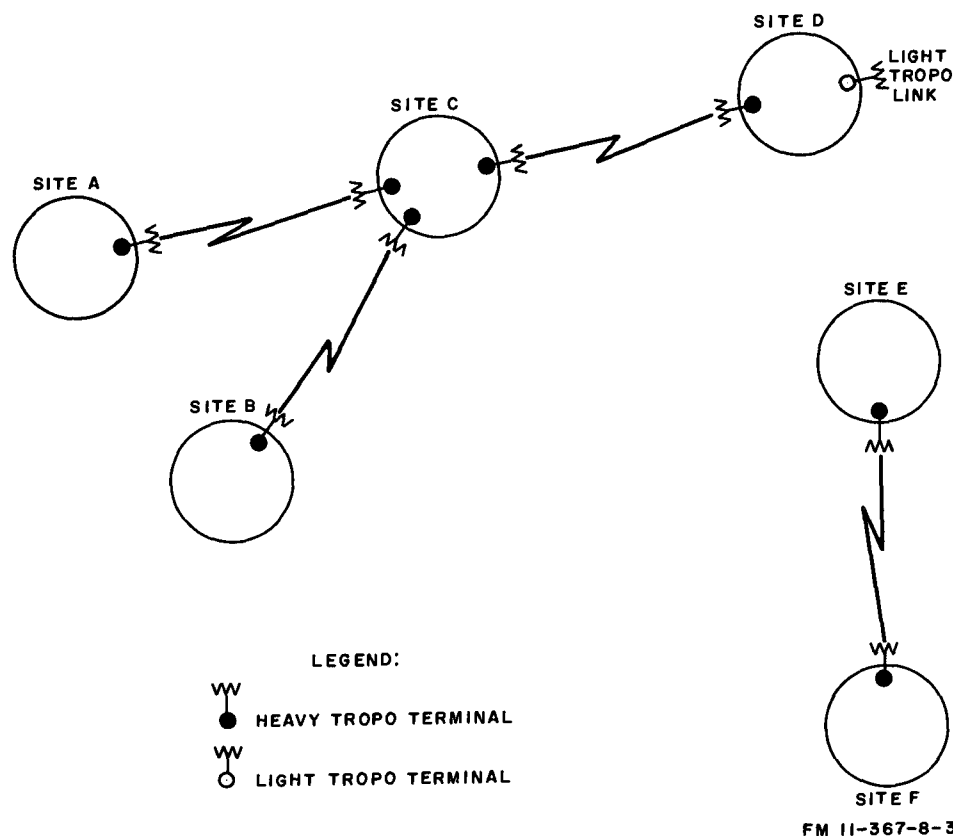


Figure 14-9. Heavy tropo company type deployment.

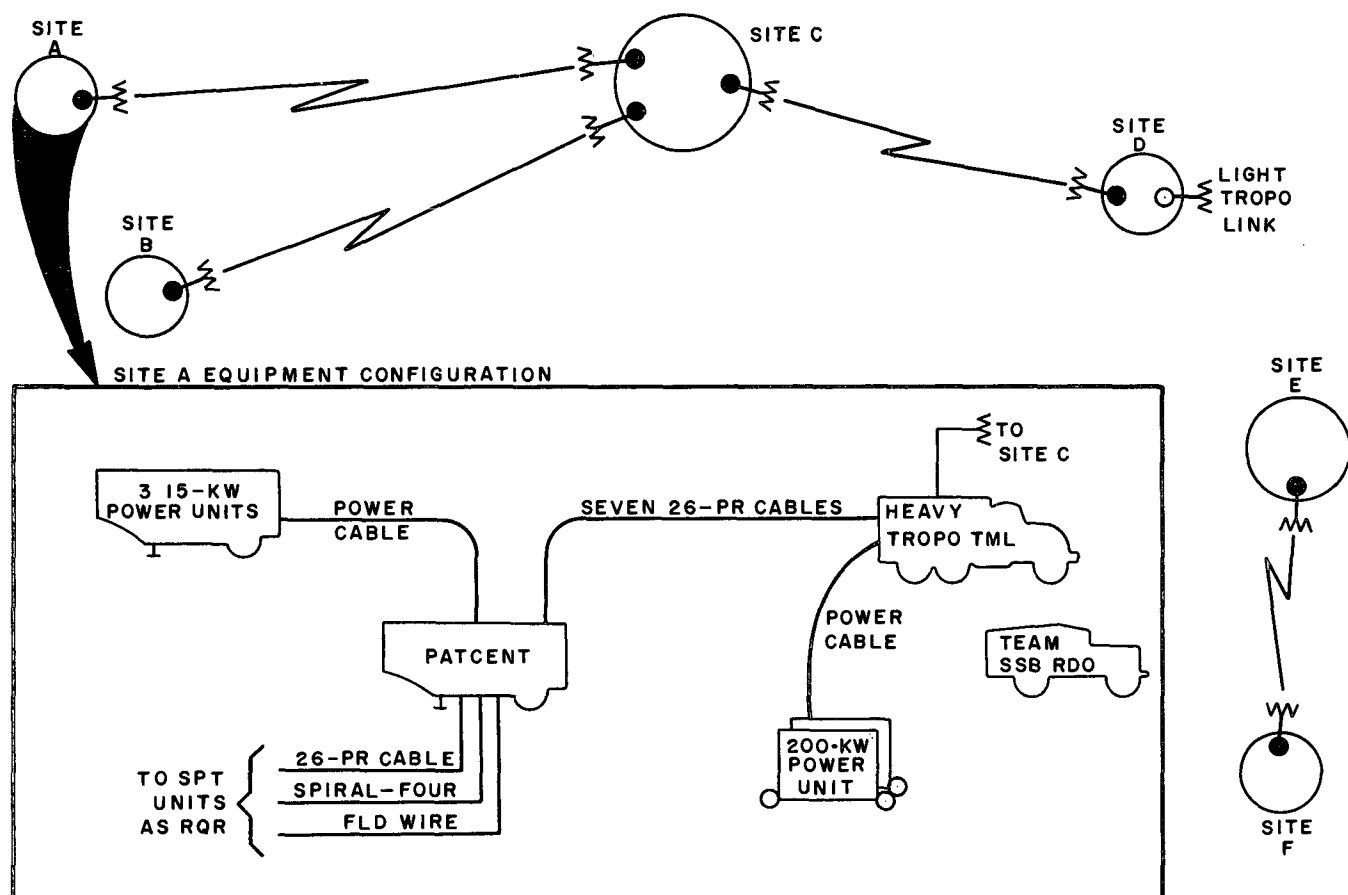
commander and he is responsible for the operation and maintenance of equipment and for the administration of the site. In the type deployment shown, site E has the following major items of equipment: a heavy tropo terminal with its power units, a PATCENT with its power units, a mobile electronic shop with its power units, and a heavy tropo terminal SSB radio. In addition, the platoon headquarters SSB radio will be located at or near the site. Preplanning of the equipment layout of a site of this size is required, and the preplanning must include power and communications cable runs. Depending on local conditions, cables may be placed underground, on racks above ground, or overhead.

*b. Operations.* The rectangular insert on figure 14-11 shows the major items of equipment at site E. In operation, 26-pair cable, spiral-four cable, and field wire carry circuits to the tropo site from supported elements in the surrounding area. These circuits terminate in the PATCENT which has facilities to patch, reroute, and test all communications circuits at the site. The circuits from

the supported elements are patched in accordance with the SYSCON SOP or in accordance with SYSCON technical orders.

#### 14-26. Heavy Tropo Company Site

*a. General.* In the type deployment of the heavy tropo company shown (fig. 14-12), site C is the major operating site of the heavy tropo company. The company headquarters and the technical control section are located here to provide command and technical control to the operating elements of the company. The headquarters of the 1st platoon is also located at or near the site. In the figure 14-12 deployment, the company commander is also the site commander, but under other circumstances, for example, collocation with a superior element, he and his personnel could be tenants in the area. The rectangular insert on figure 14-12 shows three tropo terminals with their power units, a TECHCONCEN (consisting of a PATCENT with its power units and an operations central with its power units) and a mobile electronic shop with its power units. This concentra-



NOTE:  
HEAVY TROPO TERMINALS  
CONSIST OF TWO VEHICLES.

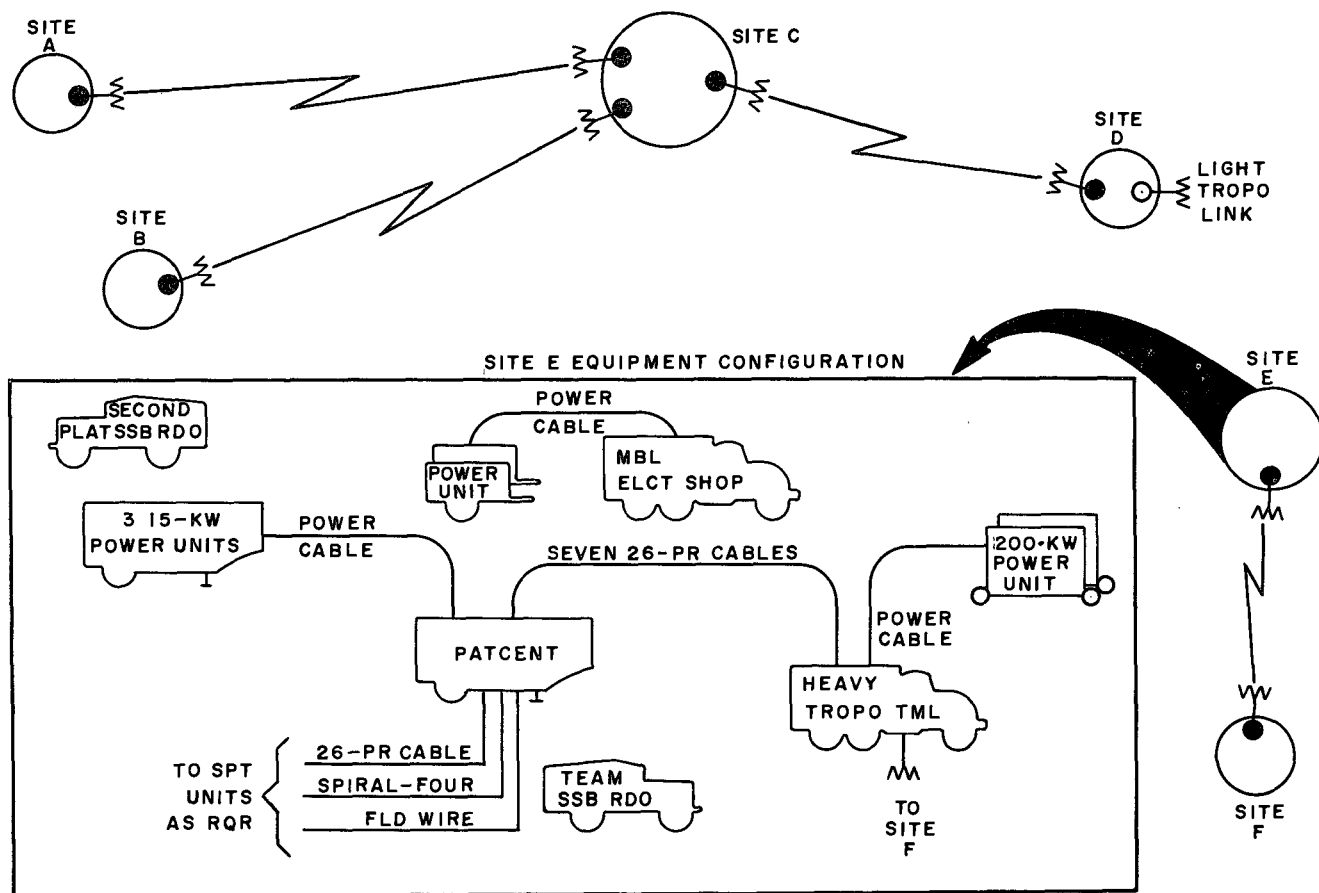
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Figure 14-10. Type equipment configuration at heavy tropo team site.

tion of equipment creates critical site layout and cable run layout problems that make preplanning imperative.

*b. Technical Control Functions.* The company commander, the technical control officer, and a 16-man technical control section establish a TECHCONCEN consisting of an operations center and a PATCENT to provide technical control of the communications facilities of the heavy tropo company. However, technical control of the link between site E and site F is exercised by the

technical control element of the command to which the site E and F teams are attached. Company planning and technical record keeping are accomplished in the operations center; incoming and outgoing circuits are controlled in the PATCENT. These circuits are interconnected in accordance with the applicable portions of the higher signal echelon SSI and SOP. PATCENT personnel use the SSI and SOP in solving emergency communications problems. The detailed functions of technical control section personnel are presented in paragraphs 14-18 and 14-19.



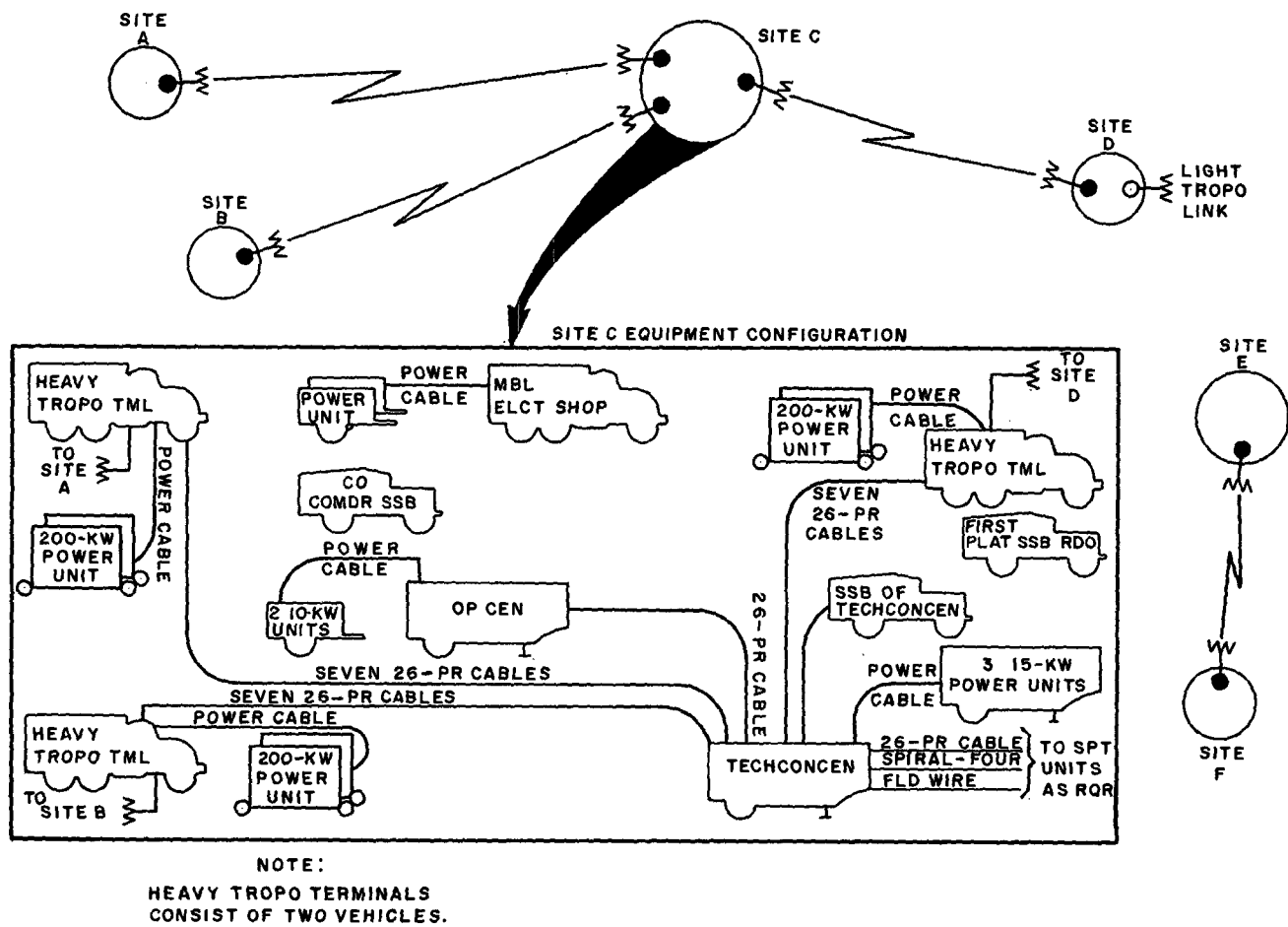
NOTE:  
HEAVY TROPO TERMINALS  
CONSIST OF TWO VEHICLES.

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Figure 14-11. Type equipment configuration at heavy tropo platoon site.



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Figure 14-12. Type equipment configuration at heavy tropo company site.

## APPENDIX A

## REFERENCES

**A-1. Army Regulations (AR)**

10-5	Organization and Functions—Department of the Army.
10-13	Organization and Functions—United States Army Strategic Communications Command.
(C) 10-122	Organization and Functions, United States Army Security Agency (U).
135-8	Reserve Component Unit Readiness.
310-20	Allied Communications Publications (ACP's) and Joint Army-Navy-Air Force Publications (JANAP's).
310-25	Dictionary of United States Army Terms.
310-31	Organization and Equipment Authorization, Tables of Organization and Equipment.
310-32	Organization and Equipment Authorization Tables, Personnel.
310-34	Organization and Equipment Authorization Tables, Equipment.
310-50	Authorized Abbreviations and Brevity Codes.
220-1	Unit Readiness.
350-1	Army Training.
380-5	Safeguarding Defense Information.
(C) 380-8	Army Communications Security Policies, Objectives, and Responsibilities (U).
(C) 380-40	Department of the Army Policy for Safeguarding COMSEC Information (U).
380-41	Control of COMSEC Materiel.
(C) 380-46	Control of Compromising Emanations (U).
(C) 380-51	Transmission of Classified Information (U).
600-20	Army Command Policy and Procedure.
711-16	DSU/Installation Stock Control and Supply Procedures (Army Field Stock Control System).
735-35	Supply Procedures for TOE and TDA Units or Activities.
750-1	Maintenance Concepts.
750-5	Organization, Policies, and Responsibilities for Maintenance Operations.
750-8	Command Maintenance Management Inspections (CMMI).

**A-2. Army Subject Schedules (ASubjScd)**

11-16	Signal Equipment Repair (Direct Support Level Maintenance).
11-19	Radio Communications.

11-20	Radio Relay and Carrier Communications.
11-21	Carrier and Repeater Communications.
11-23	Teletype Communications.
11-24	Telephone Central Office Communications.
11-25	Signal Post and Field Exercises.
11-28	Command Post and Field Exercises.
11-35	Defense of Signal Installations.
11-36	Radiotelephone Operations.

**A-3. Department of the Army Pamphlets (DA Pam)**

108-1	Index of Army Motion Pictures and Related Audio-Visual Aids.
310-1	Index of Administrative Publications (Regulations, Circulars, Pamphlets, Posters, Joint Chiefs of Staff Publications, and General Orders).
310-2	Index of Blank Forms.
310-3	Index of Doctrinal, Training, and Organizational Publications: (Field Manuals, Reserve Officers' Training Corps Manuals, Training Circulars, Army Training Programs, Army Subject Schedules, Army Training Tests, Firing Tables and Trajectory Charts, Tables of Organization and Equipment, Type Tables of Distribution, and Tables of Allowances).
310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (type 7, 8, and 9). Supply Bulletins, and Lubrication Orders.
310-6	Index of Supply Catalogs and Supply Manuals, (excluding types 7, 8, and 9).
360-522	The U.S. Fighting Man's Code.
750-1	Preventive Maintenance Guide for Commanders.

**A-4. Field Manuals (FM)**

1-100	Army Aviation Utilization.
11-9	Signal Radio Relay Company.
11-15	Signal Cable Construction Battalion.
11-20	Signal Operations, Theater of Operations.
11-21	Tactical Signal Communications Systems, Army, Corps, and Division.
11-25	Signal Construction Battalion.
11-40	Signal Corps Pictorial Operations.
11-75	Army Command Signal Radio and Cable Battalion.
11-84	Signal Radio Operations Company.
11-86	Combat Area Signal Battalion Army.
11-92	Corps Signal Battalion and Airborne Corps Signal Battalion.
11-95	Army Command Signal Operations Battalion.
11-117	Signal Support Company.
11-127	Signal Medium Headquarters Operations Company.

11-137	Signal Communications Center Operations Company.
11-147	Signal Small Headquarters, Operations Company.
21-5	Military Training Management.
21-6	Techniques of Military Instruction.
21-10	Military Sanitation.
21-26	Map Reading.
21-30	Military Symbols.
21-40	Chemical, Biological, Radiological, and Nuclear Defense.
21-41	Soldier's Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
21-48	Chemical, Biological, and Radiological (CBR), and Nuclear Defense Training Exercises.
21-60	Visual Signals.
21-75	Combat Training of the Individual Soldier and Patrolling.
24-1	Tactical Communications Doctrine.
24-16	Signal Orders, Records and Reports.
24-17	Tactical Communications Center Operation.
24-18	Field Radio Techniques.
24-19	Communications-Electronics Reference Data.
24-20	Field Wire and Field Cable Techniques.
24-21	Field Radio Relay Techniques.
29-3	Direct Support Supply and Service in the Field Army.
29-22	Maintenance Battalion and Company Operations (Nondivisional).
29-45	General Support Supply and Service in the Field Army.
31-16	Counter guerrilla Operations.
31-20	Special Forces Operational Techniques.
31-22	U.S. Army Counterinsurgency Forces.
(S) 31-22A	U.S. Army Counterinsurgency Forces (U).
31-23	Stability Operations, U.S. Army Doctrine.
31-30	Jungle Training and Operations.
31-35	Jungle Operations.
(C) 32-5	Signal Security (SIGSEC) (U).
(C) 32-20	Electronic Warfare (Ground Based) (U).
(S) 32-20A	Electronic Warfare (Ground Based) (U).
(C) 32-20-1 (Test)	Electronic Warfare (Ground Based) (U).
33-1	Psychological Operations—U.S. Army Doctrine.
44-1	U.S. Army Air Defense Artillery Employment.
54-3	The Field Army Support Command.
54-4	The Support Brigade.
54-8 (Test)	Administrative Support, Theater Army (TASTA-70)
55-10	Army Transportation Movements Management.

61-100	The Division.
100-5	Operations of Army Forces in the Field.
100-10	Combat Service Support.
100-15	Larger Units Theater Army—Corps.
(C) 100-20	Field Service Regulations—Internal Defense and Development (IDAD) (U).
100-27	U.S. Army/U.S. Air Force Doctrine for Tactical Airlift Operations.
101-5	Staff Officers' Field Manual: Staff Organization and Procedure.
101-10-1	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data, Unclassified Data.
101-10-2	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data—Extracts of Nondivisional Tables of Organization and Equipment.

#### **A-5. Tables of Organization and Equipment (TOE)**

11-15	Corps Signal Battalion.
11-25	Signal Construction Battalion.
11-45	Signal Cable Construction Battalion.
11-47	Signal Cable Construction Company.
11-75	Army Command Signal Radio and Cable Battalion.
11-85	Signal Army Area Battalion.
11-95	Army Command Signal Operations Battalion.
11-102	Headquarters and Headquarters Company Army Signal Brigade.
11-116	Headquarters and Headquarters Detachment, Signal Battalion.
11-117	Signal Support Company.
11-122	Headquarters and Headquarters Detachment, Signal Group.
11-127	Signal Operations Company, Medium Headquarters.
11-137	Signal Communication Center Operation Company.
11-147	Signal Small Headquarters Operations Company.
11-302	Headquarters and Headquarters Company, United States Army Strategic Communications Command (THEATER).
11-303	Signal Radio Operations Company.
11-327	Signal Operations Company, Large Headquarters.
11-345	Signal Operations Battalion.
11-347	Signal Long Lines Company.
11-357	Signal Truck Switching Company.
11-358	Signal Messenger Company.
11-367	Signal Company, Tropospheric, Light.
11-368	Signal Company, Tropospheric, Heavy.
11-377	Signal Radio Relay Company.

11-500 Signal Service Organization.  
 29-500 Composite Service Organization.

#### **A-6. Technical Manuals (TM)**

11-486-Series: Electrical Communications System Engineering.

11-486-1 Planning Considerations.  
 11-486-2 Traffic.  
 11-486-3 Transmission and Circuit Layout.  
 11-486-4 Inside Plant.  
 11-486-5 Outside Plant, Wire.  
 11-486-6 Radio.  
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## APPENDIX B

## TROPOSPHERIC SCATTER RADIO PLANNING FACTORS

## Section I. INTRODUCTION

## B-1. General

a. Plans and operations personnel must be familiar with the characteristics of tropo radio equipment in addition to the characteristics of other types of multichannel radio equipment. This familiarity will be helpful when selecting the type of equipment to be used to provide the multichannel communications required by the tactical situation. Only those basic features involving tropo radio propagation and factors to be considered in employment of tropo radio equipment are discussed in the following paragraphs. More complete details relative to techniques of multichannel radio communications are contained in FM 24-21 and in appropriate radio engineering publications and technical manuals.

b. Tropo radio provides extremely reliable, high quality voice, teletypewriter, and data circuits over extended distances. Because of its method of radio wave propagation, tropo radio is not limited to line-of-sight sitings, normally a factor in microwave and VHF radio employment. The capabilities (range, channel capacity, mobility, etc) of tropo radio equipment vary according to their design characteristics. To meet specific requirements, tropo radio equipments are configured into numerous types of vanized or shelter-mounted arrangements. The equipment organic to the light and heavy tropo companies is but one part of the overall family of tactical tropo radio equipments.

## B-2. The Earth's Atmosphere

a. The earth's atmosphere is separated into several layers and each layer possesses properties that determine the most effective method of radio wave propagation to be used for long distance communications. These layers are as follows: the  $F_2$  and  $F_1$  layers, the E layer, the D layer, the stratosphere, and the troposphere. The levels at which these layers occur are shown in figure B-1.

b. Regardless of its height, each layer possesses

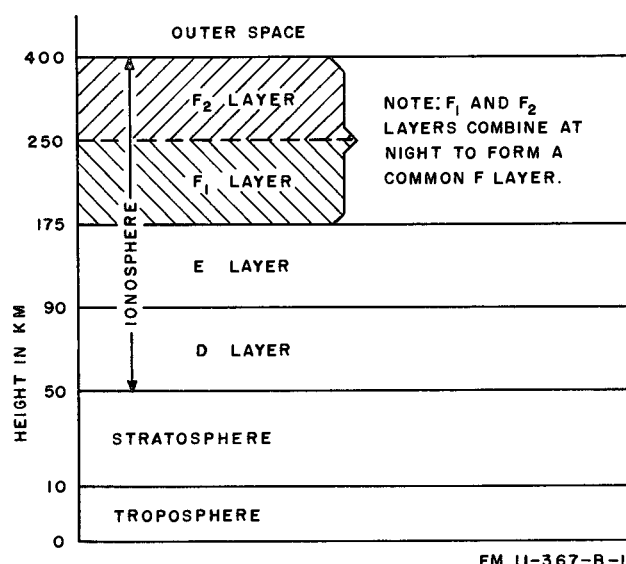


Figure B-1. Average layer distribution of the atmosphere.

to some extent the ability to refract (bend) radio waves. The amount of refraction depends on such factors as atmospheric conditions (turbulence, temperature, atmospheric pressure, ionization of air molecules, etc), frequency of the transmitted radio wave, and transmission power.

## B-3. Characteristics of Troposphere

a. Virtually all of the earth's weather phenomena occurs in the troposphere region of the atmosphere. Here, the constant motion of the air causes turbulence, or eddies, to be formed. This turbulence is most intense near the earth's surface and gradually diminishes with height. Normally, as the height increases, a steady decrease in the temperature and barometric pressure occurs. A combination of meteorological variables, such as the amount of water vapor in the air, temperature, pressure, and air turbulences, determines the refraction index of the troposphere.

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b. For radio frequencies up to about 30 megahertz (MHz), the wavelength of the transmitted signal is large compared to the size of the turbulences encountered, and there is little effect on the transmitted signal. As the frequency is increased,

however, the wavelength decreases and the effect of these local turbulences, which can be compared to small whirlpools and bubbles in a fast moving stream, become increasingly important. They are the principal factors in tropo transmission.

## Section II. TROPO SCATTER

### B-4. Propagation

a. As a radio wave passing through the troposphere encounters a turbulence, a small amount of energy is scattered away from the main beam of radiation. The scatter effect is the same as if each turbulence received the signal and then reradiated it. Although the word *scatter* implies that the spreading of the reradiated energy is equally probable in all directions, scattering occurs chiefly in a forward direction and, therefore the term *forward scatter* is sometimes used when referring to tropo propagation. A very small portion of the transmitted radio wave energy reaches the distant radio terminal.

b. The intersection of two radio beams aimed at a common point within the troposphere forms a common scatter volume around the intersected area (fig. B-2). The size of the scatter volume is determined mainly by the scatter angle formed by the intersecting beams.

### B-5. Signal Reception

The signal level received by the distance station is determined by several factors. Changes in any of these factors will cause fluctuations in the strength of received signals.

a. *Scatter Volume Turbulences.* The magnitude of the received signal depends, in part, on the number of turbulences the transmitted energy encounters in the common scatter volume. Only a small portion of the resultant scatter beam energy is directed towards the receiving station. Thus, the larger the scatter volume, the greater the number of turbulences encountered and the more refraction of useful energy occurs. The size of the scatter volume is determined by the scatter angle. As the scatter angle is increased, the amount of forward scattered energy decreases rapidly because most of the transmitted energy continues out into space. Also, the amount of scattering required to return the signal to earth (receiving antenna) is increased. The distance between terminal stations also affects the height at which the scatter volume occurs. As the circuit distance is increased, the height of the scatter volume is also increased. Therefore, the received signal level decreases as the circuit distance increases, if power output and other parameters remain constant.

a. *Atmospheric Variations.* Since tropo propagation depends on turbulences in the atmosphere, changes in atmospheric conditions will affect the received signal level. Daily and seasonal variations of temperature and air pressure cause long-term fading. In addition to long-term fading, the tropo signal is also characterized by very rapid fading. This rapid fading is caused by propagation over multiple paths from the scatter volume. Since the turbulent condition is constantly changing, the path lengths and levels of the individual signals are also changing. However, the composite signal level at any one time is the sum of all the signals received from each of the turbulences in the volume and although rapid fading may take place, no complete fadeout occurs.

c. *Propagation Efficiency.* A characteristic of tropo propagation is its relatively low efficiency. The scatter volume may be pictured as a very inefficient relay station, located above the horizon, receiving transmitted energy and reradiating it. Since most of the transmitted energy is not

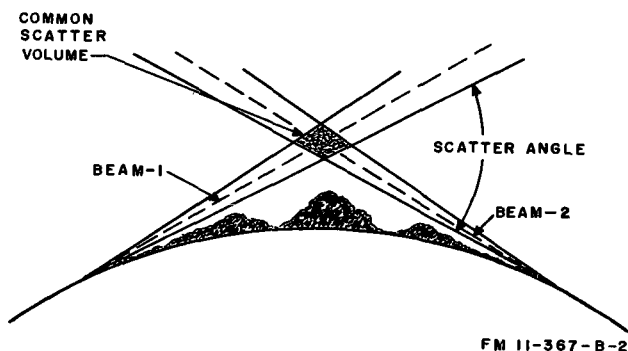


Figure B-2. Geometry of tropospheric scattering.

reradiated to the receiver, the efficiency is very low, and the signal level at the receiver is therefore low. To compensate for this low efficiency, high-power transmitters, high-sensitivity receivers, and high-gain antennas are used.

### B-6. Operating Frequency

Several factors determine the frequency range most suitable for tropo propagation. For frequencies below 30 MHz, the troposphere appears uniform and scattering does not occur. Also, at these lower frequencies, it is difficult to construct the required high-gain antennas. On the other hand, scattering loss and free-space loss increase as the frequency increases. Also, above 10,000 MHz, the wave is greatly affected by atmospheric conditions. Thus, the usable frequency range for tropospheric scatter is between approximately 100 and 10,000 MHz. Most tactical troposcatter radio equipments in the army inventory are designed to operate between 4,400 and 5,000 MHz.

### B-7. Propagation Losses

The reliability and quality of a circuit depend on the strength of the signal arriving at the receiving antenna. The total propagation loss for a circuit depends on the distance between antennas, the frequency used, and the scatter angle of the intersecting beams (fig. B-2); this angle, in most cases, is determined by intervening terrain features. The relationship between these factors and the resultant amount of energy refracted from the common scatter volume is discussed below. The formula for computing the total loss encountered between effective transmitted power and the receiver input is contained in appropriate engineering and technical manuals.

*a. Scatter Angle.* The angles at which the transmitting and receiving antennas must be aimed to clear the horizon are called horizon angles and these horizon angles determine the scatter angle of a tropo circuit. If there are no obstructions (such as mountains or hills) in front of the antennas, the antennas are aimed tangentially to the earth's surface and the horizon angle will be zero. This condition assures a greater common volume size and provides an increased amount of refracted energy at the receiving antennas. When there are obstructions, the antennas must be aimed at a higher angle to clear the horizon; this increases the scatter angle, the height of the scatter volume, and the path distance. The radiated energy scattered to the re-

ceive antenna decreases very rapidly as these factors are increased. The most advantageous situation occurs if either or both of the transmit-receive antennas are located on a site higher than the terrain in the foreground. This permits negative horizon angle aiming (aiming below a line tangent with the surface of the earth) of the antennas. Consequently, the scatter angle and the height of the scatter volume are decreased, providing maximum scatter volume area and thus an increase in refracted energy.

*b. Circuit Path Distance.* Any change that affects the circuit path distance, such as a terminal redeployment, will affect the total of refracted energy received. Circuit paths are changed when the horizon angle of either the transmitting or receiving antenna is changed. Usually, when terminals are relatively close to each other, the horizon angles will be greater and refracted energy will be reduced. For example, when two terminals are 80 kilometers apart, an increase of 2 degrees in the sum of the horizon angle will cause a 10-percent reduction in refracted energy. The effect of horizon angles decreases as distances between terminals increase because the fractional increase in scatter angle for a given horizon angle is much less at the greater distances. However, as the distances between terminals increase, the total path distance must *not* exceed the maximum transmission distance for which the tropo equipment was designed.

*c. Frequency.* As the frequency of the transmitted radio wave is increased, the refractive index of the common scatter volume is decreased. However, army tactical tropo equipment has a frequency range of 4,400-5,000 MHz, and the selection of any frequency within this range does not drastically change the total propagation loss encountered. Of more importance is the elimination of interference. The frequencies selected, when operating in the various modes (space-frequency-, dual-, or quad-diversity) must therefore adhere to the criteria established for such operations as outlined in the technical manuals for the respective tropo equipments.

### B-8. Fading

Fading has a pronounced effect on circuit reliability when the received signal level at the peak of the fade cycle approaches the minimum usable level of the receiver. There are two types of fading: short-term and long-term. Personnel involved with troposcatter employment should be

familiar with the characteristics of fading and the means available to reduce it.

*a. Long-Term Fading.* Long-term fading is the result of seasonal changes in the atmosphere. These changes affect the refractive index of the scatter volume. As the circuit distance is increased, long-term fading decreases. The predominant reason is that as circuit distance is increased, the height of the scatter volume is increased. Most of the atmospheric changes which cause long-term fading occur in the lower part of the troposphere. As the circuit distance is increased, the scatter volume is elevated to a less changeable region. A method of increasing scatter volume height is by increasing the horizon angle of the antenna. However, because long-term fading effects are considered during the engineering phase of tropo system design, the system is installed in such a way that the horizon angle of the antenna is determined by the near physical obstacle.

*b. Short-Term Fading.* Short-term fading, which is the most predominant type, usually occurs at a few cycles per second. It is caused by rapid changes in the scatter volume because the turbulences which cause the scattering effect are constantly changing positions. These changes in position are due to variations in temperature, humidity, and density. The received signal is a composite of many small signals, all of which have traveled slightly different path lengths in arriving at the receiving antenna. The amplitude of each of these small signals is constantly changing. The signals combine in random-phase relation; sometimes in an overall reinforcement, and other times in an overall cancellation. While an increase in transmitter output power or receiver gain may alleviate short-term fading, diversity operation (para B-9) is the most commonly used method to counteract short-term fading. However, diversity operation rarely improves circuit conditions attributable to long-term fading.

### B-9. Diversity Operation

*a. Short-term fading* (para B-8) produces a signal of varying strength at the receiver and therefore has an adverse effect on the quality of communications. To counteract this effect, diversity reception techniques are employed. These techniques are based on the fact that two or more transmitted signals, on different carrier frequen-

cies, using different antenna polarization, or traveling slightly different distances will arrive at a receiving location with different strengths. Diversity reception consists of combining two or more of these different strength signals at the receiving location and then causing the strongest signal to be selected for use, thus increasing the probability that a usable signal is continuously available for communications.

*b. There are several types of diversity operations available to troop radio systems. The terms dual-diversity and quadruple-diversity indicate the number of independent received signals. Other techniques that provide two or more received signals are spaced antennas (space diversity) and dual transmission frequencies (frequency diversity). Combinations of these diversity methods are used to provide greater circuit reliability than would be available if only one diversity system were used. The techniques of installation and operation of these various systems are technical in nature and are found in appropriate engineering and technical manuals; however, a brief description of some of the more frequently used methods is given below. The decision of which method to employ depends on the availability of equipment, the degree of system/circuit reliability desired, and the tactical situation.*

(1) *Space diversity.* This involves two or more receivers and antennas operating on the same frequency.

(2) *Frequency diversity.* This involves two or more receivers, transmitters, and antennas operating on different frequencies.

(3) *Quadruple space-frequency diversity.* This method requires four receivers, two transmitters, and two send-receive antennas for each terminal. The two send-receive antennas also have dual polarization (vertical and horizontal).

### B-10. Reliability

Tropo propagation provides a communications system with extremely high reliability. Current data indicates that tactical tropo systems have a capability for 98-percent reliability when operating in the nondiversity phase over a given distance. Dual-diversity operations increase reliability to approximately 99.2 percent, while quadruple-diversity operations reflect a reliability factor of 99.5 percent.



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